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Map of Central Europe

North Dakota Comes into Its Own

With 43 Illustrations and Map
35 in Natural Colors

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J. BAYLOR ROBERTS

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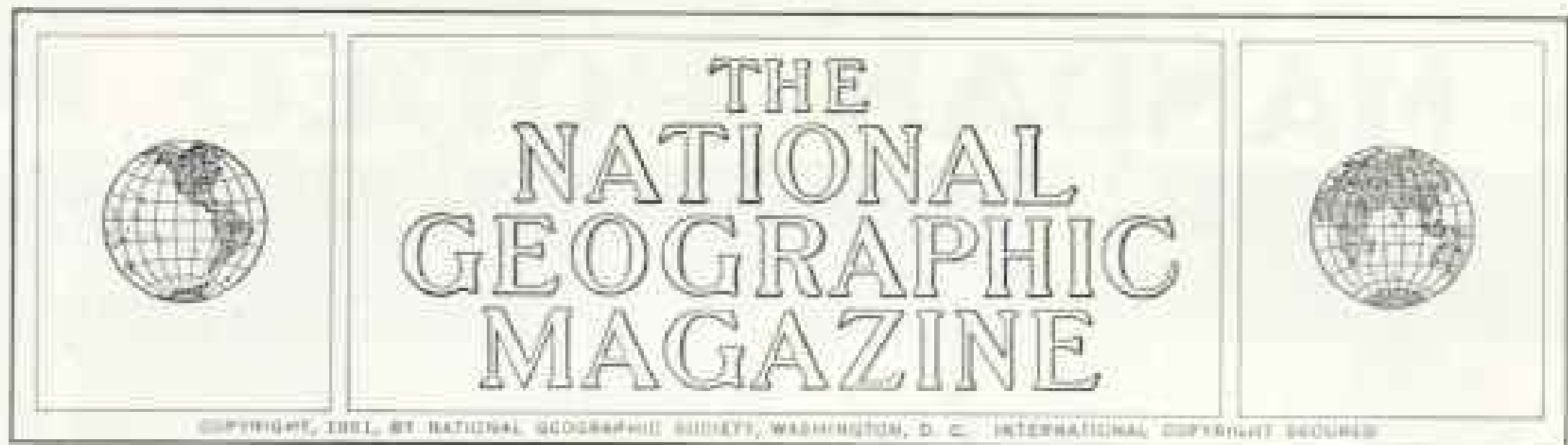
JOSEPH T. FOSTER

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North Dakota Comes into Its Own

BY LEO A. BORAH

With Illustrations by National Geographic Photographer J. Baylor Roberts

AS this issue of the NATIONAL GEOGRAPHIC MAGAZINE reaches Society members, hundreds of combines are sweeping across the golden fields of North Dakota, harvesting one-tenth of the Nation's wheat crop (pages 292 and 293).

North Dakota produces more wheat than any other State except Kansas. In hard red spring wheat and durum, source of macaroni and spaghetti, it ranks first. It led the country in flax in 1950, vied for top honors in barley and rye, and stands high in production of potatoes, sugar beets, and hay.

Under its western grasslands lie 600 billion tons of lignite coal, and last April high-grade oil was struck in a flowing well at Tioga, between Minot and Williston (map, pages 286-7).

People Have Spirit of "Never-say-die"

Rich, deep soil and vast natural resources on the eve of development are tremendous assets, but the greatest wealth of North Dakota is in the "never-say-die" spirit of its people. In spite of blizzards, floods, drought, dust storms, grasshoppers, and all manner of devastating plant diseases, they have clung to their faith in the land. That faith has been justified by ten successive crops which have brought them from near-bankruptcy in the 1930's to such prosperity that the gross income from the average farm in 1950 was \$9,000.

No longer is agriculture in North Dakota the desperate gamble it was when the only crop was wheat, the unpredictable. Diversified farming, crop rotation, summer fallowing, irrigation, airplane spraying of fields to kill grasshoppers and to destroy weeds, and development of drought- and disease-resistant varieties of grain have removed some of the

hazards. Undoubtedly there will still be bad years when acre yields will be curtailed, but even the most adverse conditions will hardly cause complete failure as in the past.

North Dakota is no place for the timid or the weak; its winters are too rigorous, its summers often too hot and dry. To the courageous and hardy, however, it is truly a land of opportunity.

When I arrived in Bismarck in mid-April this year, to begin my last survey of the State, the capital city was crowded with oilmen. Courteous Frank Hayes, manager of the Patterson Hotel, who came to my rescue with a comfortable room, told me that speculators from outside the State were engaging whole floors in the hotels.

"It's even worse in Minot," he said. "They swarmed in the minute the news of the oil strike leaked out. I hear they are paying from \$5 to \$10 an acre for leases on farms many miles away from the Tioga well.

"There is no doubt that the oil is there, but whether it's near enough the surface to make drilling profitable is a question. The first well, already 11,000 feet deep, has cost \$400,000. The flow is 400 to 600 barrels a day."

Before I left North Dakota, the Tioga well had been capped, and the drillers announced they would deepen it to 13,000 feet.

Skyscraper Capitol a Bargain

The 19-story capitol, tallest building in North Dakota, dominates the scene in Bismarck (page 291). Towering above a hill to the north of the town, it can be seen for many miles across the rolling prairie. The little city, with a population of less than 20,000, is built on bluffs above the Missouri River. Its streets are broad, its buildings low. In such

MANDAN RODEO

5

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Lee Miller

"Let Him Pitch!" Luckless the Contestant if He "Pulls Leather"

Out of the corral gate at Mandan rodeo rockets a leaping demon topped by a daring buckaroo. The rider must stay with his mount for 10 spine-jarring seconds to remain in competition. Horses used in North Dakota shows are not trained buckers but wild mustangs straight from the ranges.

a setting the height of the capitol is accentuated (page 293).

"Some people criticize us for building a skyscraper statehouse on the prairie," Russell Reid, superintendent of the State Historical Museum, told me, "but nobody can say the taxpayers didn't get their money's worth in the construction. Fire destroyed the old capitol in 1930, and the new one went up in the depths of the depression when prices for everything were down. The architects scoured the country for ideas and gave us an edifice with interior space 80 percent usable—one of the most efficient public buildings in the United States—for a total cost of only \$2,000,000."

Mr. Reid has in the museum a fine collection of Indian relics. Many decades before Pierre de la Vérendrye—first white man to set foot on the territory that is now North Dakota—came up the Missouri in 1738, industrious Mandans, Hidatsas, and Arikaras were tilling the soil there and raising good crops.*

The warlike, nomadic Sioux who ranged around the Turtle Mountains, westward into Montana and south into South Dakota, were bitter enemies of the farmer folk.

Today, most of the agricultural Indians live

* See "Indians of Our Western Plains," by Matthew W. Stirling, NATIONAL GEOGRAPHIC MAGAZINE, July, 1944.

on the Fort Berthold Reservation on the Little Missouri (pages 310-11 and 317). Near Rolla, close to the Canadian border, is the Turtle Mountain Reservation. The Fort Totten Reservation is south of Devils Lake; the Standing Rock Reservation, where, near Fort Yates, the famous Indian chief Sitting Bull is buried, is the home of Sioux tribesmen.

The Mandans and their farmer allies built houses of logs covered with earth. A full-size model of one of these early dwellings has been erected on the Capitol Building grounds.

"During the worst winter of the depression," said Mr. Reid, "relief agencies sent food to the Indians at Fort Berthold. There were potatoes from Maine—'coals to Newcastle' in this potato-growing State—and grapefruit from Florida. Of course the Indians, some of whom speak only a few words of English, had no idea what the grapefruit were; but they would shoulder bushel bags of them and stride off for home in 30°-below-zero weather. Doubtless the grapefruit were frozen solid before the Indians had carried them half a mile."

The Mandans, Hidatsas, and Arikaras actually raised corn on their northern farms. It was small and short-eared, but it matured in the brief growing season. Painstakingly, experts at the North Dakota Agricultural College have crossed that flinty Indian corn with larger and better varieties to produce strains that can be grown profitably throughout most of North Dakota.

Bismarck had turbulent beginnings as a port of call for steamboats carrying freight and passengers up the Missouri to Fort Benton, Montana, in the sixties. It was known simply as The Crossing when the Northern Pacific, first railroad in North Dakota, reached the Missouri River in 1873. Rails had been laid to Fargo in 1872, and transportation from there to the camp which became Bismarck had been by wagon trains.

The Bismarck *Tribune* Told the World of Custer

Lt. Col. George A. Custer and his 7th Cavalry were bivouacked at Fort Abraham Lincoln, which included old Fort McKeen (page 316), across the Missouri from Bismarck in 1873. Here he and his attractive wife were the center of gay social activities. When Custer set out from Fort Lincoln in 1876 with his troops for the campaign which ended in the tragic Battle of the Little Bighorn in Montana, his wife rode gaily with him for a little distance.

On July 5, 1876, the steamer *Far West*, piloted by Capt. Grant Marsh, came into Bismarck with the desperately wounded from Maj. Marcus A. Reno's command. Marsh brought the news that Custer's entire com-

mand had been annihilated. Twenty-six women at Fort Lincoln learned that they were widows.

The Bismarck *Tribune*, oldest newspaper in North Dakota (it has been in publication continuously since July 11, 1873), had sent Mark Kellogg as a reporter with Custer's troops. Kellogg was killed in the battle, but his notes were found on his body. On July 6 the *Tribune* told the world the story of the Custer disaster, and telegraphed details to the New York *Herald* at a reported cost of \$3,000 for 24 hours' use of the wires.

Though most of the business in Bismarck stems from State government offices, the city has a thriving trade as the distributing point for a vast wheat-growing area. It has grain elevators, flour mills, creameries, and the largest seed house and nursery in the State, specializing in seed corn developed from the quick-maturing variety grown in early days by the Mandan Indians.

No "Putting on Airs" in North Dakota

"Nobody has enough help here when the legislature is in session," the hotel manager said. "Some of the legislators bring their wives with them, and the women get tired of just sitting around. It's nothing unusual for them to take jobs to fill their time."

North Dakota is "plain as an old shoe." "Putting on airs" is unheard of, and even the wealthiest farmers toil in the fields with their hired hands.

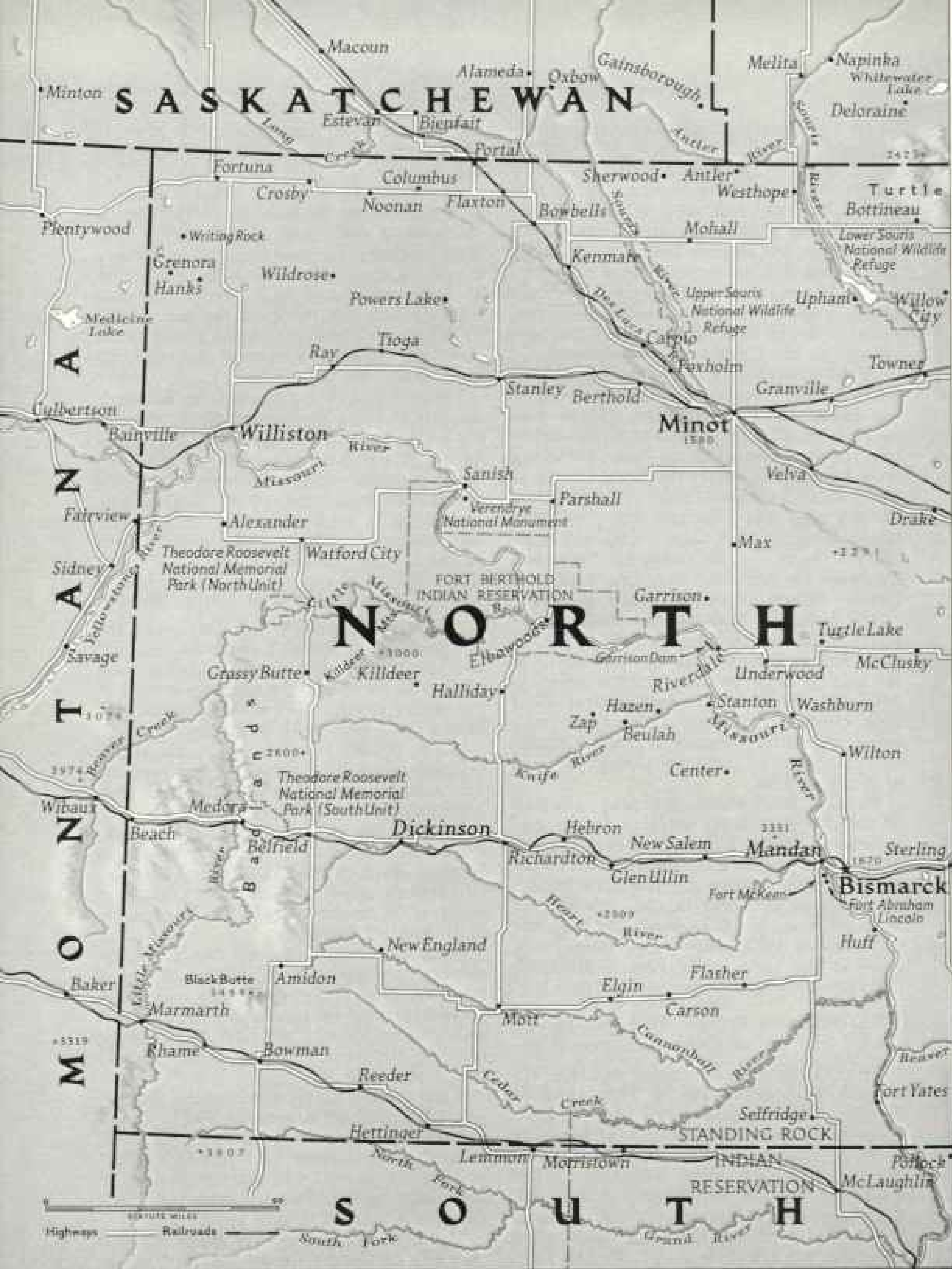
A day or two after my arrival in Bismarck, a companion and I rode 75 miles northwest to Garrison Dam on the Missouri and the new, ultramodern town of Riverdale, population about 4,000, conjured upon the bare prairie by U. S. Army Engineers.

Eight tunnels—one, 26 and two, 22 feet in diameter, for flood control, and five, 29 feet in diameter, for power—were nearing completion (page 315); and the tremendous embankment was growing rapidly as giant trucks, each carrying 30 cubic yards of earth, dumped their loads upon it.

When completed, Garrison will be the biggest rolled earth-fill dam in the world. It will contain approximately 67 million cubic yards of earth, packed down by sheep-foot rollers which exert upon it 640 pounds pressure to the square inch. Steel sheathing and rock facing will prevent erosion by the water.

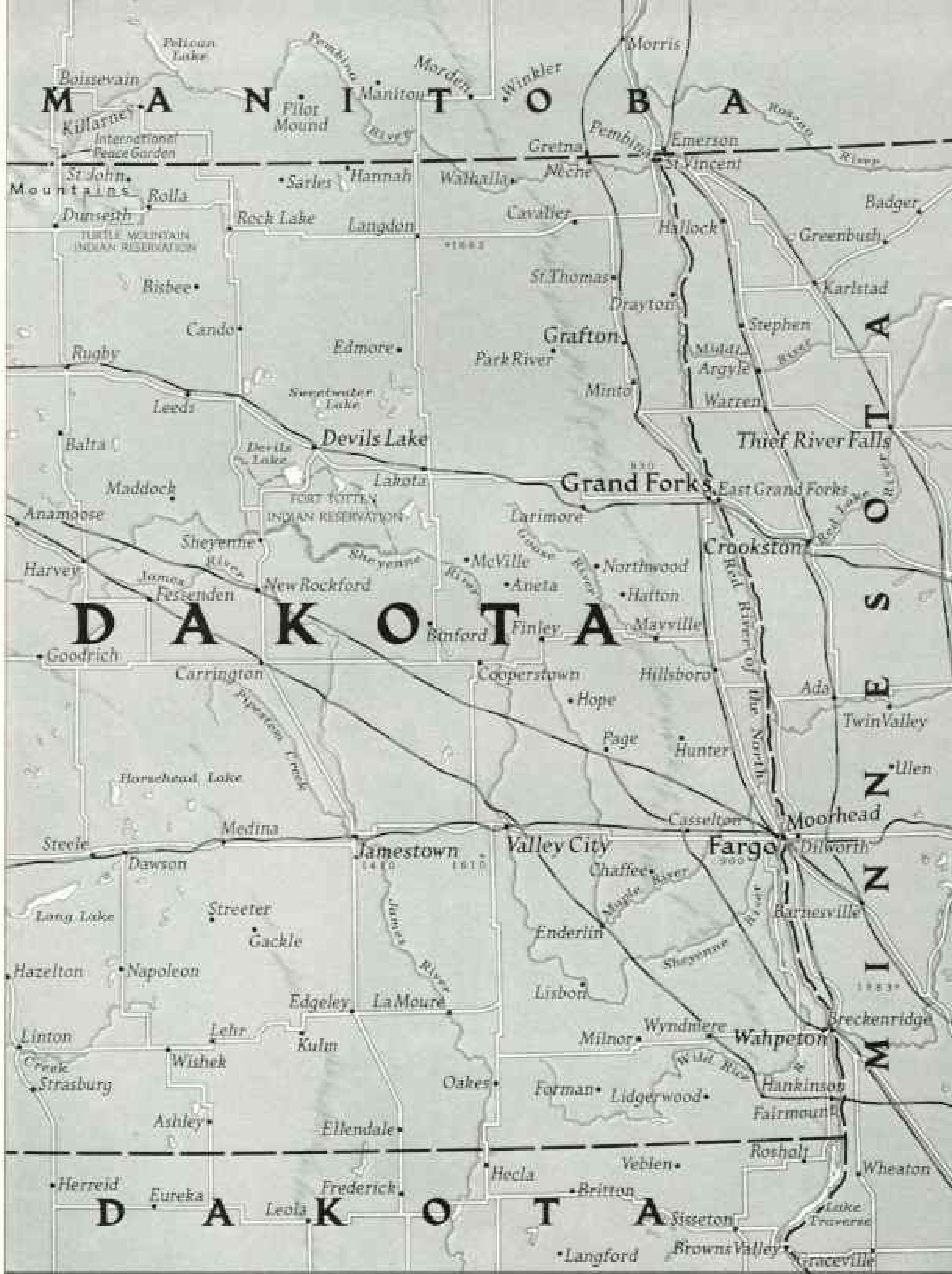
The dam will furnish eventually 400,000 kilowatts of electric energy. A part of the Pick-Sloan Plan for control of the Missouri River, it will prevent floods and metamorphose agriculture.*

* See "Taming the Outlaw Missouri River," by Frederick Simpich, NATIONAL GEOGRAPHIC MAGAZINE, November, 1945.



Under Western North Dakota Grasslands Lie 600 Billion Tons of Lignite

Scientists are now developing the possibilities of this vast store of fuel and chemicals. The weirdly sculptured Badlands are cut like sunken gardens into the Missouri slope, highest of three levels in the State. Here the soil is light and thin, but it grows large wheat and hay crops. Central drift prairies, of lower altitude, are the product of glaciation, with thicker, richer topsoil good for grain.



A Vast Fresh-water Ocean Once Rolled Over What Is Now Eastern North Dakota

Far larger than the five Great Lakes combined, ancient Lake Agassiz left on its bed, lowest level in the State, deep deposits of chernozem, the rich, black earth that makes North Dakota a "breadbasket of the Nation" with its crops of hard spring wheat. Geologists say that the Red River of the North, which now runs north to Lake Winnipeg, flowed south for centuries as an outlet for glaciers-created Lake Agassiz.



Unloading Wheat, an Electric Dumper Tilts a Ponderous Boxcar with Herculean Ease
Car and contents at a Grand Forks terminal weigh about 80 tons. In seven minutes of lifting and canting, 60 tons of grain pour down chutes to storage bins. Most North Dakota wheat goes to Minnesota mills.

The Fort Peck Dam in Montana is completed.* The Garrison in North Dakota will be finished by 1954, and the Oahe and Fort Randall in South Dakota are scheduled for completion thereafter.

From a point a short distance below the Fort Peck Dam it is proposed to divert water to irrigate a vast area in North Dakota and to raise the level of Devils Lake, largest body of water in the State.

The Garrison Dam will create a lake 200 miles long, and the Oahe, near Pierre, South Dakota, will back water up to Bismarck. Thus a land now semiarid will be converted into a well-watered area suitable for intensive farming.

In excavating for the Garrison Dam, the Army engineers uncovered thousands of tons of lignite coal. This has been separated from the earth and clay and piled in great ridges below the embankment. It is used as fuel to furnish power for the construction machinery.

The dam will be 12,000 feet long, 2,600 feet wide at the base, 60 feet wide at the top, and 210 feet high. Its crest will carry a four-lane highway. Earth dug to build the dam would leave a hole a city block square and more than four miles deep.

From Riverdale north to Minot the smooth highway goes through wheat country. Traces of snow from heavy winter falls still lingered along the way, and seeding was late. Here and there were shallow pools dotted with wild ducks and geese. The spring migration was in progress. An estimated 65,000 snow geese and Canadian honkers had descended on Devils Lake a few days before.

We saw scores of ring-necked pheasants along the fence rows. Sometimes these game birds are so numerous that motorists are cautioned to drive carefully to avoid killing them on the highways.

We watched two ring-neck cocks, handsome fellows, sparring near the road. They put up a battle for the favor of the drab-looking hens.



Here United States and Canada Pledge Eternal Amity

International Peace Garden, a 2,200-acre natural park dedicated to friendship between the countries, lies partly in North Dakota, partly in Manitoba. The cairn stands astride the border north of Dunseith. Besides a rustic lodge and other buildings, the area contains a lake, indigenous trees and shrubs, and landscaped vistas.

Shooting is prohibited by law in the spring, and game birds seem fearless then.

In the fall, however, North Dakota is a huntsman's paradise. Most of the pheasants were imported from China several years ago. On a main flyway of the mid-continent, North Dakota lakes and streams are breeding places for myriad ducks and geese (page 300).

Minot, which sprang up overnight in 1887 when the Great Northern Railway was being pushed toward the Pacific Coast, is a fast-growing city of 21,924, third in size in North Dakota. Near it are the Souris waterfowl propagation areas. The slow-moving Souris River winds for eight miles through the city.

* See "Montana, Shining Mountain Treasureland," by Leo A. Borah, NATIONAL GEOGRAPHIC MAGAZINE, June, 1950.

From this stream hundreds of acres of rich farmland are irrigated.

Time was when conductors on the Great Northern trains approaching the city are said to have called, "*My-not: Prepare to meet thy God!*" The town was then a rough frontier settlement which had grown to 5,000 population in a few weeks. Today it is a clean, prosperous business and residential city, seat of Minot State Teachers College, largest of five North Dakota normal schools. Others are at Valley City, Mayville, Dickinson, and Ellendale.

In the Minot area farms are generally larger than in the Red River Valley to the east. Wheat is the principal crop, and the city has an important privately owned grain-shipment inspection station (page 297). Besides wheat and other crops, Minot farms raise fine sheep and cattle.

Badlands, Region of Mystery and Beauty

The area west of the Missouri River is North Dakota's wild West. Here are the mysterious and weirdly beautiful Badlands (pages 308, 314, and 318), a considerable portion of them included in Theodore Roosevelt National Memorial Park. The south unit of the park is near Medora, west of Dickinson, the north unit south of Watford City.

To regain his health and recover from grief after the loss of both parents and his wife, Roosevelt came to Medora in 1883 at the age of 25. He was actively engaged in cattle raising here from 1883 to 1887. A cabin he lived in has been removed to the grounds of the Capitol Building at Bismarck, where it is used as a museum of Rooseveltiana (page 305).

At the time of Roosevelt's sojourn in the Badlands, a young French nobleman, the Marquis de Mores, set up at Medora the first meat-packing plant in North Dakota. He built a magnificent chateau, which can still be visited, and erected for his bride the first Catholic church in the region. His packing plant and other enterprises failed after three disastrous years, and De Mores returned to France.

Though carved like comparable areas in South Dakota* and Montana by the action of water on clay and sandstone, the North Dakota Badlands are different from those in the neighbor States. They are mighty clay and stone hills with color-streaked walls thrust up from flat land. On the bluff sides are alternating stripes of red and brown, spotted with red scoria. Black outcroppings of lignite and sparkling patches of snowy selenite mingle in brilliant patterns.

Among the hills are spaces covered with sagebrush. Twisted evergreens, showy cacti,

fragrant evening primroses, and clumps of willow grow along stream beds.

Through the 4,000 square miles of the rugged country the Little Missouri winds a tortuous course, often dropping a thousand feet in 20 miles. Black Butte, 3,468 feet, highest point in North Dakota, towers 700 feet over the floor of the area. Here are petrified forests, caves holding ice even in mid-summer, and all manner of Nature's sculpture.

Some observers believe part of the mineral coloring in the Badlands to be due to the burning out of beds of lignite coal. Near Amidon and at two or three other spots in the region, unquenchable underground fires are still burning (page 318). The fires have advanced only a few hundred feet in 50 years. Probably they have been raging for centuries.

Relics of prehistoric Indians are found north of Williston, the most notable the strange Writing Rock between Grenora and Crosby (page 314). Archeologists have uncovered evidence in this area suggesting human occupation millenniums before the coming of the known Indians.

The part of North Dakota between the Missouri River and the Badlands is predominantly range country, though it contains many large farms where wheat and other crops are grown. With considerably less rainfall than the drift plains in the central part of the State and the Red River Valley in the east, it is better suited to stock raising than to general farming.

At Bowman, in the southwestern corner of the State, is a plant where Van Dyke brown is made from lignite. North Dakota produces more than 50 percent of the Van Dyke brown dye used in this country.

Where the Old Wild West Still Lives

At Mandan, a railroad town of 7,268, across the river from Bismarck, the atmosphere of cowboy days still lingers. The annual rodeo here attracts entrants from all over the West (page 284). Dickinson, too, near the edge of the Badlands, and the little town of Sanish, near the Fort Berthold Indian Reservation, put on big wild West shows.

Besides the usual broncobusting, steer roping, and bulldogging, these rodeos feature races between teams of cowboys to capture, saddle, and ride wild horses from herds driven into the arena. Another unusual competition is between teams who rope wild cows from a herd and milk them. The team first to take half a cup of milk to the judges' stand wins.

The manufacture of briquettes from lignite

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "The West Through Boston Eyes," by Stewart Anderson, June, 1949, and "South Dakota Keeps Its West Wild," by Frederick Simpich, May, 1947.



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Photographs by J. Bayler Roberts

State Capitol, North Dakota's Lone Skyscraper, Soars 19 Stories Above Prairie at Bismarck
Executive and legislative offices occupy this limestone structure, built in depression years for \$2,000,000. High-school bandsmen and drum majorettes display national and State flags before a pioneer group in bronze.



Like Steamers on a Sunlit Sea, Combines Move Across Golden Wheat Fields, Leaving Curving Wakes of Stubble

North Dakota's harvest period is short; crews service machines on the ground and eat picnic lunches to save time. Work starts at dawn and continues long after dark by the light of headlamps. This square mile of grain, wimping in the breeze, grows on an 8,000-acre farm near Mott.

Whirring Combine Harvests Wheat Almost in the Shadow of the Sioux State's Towering Capitol

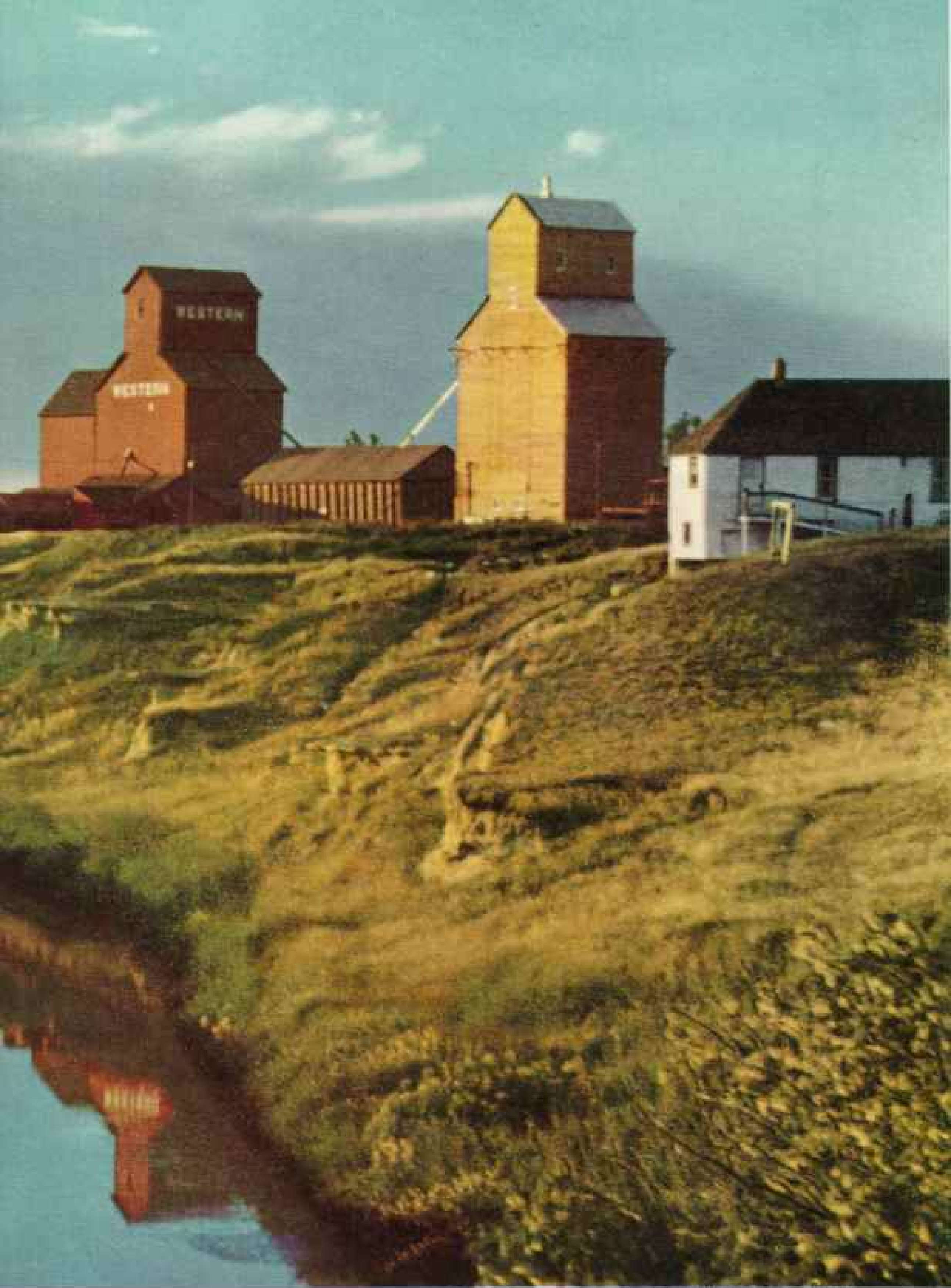
Agriculture is king in North Dakota; 87 percent of the land is devoted to crops. Farms crowd into suburbs of cities and towns. Long before they reach prairie-girt Bismarck, travelers sight the Capitol Building, tallest in the Commonwealth (page 291).





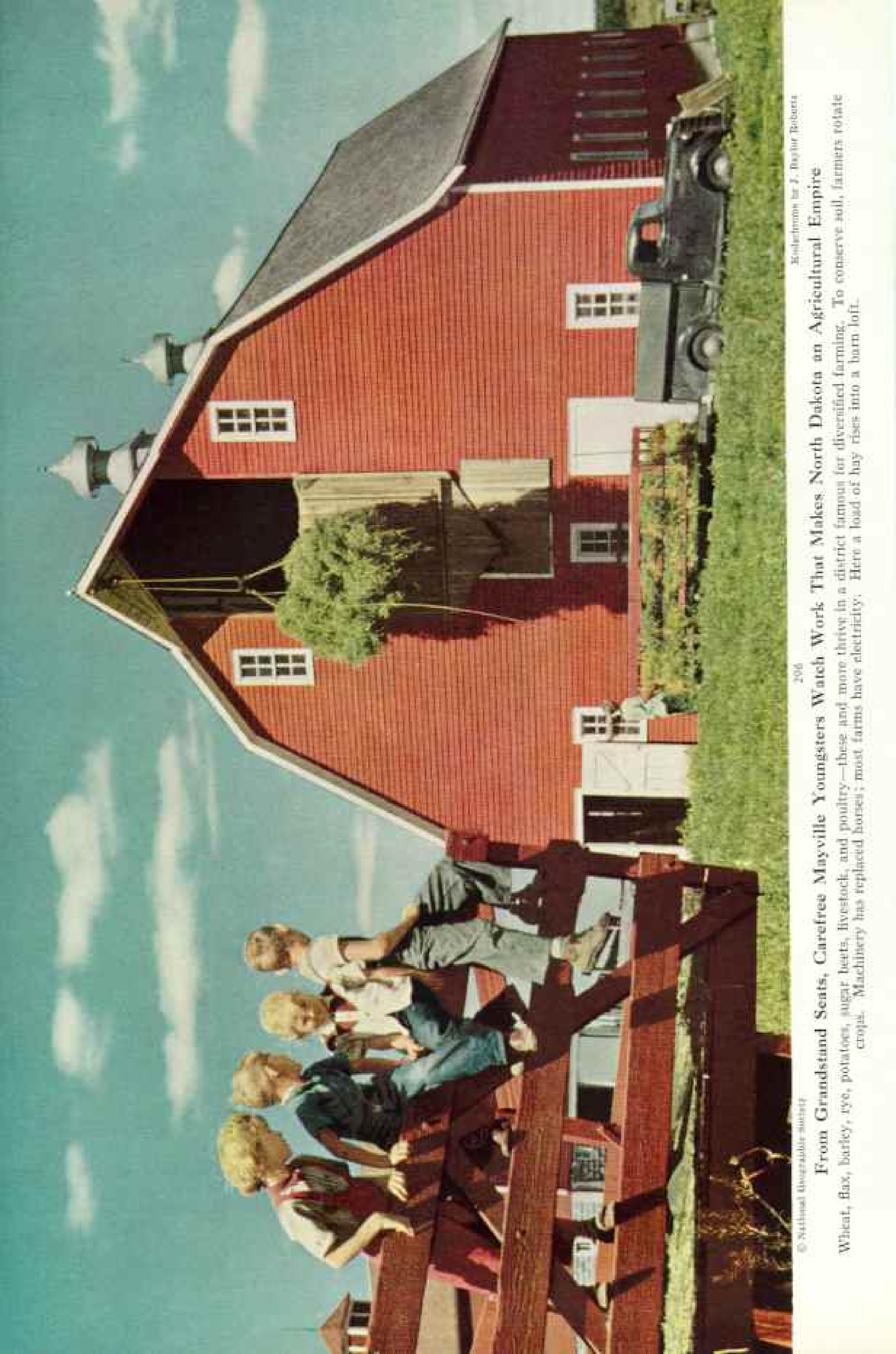
North Dakota's Trademark: Grain Elevators Etched Against Prairie Sky

Virtually every town and hamlet boasts a row of brightly painted wooden storehouses standing beside the railroad tracks. The towers, with arrowhead cupolas, rise 60 to 100 feet.



These Stand at New England, Named by Yankee Colonists Far from Home

New Englanders settled the town in 1887, but today's population is mostly Scandinavian. Grain weighed in scale houses across the tracks is stored in elevators which spout it into cars.



From Grandstand Seats, Carefree Mayville Youngsters Watch Work That Makes North Dakota an Agricultural Empire

Wheat, flax, barley, rye, potatoes, sugar beets, livestock, and poultry—these and more thrive in a district famous for diversified farming. To conserve soil, farmers rotate crops. Machinery has replaced horses; most farms have electricity. Here a load of hay rises into a barn loft.

← **Laboratory Magic
Gives North Dakota
Bigger, Better Crops**

Dr. L. R. Waldron, plant scientist, crosses varieties of wheat from all over the world to produce disease- and drought-resistant strains. He has increased the average acre yield by three bushels, improved the quality, and added \$20,000,000 a year to farmers' income.

In his greenhouse at North Dakota Agricultural College Experiment Station, Fargo, Dr. Waldron works to combat a new and deadly stem rust, a malignant invader from Mexico. The disease affects even his famous Mida wheat and other kinds not susceptible to ordinary rusts.

**Inspector's "Thief" →
Takes Samples of
Grain in a Boxcar**

By plunging his flatlike instrument to the bottom of a consignment of wheat, inspector Clay Wefald, of Minot, obtains specimen lots from a dozen levels at six places in the car.

Samples, with certificates of weight and trash content, are sent to commission houses in Duluth and Minneapolis.

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Illustrations by J. Taylor Roberts





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Kodachrome by J. Bayler Roberts

↑ **Foxholm 4-H Club Farmerettes Primp a Champion Shorthorn**

Gwynn Anderson (right) owns the buller, a consistent prize winner and holder of grand championships. Fellow members of Foxholm's Better Beef Club help prepare the animal for judging at Minot State Fair.

✚ **Patient Whiteface Gets a Final Beauty Treatment**

Rivalry is keen at Minot and other fairs. This 4-H boy and others work months to prepare their entries. They have done a yeoman job in improving the standards of stock raising in North Dakota.



coal overshadows the wheat and cattle businesses in Dickinson, a city of 7,457. This fuel is made by charring the lignite and binding it into small briquettes with substances extracted from the raw product. For each ton of briquettes about 2.8 tons of lignite are used. The briquettes burn like charcoal, with intense blue flames. From a large, modern plant 50,000 tons of briquettes are shipped out annually. They are superior fireplace fuel.

Williston, 7,353 population, has an important Experiment Station of the North Dakota Agricultural College. Here are conducted studies in scientific irrigation and tests of rust- and smut-resistant grain. Both sprinkler and siphon irrigation are tested (page 321). In the cool, dry air of North Dakota all-day watering in full sunlight can be carried on without danger of wilting crops.

Excellent crops of high-quality wheat are grown by dry farming in the Williston area. To preserve the soil and conserve moisture, summer fallowing is practiced. Ingenious machines called surface tillers are used to remove all weeds and pulverize the soil to a depth of four inches. This process creates a dust blanket which holds moisture.

Just after the spring rains and three or four times more in the course of the summer, the surface tillers go over the fields. The result is that enough moisture is retained under the dust blanket to give the following year's crop a good start. Contour plowing and strip farming are also practiced with success.

Flat North Dakota No Longer Monotonous

I took the Northern Pacific train across terrain ever more level to Fargo, the metropolis of North Dakota, a bustling city of 37,981. On previous visits this flat country had seemed to me monotonous and uninteresting. Now I had acquired new respect for it. It was once treeless, stretching away in unbroken sweep to the far horizon. Nowadays it is dotted with groves and tree rows planted to foil the winds that cause dust storms and erode the land.

A State-wide campaign of tree planting is under way. With mechanical planters thousands of seedlings from the State nurseries at Mandan and elsewhere are being set across the farmlands. The only sizable natural forests in the State are those in the Turtle Mountains near Bottineau, where the State School of Forestry is located. In a few years, however, there will be hardly a farm in the State without its groves and tree-row windbreaks.

At Fargo, William P. (Bill) Sebens, field representative of the Greater North Dakota Association, met me. Bill knows and loves every part of North Dakota. Under his guidance I obtained an intimate view of the most interesting things in the State.

Fargo is as typically midwestern as an Iowa or Indiana city (page 301). By eastern standards it is small, but population is no index to the importance of North Dakota cities. Fargo is the distributing point for a vast agricultural empire which ranks as one of the richest in the world.

In recent years it has taken much business from Minneapolis. Here are farm-machinery plants, flour mills, and a big packing plant of Armour and Company. Across the Red River in Fargo's twin city, Moorhead, Minnesota, is a big sugar factory which handles enormous crops of beets, raised extensively on both sides of the river.

Bill and I went first to the 70-acre campus of the North Dakota Agricultural College in the outskirts of Fargo. Here North Dakota crops are safeguarded and improved by the most efficient system of research I have ever observed.

President Fred S. Hultz expressed for me in a few words the purpose of the college.

"We have in North Dakota," he said, "more hazards than the average farm State. Because of moisture uncertainties, our problems are difficult. We try here at the college and in our experimental farms throughout the State to combat natural hazards and insure our farmers against calamity."

I talked to Dean Harlow L. Walser of the College of Agriculture. He pointed out to me that North Dakota has three distinct levels and three different types of soil: the Red River Valley—containing the lowest point in the State, altitude 750 feet—the flat bed of ancient Lake Agassiz where the soil is deep, black chernozem, rich as the Valley of the Nile; the drift plain, a higher, glaciated area, with earth still rich but somewhat lighter in color; and the Missouri slope, still higher, with thin, light soil best suited for grazing.

"We try," he explained "to develop seed and methods of farming adapted to each of the three levels."

Two Crop Magicians Have Worked Miracles

Since North Dakota Agricultural College opened its doors to students in 1891, many of its faculty members have rendered distinguished service to farmers. Two have made such remarkable records that no description of the State would be complete without reference to their achievements.

These men are Dr. Henry L. Bolley, now retired, who rescued the flax crop of the world from deadly wilt; and Dr. Lawrence R. Waldron, plant breeder, who has developed strains of rust-resistant wheat which save North Dakota farmers at least 20 million dollars annually. When I visited Dr. Waldron in his office at the Agricultural College Experiment



▲ Geese Darken the Sky over a Cornfield Near Oakes

On a great central flyway, North Dakota entertains myriad game birds fall and spring (page 289). Little of the corn grown in the State is picked; it is "hogged down" in the field.

After this flock of about 40,000 Canadian bonkers and snow geese had winged away, not a kernel remained on the ears overlooked by the stock which had fed here.

◀ Fargo's Broadway: Throbbing Heart of a Farm Empire

Though the North Dakota metropolis has less than 40,000 population, it does business comparable to that of many cities 10 times its size.

Two transcontinental railroads, the Great Northern and the Northern Pacific, pass through here. The latter, which came in 1872, was first to reach the State. Through efforts of its builders the earliest immigration of settlers was brought about, and the famous "bonanza farms" were established (page 305).





When Boreas Blows, Snowplows Struggle Through Limitless Fields of Drifting White

Clearing the railroad tracks after a North Dakota blizzard taxes the best modern equipment. Winds have clean sweep across the incredibly level country. In early days winter travel was perilous here, and many persons lost their lives in storms (page 305).

Station, he was working on crosses to combat a new rust which threatens calamity to even his highly resistant Mida and Rival wheat (page 297).

When Dr. Bolley began work on flax, a devastating wilt was ruining crops everywhere. He began planting seed from all over the world in an experimental plot at the college which some of his colleagues scornfully dubbed "Bolley's Folly." In the soil of that plot were spores of all the diseases known to flax. Dr. Bolley reasoned that if he could develop a strain that would grow in such soil, he could solve the flax problem.

After exhaustive research and endless cross-

ings of plants, he discovered the fungus parasite that caused the fatal wilt. He then produced wilt-resistant varieties that defied the infected soil of Bolley's Folly and saved the crop.

In his greenhouse at the Experiment Station Dr. Waldron makes crossings of hundreds of varieties of wheat. He removes the stamens from a plant of one kind and carefully fertilizes it with pollen of another. Usually one of the wheats used in the cross is a popular heavy-yield type, the other a kind found to be impervious to rust and smut. Seeds from scores of the crossed plants are placed carefully in separate pots. When the plants ma-



Where Once Only Dust Storms Throve, Herds of Whitefaces Grow Fat

Thousands of acres of light, sandy soil in southeastern North Dakota, taken out of cultivation in the 1930's by the Federal Government to prevent wind erosion, are now covered with grass excellent for stock raising. The cattle business has salvaged this formerly unproductive area on the edge of the lush Red River Valley.

ture, the wheat each yields is planted and grown in the greenhouse.

In 16-foot rows the new varieties are planted in an Experiment Station plot which has produced crops for 60 years without being fertilized. The crop is harvested at the end of the season and tested for disease resistance, acre yield, protein content, and bushel weight. Kinds obviously unsatisfactory are discarded, and the few remaining are tested for bread-making qualities.

Thus Dr. Waldron has developed his wonderful Mida wheat and other strains now in general use. Seven out of ten farmers in North Dakota plant one of Dr. Waldron's

varieties of wheat. He has raised the average acre yield by three bushels.

When I told him President Hultz had estimated his value to the State at 20 to 25 million dollars a year, he modestly replied, "That's a bit exaggerated, I'm afraid. I still have this new B 15 rust to lick."

Few sights can be more beautiful than a vast field of flax in bloom, its exquisite blue sweeping to the horizon; or than an ocean expanse of golden wheat rippling in the breeze. North Dakota farmers have Dr. Bolley and Dr. Waldron to thank for their magnificent crops of these grains.

At Grand Forks, second city in North

Dakota, is the State University, where the new lignite research laboratory of the U. S. Bureau of Mines is finding hitherto unsuspected uses for the State's tremendous supply of 600 billion tons of lignite coal. Alex C. Burr is in charge of the laboratory and the pilot plant where 400,000 cubic feet of heating gas has been made in a day from the low-grade fuel. The gas from the plant may soon supply needs of the University and the city of 26,617.

"We have found out a few of the many ways to use lignite," Mr. Burr said. "When it comes out of the ground, it is 30 to 40 percent water; consequently, to ship it far from the mines is not economical. By intense heat from furnaces we can drive off the water, then ship the coal to plants where further treatment reduces it to liquid fuel and heating gas.

"There is enough lignite in North Dakota to keep the entire United States in abundant fuel for generations. Just now the cost of producing gasoline and gas from raw lignite is high, but eventually petroleum from oil wells will become more expensive and the processing of lignite cheaper; then our product will be in high demand.

"Lignite in char form may be used to reduce low-grade iron ore, sufficiently freeing it from impurities to make mining profitable. From lignite also we are already obtaining considerable quantities of creosote. The uses of this newly tested natural resource are numerous."

Like the State Agricultural College at Fargo, the University labors constantly to improve North Dakota. It is the home of the State Medical Center, supported by a one-mill tax levy and created to improve medical services and to educate doctors, nurses, and technicians.

Founded in 1883, as the University of Dakota Territory, the University opened its doors less than 10 years after the Battle of the Little Bighorn. North Dakota did not become a State until 1889.

Cream of Wheat Started in Grand Forks

President John C. West proudly directed my attention to the fine new buildings going up on the campus. The school is growing rapidly and now has an enrollment of about 3,000 students.

Grand Forks has considerable industry: flour mills, a packing plant, a large potato-flour factory; across the river, in East Grand Forks, Minnesota, is a beet-sugar refinery. In the surrounding country diversified farming is the watchword. I was interested to learn that Cream of Wheat was manufactured first in Grand Forks before the company moved to Minneapolis.

Bill and I talked to several of the leading farmers at a potato growers' meeting. John

Scott, who farms 4,500 acres, told us he plants about 600 acres to potatoes, half that area to beets, and the rest to wheat, flax, rye, barley, and alfalfa. He rotates his crops and occasionally summer-fallows a part of his land.

Agriculture in the Red River Valley is more highly mechanized than in any other area I have visited. Machines plant beets and potatoes, weed the fields, and dig the crops. Machines handle the wheat and other grain from seedtime to harvest, the combines reaping and threshing as they sweep across the fields.

Bill showed me color motion pictures he had taken of agricultural processes in all seasons throughout the State. One reel featured airplane spraying of crops to kill weeds. I watched the plane flying low over a field depositing 2-4 D on spring wheat. A later part of the film revealed the same field several weeks later. The grain appeared green and weedless save for a 15-foot strip of bright-yellow mustard across the center. Evidently the pilot had misjudged his flight and missed that strip with his weed killer.

"Grasshoppers were terrible before we began spraying them from planes," Bill declared. "They would descend on a section of growing wheat in the morning and by sunset there wouldn't be a spear of green left. They wouldn't eat poisoned bran spread on the ground.

"But now we spray or dust the growing wheat with poison that really kills them. They are turned from a deadly menace into a fairly useful fertilizer."

Some of the motion pictures showed ingenious machines in action. In one sequence a wheat farmer was pulling with a tractor a seeder consisting of three 14-foot units hitched together. He was seeding a strip 42 feet wide each time he crossed the field—160 acres easily in a day.

"That kind of speed saved crops in 1950," Bill told me. "Spring was so late that it looked as if we'd never get the wheat in in time to mature before frost. Luckily, we had a mild October, and by working combines from early morning till long after dark, we got in the third-biggest crop in the history of the State."

If a farmer cannot find a machine to do the sort of work he wants, he devises something for his purpose. Some farms in the Red River Valley are so flat that it is difficult to run irrigation water across them. Often shallow swales in the fields become mudholes. By the use of terrace plows, ranchers fill the swales and dig sloping ditches which readily carry the flow of water.

The average farm in North Dakota has approximately 600 acres; the average for the



Teddy Roosevelt Learned to Live the "Strenuous Life" in This Cabin

Now set permanently on the State Capitol grounds in Bismarck, the log house serves as a museum of relics of the Roughrider President, who ran cattle in North Dakota from 1883 to 1887. Personal belongings, including the desk from T.R.'s Medora ranch house, attract visitors here. The building was exhibited at both the St. Louis World's Fair and the Lewis and Clark Exposition in Portland, Oregon.

whole United States is about 200. Of late years there has been a trend toward increase in size of Dakota farms, and some ranches are 10,000 acres or more in extent. Naturally, such large holdings are worked best by machinery. The coming of irrigation will bring more intensified agriculture and tend to reduce the size of individual farms.

In the early days of land settlement in North Dakota, when the Northern Pacific was encouraging homesteaders, enormous "bonanza" farms were owned by eastern capitalists, who hired managers to operate them. These ranches ranged from 3,000 acres to 65,000 in the famous Grandin farm.

The slogan of that time was "30 bushels of wheat to the acre, and a dollar a bushel." Because of careless use of the land and periods of drought, the wheat yields became lower, and eventually the bonanza farms were broken up into smaller units and sold.

A Girl Who Gave Her Life for Others

Nowadays most main paved highways are kept open during the winter, but 30 years ago roads were often impassable. One dark winter

afternoon in 1920, 16-year-old Hazel Miner started to drive her younger brother and sister home from school. She lost her way in snow driven by a 60-mile wind. The sled tipped over, and the horse broke from it.

The girl covered the younger children with every robe she could find in the overturned sleigh and finally lay over them to protect them. The next morning Hazel was found frozen to death, her brother and sister unharmed. At the courthouse in Center stands a granite monument to the young heroine.

The North Dakota countryside burgeons with wildflowers in spring and summer. First to appear are the delicate pasqueflowers, which come up amid drifts of melting snow. Later come the wild rose, the State flower, and a galaxy of other blooms (page 319), to vie with the blue of flax fields and the green of wheat.

A visitor from the East reported standing in 1864 on the plain where Fargo is now located and looking across the land dappled with blossoms. "It's a beautiful land," he wrote, "but I doubt that human beings will ever live here."

Strangely, farmers from wooded areas

looked askance in the early days at treeless country. They felt that ground from which forests had been cut was far richer.

One evening Bill took me with him to a Community Club meeting in the little village of Chaffee, where he lectured and showed his motion pictures of the North Dakota water program. Interested in irrigation, farmers had come from miles around to attend the meeting.

Everywhere in the State, folk are eager to learn new methods of agriculture.

North Dakotans Ready to Take Chances

"They are the greatest people I ever saw for taking a chance," Bill told me. "Whenever a fresh idea comes out on how to improve crops, they will try it whatever the cost."

We went from Fargo to Wahpeton one afternoon through a country of perfectly kept farms. Here is a rich dairying and livestock-growing section where purebred cattle are a specialty (page 303).

In Wahpeton is one of the unusual industries of the State, a pottery plant. It was established a few years ago by Laura Taylor, who had studied ceramics at the University of North Dakota. Robert Hughes, a successful printer, who later became her husband, backed the enterprise.

Mrs. Hughes was molding ash trays decorated with dog heads copied from the NATIONAL GEOGRAPHIC MAGAZINE (page 307).

Clay handled in the plant comes from enormous beds near Mandan. At first it was used without addition of other substances, but now a little feldspar from South Dakota is mixed with it. Rosemeade glazed pottery is shipped all over the world. Because the designs feature birds and animals, it has become a favorite with collectors.

As a gift to his city, Mr. Hughes has created a recreation park in a once unsightly river-side flood area. Wahpeton is the seat of the State Science School, where students are given vocational training.

The unpredictable North Dakota climate produced a snowstorm on a Saturday late in April, but the following Monday when Bill and I drove to Valley City and Jamestown the snow had disappeared. This flareback of winter was delaying the seeding, and the only traces of green we saw were a few fields of winter rye. Ordinarily, wheat is all sowed before the first of May.

At Valley City we drove past the trim campus of Valley City State Teachers College and dropped in at an unusual clothing store. This store, though located in a country town of less than 7,000 population, carries a stock of men's wear fully as varied and up-to-date as that of the best eastern shops.

"People here want the best money can buy," the proprietor explained, "and they have the cash to pay for it. Probably this store looks too elegant for a small city, but it is a profitable venture."

I had noticed an unusual number of expensive automobiles on the highways everywhere in the State. Gross farm income of North Dakota in 1950 was nearly \$610,000,000.

At Jamestown is the only independent college in North Dakota. Jamestown College, an endowed school under the sponsorship of the Presbyterian Church, is nationally known for its low fees. Here a student can work toward a bachelor's degree in liberal arts or toward a registered nurse's certificate for less than \$700 a year, all expenses included—tuition, books, room and board. The college is fully accredited. On the campus this spring were about 300 students.

The college, started in 1883, was the first institution of higher learning in what is now North Dakota. In the beginning it had only one building, on a hill overlooking the frontier settlement of Jamestown.

The panic of 1893 forced it to close its doors, and the lone edifice stood deserted until 1909. That year Barend Kroeze, a young college president from Washington State, saw the neglected building and determined to resurrect the college. He resigned his position and took the presidency of the moribund school.

When Dr. Kroeze retired from the presidency of Jamestown in 1946, the college had 11 modern buildings on its fine campus and an endowment sufficient to permit the enrollment of students at fees for all expenses half those of many schools of equal rank.

The southern part of James River Valley is one of the richest farming areas in North Dakota, second only to Red River Valley in fertility. With completion of the water program, it will be under irrigation.

It is a veritable mecca for wild fowl. Every autumn sportsmen come here from all over the country for pheasant shooting. Until recently hunters were permitted to carry large bags of game out of the State, but laws in force now have put an end to this privilege, which would soon have decimated the birds.

A Virile Land Finds Its Power

The future of North Dakota holds amazing promise. Awakening to a realization of its resources, the virile young State is building its power. It does not forget the tribulations of the past, but profits from bitter experiences. No longer will it be known as a land of blizzards and dust storms.

It looks back proudly upon its victory over handicaps. Truly it is coming into its own.



Laura Taylor Hughes Copies NATIONAL GEOGRAPHIC Dogs in Rosemeade Pottery

After studying ceramics at the State University, she set up a modern plant at Wahpeton in partnership with her husband. Glazed ware, adorned with animal and bird figures, is made of clay from beds near Mandan.



When Gen. Alfred Sully Crossed These North Dakota Badlands in the Sixties, He Called Them "Hell with the Fires Out"

His description was wrong in part, however, for several beds of lignite still burn near Theodore Roosevelt National Memorial Park on the Little Missouri River (page 118). Here erosion has carved fantastic buttes striped with red scoria, and many-colored clay outcrops. Medora youngsters ride where Teddy ranches in the eighties.

A Beauty from Elbowoods Reigns at the State Rodeo

Riding her well-schooled buckskin pony, Audrey Hall, who has Indian blood, captured top honors in the roping and riding festival at Beulah. Then she went on to win 1950's all-around State competition at Dickinson.

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"Have Some!" Says the Blond Queen of Macaroni Day

Mrs. James Gibbens, a Canado farm wife, was named fairest contender at the annual "Golden Triangle" festival, held at Devils Lake. The 15-county region grows durum wheat, source of flour for macaroni and spaghetti.

Photograph by E. Hector Roberts







The Old West Still Lives Along the Winding Stream That Flows Through the Badlands

Part of the day's work is this cattle drive. There is an abundance of wild grass. Bison herds, long since killed off by fur and meat hunters, roamed the country in the seventies.

Rancher, Blacksmith, Artist,
Einar Olstad Paints
Old West Scenes

He fashioned wrought-iron plaques of Theodore Roosevelt riding a bucking bronco which are mounted at the gates of Theodore Roosevelt National Memorial Park, in western North Dakota.

Like Charles Russell, the Montana painter whose *Waiting for the Chitook* made him famous, Olstad confines his work to picturing the wild West that still lingers in the untrammeled country around his isolated homestead in the Badlands. His purpose is to put on canvas realistic records of cowboy days.

Early in the 19th century John James Audubon and the Swiss artist Carl Bodmer visited the Dakotas and made paintings of birds and other wildlife. The big game is virtually gone now save for deer and a few antelope in the southwestern part of the Badlands.

Roosevelt Park may get a small herd of bison from Yellowstone. Every effort is being made to restore the preserve to its appearance in the days before Custer rode out from Fort Abraham Lincoln near Bismarck to his rendezvous with death at the Battle of the Little Bighorn.

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Recreation by L. Boyar Roberts



Dickinson Youngsters Cavort in a Shop Selling Cowboy Gear

Although North Dakota has become almost entirely a farming country, there is still enough cattle ranching in the western part of the State to provide a market for saddles, bridles, boots, chaps, lassoes, and ten-gallon hats.

The broncobuster who fancies special equipment can have it hand-made to his order in this shop.

Much elaborate gear is sold to summer "cowboys" from the East who vacation on dude ranches. Several of these are near Dickinson.

The town held its first Fourth of July celebration in 1886, with "the Hon. Theodore Roosevelt of Medora" making the chief address. Then cattle raising was in its heyday.

Now wheat farming and the production of lignite briquettes are the main sources of income for a population of about 7,500.

Here are the Dickinson State Normal School and a State Agricultural Experiment Station.

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Reproduced by J. Archer Roberts





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Reproduction by J. Boyar Roberts

Indian Signs and Nature's Sculpture Enthrall North Dakota Hikers

▲ Centuries of wind, rain, and snow have carved sandstone into fantastic shapes in the south unit of Theodore Roosevelt National Memorial Park, near Medora.

◀ Near Grenora, these girls inspect the mysterious Indian "Writing Rock." Carvings on the 10-ton boulder are believed to be the work of a people long preceding the earliest known tribesmen of North Dakota. According to legend, the symbols and pictures formerly changed to foretell coming events for medicine men, but have remained static since white men moved the stone many years ago.

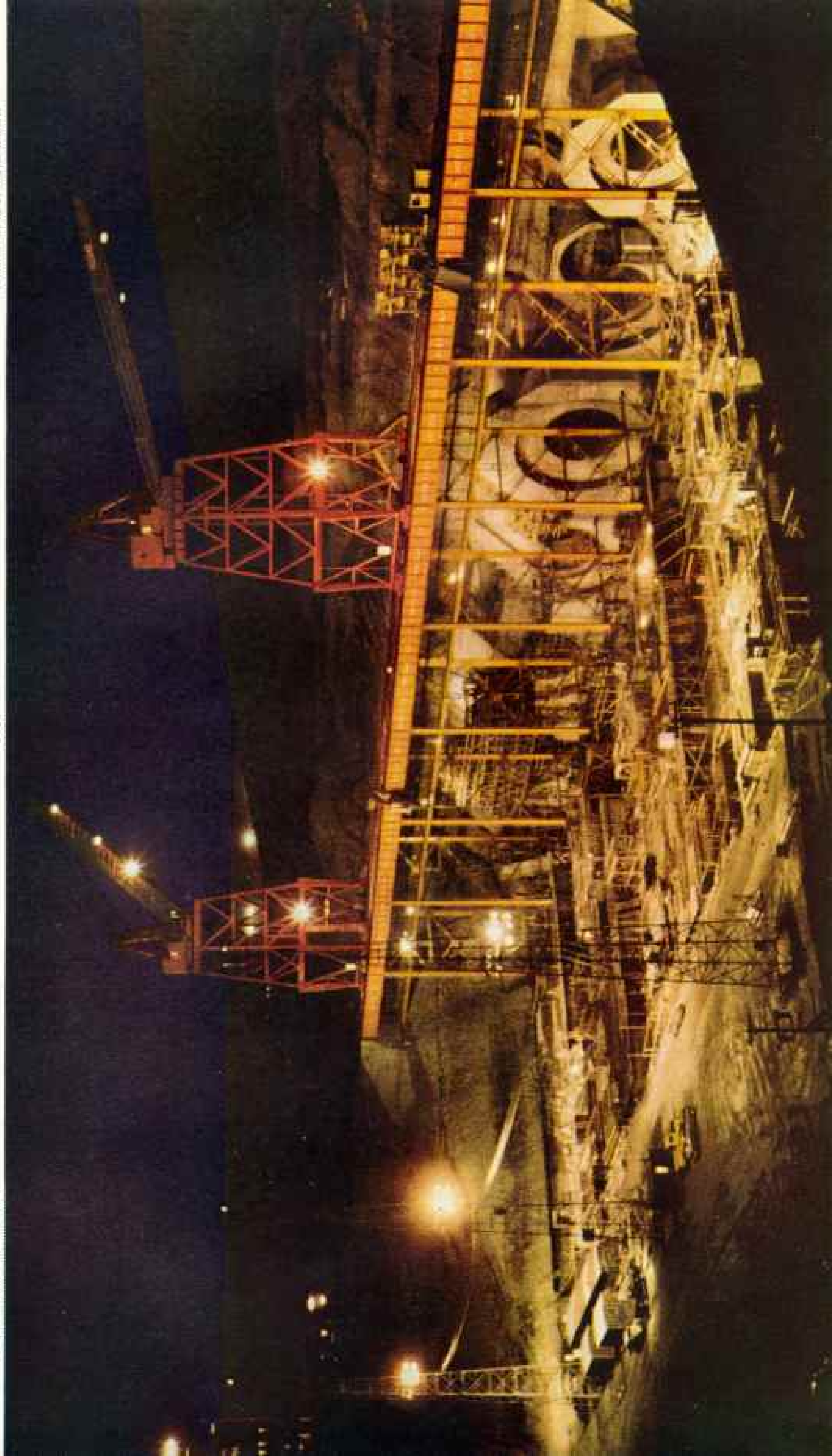
Garrison Dam, World's Largest Rolled Earth-fill Embankment, Will Divert the Missouri Through Eight Power and Control Tunnels

More than two miles long, the barrier will rise 210 feet above the stream bed. To build it, sheep-foot rollers packed layers of dry earth into tight compactness. From five giant power units an estimated total of 400,000 kilowatts is expected. The structure, impounding floodwaters from nearly 200,000 square miles of the river basin, will irrigate about 1,000,000 acres.

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Illustration by J. Bayler Roberts





Near Bismarck a Blockhouse of Old Fort McKeen Has Been Restored as It Was in the Indian-fighting Seventies

Overhanging top was built to shelter riflemen repelling attackers. When it was found that the Sioux fought running battles and had to be driven off by sorties, straight stockade walls replaced these structures. Near here Carter bivouacked with his 7th Cavalry. His wife rode daily out to see him off for the Little Bighorn.

North Dakota Indians
Wear Tribal Finery
Only to "Dress Up"

← No longer are these wards of the Federal Government idle dependents on bounty. Most of them live in snug frame bungalows and make a good livelihood by farming and cattle raising. Many operate latest-model tractors.

On Fort Berthold Reservation, Madreth Baker and Teddy Haven pose in full regalia with their grandmother, Mrs. Edna Atkins, at the door of her old-time log and mud house. Mandans built this type of dwelling on their farms before the coming of white men.

→ Talking to the farm management supervisor from the Indian agency, Clyde Baker (right), an ex-Marine, tells how he will winter-feed his stock with the millet hay he has just mowed and stacked. He farms about 100 acres.

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Reproduced by J. Taylor Roberts





Roaring Underground, Unquenchable Flames Slowly Consume a Vein of Lignite Coal in the Badlands near Amidon

The eternal fire has advanced only a few hundred feet in the last 50 years. How long it raged before white men saw it nobody knows, but old Indian legends tell of the burning ground. Russell Reid, State Museum superintendent, says he has cooked steaks over open crevices. One wide gap reveals a fiery pit (inset).



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Summer Prairies Burgeon with Bloom. A Grand Forks Girl Displays the Wild Rose, North Dakota State Flower

A close-up (upper center) reveals the rose's delicate beauty. Three varieties, from one to five feet high, brighten roadsides in June. The common sunflower (upper left) becomes a noxious weed in grainfields. One giant variety is cultivated for its seeds, which yield cooking oil. Near Langdon grow the gaillardia (lower left center), often cultivated in gardens, and the gay biennial fleabane (lower center) waits forth its fragrance in July and August.

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Photographs by J. Harlan Roberts





Making a Ton of Alfalfa Meal an Hour, This Dehydrating Plant near Minot Works Around the Clock in Hay Time

Clover mown from a 2,560-acre tract of subirrigated land is pushed to the furnaces by truck, dried, ground, and packed in 100-pound bags for shipment. Rich in vitamins, it is used in mixed stock feed. The venture, started in a small way, has become an important industry.

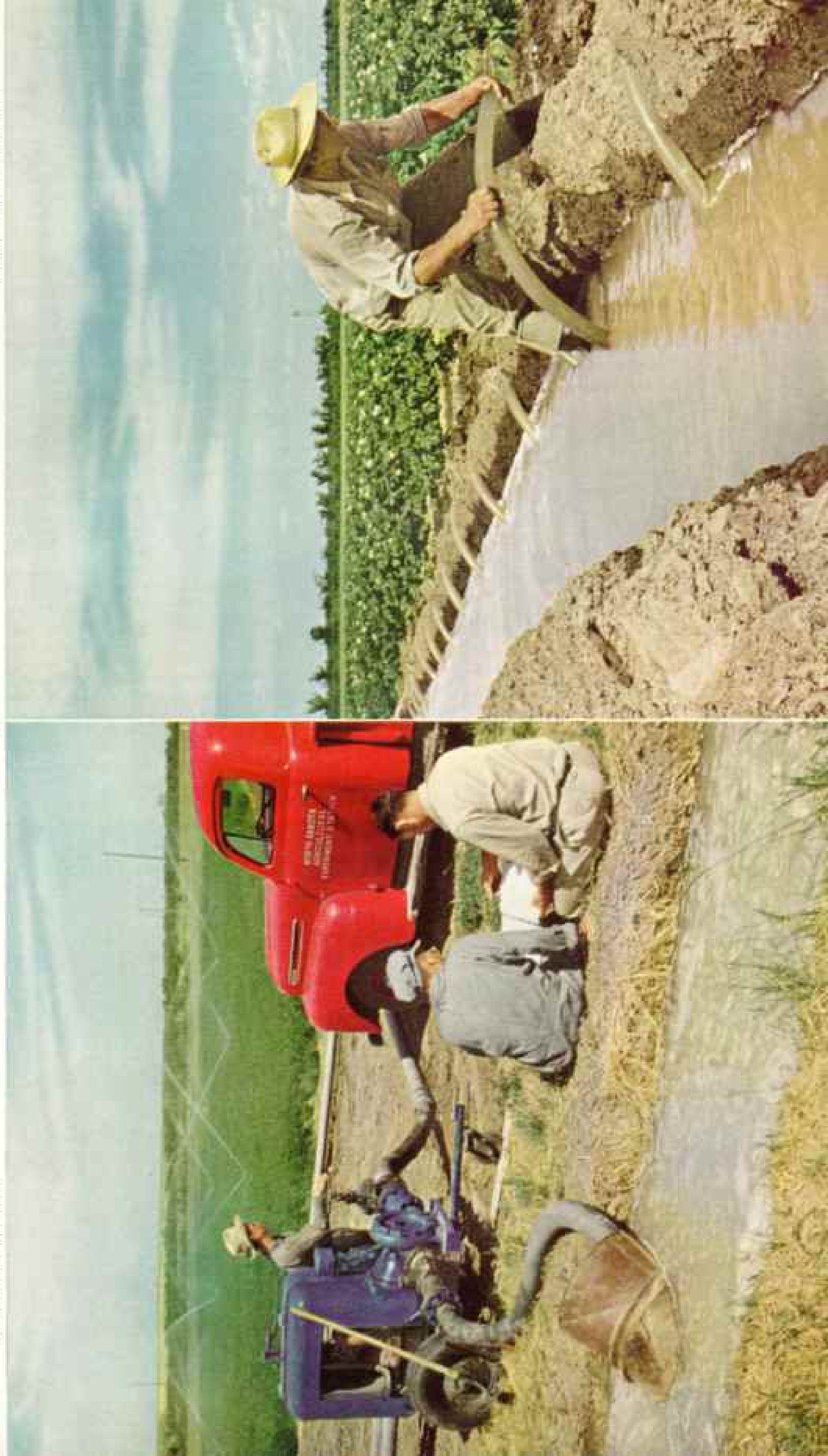
Abundant Water Means Bumper Crops, New Irrigation Methods Let North Dakota Vegetables Drink Their Fill

The sprinkler system (left) pumps water into long series of portable aluminum tubes fitted at 40-foot intervals with spray nozzles. These throw water on the land at the rate of an inch an hour. By another method, siphoned water flows through plastic tubes. Both practices are demonstrated at the North Dakota Agricultural College Experiment Station, Williston. Here day-long watering in full sunlight does not wilt vegetation.

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Reproduction by J. Hooper Roberts





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Reharmans for J. Harlow Roberts

♣ **Two Medora Old-timers Tell Tall Tales of "Neighbor Teddy"**

T. F. Roberts, 91, and Ben Bird, 85, often worked with the Roughrider when he ranched in the Badlands. In his youth Mr. Bird made five drives of cattle and horses up the northern trail from Texas.

♣ **University Rooters Show Off a Football Victory Token**

Annually the "Nodak Tribesmen" play State Agricultural College "Bisons" for the buffalo nickel. Grand Forks students display the Indian head. If their rivals win, the bison is to the fore.



The Society's New Map of Central Europe

FRONT line in the cold war—the frontier where the West confronts the East—is delineated on the National Geographic Society's new large-scale Map of Central Europe, including the Balkan States.*

More than two million copies of the new chart have rolled from the presses to go to member-families of the National Geographic Society, who receive it as a supplement to this issue of their NATIONAL GEOGRAPHIC MAGAZINE.

Sweeping postwar changes are reflected. Many boundaries have been redrawn. Cities and towns by the hundreds appear with strange names as the result of wholesale official changes.

Area Equals Third of U. S.

In land area the 29-x-38½-inch chart maps a total of 1,038,000 square miles, roughly equivalent to one-third of the continental United States. But this land of mid-Europe supports an estimated population of 231,000,000—a good 50 percent more than the 1950 census figures for the United States.

The new map is the second in a series designed to present the Continent in great detail. The first, issued in December, 1950, was devoted to Western Europe. The third will comprise Scandinavia, the Baltic, and the northwestern section of Soviet Russia. When the three sheets are matched, they will provide a European map about 4½ feet wide and more than 5 feet high.

A companion index, listing the 10,378 place names on the new map and facilitating quick location of both the better and lesser known communities, will soon be available.

The number of place names is the largest ever to appear on an overseas-area map issued by the National Geographic Society. The Central Europe total is eclipsed only by the 11,025 place names on the new Map of the United States distributed three months ago, and by the 10,437 on the sectional Map of the Northeastern United States issued with the September, 1945, NATIONAL GEOGRAPHIC MAGAZINE.

The Iron Curtain line, twisting some 2,000 miles from the Baltic to the Turkish-Bulgarian frontier on the Black Sea, divides the Central Europe map. Behind this line lie Lithuania, seized by the U.S.S.R.; the five Red satellite nations of Poland, Czechoslovakia, Hungary, Romania, and Bulgaria; and the Soviet occupation areas in Germany and Austria. Western Russia is covered to a line slightly east of Smolensk and Odessa.

West of the Iron Curtain lie the Allied occupation zones of West Germany and Austria,

Italy, Communist but anti-Kremlin Yugoslavia, Greece, and the Turkish Straits region. In the beyond-the-Curtain area, Albania stands isolated, keeping the Soviet bloc's watch on the Adriatic.

New Names for Old, Wholesale

The epidemic of name changing that has been sweeping Central Europe, particularly its eastern half, since World War II posed a major problem for The Society's cartographers. Painstaking research was required to record correctly more than 900 new place names, which have been paired with their old designations in parentheses to aid in identification.

In that part of old Poland which was acquired by Russia, and in seized Lithuania, names have been Russianized and appear on Russian maps in the Cyrillic alphabet. To transliterate, or spell these names correctly in Latin characters, was a difficult task.

Other places have received entirely new names. The satellite nations behind the Curtain also have indulged in the practice.

Ever since the name switching began, The Society has had a steady flow of inquiries from persons seeking information on the correct name for a village, town, or city within the Soviet orbit in order to communicate with relatives, locate birth data, or for other reasons.

Mail addressed to old names frequently comes back marked "No such place." Information contained on the map also is valuable to students of current events, historians, and many others. Older maps or atlases are hopelessly outdated.

Braşov in Romania now is called Oraşul Stalin (City of Stalin), and Bulgaria has renamed its port of Varna, on the Black Sea, for the Kremlin chief.

As a taunt, Yugoslavia has changed the name of the border station of Caribrod, on the Bulgarian border, to Dimitrovgrad, honoring the former Bulgarian Communist leader, Georgi Dimitrov, who went to Moscow for his health, according to official announcement, and did not live to return.

Luck has not vanished entirely from Central Europe. It still appears, but in parentheses. The Polish community that once bore the happy name of Luck is in an area taken over

* Members may obtain additional copies of the new Map of Central Europe (and of all standard maps published by The Society) by writing to the National Geographic Society, Washington 6, D. C. Prices in United States and Possessions, 50¢ each on paper; \$1 on linen; Index, 25¢. Elsewhere, 75¢ on paper; \$1.25 on linen; Index, 50¢. All remittances payable in U. S. funds. Postpaid.

by the Soviet, so now it is officially called Lutsk.

Boundaries, for the most part, are officially recognized internationally. Polish and Russian frontiers are represented on the basis of treaties and claims existing as of July 1, 1951.

Recognition of some of these claims awaits Four Power agreement on a peace treaty for Germany, a prospect still remote more than six years after V-E Day.

The United States has consistently refused to recognize the legality of the "admission" of Lithuania to the family of Soviet Socialist Republics, as well as the like fate of its neighbors, Latvia and Estonia, not shown on the map.

Central Europe also has shadowy unofficial boundaries. For example, the "green frontier" is a shifting stretch along the heavily patrolled edge of the Communist sphere, across which fugitives from the Soviet frequently flee. Asked how they escaped from behind the Iron Curtain, they reply that they have arrived in the West "via the green frontier."

Reds Carved Slice from Poland

The biggest slice of land taken by the U.S.S.R. as a result of World War II was the 69,866 square miles it carved from eastern Poland. Another 19,725 square miles was annexed from Romania. Czechoslovakia's assessment was 4,921 square miles; Germany's, 4,940 square miles of East Prussia. The absorption of Lithuania added an additional 21,500 square miles.

Poland acquired 38,232 square miles of eastern Germany and southern East Prussia (by way of compensation for territory lost to Russia), plus the Free City of Danzig, representing 754 square miles.

Romania had to give up the 2,925 square miles of southern Dobruja to Bulgaria; Hungary yielded to Czechoslovakia the Bratislava bridgehead, an area of 25 square miles south-east of Austria's Vienna.

Albania picked up a highly strategic two-square-mile piece of real estate from Italy—the island of Sazan (Saseno). Here, under Soviet supervision, a major submarine base is reported being pushed energetically toward completion.

Within the Soviet bloc, further readjustments of present frontiers may continue for some time to come. Best indication of this is the recent deal whereby Poland traded agricultural land on its eastern border, just across from the Lvov-Kovel area, in exchange for Soviet oil-bearing territory west of Drogobych. As a result, the important Lvov-Kovel rail line no longer passes through a jutting spur of Polish territory.

Searchers will scan the new chart in vain for St. Joachimsthal (St. Joachim's Dale), the name that has identified a historic Bohemian mining town on maps for centuries. At St. Joachimsthal in 1516 an extremely rich silver mine was discovered. The feudal lord of the area had many coins minted from the silver. The first struck were dated 1518, and, since they bore a likeness of St. Joachim, people referred to them as *Joachimsthaler*. Before long the Joachimsthaler became *thaler*, with such variant forms as *daler*, *dalar*, and others.

When England learned of the new coin circulating in Central Europe, the first mention of it in English was "dollar."

Czechoslovakia has renamed St. Joachimsthal. It appears on our map as Jachymov, and its mines are the major known supplier of uranium for Russia's A-bomb program.

The Soviets are reported working other uranium mines in the Thuringia-Harz Mountain areas of East Germany, and a new field is reported under exploitation near Kowary in Poland's Lower Silesia. But none of these compares with Jachymov's deposits of high-grade pitchblende (uranium ore), which are the most extensive in Europe and among the largest discovered to date in the entire world.

Ironically, the Joachim in whose honor the mining village originally received its name was the father of the Virgin Mary, whose Son is known as the Prince of Peace.

Historic East-West Battleground

For thousands of years the area of this map has been a meeting place and battleground between East and West. The flat plains of Poland and the land bridge of the Balkan Peninsula provide natural throughways over which invading hordes have spilled out from the Asian land mass into Europe, or European conquerors have tried their luck against the vastness of Asia.

Like the new Map of Western Europe, the new chart is drawn on a scale of 1:2,500,000, or 39.46 miles to the inch, and was made on the same Albers Conical Equal-Area projection.

One inch on the map represents a ground distance that would be covered by a one-hour automobile drive at 40-mile speed. In this space four to six towns are named, so that a traveler using the chart will find a complete coverage of all cities and towns of importance, together with a clear picture of their transportation facilities.

Extensive road and railway changes which mark postwar reconstruction programs are shown. Road networks appear in red, rail lines in black. Red stars designate major airfields.

How Fruit Came to America

By J. R. MAGNESS

Director of Horticultural Research, United States Department of Agriculture

With 24 Paintings by Else Bostelmann

"JOHNNY," says the lady of the house, "here's a dollar. Run buy me a can of fruit salad, and bring me the change."

Johnny knows where to go—the grocery store around the corner. It doesn't occur to him to ask where the grocer gets fruit salad. But if it should, the grocer, too, would know the answer—from the wholesaler, who, of course, buys it (at a discount) from the packer. Obviously, it's a simple matter to trace a fruit salad back to its source.

Or is it?

Where did the packer get it? Here the story becomes complicated. Suppose the canned salad contains just a handful of the commonest fruits: part of a pear, a few grapes, half a dozen sweet cherries, a piece of pineapple, and a few slices of peach. At home, Johnny's mother may garnish these with a little fresh apple, grapefruit, or orange.

To track just these few to the places where they are grown today would take much travel. The apple is likely to have come from Virginia, New York, Washington State, or perhaps from the Midwest, near the Great Lakes; the cherries are probably from Oregon or Washington; the grapefruit and orange from Florida or California; the peach, pear, and grapes from the Pacific coastal area; and the pineapple all the way from Hawaii.*

Most Fruits Are Newcomers

But that is still only half the story. Peaches didn't always grow in California, nor apples in Washington. In fact, 500 years ago—before the first white settlers came—only the grape of all these common fruits had ever been seen or heard of in what is now the United States.

The rest got here only after toilsome journeys lasting tens of centuries and starting in the farthest parts of the world. Peaches and oranges came to us from China; it took them about 4,000 years, perhaps longer, to finish the trip (pages 334 and 352). Apples, pears, and sweet cherries first appeared in the fertile, temperate, hilly land around the Black and Caspian Seas (pages 330, 332, 343, and 345); ancient civilizations there and in Europe knew and ate them centuries before Columbus, or anyone else, thought of sailing west to get to India.

Grapefruit? Five centuries ago there weren't any. There was, growing in the East Indies, a big, tough fruit, the shaddock.

Eventually—sometime in the 1600's—it was to make a long voyage in a trading ship bound for the West Indies. There, by one of those strange tricks of Nature we call mutations, it would turn into a fruit like the one in our salad bowl (page 354).

Pineapples started in the Western Hemisphere;† Columbus found them growing in the West Indies. But even this fruit had moved halfway across the Pacific before it was sent to our fruit salad packer (page 365).

The fruits we grow in America, in other words, didn't just spring up here naturally. They had to travel to get here, which, of course, is also natural, since Nature designed fruit especially to travel.

Why You Should Not Eat the Apple Core

A man, going for a walk, plucks an apple from a tree, munches it as he walks, and then throws away the core. From the man's point of view, eating the meat on the apple is the important part of this operation. To the tree, however, the important parts are that he walked, and that he threw away the core.

In the struggle for survival, plants, like animals, have worked out tricks and devices to spread their seed. Or, putting it backward (but more accurately), those plants on which no such device evolved were very likely to die out. Some developed seed pods which open explosively, scattering seeds for yards around. Others, like the dandelion, grew seeds on tiny parachutes which float in the wind; still others evolved seeds which can survive long, wet trips in ocean currents.

On fruit plants, however, a different method of propagation evolved. Their seeds were covered with a layer of pulp or flesh which attracted animals and men because it was nourishing or had a pleasant flavor. Often, too, the skin covering the pulp was bright-colored and attractive.

It is no accident that berries and cherries have been among the most widely distributed plants since prehistoric times. Their fruit was especially suited to birds, which could carry the seed farthest and fastest.

At first, men, like the other animals, simply picked and ate the wild fruit, propagating it

* See "Because It Ruins on Hawaii," by Frederick Simpich, Jr., NATIONAL GEOGRAPHIC MAGAZINE, November, 1949.

† See "Puya, the Pineapple's Andean Ancestor," by Mulford B. Foster, NATIONAL GEOGRAPHIC MAGAZINE, October, 1950.



Two Young Fruit Merchants Test Their Grapes on a Hungry Customer

This roadside stand near Spartanburg, South Carolina, typifies thousands that spring up every summer in fruit-growing areas. Often the proprietors are children; their wares, because they are tree-ripened, may be juicier and sweeter than fruit shipped to market. Though the soldier seems fonder of grapes, the peaches at his feet are a much more important crop in this part of the country. In the past decade South Carolina has edged up beside Georgia as one of the Nation's leading fresh peach producers, and a keen rivalry now spurs growers in both States. Crops in recent years have averaged about 5,000,000 bushels for each State. Their peaches are almost all freestones—the kind in which the pulp separates easily from the pit—and most are sold as fresh fruit. Elberta is the leading variety. Clingstone peaches, used mostly for canning, are largely grown in California.

accidentally.* As time went on, however, they learned to dig holes and plant the seeds instead of discarding them, and to keep weeds and other plants cleared away from the spot where the new fruit was to grow. This was the beginning of horticulture.

Primitive man quickly learned, too, to pick out the seeds of the best plants—those which bore most abundantly or produced food with the best flavor. This was scientific breeding in its earliest stages.

He found that with most of the plants we now classify as vegetables, this system worked fairly well. These are the crops that we plant anew each year from seed, and which generally mature in a single season. They come fairly true from seed; that is, the offspring of any plant usually resemble the parent.†

With fruits, however, this didn't work so well. One distinguishing feature of all the crops we commonly call fruits is that they grow on plants that live and produce for a number of years. Many of them, in fact, must grow for several years before they bear fruit at all. This makes seed selection a slow and tedious process. Also, most of them do not come true to seed.

These early horticulturists soon found out that seed of a superior fruit tree—a peach, an apple, a pear, or almost any other—might or might not produce trees as good as its parent. More often it did not. And so men worked out a third important step in the science of fruit growing, what is now known as "vegetative propagation."

This was based on the discovery, made long before there were any historians to record it, that it was possible to plant a branch rather than a seed from a fruit tree. Sometimes the branch, or cutting, could be set directly in the soil, where it sprouted new roots. More often it was "planted," or grafted, into the stem of another and similar tree, letting the already growing roots supply it with food from the soil. In other cases, "suckers" instead of cuttings were planted, or even sections of roots.

Millions of Bushels from One Tree

The important fact was that whenever a tree or bush was propagated in this way, the new plant produced fruit with exactly the same characteristics as the parent; it was, literally, a "chip off the old block."

Today virtually all of the cultivated fruit we eat is taken from plants propagated in this way. For example, one of our most popular apples, the Winesap, has spread across the country by means of twigs or shoots budded or grafted into seedling apples. These shoots all trace originally to a single tree discovered more than two centuries ago. Because this

one tree bore superior apples, it was transformed into thousands of trees which have produced millions of bushels of fruit (page 330).

If you eat grapes of a popular variety known as Thompson Seedless, you are eating fruit from a plant which first sprouted almost 1,000 years ago.

Naturally, the earliest selection and culture of fruit took place in areas where men first moved haltingly toward civilization. Thus it is not surprising that, of the cultivated fruits we know today, the largest number can be traced to two broad areas where the oldest civilizations grew up.

One includes the sections of southeastern Europe and southwestern Asia stretching from the eastern Mediterranean to the Caspian Sea. From here, in addition to apples, came pears, cherries, figs, olives, and most of our plums and grapes.

The other is the part of central and southern Asia that stretches from China through Burma and eastern India southeast into the Malay Archipelago. There, thousands of years before the Christian Era, men were eating and learning to cultivate peaches, apricots, bananas, mangoes, and, a little later, oranges and lemons.

"American" Varieties Grow Up

As men and civilization spread from these areas through Europe and eventually around the world, they took their improved fruits with them, either as seeds or plants. When America was settled, the choicest kinds of fruits from Europe were transplanted to our shores.‡ Even though the art of grafting was well known, and some grafted trees were brought over, most of the earliest plantings were seedlings. The Indians in many cases secured seed of the European fruits and planted them about their villages. Thus, along with the earliest white settlements, and progressing westward even in advance of the settlements, groves of fruit trees, mainly seedlings, became established.

These seedling trees were highly variable. Occasionally one would be found bearing unusually good fruit. As the country became settled, these superior trees were propagated, given local names, and more or less widely tested. Many of our present varieties began this way. Others have been brought in directly from older countries.

Not all the improvement and selection of varieties have been due to chance or to impor-

* See "American Berries of Hill, Dale, and Wayside," NATIONAL GEOGRAPHIC MAGAZINE, February, 1919.

† See "Our Vegetable Travelers," by Victor R. Boswell, NATIONAL GEOGRAPHIC MAGAZINE, August, 1949.

‡ See "The British Way," by Sir Evelyn Wrench, NATIONAL GEOGRAPHIC MAGAZINE, April, 1949.

tations. Beginning a little more than a century ago, an intense interest in fruit breeding developed in this country. Private individuals began to cross varieties, grow the resulting seed to fruiting, and evaluate the fruit they got. Greatest interest was displayed in grapes, strawberries, raspberries, and American plums, but all fruits received some attention. Many excellent varieties resulted from such efforts.

A little later, after the State agricultural experiment stations and the U. S. Department of Agriculture were organized, a number of such Government-supported stations began fruit-breeding work. This made possible the development of more extensive and longer-range work than could be conducted by private growers.

Today a more extensive program of fruit improvement than ever before is under way in this country. Using new techniques discovered by geneticists, breeders sometimes even alter hereditary characteristics of the plant cells themselves and produce hybrids of plants which could never have been crossed naturally.

In this way they work to combine qualities such as superior flavor, large size, and abundant production with others like resistance to disease, hardiness to cold, and late (or early) ripening. Production of just a few greatly improved varieties of berries, plums, apples, or grapefruit may pay the cost of research many times over.*

The War Against Pests

Unfortunately, as fruits and fruit plants moved from continent to continent, they did not always travel alone. With them, hidden in the fruits themselves or in the leaves, bark, or roots, sometimes rode insects or their eggs or larvae. Other stowaways were the fungi, bacteria, and viruses which cause plant diseases.†

Often, too, in the new land to which the fruit moved, new pests were waiting—pests to which they had developed no resistance. As transportation improved and commerce increased, it became less and less easy to keep these bugs and blights localized.

A good example is the phylloxera, or root louse, which feeds on the roots of native American grapes. Here it causes little damage; the American plants are largely resistant to it. Taken to Europe, however, probably on the roots of American vines, it threatened to wipe out Europe's great grape and wine industry. The European vines were saved only by grafting them on the roots of American grapes, a practice still followed today (page 345).

A more familiar example to most American gardeners is the Japanese beetle. About half

a century ago it was transported from Asia to the eastern United States. There, in the absence of natural enemies, it spread steadily. It still causes heavy damage to crops.

A virus disease of citrus, apparently carried in trees from Africa, has destroyed a large portion of the citrus orchards of South America. These must now be toilsomely replanted on rootstocks resistant to the disease. In recent decades strict regulations have been set up to control the spread of such diseases and pests to the United States.

Thus men, having undertaken the job of propagating and breeding fruit trees in order to harvest their food, have also been forced to take over a large part of the fight against their insect and disease enemies. The modern orchardist must know these pests—their life stories, how they pass the winter, when they invade the foliage and fruit.

He must know what materials to use and when to spray to control specific insects and blights. He uses mechanized equipment costing thousands of dollars to protect his trees. This includes power sprayers which can pump tens of gallons of liquid a minute over wide areas, and even planes and helicopters to fly low and dust treetops.

The cost of such equipment, combined with the superiority of the fruit it helps to produce, has tended more and more to concentrate fruit growing into large commercial enterprises, gradually squeezing out the small, local farm orchard and the back-yard grower.

With such heavy investments, commercial fruit growers can ill afford to lose a season's crop to frost, drought, heat, or humidity. Thus they confine their operations to areas where climate and water supply are dependable and best suited to the individual fruit.

This tendency to concentrate large orchards in fairly limited areas has led, in the past few decades, to another revolution in the fruit industry. It is mainly concerned with the problem of getting the fruit from the grower to the market.‡

To move fresh fruit to consumers while it is still fresh, there are now fast freight trains and vast fleets of refrigerated railroad cars and trucks.

Our can of fruit salad represents another solution. Largely in the last half-century, commercial fruit canning in the United States has grown to vast proportions. Americans

* See "Patent Plants—Enrich Our World," by Orville H. Kneeb, NATIONAL GEOGRAPHIC MAGAZINE, March, 1948.

† See "Our Insect Fifth Column," by Frederick G. Vosburgh, NATIONAL GEOGRAPHIC MAGAZINE, August, 1941.

‡ See "Revolution in Eating," by J. R. Hildebrand, NATIONAL GEOGRAPHIC MAGAZINE, March, 1942.



Shiny California Olives Ride Past Critical Eyes on Their Way to the Packer

These ripe appetizers, grown near Friant in the Central Valley, have been soaked and washed twice to remove bitter taste. Rubber-gloved girls in starched white spend the day at conveyor belts removing damaged fruit. Handwork adds to the price of the "fancy" olives that pass inspection.

now eat millions of pounds of canned fruit each day.

Even more startling has been the growth of the frozen-fruit industry. Quick-freezing of fresh fruit for home use began commercially about 25 years ago; most of the expansion has taken place in the past decade. Yet this year Americans will consume more than 500,000,000 pounds of frozen fruit. Frozen concentrated orange juice, developed almost entirely since World War II, already uses up almost one-fourth of our orange production (page 352).

So man spends millions of dollars and millions of hours of labor each year propagating and caring for his fruit trees and bushes, and picking, sorting, shipping, and preserving the fruit they bear. In return he gets a huge food crop which supplies him with a large part of the vitamins, minerals, and other nutrients he must eat to stay healthy.

Americans are lucky to have, within the borders of their country, a wide variety of

soils and climates suitable for growing fruit. Thus of the fruits whose pictures and histories are presented on the following pages, all but four are grown extensively in the United States.

The Pacific States particularly, with equable climates ranging from cool to subtropical, are ideal for orchards and vineyards and now produce about half the Nation's fruit.

This year, if you are a typical American, you will eat about 200 pounds of fresh, canned, dried, and frozen fruit—which makes you by far the biggest consumer in the civilized world.*

* For this article and the biographies which follow, these books have been used extensively as sources of historical material: *Origin of Cultivated Plants*, by A. de Candolle; the classical fruit description books by U. P. Hedrick and associates of the Geneva, N. Y., Experiment Station; *Manual of Tropical and Subtropical Fruits*, by Wilson Popenoe; *Tropical Fruits*, by O. H. Barrett; *The Fig*, by Ira J. Condit; *Pineapple*, by Maxwell O. Johnson; *The Citrus Industry*, by H. J. Weber and L. D. Batchelor. Statistical data are mainly from the U. S. Department of Agriculture.

The Apple Is King

IN the United States in a good year about a bushel of apples is grown for every man, woman, and child in the country. There is no State in the Union—and hardly a temperate land in the world—which does not grow apples to some extent. They blossom throughout Europe and across Asia—in Russia, Siberia, China, Korea, and India; they are picked and eaten in Japan, Australia, New Zealand, and South America.

The apple's popularity is not all due to its flavor, which seems equally effective raw or in a steaming deep-dish pie. Just as important is its hardiness. Many varieties can stand temperatures down to 40° below zero F. and will also grow in warm climates, provided that there is a moderate winter to give the trees a rest. Thus it can thrive in areas where few other fruit trees survive.

America regards the apple and the apple pie as its own, producing more of both than any other country. Actually, the fruit is an immigrant. It came, along with the first white men, from Europe.

Apples Were a Stone Age Crop

There are many species of apples, or crab apples, but the one from which our present varieties were developed, *Malus pumila*, probably started in southwestern Asia in the area from the Caspian to the Black Sea. Long before recorded history begins, however, apples had spread across Europe. The Stone Age lake dwellers of central Europe used them extensively. Remains found in their habitations show that they not only stored fresh apples for eating but also preserved them by cutting and drying in the sun.

Cultivation of the apple apparently started with the beginning of agriculture in Europe. The Greek writer Theophrastus mentions a number of varieties grown in Greece in the 4th century B. C. And according to mythology, an apple (albeit a gold one) was awarded to the goddess Aphrodite in what may have been the world's first beauty contest.

At the time of the discovery of America, apples were central and northern Europe's most important cultivated fruit. Not surprisingly, they were taken along by the first settlers to the temperate regions of the New World—by the English to Virginia and New England, the Dutch to New York, and the French to Canada.

Once started, seedling apple plantings moved west faster than the white settlers did. Some Indian tribes planted orchards around their villages. John Chapman, an itinerant missionary better known as Johnny Appleseed, roamed Ohio and Indiana early in the 19th century teaching the Gospel and planting apples. Apple seeds were planted at

Vancouver, Washington, as early as 1817.

Though their ancestors came from Europe, most apple varieties now popular in America started as seedling trees developed here. The apple does not come true from seed; 100 trees grown from seed of a single tree will all differ from each other and from the parent. Thus occasionally a chance seedling found in a pasture or fence row will prove better than the varieties previously known. When this happens, if the new tree is discovered, named, and propagated by grafting or budding, it becomes a new variety.

In a fruit-growing community, such a discovery is not unlike finding a new oil well or a gold mine. Grateful citizens may even erect a monument to mark the site where a new apple was born. A tall memorial pillar, topped with a huge stone apple, marks the spot where the first Baldwin apple tree was found in Wilmington, Massachusetts. Another, in Dundas County, Ontario, Canada, shows where one John McIntosh stumbled on the apple that bears his name while clearing forestland.

These and some of our other important varieties, like the Winesap and Yellow Newtown, date back to colonial days. Others are more recent; the famous Delicious, for example, was discovered a little more than half a century ago in Winterset, Iowa.

Greatest centers of commercial production in the United States today are in the irrigated valleys of the Pacific Northwest, particularly Washington; in the areas south and east of the Great Lakes—in New York, Ohio and Michigan; and in the foothills and valleys east of the Appalachian range, from North Carolina to New England. Commercial orchards produce about 120,000,000 bushels of apples a year; total production, including home garden trees and small farm orchards, may run as high as 150,000,000 bushels.

Crab Apples, Small and Sour

The name crab apple is popularly applied to trees that give small fruit ($\frac{1}{2}$ inch to $1\frac{1}{2}$ inch diameter), usually very acid and tart in flavor. These may be "native" (unimproved) species, or crosses of small-fruited species with cultivated varieties. A good many kinds of crab apple aren't grown to eat at all but as flowering shrubs.

Most crab apples grown for fruit in this country started as crosses of the Siberian species *M. baccata* with standard apples, and are generally called Siberian crabs. They are particularly popular in Canada because they are extremely hardy and early ripening. In northern Europe many varieties of crab apple are grown for making cider. American housewives like them for pickles and jelly.



Apples, Native to Southwest Asia, First Came to America with Early Colonists

Small, sour crab apples (right) were hoarded in caves by Europe's Stone Age men. Centuries of cultivation produced today's big, juicy varieties. Americans grow more than 100,000,000 bushels of apples a year.

Pears and Quinces: Butter and Jelly

“WHEN you dive into a pear,” a fruit lover once remarked as he tucked in his napkin, “you never know whether you’re going to strike water or sand.”

The great variation in pears sold in our markets—from the softest, juiciest of fruit to one of the hardest and grittiest—can be blamed chiefly on a tiny bacterium with a musical name, *Erwinia amylovora*. Except for *Erwinia*, the gritty sand pears probably would not be grown in the United States to any extent.

The common pear, *Pyrus communis*, like its cousin, the apple, seems to have come originally from western Asia and near-by Europe. Like the apple, it was used as food by Stone Age men and improved by the pre-Christian Greeks. The conquering Romans carried it with them into the temperate parts of the Old World.

When America was discovered, pear culture was common throughout Europe, and pear seed and some trees were brought over by the earliest colonists. At first, like the peach and the apple, the pear trees thrived and produced abundantly in the new land. As early as 1771 the famous Prince Nursery on Long Island, greatest of colonial fruit nurseries, listed 42 varieties of pears.

Belgians Breed for Butter

Meanwhile in Europe, particularly in France and Belgium, horticulturists were working to produce new and better varieties of pears. In the 18th and 19th centuries many breeders named superior types, though two deserve particular credit. Nicolas Hardenpont (1705-44), a priest in Mons, Belgium, grew quantities of seedling trees and produced the first of the varieties having the soft, melting flesh that gave the best pears the nickname “butter fruit.” Later, Jean Baptiste van Mons (1765-1842), a Leuven, Belgium, physician, developed pear breeding on a large scale and helped popularize some 40 superior types.

But as the improved varieties made their appearance in American orchards, so did *Erwinia amylovora*. These bacteria invade the bark, roots, and other soft tissues of the tree, causing oozing cankers and giving the infected parts a scorched appearance which accounts for the popular name of the disease, fire blight. It kills off large limbs and eventually whole trees. Fire blight was first observed in America as early as 1780, but it was not until a century later that Dr. Thomas Jonathan Burrill, a University of Illinois plant pathologist, worked out the cause.

Unfortunately, no one has yet worked out an effective control, and down to the present

day pear blight makes growing the high-quality “butter” pears of Europe extremely hazardous in most of the United States east of the Rockies.

In eastern Asia another kind of pear had developed, *P. pyrifolia*, hard of flesh and with numerous “sand” or grit cells. These sand pears, still widely grown in China and Japan, reached the United States before 1840, by way of Europe. They proved quite resistant to fire blight, also to the teeth and palates of the consumers.

Softer, but Still Sandy

Hybrids of sand pears and European varieties soon appeared, starting as chance seedlings where trees stood adjacent in orchards. The most important of these, the Kieffer, first fruited in 1875. Hybrids are now grown extensively in the eastern half of the United States; they are blight-resistant and better to eat than the original sand pears, but still inferior to the best European kinds. In recent years research has been started to breed better blight-resistant varieties for eastern growers.

In the mild, dry-summered valleys of California, Oregon, and Washington, the best European varieties grow near to perfection. From here come most of the commercially grown pears used for canning and for sale as fresh fruit—about two-thirds of the annual national crop of 30,000,000 bushels. Millions of bushels from these three States have been shipped back to the Low Countries of Europe, whence their ancestors came.

Pears are an important crop in all of the temperate parts of Europe. Total production there averages about 100,000,000 bushels a year. France, Germany, Italy, and Switzerland lead in production. In France, particularly, many pears are made into perry, a fermented pear cider. Argentina and Australia are also among the important producing countries.

The Sour Quince Makes Good Jelly

To most Americans the quince, *Cydonia oblonga*, is just a name on a jelly jar or a nugget in a fruitcake. Closely related to the pear, it appears to be native to northern Persia, was known in Greece and Italy long before the Christian Era, and was brought to this country by the earliest colonists. For a time its low, gnarled trees were widely grown in back-yard orchards. It has since fallen into disrepute, so much so that in American slang “quince” denotes a particularly unpleasant or sour person, usually female. A few small commercial plantings satisfy the steady domestic demand for preserves and flavoring.



From Kashmir to Western Europe, Pears and Quinces Grew Wild Before History Began

Like most fruit trees, the best pears—Bartletts, Anjous, and others—are grown by grafts or cuttings from superior trees, not from seed. Early settlers brought pear and quince trees to the New World. Today a blight limits most of our commercial pear production to western States.

The Peach, Most Versatile of Fruit

WHAT fruit besides the peach can be eaten whole like an apple, sliced with cream, dried, stewed, pickled, spiced, canned, distilled into a fine liqueur, cooked into pie or jam—or frozen into delicious ice cream?

Partly due to its amazing versatility, partly because its flavor and texture are unsurpassed, the peach ranks near the top in popularity in the United States. In recent years annual production has averaged more than 70,000,000 bushels. It is also extensively grown in Europe, Asia, South Africa, Australia, and South America. Despite trouble with diseases and insects, it is much grown in small orchards and even back yards. In fact, some of the best thin-skinned, soft-fleshed varieties, like the Cumberland and Golden Jubilee, are so delicate they may be damaged in handling and shipping, and are best grown where long trips to the market are not necessary.

Americans show their high regard for the peach in symbolism. To tell a young lady she has a "peaches-and-cream" complexion is a high compliment; to describe the lady herself as a peach is also flattering, if less subtle.

The Chinese thought the peach was symbolic. Some early Chinese writers called it the tree of life, others the tree of death; still others thought it symbolized longevity. The pink peach blossom, for some reason, was associated in ancient China with feminine promiscuity, and all growers were warned against planting peach trees near the windows of a lady's boudoir.

How a Name Misplaced a Fruit

The word "peach" is based on a Latin word meaning Persian. The scientific name, *Prunus persica*, also implies origin in Persia; peaches, in fact, used to be called "Persian apples." Thus for more than 2,000 years the native home of the peach was believed to be Persia. This belief, however, has not stood up under scientific scrutiny in the past century.

In tracking down the origin of a plant, scientists, like detectives, must piece together a variety of clues. One hint that Persia was not the home of the peach was the fact that there was no mention of the fruit in early Hebrew literature or in Sanskrit; this would indicate that it was unknown in the area from Persia to western India about 1500 B. C.

Looking farther east, botanists found peaches of a number of types which appeared to be native over large areas of China, with all the characteristics of the western fruit. Moreover, peaches are mentioned in Chinese literature earlier than 2000 B. C.

Most recent students therefore agree that China is undoubtedly the native home of the peach. The range of the species probably was wide, extending over much of the country

from Turkistan as far as the eastern coast.

Once its home was settled as China, it was comparatively easy for botanists to trace the fruit's slow progress westward. Exactly how and when it reached Persia is unknown, but it probably traveled from China along caravan routes used in the pre-Christian Era. By 332 B. C. it had reached Greece—where a Greek writer described it as a Persian fruit. Virgil (70-19 B. C.) was the first Roman to mention the peach. Its culture spread all over the temperate parts of Europe in the centuries that followed.

The Spaniards probably planted the first peaches in the New World; by 1571 three types were growing in Mexico. The French in Louisiana, the English at Jamestown, the Pilgrims in Massachusetts, and others planted peaches as soon as their settlements were established. The Indians, always alert to new food supplies, carried them inland far in advance of white settlements.

Practically all varieties now grown in this country started here, most of them through chance discovery of superior trees among the many seedlings. Within the past 50 years Government experiment stations, both State and Federal, as well as some private researchers, have been systematically breeding peaches to develop good-quality varieties.

The peach is not one of the hardiest fruits. Fruit buds are often killed by winter temperatures of 10° below zero F., and temperatures down to -20° F. will frequently kill trees. Most varieties also need a fairly long winter dormant season to start growth normally in spring. In the United States, peaches do best in the Pacific Coast States, especially California; along the Atlantic seaboard from Georgia to Massachusetts; and south and east of the Great Lakes—in New York, Ohio, and Michigan.

Nectarine, the Same Fruit, but No Fuzz

The nectarine, not widely known in the United States, is a smooth-skinned, or fuzzless, peach. It is indistinguishable from the peach in tree, leaf, or flower. Fruits are similar in shape, in pit, or stone, and both have varieties that have white, yellow, or red flesh color. Nectarines are usually somewhat smaller, firmer-fleshed, more aromatic, and have a distinct flavor often richer than the peach. They originate as true breeding mutations of the peach, and have been esteemed in Old World countries for more than 2,000 years. But, because their smooth skin makes them vulnerable to insects, disease, and cracking, they are not as successful as peaches in the humid eastern United States. They reach our markets in limited quantities, mainly shipped from the western States.



Peaches Were Cultivated in China More than 4,000 Years Ago

Spanish settlers planted the first peaches in America before 1600. They now rank third among our tree-grown fruit. Nectarines (right) are smooth-skinned peaches, easier to eat but harder to grow.

Two Stone Fruits from the Orient

APRICOTS and Japanese plums are two more of the great group of stone fruits, or drupes, which include fruit ranging in size from the cherry to the peach, all containing a single hard, woody pit. These two are considered together because they are both believed to have originated in China. Their routes around the world, however, were quite different, as are the ways in which they are eaten.

The apricot, though juicy and aromatic when fresh, is one of the fruits which most Americans seem to prefer dried or canned. Of the more than 200,000 tons a year grown in this country, about 40 percent are dried, 40 percent are commercially canned, and 20 percent are sold fresh.

The apricot reached the Mediterranean countries before the time of Christ. It has been claimed that Alexander the Great carried it to Greece at the time of his conquest of southwestern Asia, in the 4th century B. C. It was long said to have come from Armenia, hence the botanical name *Prunus armeniaca*, by which it is known to this day.

More recent botanical and language research, however, has indicated that the original home of the apricot was not southwest Asia, as long believed. There is no name for the fruit in either the Hebrew or Sanskrit languages, as would be expected if the fruit was present in the area when these languages were developed.

On the other hand, the Chinese used a character believed to represent the apricot in writings earlier than 2000 B. C. Also, in China today apricots are found which have all indications of being truly indigenous.

Believed to Be Native of China

Thus it is now generally believed that the apricot originated in central and western China, and that it had been carried to southwest Asia before the time of Alexander the Great. Pliny stated it reached Italy about 100 B. C. It had spread throughout the temperate parts of Europe, including England, before the discovery of America.

The Spaniards apparently took the apricot to the New World with the earliest settlements. It thrived in the drier parts of Mexico. Seedlings were planted in California at the Spanish missions in the 18th century, and named varieties from Europe were introduced before 1850.

The English also established apricots in Virginia; Capt. John Smith reported in 1629 that apricots were thriving there. However, the apricot has never proved well adapted to the climate of the eastern United States.

The name "apricot" comes from a Latin

word *præcoquum*, meaning early ripe. Because it blooms very early in the spring, its blossoms are almost always killed in the East by spring frosts. The fruit also tends to crack badly and decay in warm, rainy weather.

Apricot growing in the United States is therefore largely confined to the area west of the Rockies, with California producing by far the largest part of the crop. Washington, Oregon, and Utah also produce commercial quantities of apricots.

Burbank Promoted Japanese Plums

Little is known of the background of the highly colored, juicy, spicy plums of the species *P. salicina*, known in this country as Japanese. Certain it is that they did not originate in Japan; no plum appears to be native there. Japanese horticulturists say they were introduced into Japan from China some 200 to 400 years ago. It seems almost certain that their native home is in China, perhaps in the southwest part, a region little explored by western botanists.

These plums first reached America about 1870; trees from Japan were imported in that year by a fruit grower of Vacaville, California. They quickly attracted attention, and commercial propagation soon started.

Luther Burbank, the great plant breeder, who moved from Massachusetts to California, imported many kinds, grew numbers of seedlings, and highly publicized the fruit. He gave American names to imported varieties and to selections from his seedlings. More than any other man, Burbank was responsible for the rapid spread and great interest in Japanese plums.

These plums apparently were unknown in Europe prior to their introduction into this country. In recent years they have been widely tested in temperate countries throughout the world.

Hybrids May Be Important

In this country they are grown to a limited extent in many of the States. They are early blooming, and the blossoms are subject to killing in areas where spring frost occurs frequently. On the other hand, they stand summer heat and rain better than the European plums, and are of better quality than most of our native kinds. They will cross readily with most kinds of native American plums, and promising varieties are being developed from such crosses.

Commercial production is most extensive in California. The large, highly colored plums on fruit stands and markets from mid-June through August are mainly varieties of the Japanese, or, more accurately, Oriental plums.



Apricots and Japanese Plums Traveled East and West from China

Capt. John Smith reported newly planted apricots thriving in Virginia in 1629; today most of our crop comes from California. The "Japanese" plum is also Chinese, but first reached our west coast from Japan.



Asiatic Plums Grow in a Bewildering Variety of Shapes, Colors, and Sizes

To eat them fresh, Americans grow Greengage and large yellow Egg plums, both native to western Asia. Dried, smaller Asiatic reds and purples become prunes. Tart blue Damsons, from Europe, make good jam.

Plums and Prunes from Europe and West Asia

MOST important commercially of the plums grown in the United States are those which came here from southwestern Asia by way of Europe. These are of the species *Prunus domestica*, of which three main types lead in production here.

First in quantity and market value are the drying plums, or prunes. These are fairly large, firm-fleshed, meaty plums with a high sugar content. They can be dried without removing the pit. In the sun or in dehydrators, these are dried in tremendous quantities and form our familiar dried breakfast prunes. More than 200,000 tons a year of these are shipped from western States, chiefly California.

Some varieties of this type are also widely used as fresh fruit, and many are also canned. Production centers for these two categories are Oregon, Washington, and Idaho.

The second type of European plum is popularly called the Greengage or Reine Claude group. These fruits are nearly round, light green to golden yellow when ripe, and the flesh adheres to the pit. They are generally softer fleshed than the prune group and are not suitable for drying. Many varieties in this group are of excellent quality. They are widely grown in home gardens and in small commercial orchards near market centers, but do not enter extensively into commerce.

The third group varies from the second mainly in size and shape. These are the Egg plums, very large, generally long-oval in shape, sometimes with a neck at the stem end. They vary from yellow to purple in color.

One other species which came by way of Europe, *P. insititia*, is also grown in this country. These are the small, nearly round to oval Damson type, named for the city of Damascus and greatly prized for jam and plum butter.

The *domestica* plums are commonly called European, but it is quite certain that the original home of the species is not Europe but rather western Asia. A number of botanists have reported the species as apparently native in the area south of the Caucasus Mountains to the Caspian Sea.

Romans Had "a Vast Number"

Plums do not thrive in tropical or subtropical climates. The Egyptians left no record of them. The first Roman writer to mention them was Pliny. In the first century he described several kinds briefly and referred to "a vast number of varieties."

The major areas of plum growing in Europe developed north of the Mediterranean countries, and apparently the growing of

domestica type plums in those countries is rather recent. According to European historians, prunes were introduced into Hungary from Turkistan late in the 15th century. All the Balkan countries are now important prune producers.

The Reine Claude group takes its name from Queen Claudia of France, whose husband, Francis I, ruled at the time of their introduction into that country, about 1500. A little later they were introduced into England by Sir William Gage, whence came the name Greengage. Thus it may be presumed that these plums were not widely grown in Europe before the settlement of America.

There is only meager data as to their introduction into America. The French brought them to the Maritime Provinces of Canada, and undoubtedly the English brought them to their colonies. *Domestica* plums did not assume an important place in American horticulture, however, until after the Revolution, and did not reach the proportion of a major crop until the settlement of the Pacific States.

These plums and prunes require an equable climate for best development. They bloom early in the spring, and in many locations are subject to frost damage and loss of crop. The fruit cracks badly and is subject to decay under heavy rainfall conditions. Thus in the eastern United States only the most favored fruit sections, such as the lake area of western New York, can achieve much success with them.

In the valleys of the Pacific States the *domestica* plums are ideally adapted and reach maximum production. There all the prunes for drying are produced, and large quantities are commercially canned or shipped fresh.

Damsions Got to Europe First

Damson plums apparently were native not only in western Asia but across most of Europe. Pits of this type of plum have been found in the lake dwellings of Switzerland. The recorded history of the Damson is older than that of other species. Greek poets of the 6th century B. C. mention them. The selected, improved varieties, however, appear to have come originally from western Asia.

The Damson types were introduced into the Colonies and, prior to the Revolution, appear to have been grown more widely and successfully than the *domesticas*. These tart, spicy plums are now widely disseminated in those parts of the United States having a moderate climate. They are produced mainly in home gardens and for local markets. Damson jam or plum butter is greatly esteemed by most of those who know it.



Small-fruited American Plums Are Cultivated Chiefly in the Plains States

Pioneers found them growing wild on beaches, hills, and fields across the country. Larger imported plums have crowded these "natives" out of most markets, but they are still gathered wild in many areas.

American Plums—Fruit of the Pioneers

NATIVE American plums belong in this story of fruits, not because they are important in commerce, but because of the place they filled in the diets of pioneer settlers.

From New England to Florida, the early colonists found wild plums. As the wagon trains rolled westward, the settlers discovered them growing in all sections west to the Rockies. Beyond the Rockies, on to the Pacific, they occurred in scattered locations.

No other native tree fruit is so widely distributed in this country as the plum. Some form of it is found in every State in the Union. And, while our native plums are not generally of high dessert quality, most of them, as they grow wild, make very good jam, jelly, and plum butter. These offered a welcome and valuable variety to the simple and often monotonous diet of the pioneers.

Even today, large quantities of native plums are gathered from the wild. Cultivated varieties derived from them are among the most dependable fruits for growing in some parts of our country, particularly in the colder sections.

The colonists who settled in New England found two principal kinds of plums. The Canadian plum, *Prunus nigra*, grows throughout New England and New York, about all the Great Lakes, over much of Minnesota, and into Canada. The flowers are large for a plum and have a pink tinge, an unusual characteristic since plum flowers are generally pure white or green tinged. The fruit is oval to oblong, a little over an inch long, and varies from crimson to orange-yellow in color. It ripens in late August and September.

The Indians gathered and dried these fruits in large quantities. This species is very hardy, and a number of horticultural varieties from it are now widely grown in northern areas.

The second plum in New England grew only near the ocean, on sandy soils. This beach plum, *P. maritima*, is a small bush bearing nearly round fruit about two-thirds of an inch in diameter. It grows in a narrow belt from southern Maine to Virginia and is greatly prized today for jam making. It is most like the European Damson of any native plum and has a special spicy flavor that many people enjoy.

The Red, Horse, Hog, or Goose Plum

A third great species, *P. americana*, is well named. It spreads over about half the area of the United States, from New York to Montana and south to Louisiana and Mississippi.

In most sections it is simply called wild plum, but it is also known as Red plum, Yellow plum, Horse plum, Hog plum, Goose plum, August plum, and, in the far south,

Sloe. The fruit ripens mainly in July in the south, and in September in the north. While the plums vary somewhat in different areas, they are generally nearly round, reddish-orange to red, and one inch or less in diameter. This plum has contributed many varieties of value, especially in the western Plains States.

The Chickasaw plum, *P. angustifolia*, is native in the southern States from Maryland to the Gulf and west to Kansas and Texas. The fruit is oval to spherical, usually bright red, but sometimes yellow. It does not survive in the north. The sand plum of the western Plains, closely related to the Chickasaw, is one of the most valued fruits in Kansas and Nebraska.

Two species of plums native in the lower Mississippi Valley are valuable both as native fruits and as sources of cultivated varieties. Both are found from Tennessee and Kentucky west to Kansas and Oklahoma. *P. hortulana* is late ripening, its fruit nearly round, about one inch in diameter, color, red to yellow. The wild Goose plum, *P. munsoniana*, is early ripening, fruit round to oval, bright red. Both are late blooming, so the blossoms are likely to escape spring frosts.

One other species deserves mention, not because it is widely distributed, but because the quality of the fruit closely approaches that of the European plums. *P. subcordata*, the Pacific or Western plum, is found in the foothills from central California to central Oregon. The fruit is late ripening, globular, red to purple, about one inch in diameter, and is extensively used for preserves.

Improving the American Plum

While the colonists who settled along the eastern seaboard gathered plums from the wild to some extent, there was little effort to improve them during colonial times. Perhaps this was because good-quality European varieties could be produced in the central and northern colonies at least. Not until settlers crossed the Mississippi were native plums of special merit selected, named, and planted in home orchards.

During the last half of the 19th century, literally hundreds of such selections were made and named. Many of these represented little improvement and soon passed out of use. Breeders, both private and in State experiment stations, have continued efforts to improve these plums, and a number of varieties are now available that are of great value where European varieties do not thrive. Particularly in the Plains States, the North Central States, and in the South, these varieties are more satisfactory for home and local market growing than are any other plums now available.



Birds Spread Cherry Seeds Across Asia, Through the Balkans and Western Europe

We cultivate sweet cherries, like the Bing and Napoleon, as desert fruit; sour ones like the Montmorency for pies and canning. Some Asiatic varieties are prized more for snowy blossoms than for fruit.

“Loveliest of Trees, the Cherry . . .”

IN AN average year Americans consume fresh or in pies, candies, preserves, beverages, and assorted drugstore delicacies about 200,000 tons of cherries. Round, plump, and abundant—a single tree has been known to yield 2,000 pounds of fruit in one year—cherries have for centuries been looked on as the symbol of ripeness and sweetness.

Species of cherries are plentiful throughout the northern Temperate Zone—from Japan, throughout Asia and Europe, to our own Pacific Coast. Asiatic species have contributed the famous flowering cherries of Japan, now flourishing and famous in our own Capital and gaining popularity as ornamentals in many American gardens and parks.

The fruit of a few American species is gathered and used to a limited extent, particularly the chokecherries and sand cherries in the Plains and Rocky Mountain States. The two species that have furnished our cherries of commerce, however, both appear to have originated in the area of Asia and Europe centering about the Dardanelles and extending from the Caspian Sea in Asia westward through the Balkan countries of Europe.

Cherry Pits Found in Stone Age Caves

The sweet cherries, *Prunus avium*, had spread throughout temperate Europe before the beginning of civilization there. Commonly known as bird cherries, this species, a favorite food of birds, had reached Britain and western continental Europe before the history of those countries was recorded. Pits of sweet cherries found in the remains of cave habitations of central Europe indicate that these fruits were gathered and used there as early as the Stone Age.

The sour, or pie cherry, *P. cerasus*, seems to have spread more slowly, and perhaps mainly through human agencies.

Apparently the earliest reference to cherries is by Theophrastus, the Greek “Father of Botany,” who described the trees and fruit about 300 B. C.

Pliny, in Italy in the first century, described 10 kinds of cherries. These appear to have been types, rather than varieties as we regard them today. He also referred to the cherry as having been taken to Britain. Another Roman, Marcus Terentius Varro, in his book on farming written about 50 B. C., discussed grafting of cherries, and by implication indicated that neither cherry culture nor grafting were new when he wrote.

Thus cherry culture was apparently under way in a number of European countries by the beginning of the Christian Era. Little further progress seems to have occurred until the emergence of Europe from the Dark Ages, in the 15th and 16th centuries. Not until

the latter century did variety names appear.

Cherries from Europe were introduced into America as soon as the English, French, and Dutch settlements were made. If cherries were planted by the Spaniards in the West Indies and Florida, they did not thrive. But in the cooler climates, from Newfoundland to Virginia, they were growing shortly after the first settlements. Reference is made to the cultivation of the Red Kentish cherry in Massachusetts in 1629, only nine years after the Pilgrims landed.

By the middle of that century, cherries, in common with other Temperate Zone fruits of Europe, were widely distributed in the Colonies. According to tradition, if not fact, one early American farmer, Augustine Washington, valued his cherry trees only slightly less than the veracity of his son George.

Cherries advanced westward with the settlement of the country. They were first taken to California by the Spanish missionaries when that State was a part of Mexico. Cherries were a part of the covered wagon load of named fruit varieties that pioneer horticulturist Henderson Luelling took to Oregon in 1847. This resulted in the start of the great sweet-cherry industry in the western States.

The cherry thrives best in moderate, rather cool climates. The sour cherry is more tolerant of both summer rainfall and winter cold than is the sweet. The latter cracks and rots when rains occur near ripening time. As a result of this, the principal centers of sweet-cherry production are in the States west of the Rockies where summers are dry and winters are generally moderate.

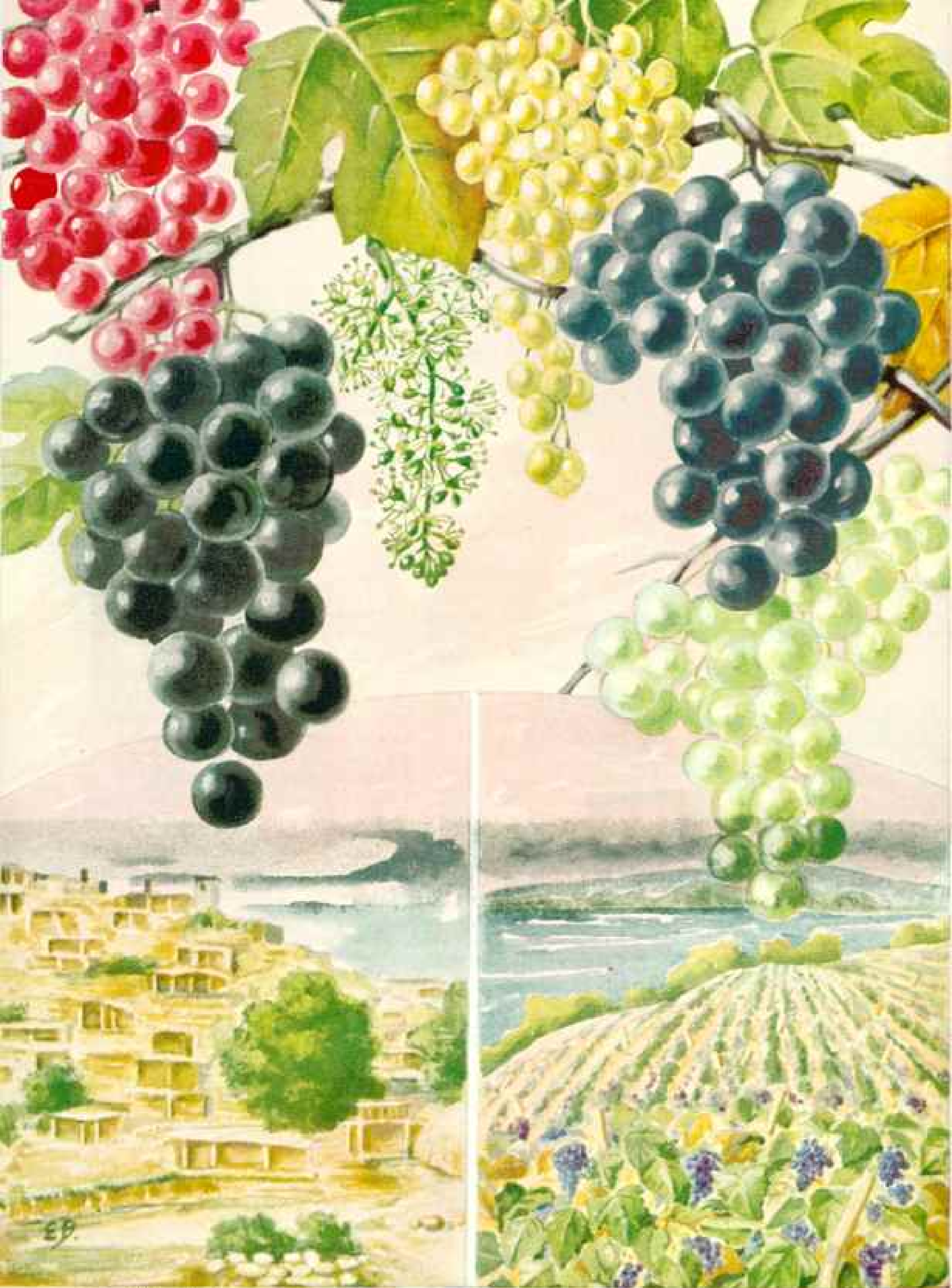
Sour cherries are produced throughout the northern half of the United States, except in the coldest areas of the Plains States. Greatest production is around the Great Lakes, with Michigan, New York, and Wisconsin leading.

Neither the sweet nor the sour varieties are adapted to the hot, often humid conditions in the southern half of the country.

First Bing Cherries Were American

Our important sour cherry varieties all represent direct importations from Europe; no important varieties have been developed in this country. On the other hand, several of our sweet varieties, including the large, nearly black Bing and Lambert, which are the most important fresh market kinds, originated here as chance seedlings.

Sour cherries are mainly marketed canned or frozen. The major use is in pies and preserves. Sweet cherries are popular in mid-summer on fresh-fruit markets, the richly flavored fruits being highly esteemed. They are also canned commercially, and are the principal source of maraschino cherries.



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Painting by Elie Dostelmann

Men Grow More Tons of Grapes than Any Other Fruit. Most Are Used for Wine

Grapes are native to most temperate lands, but Asiatic types (left) make up 98 percent of commercial production. Of native American grapes (right), purple Concord is most grown.

Fruit of the Vine

ONE way to get an idea of the scope of world grape production is to start with California. On a little over half a million acres, Californians grow a little less than 3,000,000 tons of grapes a year. These provide more than nine-tenths of all the wine, raisin, and table grapes sold in this country. A single vineyard, in Cucamonga Valley, covers 5,000 acres.

Yet California produces less than ten percent of the world's grape supply and only about three to four percent of its wine. World-wide, grape growing is the biggest of all fruit industries.

Used mostly for wine, grapes are produced in tremendous quantities in all the Mediterranean countries of Europe, and in all other countries having moderately dry summers and equable temperatures. Both grape culture and the art of wine making were known to men before the beginning of recorded history.

The Old World grape, *Vitis vinifera*, has been cultivated so long that its place of origin cannot be determined with accuracy. Seeds of grapes found in Swiss lake dwellings date to the Bronze Age in Europe. Grape seeds have been found in the oldest tombs of Egypt, and there is evidence that the Egyptians grew grapes and made wine 6,000 years ago. The oldest Hebrew, Greek, and Roman writings all refer to grapes and wine making.

The best evidence indicates that the *vinifera* grape originally centered in the area about the Caspian and Black Seas, the great cradle of deciduous fruits. It was spread both by natural means, with birds and mammals carrying the seed, and by the hand of prehistoric man.

North America Was a Land of Vines

The first European visitors to North America, the Norse voyagers, found native grapes so abundant that they called the country Vinland. The first English settlers in Virginia found great vines climbing over the trees, especially along the streams.

In quality, however, the wild American grapes were far from the choice European kinds, improved through thousands of years of selection. Why not transplant the Old World varieties?

Steps were quickly taken to import superior European vines. Almost every colony had laws to encourage grape growing. Literally hundreds of vineyards were set, and skilled French vine growers were brought over. There even were penalties for settlers who failed to plant grapes, and rewards were offered for success in vine growing and wine making.

Yet despite great effort, no one attained success with the Old World grape. In the "vineyard paradise" of the Colonies there

were fungus diseases and insect pests that attacked and destroyed the plantings of Old World grapes. To this day, and even with modern insecticides and fungicides, the Old World grape is not successfully grown in the humid climate of eastern North America.

While the eastern colonists were struggling to establish *vinifera* grapes in eastern America—and failing—the picture was far different in the West. The Spaniards established a colony in New Mexico in 1598 and founded missions in California beginning in 1769. There the Old World grape flourished in the dry growing season and mild winters.

Production of the Old World grape in the United States is today largely limited to the southwestern States. Varieties grown have largely been imported directly from Europe. The largest portion of these grapes is dried for raisins, though large quantities are made into wine, and thousands of carloads are shipped to all parts of the country for use fresh.

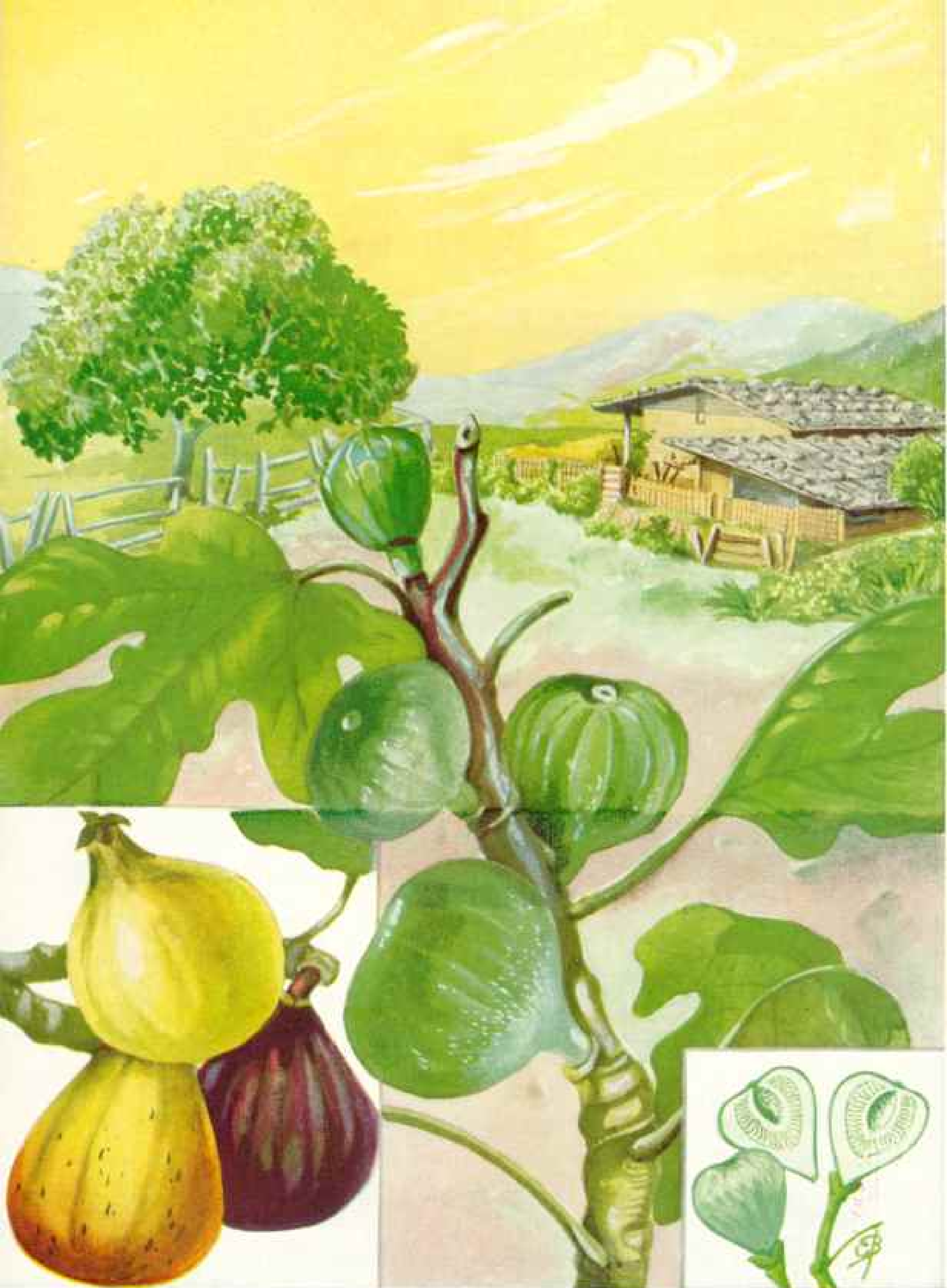
Our "Natives" Still Thrive in the East

In all other sections of the United States, varieties derived in part or entirely from native species are grown. In the South the Muscadine varieties, derived from the species *V. rotundifolia*, are best adapted. They are highly disease-resistant, have a tough skin, and are borne in very small clusters. In more northern areas varieties derived from *V. labrusca*, such as Concord and Niagara, are mainly grown.

The American grapes are hardier to winter cold than the Old World grape. They are generally considered less suitable for wine making, though excellent wine can be made from many varieties. They are the only kinds used for making grape juice, and are superior to the *vinifera* grape for jellies and jams. They have a less meaty pulp than most Old World varieties, so are less suitable for raisins.

An insect pest that attacks the roots of grapes, the root louse phylloxera, was native in eastern America and was accidentally taken to Europe at least a century ago. For a time it threatened the existence of grape growing in many European regions. American species, however, are resistant to this sucking insect.

Now most European vineyards are grown on roots partly or wholly of American stock. These stocks are also used for Old World varieties in California and in many other grape-growing regions of the world. Thus today the grapes of the East and the grapes of the West are truly joined in practically all grape production of the world. American varieties have also spread to other world areas where, because of winter cold or humidity, the *vinifera* grape is poorly adapted.



Figs, Cultivated Since Antiquity, Grew First in Mediterranean Lands

In parts of Europe figs are known as the poor man's food. Spanish missionaries planted them in California in 1769, but choicest varieties would not fruit until a special wasp was imported to pollinate them.

To Ancient Man, Figs Were a Sacred Fruit

IN AMERICA figs are generally eaten as a luxury, a sweet dessert, or a morsel in a fancily wrapped box of gift fruit. In some Mediterranean countries, however, they are a basic part of the diet.

Their importance in these areas is shown by legends that grew up about them in ancient times. The Romans considered the fig, *Ficus carica*, a gift of the god Bacchus. In the countries of southwestern Asia, in Egypt, Greece, and Rome, figs were regarded as sacred. Their significance in Hebrew life is indicated repeatedly in the Bible, beginning with the story of the Garden of Eden. A well-drawn fig tree, showing the harvesting of the fruit, is on the wall of a 12th dynasty Egyptian grave (circa 1989-1776 B. C.).

The species from which the cultivated fig has come apparently had a wide range in the area near the Mediterranean, from Syria westward to the Canary Islands. A fruit so long cultivated may have become naturalized in parts of the area, but fossil remains found in France and Italy indicate that figlike plants grew there long before the Stone Age.

Aristotle Studied Fig Pollination

Figs were probably first cultivated in Arabia and Egypt, and doubtless the sweeter, better kinds were selected and propagated with the beginning of agriculture in those ancient countries. They were known and prized in Crete in 1500 B. C., and in Greece a little later. The Greeks even knew in part the need for caprification, a process whereby some of the fruit-bearing trees must be pollinated. Aristotle, in the 4th century B. C., recorded that insects had to visit the young fruits or they would drop. He did not, however, fully understand why.

Introduction of figs into America can be credited to the Spaniards. Varieties from Spain were sent to Hispaniola in 1520, and were reported to be bearing well in 1526. Before the end of the 16th century, figs were reported as abundant in Peru, and were established in Florida at St. Augustine. Capt. John Smith reported in 1629 that one "Mistress Pearce" of the Jamestown, Virginia, settlement, harvested "neere a hundred bushels of excellent figges."

In California the fig, like many other fruits, dates from the establishment of the mission at San Diego in 1769. The variety now called Mission, which was planted there, is still the leading black fig grown in the State. Although figs were widely planted in gardens in California earlier, commercial culture did not start until about 1885.

Many varieties of figs will set fruit without pollination, and these can be grown successfully without caprification. The choicest

of the white, drying varieties, however, belong to a group known as the Smyrna type, and these must be pollinated.

Many trees of this type were planted in California late in the last century and grew well, but the fruit dropped before maturing. Caprifigs, the trees used for pollinating this type in Europe and Asia, had been brought into the State. But the insect that carries the pollen into the fruit, a small wasp called the *Blastophaga*, was not present, and early efforts to introduce it were not successful.

There was wide difference of opinion as to the necessity for the insect. Finally it was successfully established in the State through an importation in 1899 by the United States Department of Agriculture of caprifig fruits containing the *Blastophaga* wasps.

This insect breeds in caprifigs, which are grown in special blocks away from the fruiting fig trees. At the proper time, the caprifigs are gathered with the wasps in them and hung in small bags in the fruit-bearing trees.

The female wasps crawl out, becoming covered with pollen as they do so. They crawl into the fruit of the Smyrna varieties seeking a place to lay eggs, and in the search pollinate the flowers. Since the introduction of the insect and the working out of suitable handling techniques, production of these Smyrna varieties in California has been successful.

The fig is a semihardy tree which sheds its leaves in the winter. When fully dormant, the trees will stand temperatures down to about 10° F. without serious injury. Temperatures below 5° will kill them to the ground, but in most cases, when this happens, new shoots will sprout up from the roots.

California Grows Most of Our Figs

Most commercial fig growing in the United States is in California. About 35,500 acres there are devoted to figs, with an annual crop of some 32,000 tons of dried figs, 19,000 tons of fresh, and more than 700,000 cases of canned fruit. Figs are also grown commercially in Texas and as a home-garden fruit in other parts of the South.

Most of the world's commercial fig production is marketed in the dried form; some of it is canned or preserved. Figs are esteemed in the fresh form in countries where they are grown, but are difficult to ship and handle for distant markets.

Italy is now the leading country of the world in fig production, most orchards being located south of Naples and on Sicily. Turkey ranks second. Spain, the United States, Algeria, Greece, and Portugal all have major industries. Many other countries with suitable climatic conditions produce figs on a smaller scale.

Olives, Oil-bearing Fruit from Southern Europe

IN CROWDED countries, or those where conditions are not suitable for extensive meat production, men turn to plants for the oil they must eat to live. In lands bordering the Mediterranean Sea, the olive tree supplies much of this need. From 20 to 60 percent of a ripe olive is oil. Men extract almost a million tons of oil a year from olives.

In Spain, which leads the world in olive-oil production, 6 percent of agricultural production is in olives. In Greece the proportion runs as high as 18 percent. Italy ranks olives second only to grapes in importance; in Portugal they are the leading tree crop—and the Portuguese consume nine-tenths of all the oil they produce.

A Good Omen to Men Ever Since Noah

The olive is another of the fruits that may be traced to the beginning of recorded history, and beyond. The earliest Hebrew books mention the olive under the name *sait* or *zeit*. The story of the dove from Noah's Ark returning with an olive leaf, as told in the Book of Genesis, is familiar to all. The olive was a very important and valuable source of oil to the early Hebrews, and was also cultivated by the ancient Egyptians.

Today the wild olive, *Olea europaea*, is found from western India westward throughout southwest Asia and all about the Mediterranean borders. It is not certain that it is truly native throughout that range. In some districts, especially about the edges of the present range, the trees may be escapes from cultivation. Language research indicates that the true center of the olive species was probably the area from Syria to Greece.

Certain it is that the olive was known and cultivated for its oil from the beginning of agriculture in Syria, in Palestine, in Egypt, in Greece, and, a little later, in Rome. The ancients used the oil for food, for medicine, and for anointing their bodies. In Rome a favorite saying was that a long and pleasant life depended on two fluids, "wine within and oil without." Olive oil was also burned in lamps for lighting.

The olive requires a long growing season to mature its fruit, and is not tolerant of low temperatures. The tree is injured when temperatures down to 15° to 10° F. occur. Thus its range in Europe is limited to countries around the Mediterranean.

The Spaniards apparently introduced the olive into America. While it did not thrive in the humid climate and acid soil of the West Indies and Florida, it prospered in the drier air of Mexico. It was introduced into California with the establishment of the first missions. Since then, other valuable varieties have been brought in from Europe.

Only in California and, to a limited extent, in Arizona has commercial olive culture developed in the United States. The industry here is primarily based on olives for pickling. Oil is extracted from the fruit which fails to grow large enough for that purpose.

The olive fruit is green in color when immature, turning to black as it ripens. For green olive pickles, the fruit is picked immature; for black olive pickles, it is allowed to become mature on the tree, but not soft ripe. When harvested for oil, the fruit is allowed to ripen fully.

The olive fruit fresh from the tree, both green and ripe, is intensely bitter. In the pickling process the fruit both for green and ripe pickles is first soaked in lye solution to destroy the bitter taste. After thorough washing to remove the lye, the ripe olives are soaked in strong salt solution. They can be held for a long period in brine, but should then be soaked in fresh water overnight to remove the excess salt.

After salting, they are canned commercially under steam pressures which hold them at a temperature of at least 240° F. for 60 minutes. In the preparation of green olives there are variations in the process to bring about the development of special flavors.

Methods used to extract oil from olives vary greatly from one country to another, and depend in part on what the oil is to be used for.

In some cases fruit is first crushed beneath rollers, then squeezed in presses—which may be simply flat boards with stones on top, or, in modern plants, costly hydraulic machinery.

Since the oil is contained in the pulp of the fruit, stones are sometimes removed before pressing. In all cases where the oil is to be eaten, speed is essential between harvesting and pressing; oil left in bruised olives soon grows rancid.

We Import as Much as We Grow

There are large areas in the southwestern States of this country where olives can be grown successfully. Because of the great amount of hand labor, particularly in harvesting fruit, the growing of olives for oil has not developed on a large scale here. Total production of olives in this country, almost entirely in California, averages about 50,000 tons of fruit per year, of which about half is used for pickling and half crushed for oil.

American imports of olive oil amount to approximately 15,000 tons per year. In addition, about 10,000,000 gallons of green olive pickles are also brought in annually from south European countries, mainly Italy and Spain.



In Mediterranean Countries the Olive Tree Provides the Fat of the Land

Olives, a symbol of peace and wealth to the ancients, were probably first cultivated in Greece. Romans sometimes collected olive oil, instead of money, as taxes. Spanish missionaries planted our first olives in California.

Dates Provide Food in Barren Deserts

SAID MOHAMMED: "There is among the trees one that is preeminently blessed, as is the Moslem among men; it is the palm."

Small wonder that desert dwellers of Arabia, Egypt, and westward to Algeria and Morocco call the date palm blessed. The fruit, containing more than half its weight in sugar and smaller quantities of fat and protein, is one of the most important food sources in a generally barren land. It furnishes shade for men and animals. The leaves are used for making baskets, matting, and bags, the fiber for rope. The roasted stones, or pits, are a substitute for coffee.

When the palm becomes old and nonproductive, or before, it is tapped to draw off the sap, from which a toddy is made, called in ancient cuneiform inscription "the drink of life." Finally, the trunks are used as fuel.

The exact origin of the date palm, *Phoenix dactylifera*, is unknown. Certainly it is one of the oldest food plants known to mankind. Long before history begins, it grew in Arabia, Babylonia, and Egypt, as indicated by plant remains as well as by tradition and the oldest writings.

Moisture Feeds Roots but Molds Fruits

Although the date palm will grow throughout great areas of the world, wherever temperatures do not go lower than 5° to 10° F., the areas where fruit production is successful are much more limited. Even a small amount of rain and humid weather as the fruit approaches maturity will cause it to mold and sour. Thus fruit production is largely limited to areas having very dry summer and fall seasons. Although grown in naturally desert countries, the date palms require abundant soil moisture. Thus they thrive only about springs or oases, or where they can be irrigated.

Present Old World centers of date growing are the same countries that grew them in earliest times, Iran, Iraq, Arabia, Egypt, Libya, and Algeria. A few are grown in Spain, but in general date culture is meager in countries north of the Mediterranean. Too much rainfall and humidity are the chief limiting factors.

No one knows exactly when date palms were first planted in the United States. Spanish missionaries planted seeds around the missions in the Southwest before 1800, at the latest.

The real beginning of date culture in the United States came in 1890. In that year, the U. S. Department of Agriculture arranged for palms of some of the better varieties from Egypt to be planted in tubs and shipped to this country. Later, plantsmen from the Department visited all important date-grow-

ing countries, secured offshoots of the better varieties, and successfully established them. Commercial firms followed with larger importations of the better kinds.

The only way of propagating superior date varieties is by these offshoots, or "suckers," which develop from the base of relatively young palms. The suckers, much like those that form near the base of corn plants, may be cut off when 3 to 5 years old. Carefully handled, especially as to watering, each will grow into a new palm. Since each palm produces only a relatively few offshoots, mainly in its early years, the multiplication of superior dates is a slow process.

Only a few areas in this country are adapted to date-fruit culture. Our industry is centered in the interior desert valleys of southern California and Arizona, which have intensely hot, dry summers and autumns, much like Arabia and North Africa.

The greatest concentration of planting is in the Coachella Valley in California, northwest of the Salton Sea. There are now some 5,000 acres of date palms in this country, with production averaging around 20,000,000 pounds a year. Even so, considerable quantities are still imported from southwest Asia, chiefly Iran.

Date varieties are of three kinds, soft, semidry, and dry. The soft dates are richly flavored, but are difficult to ship and handle. They are used extensively in various date confections. The semidry dates are those principally found in the markets of this country. The dry dates, little grown or sold in the United States, are relatively hard-meated, sweet, and nonperishable, and are a very important food in Arab countries.

In our southwestern desert date centers, production practices have been studied more scientifically than any other place in the world, and Old World countries now look to us for technical information on date culture. The U. S. Department of Agriculture has maintained a research station for date investigations at Indio, California, almost from the start of date culture here.

Flying Fans Make Artificial Breezes

Such research has turned date growing in the United States into a complex science based on a mixture of tedious hand work and mechanization. Heavy paper wrappings are sometimes tied over individual bunches—which may contain 1,000 or more fruit—to guard against insects, birds, or dampness. Pollination may be done by tying male flower strands into female flower clusters with rubber bands, or with a pollen duster. On occasion, helicopters have been hired to fly low over date treetops and fan away moisture.



In Deserts of Egypt and Arabia, Tall Date Palms Shade Green Oases

Growing wherever there is moisture for their roots, dates have provided desert dwellers with food, shade, and fuel since Biblical times. A sizable date industry in California and Arizona began in 1890 with imported trees.

Gold Flows from Orange Groves

THE orange industry, in the past half-century, has undergone one of the most astounding booms in the history of agriculture. In 1900 oranges were a luxury in most of the United States, a Christmas treat or a dessert for special occasions.

Today oranges are for sale in every cross-roads store the year round. Orange juice is a regular part of the breakfast of most children and many adults. In tons produced, in dollar volume, and in popular taste, oranges are our leading fruit.

Most recent increase has come in the production of frozen, concentrated juice. From almost nothing before World War II, frozen orange juice has grown into a \$100,000,000-a-year business using about one-fourth of our total crop of some 4,000,000 tons a year.

Oranges, Too, Got Their Start in Asia

The native home of the orange is south China and Indochina. From there it has spread to every part of the world which has a suitable climate. The orange tree will withstand only a few degrees of frost. Temperatures of 25° F. will cause some injury to the trees, and temperatures below 20° will cause severe injury or death.

The oranges of the world are classed in three principal kinds, each with many varieties. The most important, both in the United States and in most other countries, is the sweet orange, *Citrus sinensis*. These oranges are relatively sweet, generally round to oval in shape, and the peel adheres rather tightly to the pulp, or flesh.

The mandarin oranges, *C. reticulata*, have thin, loose skin that separates very readily from the pulp. The segments of the pulp also separate easily. These can be further classed as the tangerines, having dark, orange-red peel, and the satsumas, having lighter, yellow peel. The mandarin oranges are the kinds most extensively grown in China and Japan.

The third group, the sour or bitter oranges, *C. aurantium*, has fruits too sour and bitter for eating out of hand. They are used for making marmalade and for ade drinks in some countries.

Sweet and mandarin oranges have undoubtedly been eaten in south China since the country was inhabited. References to oranges in Chinese writing date back to about 2200 B. C. Their spread to other countries, however, was relatively slow. The sweet orange is not mentioned in European writing until after the beginning of the 15th century.

As with the lemon (page 356), Columbus carried seed of the sweet orange when he sailed in 1493 to establish a settlement on Hispaniola. The orange flourished there;

early in the 16th century it was taken to Mexico and Central America.

It was planted in Florida when St. Augustine was settled in 1565. It may have reached Florida even earlier, but there is no definite record to this effect.

Two centuries later, settlers found many wild orange groves, spread by seed from early plantings, in central Florida. These were growing about the lakes and, particularly, where there had been Indian villages. One such wild grove, described in 1764, was 40 miles long. Not until Florida became a part of the United States in 1821, however, did a commercial industry start.

The sweet orange reached California with the establishment of the mission at San Diego in 1769, and was carried to other missions as they were established. A planting of some 400 trees at the Mission of San Gabriel about 1804 represented the first sizable citrus orchard in the State.

The mandarin oranges, outranking the sweet oranges in popularity in China and Japan, did not reach Europe until 1805. By 1850 they were well known in Mediterranean countries. The first recorded introduction into the United States was by the Italian consul at New Orleans, who planted Chinese mandarins there between 1840 and 1850.

Research workers of the United States Department of Agriculture have crossed sweet oranges and tangerine oranges, the crosses being known as tangors. Such crosses also have occurred naturally and are among the most delicious of our citrus fruits.

Florida Raises Most Oranges

Today, Florida leads the world in orange production. California is a close second, followed by Texas, Arizona, Louisiana, and Mississippi.

In Florida and California, orange production is highly organized and strongly competitive. Both States have laws regulating the maturity, quality, and even the sweetness of oranges sold. To prevent diseases and molds which result from damaged skins, the fruit is picked by skilled workers, often wearing soft cloth gloves. Long conveyor belts may then carry the ripe oranges through successive washings in soap and water, borax solution, and clean water. Mechanical brushes scrub them as they go through the bath; then they are dried in wind tunnels. Some are even coated with wax for additional protection. Grading the fruit, wrapping them in tissue paper, and packing are done by hand.

Spain, Brazil, China, Japan, Italy, and Palestine are heavy orange producers; in fact, all tropical and subtropical countries produce considerable quantities.



Oranges, Grown in Burma 4,000 Years Ago, Are the World's Leading Fresh Fruit

Sweet oranges and mandarins (tangerines) had spread west to Europe by the 3th century. Columbus took orange seeds to Haiti; Spanish settlers brought them to Florida about 1565, to California in 1769. The United States now produces more than 100,000,000 boxes of oranges a year—about half the world supply.

The Aristocrat of the Breakfast Table

AMERICA has given grapefruit to the world, although the grapefruit, like most of us living in America, traces its ancestry to other lands.

In tracing the grapefruit, we must consider first the pummelo, or shaddock, *Citrus grandis*. The native home of the pummelo is not definitely known. The general abundance of trees indicates that it probably originated in the Malay Archipelago and neighboring islands as far east as the Fijis.

The pummelo fruit is very large, often up to 8 inches in diameter. It has the color and general appearance of a very large, coarse, thick-skinned grapefruit. The membranes that enclose the segments are extremely tough. The tree is large for citrus, and a vigorous grower.

The pummelo apparently reached Europe about the same time as did the lemon (by, or before, the middle of the 12th century). Known under the name "Adam's apple," it was grown mainly as a garden curiosity.

There is no record that the Spanish took the pummelo to the New World. It was first recorded as being in the West Indies in 1696 by Hans Sloane, in a catalogue of plants of Jamaica. Its introduction there is credited to a Captain Shaddock, commander of an East Indian ship, who stopped at Barbados on his way to England and left seed of the pummelo there. Captain Shaddock not only introduced the fruit to the Americas but gave this ancestor of the grapefruit its generally known English name.

First Known as "Forbidden Fruit"

The grapefruit, so far as is known, originated in the West Indies, but the exact place or manner of its origin is unknown. It was first described in 1750 by Griffith Hughes, in his publication *The Natural History of Barbados*, under the name "Forbidden fruit." A little later the forbidden fruit, or "smaller shaddock," was said to be "cultivated in most parts of the country (Barbados)."

The name grapefruit originated in Jamaica, apparently either from a belief that the fruit resembled the grape in flavor, or from the fact that the fruit is frequently borne in clusters.

The characteristics of the grapefruit suggest that it might have come from a cross of the shaddock and the sweet orange. Its behavior in breeding or when grown from seed indicates, however, that it is not a hybrid. Its seed progeny is typically grapefruit, instead of showing the characteristics of two parents. It seems most probable that the grapefruit originated as a mutation of the pummelo, or shaddock.

Although grapefruit was described from

Barbados in 1750, almost 100 years passed before it was introduced into Florida. Don Phillippe, a Spanish nobleman, planted trees at Safety Harbor, Florida, presumably from seed from the West Indies. The exact date of this planting is not known, but it is believed to have been about 1840. From these Phillippe trees and their seed progeny most of our grapefruit varieties have come.

The grapefruit's rise in popularity—after a comparatively slow start—has been meteoric. For several decades after it was brought to Florida the grapefruit was hardly known outside the State. There were no shipments to northern markets until after 1880. At the turn of the century only a few thousand boxes a year were being produced; individual grapefruit were still something to be stared at in fruit shops and talked about when served at the table.

Yet in 10 short years, by 1910, production had reached 1,000,000 boxes a year. It has grown steadily since, until today America produces some 50,000,000 boxes a year (about 80 pounds to a box).

Today's cultivated grapefruit trees are highly productive. They grow from 15 to 25 feet high, and have dark green leaves; a single tree, when mature, may produce up to 1,500 pounds of fruit a year.

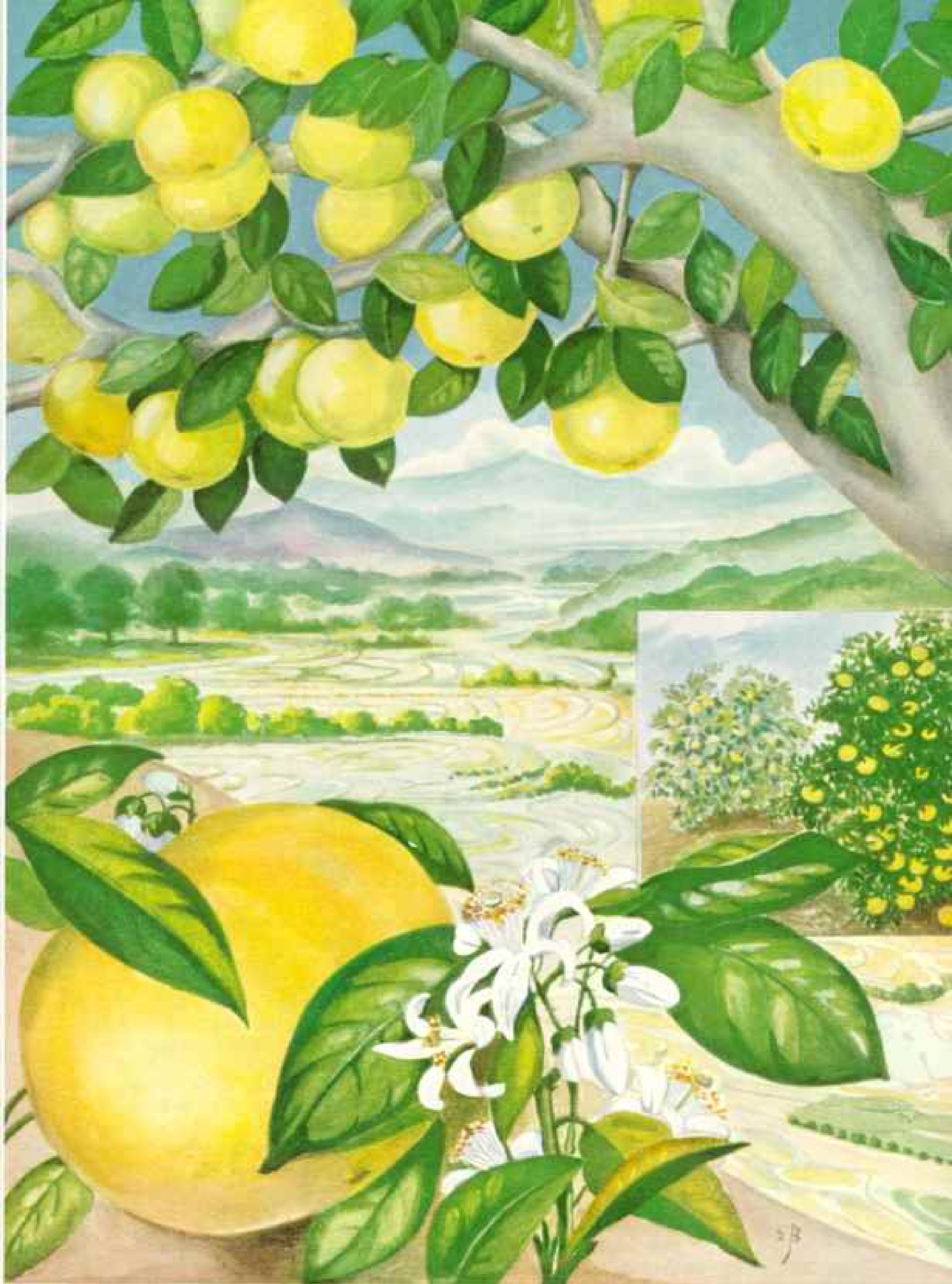
End of the Seedy Core

The grapefruit of the early years was seedy, but a tree producing nearly seedless fruit was discovered near Lakeland, Florida, and propagated about 1890. This tree was the start of the nearly seedless variety, Marsh, which is now the most widely grown kind. Still later, mutations having pink color in the flesh were found, some of them seedless, or nearly so. Today the pink-fleshed, seedless varieties command a premium on the fresh-fruit markets.

The State of Florida, cradle of grapefruit culture, still leads in the growing of this crop. Since 1925 there has been a great development in grapefruit growing in the Rio Grande Valley in the extreme southern tip of Texas. Arizona and California also produce substantial quantities.

When the fruit became so popular in this country, other citrus-producing areas also became interested in it, and today grapefruit is grown to some extent in all citrus-growing countries. Nowhere else, however, has it become as popular as in the United States.

Grapefruit have been crossed with a number of other kinds of citrus. Crosses with tangerine oranges have produced a new class of fruits called tangelos. These are usually juicy, rather thin-skinned fruits which peel easily and have a rich flavor.



Grapefruit Evolved from the Shaddock, a Thick-skinned East Indian Fruit

First grapefruit, tart and seedy, were found in Barbados about 1750. Introduced into Florida in the 1840's, grapefruit have since been developed into our nearly seedless, semisweet breakfast and dessert fruit.

The Ade Fruits, Lemon and Lime

LEMONS and limes probably have more varied uses than any other citrus fruit. In many parts of the world, one or the other is used to flavor fish, meat, pies, puddings, and other food. In the United States lemon juice is a popular ingredient in salad dressing, and also goes into much of the tea drunk. Both form the basis of ade drinks, popular in hot weather.

Their richness in vitamin C makes both valuable additions to the diet. Sales of lemons in this country are noticeably linked to the prevalence of colds as well as to hot weather. British sailors were first called "limeys" because of the quantities of limes furnished them on shipboard to prevent scurvy, a disease caused by lack of vitamin C.

Yet, despite their value and versatility, both fruits are limited to a comparatively small share of the citrus market. The reason is obvious: in a beverage glass one small lemon or lime does the work of two or three good-sized oranges.

The Orient Grows a Sweeter Lemon

The lemon, *Citrus limon*, and the lime, *C. aurantifolia*, are closely linked botanically and historically. Both occur as sweet fruits, as well as the highly acid fruits we know. The sweet varieties are chiefly prized in Oriental countries.

Their native home is believed by most authorities to be the warm, humid district to the east of the Himalayas, in northern Burma, and possibly in eastern India. Both of these fruits, however, have tended to naturalize in any country in which they are well adapted, so the exact original home cannot be determined.

The Arabs established the lemon, and apparently the lime also, in Persia and Palestine, and both undoubtedly were growing in those countries at the time of the Crusades. European writers mention lemons and limes only after that time, and there is strong evidence that the returning Crusaders carried these fruits, as well as sour oranges, to Europe. By the middle of the 13th century they were recorded as well known in Italy.

The date of the introduction of citrus fruits, including lemons and limes, into the Western Hemisphere is well established. On his second voyage to the New World, to establish a colony, Columbus took seeds of many plants. It is recorded that he stopped at the island of Gomera, one of the Canary group, from October 5 to October 13, 1493, and while there secured seeds of oranges, lemons, and many vegetables.

He landed on the island of Hispaniola and established his settlement at Isabela, not far from the present town of Monte Cristi.

Apparently the citrus that he planted prospered, for some 30 years later the abundance of citrus trees on the island was described as beyond counting.

The Spanish conquerors carried citrus fruits to the mainland of Mexico and Central America in the early years of the 16th century. The Portuguese had established them in Brazil by 1540. They were planted at St. Augustine, Florida, when the Spanish settled there in 1565. Soon groves of seedling citrus, spread by the Spanish and Indians, were present in various parts of Florida.

It was two centuries later that the Franciscan padres established at San Diego the first mission in what is now California. They moved there from Mexico and presumably took with them the fruits they had been cultivating, among them, lemons and limes.

Under commercial culture the lemon is subject to serious diseases in hot, humid climates. An early lemon-growing industry in Florida was wiped out by a great freeze in 1894-95. It was never re-established, partly because of the disease problem which had harassed growers even before the freeze.

Today two great centers of lemon production have grown up, both with equably warm climates. One of these is southern Italy and Sicily. The other is in southern California, mainly in the counties near the coast, where the Pacific tempers both the winter cold and the summer heat.

Curing Improves the Flavor

Though lemons were introduced in California more than a century earlier, commercial production did not expand much until about 1880. For years California lemons were regarded as inferior to the Italian. This has been blamed on the fact that growers there did not "cure" the fruit before shipping, a practice commonly followed in Italy.

The curing process consists in picking the fruit while still green and allowing it to ripen in cool storage before packing for shipment. After adopting this practice, the California lemon industry grew rapidly; the State now supplies more than half the world's lemons.

The lime thrives better than the lemon in hot, humid climates, being more resistant to fungus diseases. Thus in humid, tropical countries, the lime, instead of the lemon, is the predominant acid, or ade, fruit. Limes are grown extensively in Mexico and the West Indian islands. Production in the United States is mainly in southern Florida, although some are produced in California. Egypt leads the nations of the world in lime production, both sweet and sour kinds being grown there.



Columbus Planted the First Lemons and Limes in the New World in 1493

Both types of citrus probably originated in Burma and spread west. Crusaders brought them to Europe from Palestine in the 12th century. More than half the world's lemons now grow in the United States.

Banana, Fruit of the Wise Men

BANANAS are the most important fruit in tropical lands around the world. Not only are they a major part of the diet for millions who live in the Tropics but they are also a leading export. About 90,000,000 bunches a year go into world trade, each bunch containing 10 to 20 "hands" of fruit and averaging about 50 pounds in weight.

There are many reasons for the banana's popularity. One is its high nutritive value. A banana contains as much as 22 percent carbohydrate, a rich source of food energy; it also contains vitamins A and C. All these hidden benefits, moreover, are contained in a meat which is soft, sweet, and pleasantly aromatic.

Also in the banana's favor are the ease and speed with which it grows. Banana "trees" are not really trees at all; they are huge herbaceous plants which quickly shoot up to a height of 15 to 30 feet. The plant's true stem is underground and has buds, or "eyes," like a potato. These underground stems, or rhizomes, are transplanted to establish new plantings; as with potatoes, each may be cut into several pieces.

Ready to Eat in 18 Months

Under favorable conditions, the leaf-bearing stalks appear above ground some three to four weeks after planting. They grow rapidly. The bloom appears about ten or twelve months after planting, and the fruit is mature five or six months later.

The botanical name of the common banana of commerce, *Musa sapientum*, means "fruit of the Wise Men." It traces to an ancient legend that the sages of India rested in the shade of the plant and ate of the fruit.

A second species, *M. nana*, the dwarf banana, is a smaller plant, but it bears fruit similar to that of the common banana. These two species, native in southern Asia, probably India, and in the Malay Archipelago, have contributed the varieties of bananas grown throughout the world today.

The closely related plantains, or cooking bananas, *M. paradisiaca* and *M. fehi*, are important food plants in the Tropics. These fruits are not palatable raw since they remain starchy when ripe, but they are excellent food when cooked.

All evidence shows that the banana is one of the oldest fruits known to mankind, perhaps one of the first plants to be cultivated. It had distinctive names in Sanskrit, in ancient Chinese, and in the Malay languages, indicating that it was known throughout much of southern Asia in prehistoric times.

Bananas were found on all the tropical Pacific islands when those islands were first visited by white men. Apparently the fruit

was transported with the waves of migration eastward from the Asiatic mainland to these islands. The first such immigration is believed to have occurred at about the time of Christ.

The Arab poet Masudi, who died A. D. 956, extolled a dish popular in Damascus, Constantinople, and Cairo—a confection of almonds, honey, and bananas in nut oil. This indicates that bananas had reached the Mediterranean shores by that date.

Friar Tomas de Berlanga, a missionary priest, is authentically credited with introducing the banana into the New World. He brought plants from the Canary Islands to Hispaniola in 1516. Shortly afterward, bananas were taken to the mainland of Mexico. The fruit thrived so well and spread so rapidly throughout the American Tropics that later visitors mistakenly thought the banana native on this continent.

Growth of a Giant Fruit Industry

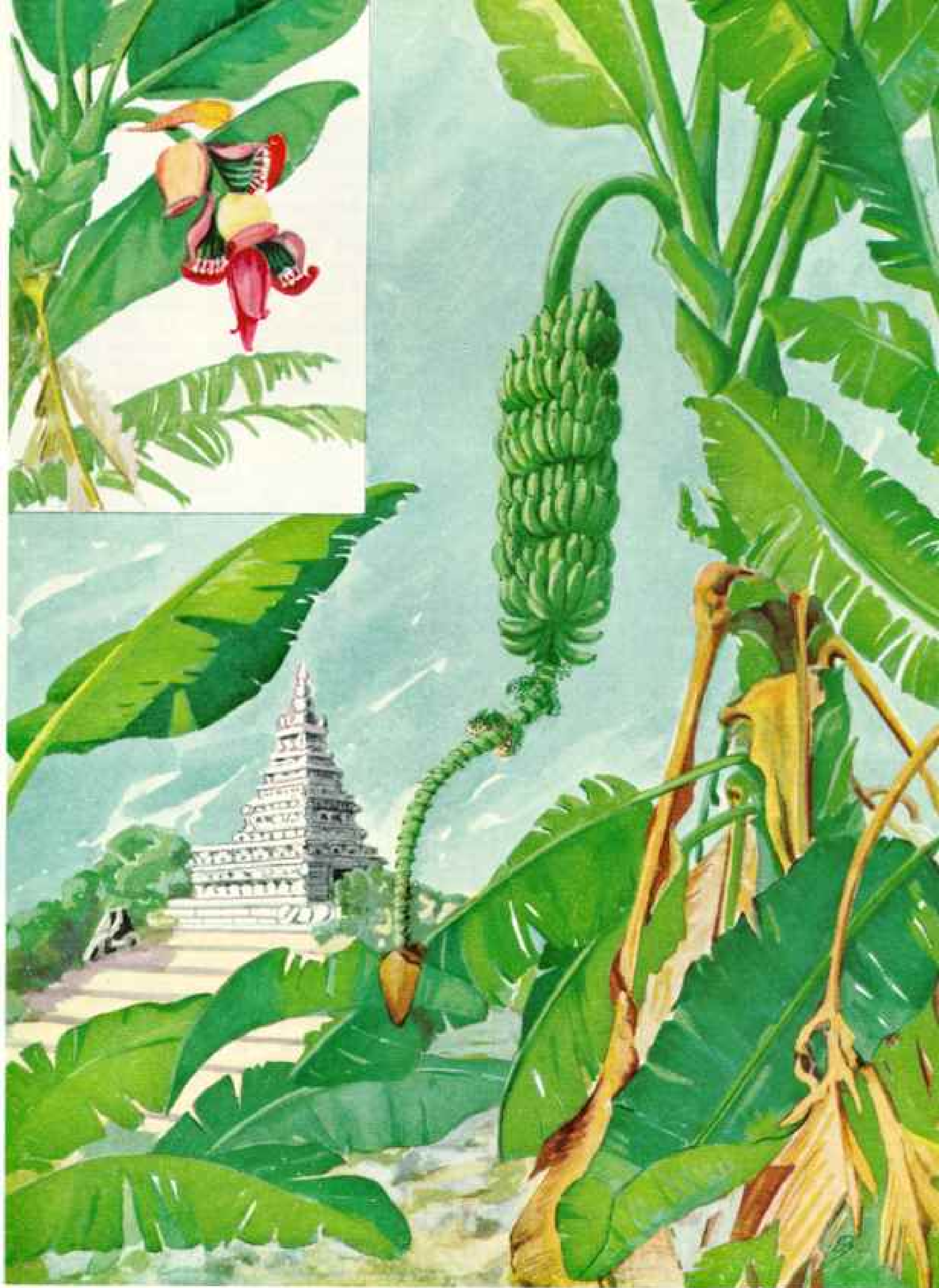
Throughout the first half of the 19th century, vessels occasionally brought a few bunches of bananas from the West Indies into American ports. After the close of the Civil War this trade increased, but many shipments were overripe when they arrived. Between 1870 and 1880 American planters established commercial production in Central American countries, and, with steam vessels, delivery to northern markets became more dependable.

During the same decade, banana production in Jamaica became commercialized, with regular shipments to Boston. At this time large numbers of companies were engaged in growing, shipping, and distributing bananas in the United States. Conditions in growing and marketing were chaotic, and there was great variability both in the supply and in the condition of the fruit delivered. In 1899 the principal companies in the banana trade incorporated as the United Fruit Company.

The banana industry is now one of the most highly organized fruit industries of the world. Plantations are distributed throughout Central American countries, Colombia, and the West Indies, so that risk of crop failure is minimized.

Railroads have been built to carry the fruit from the plantations to shipside. Modern refrigerated steamers transport the fruit to American ports; there it is loaded into refrigerator cars for shipment to all parts of the Nation.

About 60,000,000 bunches of bananas are sold annually in the United States, and this strictly tropical fruit is available in almost every food store in the country. Large quantities are also marketed in Europe. Thus the fruit of the Wise Men, the food staple of the Tropics, has become a world-wide article of commerce.



Bananas, from India, Are the Most Important Fruit of the Tropics.

Most bananas are now grown in the Caribbean area. Half the world's exports go to the United States.

Mango, an Evergreen from India

MANGOES, possibly more than any other fruit, have their critics and their enthusiasts. A true mango lover may develop an almost crusading spirit in promoting the fruit. In India, where mangoes are most widely grown and eaten, wealthy gardeners often collect varieties of mango trees; one such garden is reported to contain 500 varieties.

A leading American mango enthusiast is the naturalist and author, David Fairchild, first famous as a plant explorer for the U. S. Department of Agriculture. In his Florida home, The Kampong, he has collected and cultivated many fine varieties. His recent book, *The World Grows Round My Door*, contains a chapter on "The Gorgeous East Indian Mango"; the following quotation from it gives an inkling of the feelings of a true mangophile:

"Every morning in mango time, as I walk along the path . . . I have to lower my head to avoid striking one of the beautiful Borsha mangoes swinging like a pendulum . . . I fondle it with my hands and watch the red blush growing larger and brighter every sunny day while its greenish-yellow tip turns to gold, my mouth watering for a taste of it."

On the other hand, there are the mangophobes, people who, after tasting a single mango, have pronounced the fruit inedible. They complain of a strong, rank flavor or, most often, say that it "tastes like turpentine."

It All Depends on the Mango

Why the sharp difference of opinion? The basis for it lies in the fruit itself. A superior variety of mango, properly ripened, is all that its supporters say it is—one of the world's finest fruits. An inferior mango, or an unripe one, is fibrous, tough, acid, and does have a flavor resembling turpentine.

Early shipments of such inferior fruit from Florida to northern United States markets helped to start the mango off on the wrong foot in this country. It is this false first impression which the mangophiles now feel duty bound to overcome.

The mango is still little known in the United States outside of Florida, though it is one of the important fruits of most tropical countries. Its culture in the United States is limited to the southern third of Florida, and to the most favored locations there. Temperatures two or three degrees below freezing will kill or seriously injure the trees.

Mango fruits are favored foods of a number of the fruit fly insects not now in the United States—the Mediterranean fruit fly, the Oriental, and others. For this reason, fresh fruits can be shipped into the United States only from Mexico, and from there only after special treatments. Thus mangoes on American mar-

kets are mainly those from the limited acreage in south Florida.

The cultivated mango, *Mangifera indica*, like the citrus fruits, is native to southeast Asia, probably also to the near-by islands. It has been known and cultivated in India since the beginning of agriculture there, and has long been one of the most important fruits of that country.

A mango grove is said to have been presented to Buddha in order that he might use it as a place of repose. Akbar, an emperor who reigned in northern India in the 16th century, is said to have planted a mango orchard of 100,000 trees, or well over 1,000 acres, at a time when large orchards were unheard of in any other part of the world.

The mango was slow to be transported to other countries. The Portuguese probably carried it to East Africa, where mangoes are now common, and also first introduced it into America. They planted it at Bahia (Salvador), Brazil, about 1700. It reached the West Indies some 50 years after its introduction into Brazil, and was taken to Mexico from there early in the 19th century.

First Florida Planting Failed

Henry Perrine, a pioneer Florida horticulturist, took mangoes from Mexico to his place south of Miami in 1833. These trees apparently were lost after Perrine's death. A second introduction, about 1861 or 1862, was successful. These early plantings were seedling trees, however, and bore inferior fruit.

Early attempts to introduce choice Indian mangoes were unsuccessful, but in 1889 the U. S. Department of Agriculture brought in six varieties. Most of these trees were also lost, but at least one tree of the high-quality Mulgoba variety survived. When it began to bear, some nine years later, the superior quality, as compared to seedlings, attracted wide interest. Since then, many choice Oriental varieties have been established.

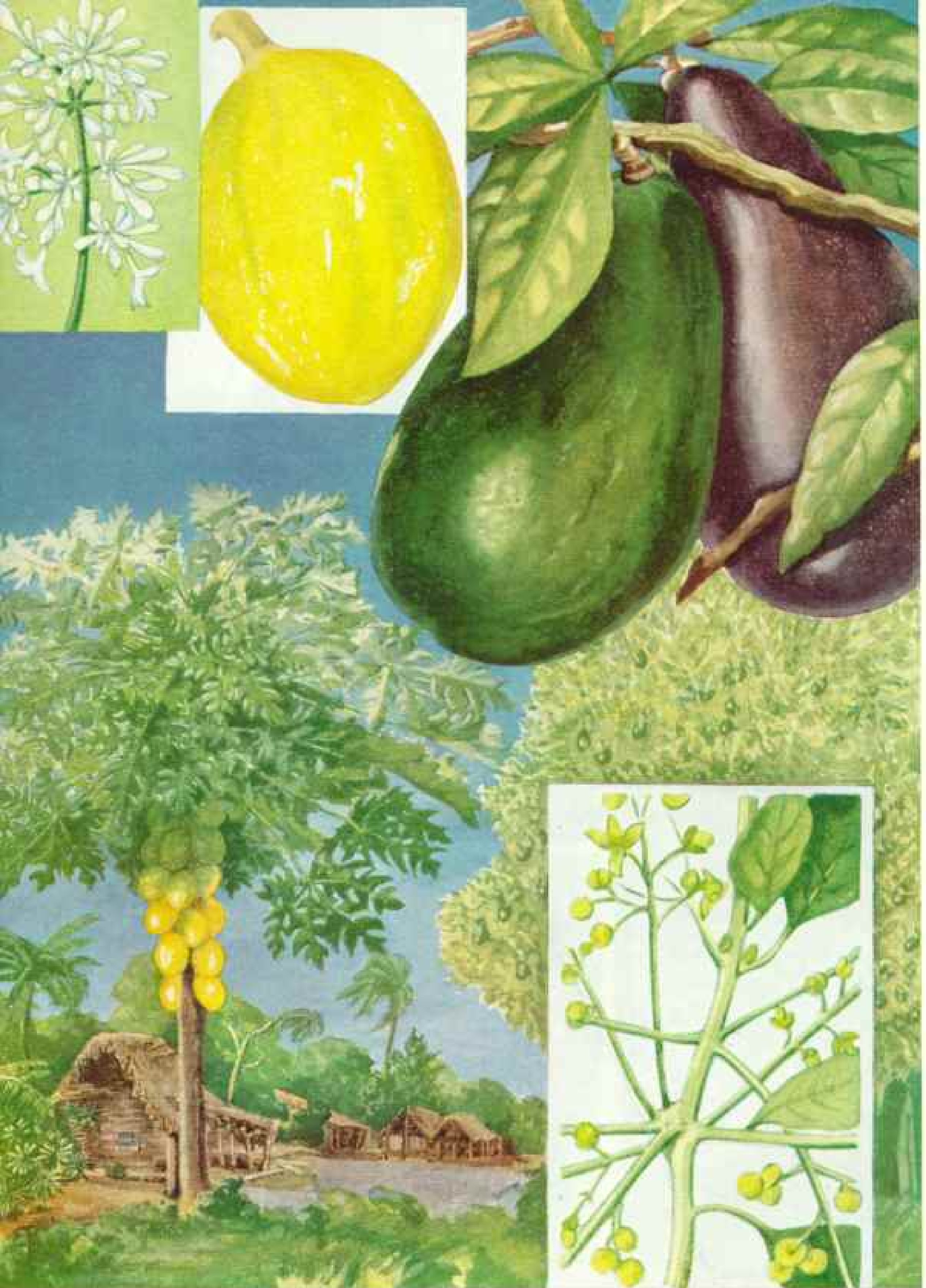
The mango is a large tree with dense, glossy, green foliage. It is most fruitful in areas having alternate wet and dry periods during the year. Choice varieties are fastidious in their requirements; not only are they very subject to low-temperature injury but the roots will not tolerate water-logged soil. Even under the favorable conditions in Florida, yield of fruit of the choice varieties has often been low.

Some commercial canning of mangoes is done in Mexico and other large producing countries. In quality, canned mangoes are comparable to canned peaches. Canned mango is rarely seen in our markets, though Indian chutney, made with mangoes, has had substantial sale here.



Mangoes, a Basic Fruit in the Tropics, Are Still Rare in America

Mangoes are native to southeast Asia and the Malay Archipelago. Portuguese planted them in Brazil about 1700; first successful Florida plantings came after 1860. The fruit, hanging like pendulums from long stems, may grow to four or five pounds. Best varieties have a rich, spicy flavor unmatched by any other fruit.



Papayas and Avocados from Tropical America Have Spread Around the World

Spanish conquistadors found Aztecs and Incas growing melonlike papayas (left) and oily avocados. Papayas are now abundant in Africa, India, and Hawaii. Mexicans use avocados, rich in protein, as a meat substitute.

Avocado and Papaya, Gifts of the Aztecs

TWO native American fruits, the avocado and the papaya, have become important in tropical areas around the world. One of these, the papaya, is little known in the United States. The avocado, on the other hand, is widely shipped from the limited areas where it can be grown, in California and Florida, to markets all over the country.

In this country, avocados are used mainly in salads or desserts. In parts of Mexico and Central America, however, they are often used as a meat substitute; an avocado is rich in protein and contains up to 30 percent of its weight in oil.

A Native American

The avocado, grown long before the discovery of the New World, is native to Mexico and Central America. Two species are recognized by botanists and horticulturists, and both are now important in commerce. The Guatemalan avocados, *Persea americana*, are relatively thick-skinned and ripen their fruit mainly in winter and spring. A subgroup of this species, called the West Indian race, ripens the fruit mainly in summer and fall.

The Mexican race, *P. drymifolia*, has much thinner skinned fruit and is slightly hardier to cold than the Guatemalan and West Indian races. All of the races cross freely, and some of our most valuable avocado varieties appear to be hybrids. Enough varieties have been developed to make mature fruits available practically every month in the year.

The avocado was being extensively used by the Aztecs and other natives when the Spaniards arrived. It is today an important part of the native diet where it grows. Tortillas, avocado, and coffee are considered an excellent meal by natives of Mexico and Central America.

Aztec picture writings had a sign for the avocado. The early Spanish spelling of the Aztec name was *ahuacatl*, but many modifications developed. The English name, avocado, is derived from the Spanish modifications of the original Aztec.

Before the Europeans came to these shores, avocados were growing in much of Mexico and in northern South America, possibly as far south as Peru. They were probably not present in the West Indian islands.

European visitors recognized the value of the rich, oily, nutritious fruit. Even so, it was slow to be transported to other tropical countries, perhaps because it does not propagate very readily.

It was growing in the Hawaiian Islands as early as 1825, and has since been widely distributed in Africa and Polynesia. There are now plantings in most parts of the world where the climate is suitable.

The avocado apparently was not established in the United States until the last century. The first trees of definite record in Florida were brought from Mexico in 1833 by Henry Perrine, a well-known horticulturist, and planted south of Miami. Successful introduction into California was even later. The first recorded planting there was in Santa Barbara in 1871, also with Mexican trees.

The papaya, *Carica papaya*, or melon tree, is a unique contribution from the Americas. This very large, melonlike fruit is still unfamiliar to most Americans, though it spread quickly to other tropical countries after Columbus reached these shores. Before 1600, it had reached the Philippines, India, and probably Africa. Its showy, high-quality fruit and its ease of transport and propagation by seed account for its rapid spread—so rapid that for a time there was question as to whether its original home was America or Africa or India.

There still is uncertainty as to whether its native habitat is the West Indian islands or the mainland of Mexico, or both. Its American origin, however, is well established.

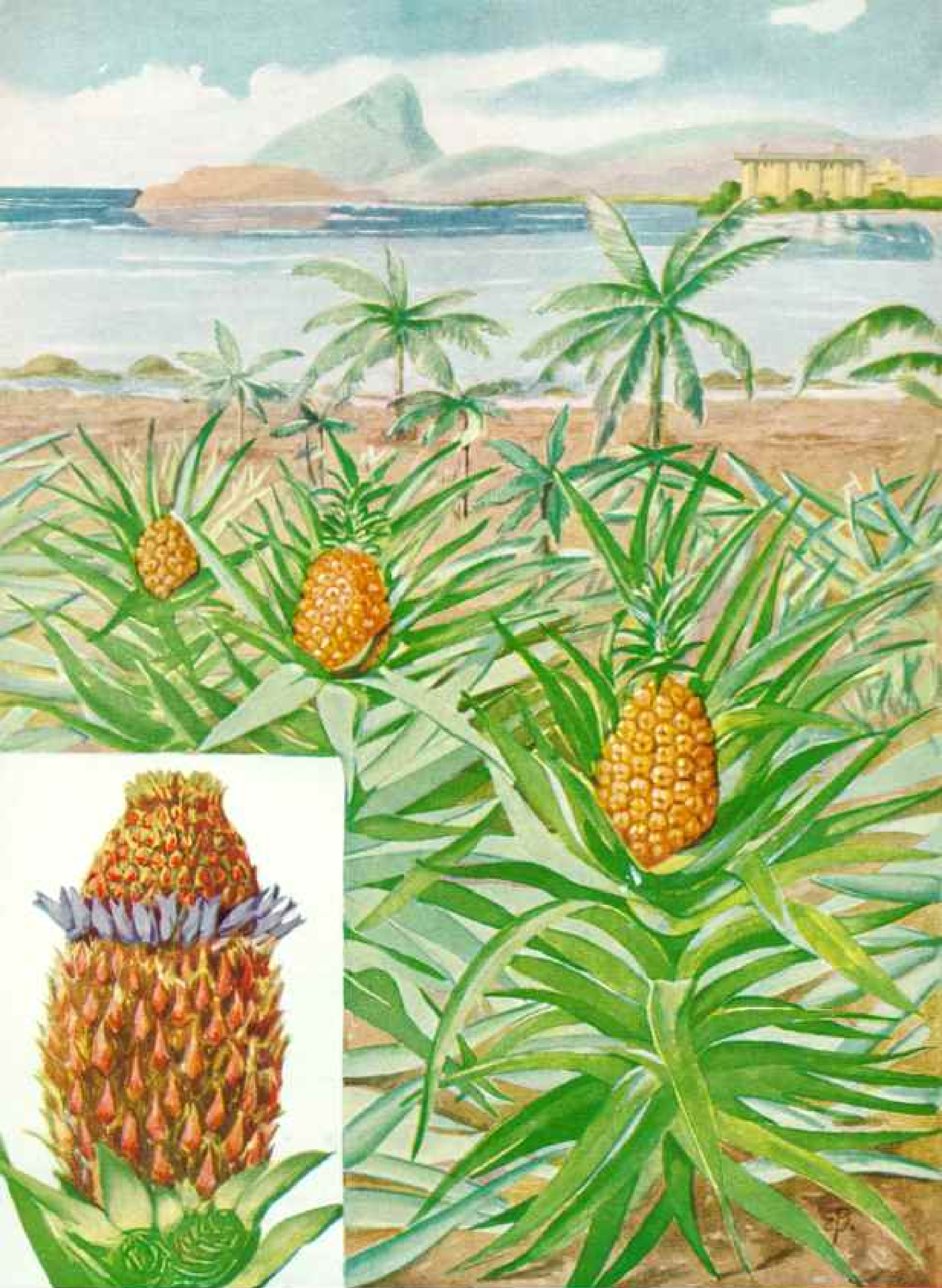
The papaya grows on a giant herbaceous plant, rather than on a tree. The fruits, which range from a pound up to 20 pounds in size, will mature in about 18 months from the time the seed is planted. In frost-free countries plants will produce for several years.

Papaya Juice Makes Tough Meat Tender

The papaya also produces an enzyme, papain, which has become an article of commerce. It resembles pepsin in its digestive action and is used for the treatment of certain digestive ailments. Its major use is as a tenderizer of meats. The principal commercial source of papain is India.

Outside America, the papaya ranks as one of the most important tropical fruits. It is used extensively in Hawaii and is of major importance in tropical Asia and Africa. It is grown only in limited quantities in the United States, almost entirely in southern Florida. The heavy, very tender fruit is difficult to ship.

The avocado, too, is so tender to frost that areas of production in the continental United States are very limited. Most of our avocados are grown in sections of California south of Los Angeles and near the coast. A second important area is south Florida. Neither avocados nor papayas will tolerate temperatures more than a degree or two below freezing. Avocados can be shipped readily, however, and many an American who never saw an avocado tree is appreciative of this gift from the Aztecs.



Pineapples, Sweet and Spiny, Are America's Most Important Fruit Gift to the World

Spread from South America by early traders, pineapples rank next to bananas among tropical fruits. Center of cultivation is Hawaii, where vast fields of low, leafy plants produce some 500,000 tons of fruit a year.

Columbus Found Pineapples in America

FEW Americans know what a really good fresh pineapple tastes like. Only those who have traveled or lived in the Tropics where they are grown know the soft, sweet, juicy fruit as it comes fully ripened from the plant. We can get just an inkling of the flavor by comparing sweet canned pineapple juice, made from ripe fruit without adding sugar, with the hard, tart fresh pineapples sold in grocery stores.

There is a reason for this great difference. In the pineapple plant, a large quantity of starch is stored in the stem. Just before ripening, this starch turns to sugar and is carried into the fruit; the sugar content sometimes increases 100 percent in this last stage.

Unfortunately, fresh pineapples cannot be successfully shipped very far after they are fully ripe. For this reason, combined with the fact that a raw pineapple is troublesome to prepare for eating, Americans eat most of theirs out of cans.

Indians Pronounced It "Excellent"

The pineapple, *Ananas comosus*, native to South America, is one of the most esteemed and widely grown of tropical fruits. Of all the fruits native in the Americas, it ranks first in world-wide importance, and is second only to the banana among fruits grown in tropical countries.

Columbus found the pineapple on the island of Guadeloupe at the time of his second voyage, in 1493. The pineapple, however, apparently is not native in the West Indies but had been taken there by the Indians. The native home appears to be Brazil and probably Paraguay.

Its European name, *anana*, is derived from the Guarani Indian language, in which *a* signified fruit in general and *nana* meant excellent. This tribe, native to Paraguay, overran the other countries north to Panama, and are believed to have spread the "excellent fruit" throughout northern South America long before the coming of the Europeans. Early Spanish explorers found the fruit both in the West Indies and in Mexico.

The Spaniards gave the name "*pina de Indias*" to this fruit because of the general resemblance of the fruit to the pine cone. The English called it pineapple—although it has no resemblance to apple either in appearance or flavor. Other European tongues have retained the native name, or slight modifications of it.

After the discovery of America, the fruit was quickly disseminated throughout the world. The fruit generally is seedless, but the suckers by which the plants are propagated will stand long handling and still grow. There

was no problem, therefore, in distributing plants, even by the slow sailing ships of the 16th century.

It was not only in tropical countries that the pineapple created interest. Fruits taken to Europe were greatly esteemed, and soon gardeners of northern Europe were attempting to produce them under glass.

A wealthy merchant of a small town near Leiden, in the Netherlands, is credited with being the first to produce mature fruit under glass, early in the 18th century. Soon many glasshouse growers in England and other European countries were producing fruit in quantity for sale, and numerous publications described in detail the methods used.

This industry flourished during the 19th century, and some fruit is produced under glass at present. In the Azores, particularly, growing pineapples under glass for the European trade is a principal industry. Large-sized, high-quality fruit can be grown; but the development of large outdoor plantations in the Tropics, together with improved shipping facilities, have made commercial production under glass generally uneconomic.

Pineapples grow on an herbaceous plant with stiff, large, grasslike leaves. New plants are produced by setting the offsets, or shoots, taken from the mother plant. Because the leaves contain tissues especially adapted for retaining moisture, pineapples can survive long periods of dry weather and are often grown in semiarid regions.

Moisture Conserved by Holes in Paper

Where commercial production is on a large scale, as in Hawaii, ground where pineapples are to be planted is often covered first with asphalt-treated paper to conserve moisture. Shoots are set through holes in the paper, and moisture which collects on the leaves from rain or dew flows inward to the stem and down through the holes.

Between 15,000 and 20,000 plants are set to an acre. In 12 to 18 months after setting, each of these produces a single fruit, on a stem usually two to three feet high. After the fruit is harvested, the shoots along the stem will grow and produce a second crop about 12 months later. Under favorable conditions plantings will last for years, but the size of the fruit tends to decrease. In commercial production, two to five crops are harvested before the plantings are torn out and reset.

About four-fifths of the pineapples entering world trade come from Hawaii, and most of these are sold in the United States. Shipments of juice to the mainland total more than 30,000,000 gallons a year, and an equal volume is sold as canned fruit.



In Most Temperate Lands, Strawberries Are the First Fruit of Spring

Small, sweet strawberries grow wild around the world (upper left). Best of the larger varieties cultivated commercially come from a chance crossing of hardy North American and Chilean berries in the early 1700's.

A Pan American Union Produced Our Strawberries

THE strawberry is America's favorite cultivated berry. In large commercial plantings and small gardens, we devote approximately 180,000 acres to growing it. The annual crop has a cash value of more than \$35,000,000.

The berries are sold fresh or frozen for breakfast or dessert fruit; cooked and canned, or made into unexcelled preserves; or combined with other ingredients into two of our most popular confections, strawberry shortcake and strawberry ice cream.

Because they are easy to grow, strawberries are found in many home gardens. Spraying is generally not necessary; a moderate amount of cultivation, weeding, fertilizing, and occasional transplanting are all the care they need. They are also one of the few crops which part-time farmers can easily turn into profits.

The plants will grow on soils ranging from sand to clay, and in climatic areas from Florida into Canada and Alaska. In colder parts of the country, beds must be covered in winter, usually with from one to six inches of straw.

Breeding and Cultivation Began Late

Although species of strawberry are native in most of the temperate regions of the world, the large-fruited, productive varieties of the present have come from the union of species found in the two Americas. As an important cultivated fruit, the strawberry is a recent addition to world horticulture.

Wild strawberries were found over much of Europe from the earliest days, being mentioned by Virgil (70-19 n. c.) and Pliny the Elder (A. D. 23-79). Not until centuries later, however, is there evidence of cultivation. Berries from the wild were taken into gardens at least by the 15th century. These European species bore fruit of good quality and were especially notable for their aroma, but the fruits were small and the plants bore sparingly. Little improvement in size or yield occurred under cultivation.

When the colonists landed in eastern America, they were amazed at the abundance, plant vigor, and fruitfulness of the native strawberry, *Fragaria virginiana*. "Wee cannot sett downe a foote but tred on strawberries," a colonist from Maryland wrote home to England.

This strawberry was taken to France; the date, as given by Jean Rodin, gardener to Louis XIII, was 1624. From France it was taken to England and other European countries and was extensively grown in gardens. The berries, even under cultivation, remained small, although of good flavor and much more productive than the old European kinds.

The next great event in the history of the strawberry was the introduction of plants from Chile, South America. Long before the white men arrived, the Indians of Chile had cultivated a strawberry better than the European or the wild North American varieties. Some plants bore fruit as large as walnuts. A Frenchman, Captain Frezier, observed these strawberries and took plants to France in 1712. A few years later, the Chilean berries, *F. chiloensis*, were taken to England.

It seems probable, although direct proof is lacking, that European gardeners in many cases planted the Chilean and the North American kinds in the same gardens. Seedling plants which were crosses of the two kinds originated by chance. Some of these were large-fruited, vigorous, productive plants, the ancestors of our modern varieties.

Not until shortly before 1800, however, were these improved varieties listed by American nurserymen. One of the first of these, a variety from Europe named Pine, but with *F. chiloensis* in its ancestry, became a parent of many varieties produced in this country. By 1825, strawberry growing was well established in home gardens, and commercial culture near the larger cities was developing.

In 1838, Charles M. Hovey, a fruit grower, breeder, and writer on horticulture at Cambridge, Massachusetts, introduced a variety which he had grown from seed produced by cross-pollination. This variety, named the Hovey, not only was a sensational improvement in strawberries but represented, so far as is known, the first fruit variety of any kind originating as a result of definite breeding effort in the United States. It proved a great stimulus to fruit breeding.

Improvement Projects Under Way

Since the latter half of the 19th century many amateur breeders have crossed and selected strawberries, and the general quality of the varieties has continually improved. In addition, several of the State experiment stations and the U. S. Department of Agriculture have large-scale breeding projects for the improvement of this fruit. Most of the outstanding new varieties of the past 20 years have come from this State and Federal work.

Strawberries are grown to some extent in every State in the Union. Largest centers of commercial production are in Louisiana, Tennessee, Arkansas, Oregon, California, North Carolina, and the sections of Maryland, Delaware, and New Jersey east of Chesapeake Bay. Commercial production is carried on in almost every State, however, and in all other nations of the Temperate Zones the "Pan American" strawberries are the kinds principally grown.



Thorny Blackberries and Raspberries Were Pests to Land-clearing Colonists

Raspberries grow wild from the Arctic to the Equator; blackberries chiefly in temperate areas. Because they are plentiful, efforts to improve them began late. Crosses produced Young- and Loganberries.

Fruits That Grow Among the Brambles

MANY a bare-legged hiker, pausing as a bramble tore at his skin, has stayed to pick the fruit that grew on it. In almost any part of the temperate world, this fruit would probably be either of two closely related kinds, blackberries or raspberries.

These two berries, both members of the rose family, have similar histories. Both are native to Asia, Europe, and North America. If raspberries go a little farther north (to the Arctic) and south (to the Equator), blackberries are generally more abundant in temperate regions.

Both are quick to spring up in neglected fields, and for many years were more apt to be mowed or plowed under than cultivated. Their very abundance kept them from commercial planting and scientific breeding until comparatively late in horticultural history.

Raspberries were first mentioned in agricultural writings by the Roman naturalist Pliny in the 1st century. He spoke of wild raspberries as having come from Mount Ida, in Greece. Centuries later the great Swedish botanist Carolus Linnaeus gave the name *Rubus idaeus* to the common form of the European red raspberry, because of this early reference to Mount Ida.

"An Afternoon's Dish to Please the Sicke"

The raspberry was mentioned so seldom in early European writings that it is apparent that the fruit was of little importance. Not until 1629 did an English writer more than mention the fruit. In that year a work on orcharding devoted a short chapter to raspberries. It described red and white kinds, and recommended them for "an afternoon's dish to please the taste of the sicke as well as the sound."

During the 19th century many varieties of high quality were selected or developed from breeding efforts, particularly in northern European countries. Raspberries there are mainly derived from the native European species, *R. idaeus*, and many of the varieties are richly flavored.

In America early colonists found raspberries growing abundantly. Two kinds were common, the red raspberry, *R. idaeus strigosus*, quite similar to the European, and a black-fruited kind, *R. occidentalis*, now known as the black raspberry or blackcap raspberry. From these two American species, and from hybrids with the European species, our cultivated American varieties have been derived.

Named varieties appeared in America at about the same time they did in Europe. Several are named in the *American Gardener's Calendar*, published in 1806, one of the first books published in America dealing especially with gardening and orcharding.

Beginning about the middle of the 19th century, great interest developed in America in the breeding of fruits, including raspberries. The most prominent of the raspberry breeders was Dr. William D. Brinckle, a physician who spent most of his life in Philadelphia. Fruit breeding was his avocation, and he introduced several excellent red raspberries. The variety now probably most widely grown, the Latham, was originated by the Minnesota Experiment Station.

Blackberries Grow High and Low

While blackberries have been divided into hundreds of species, two major kinds occur both in Europe and America. These are the upright growing forms and the prostrate, or trailing, forms, often called dewberries. How this name originated is uncertain. Perhaps it was because the berries frequently were covered with dew when gathered.

The upright blackberries not only have stiff, erect canes but are generally very thorny. They propagate by suckers from the roots. In contrast, the trailing blackberries of America have slender canes, are much less heavily thorned, and do not sucker. The tips of the canes, if in contact with the soil, strike root and establish new plants. In general, the upright forms have a strong flavor, with a somewhat bitter aftertaste. The trailing forms are usually milder flavored.

In America blackberries thrive in all except the coldest or driest parts of the country. They are particularly abundant along the eastern seaboard, west to the Plains, and throughout the southern half of the country. Texas is particularly rich in this fruit. Two very high-quality species of dewberries also grow along the Pacific Coast.

In Europe blackberry culture seems to have occurred mainly in the past 50 years; in America it started somewhat sooner. In 1850 a bush-type variety, Dorchester, was named in Massachusetts, and remained a valuable variety for nearly half a century. About 1875 a dewberry, the Lucretia, was discovered in West Virginia and transplanted to Ohio. This is still the leading dewberry in more northern latitudes.

In recent years, three high-quality trailing types have been widely grown. These are the Youngberry, bred by B. M. Young, a private breeder of Morgan City, Louisiana; the Loganberry, apparently a cross between the Pacific trailing type and the raspberry, which originated in the garden of Judge J. H. Logan at Santa Cruz, California; and the Boysenberry, a variety quite similar to Youngberry, of chance origin in California. Unfortunately, all are tender in the colder parts of the country.



Pilgrims Found Cranberries Ripe and Ready for the First Thanksgiving Dinner

In 1677 Massachusetts sent King Charles II ten bushels of these native berries as a gift, calling them "choicest product of the colony." Cranberries grow best in land that can be flooded in winter.

Indians Taught Us to Use Cranberries

WHEN the Pilgrims landed at Plymouth Rock, they found a thornless vine growing thick over most of the low, semiswampy areas. On the vines were red berries, unfamiliar and bitter to the palate.

Later the Pilgrims learned that the Indians valued these berries highly, both as food (probably pounded with meat into a paste called "pemmican") and as a poultice for blood poisoning. The Indian name for them was *I-bimi*, "bitter berry." The colonists, perhaps because the berries were a favorite food of cranes, called them crane-berries, and eventually, cranberries.

It would be pleasant to say definitely that the Pilgrims ate cranberries with their turkey and bear meat at the first Thanksgiving dinner, but there is no sure evidence that they did. The record of that feast, contained in a letter believed to have been written by Governor Edward Winslow, tells that four hunters were sent out and killed enough fowl in one day to serve the company for a week.

Chief Massasoit and a party of his tribe joined them for three days and added three bears to the larder. Cranberries would have blended admirably with this menu; the Indians were familiar with them; and at that season of the year they should have been plentiful. Beyond that the evidence does not go.

Berries That Thrive Under Water

The American cranberry, *Vaccinium macrocarpum*, is native from Nova Scotia, Canada, to North Carolina and westward to Wisconsin. It is found mainly in low, swampy sites, particularly those that flood in winter and drain in summer. The coast of Massachusetts, particularly Cape Cod, was a rich center of native cranberries in colonial days; it still leads in production today.

For nearly 200 years the settlers were content to harvest their cranberries from wild vines. This wild crop was a considerable source of revenue on many farms. Early in the 19th century the first attempts were made to transplant and cultivate the fruit.

Henry Hall, a veteran of the Revolution, is credited with being the first to try. About 1816 he transplanted wild vines to a swampy site near Dennis that appeared favorable for cranberries. His efforts were apparently successful. In 1852 the local paper printed a story of his work, stating that his grounds averaged about 70 bushels per acre production.

Soon other growers in Massachusetts were planting cranberries; a little later culture was started in New Jersey. Many plantings failed before growers gradually learned the conditions essential for success. They learned that bog areas with peat soil were favorable; that

these should be leveled and the surface layers removed to eliminate weeds; that they should be well ditched to provide drainage, but should also be built so that they could be flooded during the winter, both to protect the vines from cold and to control insect pests.

Thus in the last century cranberry growing has evolved as one of our most intensive and complicated horticultural industries. Expensive preparation is necessary before planting. Practically all bogs are built so that they can be flooded and drained quickly, either by large pumps or by natural flow. Sand is spread over the peat to promote the growth of vines. Problems of insect and disease control must be solved.

Yet the industry has grown until about 800,000 barrels are produced in an average year, mainly in Massachusetts, Wisconsin, New Jersey, Washington, and Oregon. Massachusetts is by far the leading State, raising more than half the Nation's crop.

The earliest plantings were made with unselected wild plants, but soon growers began to choose highly productive plants with especially fine berries. These were propagated and became the basis of the present industry. Modern growers have produced as many as 300 bushels of cranberries on a single acre.

Cranberries are picked by hand, or with large, rake-toothed scoops which are pulled through the vines and remove the berries. Since some of the berries are usually bruised, damaged, or decayed, they must be sorted before they are sold.

One method, common in earlier times and still used in principle, was to roll the berries down a series of 10 to 30 steps. The good ones, being firm, bounced to the bottom like little rubber balls; the damaged berries, being soft, stayed on the steps. Machines are now largely used for grading, but even these depend on the ability of the good berries to bounce.

Equally Good on the Fourth of July

The American cranberry has not become a cultivated crop outside the United States and Canada. In the far north of Europe a related, but smaller-sized, fruit is abundant as a native plant, and great quantities are harvested. Neither the European species nor the American is extensively cultivated in Europe.

The tradition that helped to give cranberries their start in America has in recent years held the industry back. Growers and canners, producing far more berries and sauce than consumers can possibly eat at Thanksgiving season, have sponsored publicity campaigns to persuade housewives that cranberries are good to eat the year around, not just on one Thursday in November.

Blueberries Are Crops That Raise Themselves

WHEN forests are cut or burned away, blueberries are often among the first plants to spring up on the cleared field. Frequently they become the dominant vegetation, providing the landowner with a paying crop that requires little care except for harvesting.

If the field is completely neglected, however, taller shrubs and trees soon grow and shade or choke out the blueberries. Thus in New England and other areas where native blueberries are harvested, it is a common sight to see a farmer burning or mowing his blueberry fields. The berries quickly spring up again; the second year after burning a maximum crop will be ready. Some farmers fertilize the fields occasionally and also dust or spray them to control berry worms. On many farms this wild crop is a principal source of income.

The blueberry group is probably the most widely distributed fruit in the world. Species of this group are distributed over much of Asia, Europe, and North and South America. They extend from the Tropics to the northern limits of human habitation. They are a valuable addition to the diet of the Eskimos.

Although widely distributed and widely used as food, only in the United States and Canada is the blueberry a cultivated, horticultural crop. All of the blueberries grown in North America have been bred from species which are native here.

If You Feel the Seeds, It's a Huckleberry

There is great confusion in the common names blueberry and huckleberry. In some areas the names are used interchangeably. The U. S. Department of Agriculture and most botanists and horticulturists now use the name huckleberry for the berries belonging to a related group of plants that have 10 rather large bony seeds which are noticeable and somewhat objectionable when the fruit is eaten. Blueberries, on the other hand, have a large number of very small, inconspicuous seeds—so small that they are not noticed when eating the fruit. Only the blueberries are grown as a horticultural crop.

The blueberry thrives only on acid soils. Various species occur over most of the United States and Canada east of the dry prairies. Along the west coast, especially in mountain sites, blueberries also thrive abundantly.

The blueberry still is gathered in quantities from the wild. The coastal counties of Maine, the Appalachian plateau from New England to Georgia and Alabama, the Ozarks of Missouri and Arkansas, and the Cascade and Coast Range mountains of the Pacific States are areas where picking and selling wild blueberries is an important industry. Cash value

of the annual wild blueberry crop in the United States has been estimated at between \$8,000,000 and \$10,000,000.

The fruit of at least seven species is harvested on a fairly large scale. The most important species for native harvest is the low-bush blueberry, *Vaccinium angustifolium*, the dominant kind from New England west to Minnesota. Second is the high-bush blueberry, *V. corymbosum*, found throughout the Atlantic Coastal Plain from New England to Georgia, and westward to Lake Michigan.

Improvement of blueberries by breeding is the work of the past half-century. Two names stand out in the story of this research. One is Dr. Frederick V. Coville, long a botanist of the U. S. Department of Agriculture; the other is Miss Elizabeth C. White, a pioneer grower in Whitesbog, New Jersey. Miss White offered cash prizes for the native high-bush plants producing the largest fruit, and thus was able to assemble many large-fruited forms.

Dr. Coville and Miss White made crosses, starting in 1909, among these superior plants. The breeding work was continued until Dr. Coville's death in 1937. Miss White has continued her research to the present.

As a result of this work, 18 varieties having large fruit, attractive color, and ripening over about a two-month period have been introduced. These varieties today constitute the extensive cultivated blueberry industry in New Jersey, Michigan, North Carolina, and other States. The fruit of some of them is more than double the size of the largest wild berries.

In the far South, the rabbit-eye blueberry, *V. ashei*, is cultivated on a considerable scale. A number of varieties have been selected from the wild, but only in the past decade has systematic breeding been undertaken. This species is well adapted in the areas within about 300 miles of the Gulf of Mexico. Between 3,000 and 4,000 acres are devoted to growing them in northwestern Florida and near-by States.

Mulch Is Best for Growing

Because of the exacting requirement of the blueberries as to soil, they are not widely adapted to upland garden culture. They can be grown on many acid soils, particularly if the soil is kept mulched. A heavy mulch of sawdust, oak leaves, or similar material seems to provide the best growing conditions.

In small gardens, birds, lovers of blueberries, frequently will harvest the crop before it is fully ripe. Covering the plants before the fruit begins to ripen is about the only way to save the fruit where only a few bushes are grown.



Blueberries, Most Widespread of Wild Fruit, Feed Tropical Tribes and Eskimos

Blueberries and their seedier cousins, huckleberries, grow wild in virtually all areas between the Poles. Only recently have botanists tried to improve blueberries by breeding and cultivation; yet already new varieties have been produced with berries up to seven-eighths of an inch in diameter.

Two Berries Known Best for Their Jelly

CURRENTS and gooseberries, spicy-flavored berries used in America chiefly for cooking, are prime examples of how fruit can be improved and yields increased by cultivation and breeding. In its wild state, a gooseberry weighs somewhat less than a quarter of an ounce. Under culture, gooseberries have been increased to eight times this size, with individual berries weighing up to two ounces.

At an experimental farm in Ottawa, Canada, currant bushes of the Pearl variety have been grown for years with an average yield at the rate of 12,402 pounds per acre. Peak yield has been at the rate of more than 13 tons an acre.

Currants and gooseberries, related fruits of the genus *Ribes*, are native in the colder parts of Europe and North America. While they are planted in many home fruit gardens in the northern half of the United States, they are not nearly so important here as in the northern European countries. In England especially they are grown in great quantities and eaten both as fresh fruit and in jams, pies, and puddings.

The European history of these two fruits is very similar. Neither is well adapted to culture in southern Europe, and neither is mentioned in early horticultural writings from the Mediterranean countries. Species from which the cultivated varieties were developed are native over most of Europe, but in southern areas grow only in the high mountains. Thus it was not until agriculture and horticulture developed in northern Europe that these fruits attained any importance.

Both currants and gooseberries were first mentioned as garden fruit plants about the time of the discovery of America. References in English writings begin about the middle of the 16th century. At least one German writer described currants in some detail late in the 15th century. Both fruits probably first attained importance in the Low Countries of Europe, particularly the Netherlands.

Dried "Currants" Are Really Grapes

The name currant is misleading. It apparently derives from the resemblance of the berry to the currant or Corinth grape, a small-fruited, seedless grape long grown for drying. So-called dried "currants" of commerce, to the present time, both in Europe and America, are actually dried grapes of this type, and not really currants at all.

The origin of the name gooseberry is less certain. The obvious assumption is that it was once largely served with goose. It seems more probable, however, that the English name is derived from the Dutch name *kruis-bes*, literally, "cross-berry."

The currant was listed with other fruits and crop plants sent to the Massachusetts Bay Colony in 1629. Gooseberries also were sent to the New World then, or shortly thereafter, though we have no specific record of the date. The European currants thrived so well in America that little effort has been made to improve our native kinds, although many species of currants are native here. The white and red varieties commonly grown are derived mainly from the European species *Ribes sativum* and *R. rubrum*. The best commercial varieties are probably hybrids of these two species.

Black currants of the species *R. nigrum* are extensively grown in northern Europe, and have long been said to have medicinal value. Recent research has shown that they are extremely rich in vitamin C. They are not grown to any extent in this country.

The European gooseberries, *R. grossularia*, thrive in the United States only in the cool Pacific Coast regions where summers are dry. In the more humid eastern States, the mildew disease attacks the plants of European kinds so severely that culture is difficult.

Selections of native American species resistant to the mildew, mainly *R. hirtellum*, began to appear in American fruit catalogues about a century ago. A little later, varieties that apparently are natural crosses of European varieties and the Americans were selected, and today are the important kinds grown here. They combine the quality of the Europeans with the disease resistance and the heat tolerance found in native kinds.

Host to an Enemy of the Pine

The white pine blister-rust disease is extremely destructive to the white, or five-needle pine, one of our most valuable forest trees. Species of *Ribes* are agents in the spread of this disease. The blister-rust fungus does not spread from pine to pine, but undergoes one stage of its development in the leaves of currants and gooseberries.

For this reason, Federal and State Governments have spent millions of dollars to eradicate native *Ribes* in areas where the white pine is important. For the same reason, planting of currants and gooseberries is prohibited by law in the areas of the country where white pine is of major importance.

Where growing these fruits is permitted, they are valuable additions to the home gardens in the northern half of the country. They are little used in this country as fresh fruit; gooseberries are most often picked for cooking while still green. They are prized by those whose ancestry traces to northern European countries, where these tart, strongly flavored fruits are traditional favorites.



Currants and Gooseberries Grow in Northern Forests and on Mountainsides

Both currants (left) and gooseberries, prized for jam and pies, are native to America, Europe, and Asia. Cultivation is prohibited in many areas because the bushes harbor a fungus that kills white pine trees.

Even a Sour Persimmon Can Be Sweetened

IN the South, small children sometimes dare one another to bite into a green persimmon. The one foolish enough to accept the challenge undergoes a form of torture which cannot be adequately described. One sufferer put it this way: "Your mouth feels as if it's trying to turn itself inside out. It's not exactly sour, but it's puckery."

Two species of persimmon are commonly grown in the United States, one native, one imported from the Orient. Most varieties contain measurable quantities of an acid called tannin which, when the fruit is green, produces the mouth-twisting effect for which the persimmon is famous.

The Oriental persimmon, *Diospyros kaki*, is one of the popular fruits of subtropical Oriental countries. Hundreds of varieties are known in the southern islands of Japan and in the south-central part of eastern China. The species is not definitely known in the wild. It evidently originated in the southern part of China, possibly from an amalgamation of native species. That area has been so little explored by western botanists that the origin of the cultivated form is uncertain.

The *kaki*, as it is known in Japan, is a truly subtropical fruit. It is not well adapted in the Tropics, nor will it endure winter temperatures below about 10° F. Trees grow up to 40 feet high and, like native American persimmons, are usually dioecious—that is, a single tree bears only female, or pistillate, flowers, or only male, or staminate, flowers. Both kinds must be present in a planting for satisfactory fruit production.

To Sweeten, Cover and Seal Tightly

Some varieties of Oriental persimmons are astringent and puckery until dead ripe, like our native kinds; others are mild flavored. The tannin which causes the astringency can be rendered tasteless by sealing the fruit in tight containers for several days. In the Orient, the fruit is often placed in tubs from which saki (rice beer) has been removed, and the tubs tightly covered. The presence of alcohol was long believed helpful in removing the astringency, but apparently is not necessary.

From Japan and China, the Oriental persimmon has gone around the world, but its popularity in other countries has been limited. It reached France early in the past century, but seems not to have arrived in the United States until after Admiral Perry visited Japan in 1853. It was about 1870 that grafted trees of the better varieties were introduced, largely through the efforts of plant explorers of the United States Department of Agriculture.

During the early years of the 20th century, there was wide interest in these fruits throughout the southern States, particularly Louisiana and Florida, and in California. In many cases production was poor because of failure to provide pollinating trees. Also, in spite of its good qualities, the fruit was unknown on American markets and did not find a ready demand. The abundance of fruits on our markets makes the introduction of a new and little-known kind difficult. Today persimmons enjoy a steady but moderate sale. Through a large area of the South they are especially valuable for home gardens and local markets. The trees bloom very late, and blossoms are rarely destroyed by spring frosts.

The American persimmon, *D. virginiana*, is a fairly abundant tree throughout the southeast quarter of the country. It occurs most frequently from central Kansas and Nebraska eastward to Maryland, Virginia, and the Carolinas. A few trees are found as far north as southern New England and Michigan.

"Delicious as an Apricock"

The native persimmon impressed early explorers and settlers as a promising and valuable fruit. Capt. John Smith wrote soon after settling at Jamestown: "Plumbs there are of 3 sorts. The red and white are like our hedge plumbs: but the other which they call Putchamis grow as high as a palmeta. The fruit is like a medlar; it is first green, then yellow and red when it is ripe: if it is not ripe it will drive a mans mouth awrie with much torment; but when it is ripe, it is as delicious as an apricock."

Even more than the Orientals, the native persimmon must be dead ripe to be eaten without causing puckering.

Only sporadic attempts have been made to improve the native persimmon. Trees bearing superior fruit have been selected from the wild. During the 19th century, a good many gardeners collected persimmon trees; the poet William Cullen Bryant was an ardent persimmon enthusiast.

Improvement, however, has never gone further than this selection of wild trees. The work that has been done in breeding blueberries indicates what could be accomplished by similar work with the persimmon. If the native variety could be successfully crossed with the Oriental, the possibilities of improvement would be enormous.

In the meantime, persimmon lovers will continue to seek out native trees in the late fall, shake down the dead-ripe fruit, and eat it out of hand or take it home for the preparation of persimmon pudding, persimmon cake, or other culinary delights.



Persimmons Are Good When Ripe—but Don't Bite Into a Green One!

Small native American persimmon (top) grows wild in the South. The *kaki*, a larger species from China and Japan, is cultivated in California and southern States. Tannic acid in an unripe persimmon puckers the mouth.

A Stroll to Venice

BY ISOBEL WYLIE HUTCHISON

"THE DOLOMITES," said an Austrian friend in Innsbruck (page 387), "are, I believe, the most beautiful of all places in the world! They are not to describe, only to see."

And so, on a brilliant May morning, I set out to see them with a knapsack on my back, planning to go through the Brenner Pass and over the Sella and Rolle Passes to Venice (Venezia) by way of the Dolomites. Surely no scientist has a grander memorial than the French geologist Count Déodat de Dolomieu, born in 1750. He was the first to describe as magnesium limestone the composition of many peaks which now commemorate his name.

"Begin your walk at Igls and go over the hills to Mauterei by the old post road," my friend advised. "The Romans used to bring salt that way from the mines at Hall."

The old salt road seemed the right path to take for Venice, Queen of the Sea, for, like her mountain background, she has risen above the waters through the ages, the work of man. With bright hopes, destined to be more than fulfilled, I took the mountain railroad for Igls, near Innsbruck (map, page 380).

Highway of History

It was Whitmonday. Holiday crowds in holiday clothes filled the train. Many still wore the national costume. I planned to reach the village of Mauterei, 13 miles from the Italian frontier at Brenner Pass, by evening. The Brenner is the lowest of the Alpine passes, though its highest point, 4,511 feet, tops Britain's tallest peak, Ben Nevis.

Here, up the long valley of the Isarco, or Eisack, River, a tributary of the Adige, Mediterranean vegetation has penetrated farther into the Alps than elsewhere. The Brenner has thus been a favorite highway between central and southern Europe since earliest times (page 385).*

It was through its winding ravine, say many historians, that conquering Roman legions came in 15 B.C. under Drusus, stepson of Emperor Augustus. In the reverse direction streamed hordes of Goths and Ostrogoths, Cimbri and Bavarians, on their equally victorious way south.

In our own day, to their notorious meeting at Brenner station on October 4, 1940, came Hitler and Mussolini, to dilate on their plans for the conquest of Europe. The rushing waters of the gray torrent outside the windows of their armored train were less fleeting than the plans of the two dictators, for since 1929 these streams have been harnessed and

their waterpower used to electrify the railway which crosses the pass.

The old road from Igls to Mauterei twists along the hillside hundreds of feet above the railway and trunk road in the valley. From its height the hurrying cars and occasional train seemed dwarfed to the size of toys.

So perfect was the scene I might have stepped into the wings of a theater. The flowers, the frescoed houses, and gaily clad throng seemed unreal. In the crystal-clear atmosphere the snow-dusted ranges behind the Inn River Valley stood out like cardboard scenery.

Scented pinewoods enclosed me as I walked on. I heard the clack of cowbells, and somewhere a cuckoo called. I stopped to turn the money in my pocket and take my direction, for a long road lies before you when the first cuckoo of the year is heard. Sure enough, I was facing south, and a long road separated me from Venice.

At St. Peter I found a little church clinging to the hillside, with gay cherubs holding up its pulpit, a richly painted ceiling, and a blue Madonna enshrined in gold above the altar. A cock topped the stately spire. The few country folk I met gave me the lovely Tyrolean greeting, "*Grüss Gott*."

Beyond St. Peter the road descended to the picturesque stream and mill at Mühlthal. The cobbler's frescoed house, with its brilliant window boxes and overhanging eaves, was like a fairy tale. Cheek by jowl with the Old World mill, iron pylons harnessed the power of the little waterfall and stalked away over the hill with their electric treasure.

Only a Picture Remains

The Sill, a tributary of the Inn, races past the long village of Mauterei (pages 379 and 388) and plunges through a gorge beyond. Above on a high rock, the Castle of Trautson stood until 1945, when it shared the fate of the railway bridge below, which was bombed by the Allies.

The old post road wound around this rock and entered Mauterei by a wooden bridge watched over by a saint in his niche. As I stood gazing at the ruined castle, an old man hobbled up.

"You are looking for the castle?" he asked. "Yes, it is gone. It was very old. But you can see its picture, just as it was, on the side of the third house as you enter the village."

And there I found it, complete with Gothic tower.

* See "Over the Alps to Brenner Pass," 15 ill., NATIONAL GEOGRAPHIC MAGAZINE, December, 1943.



Skin-clad Barbarian Hordes Once Marched Like This Through Historic Brenner Pass

A pageant re-enacts the flow of 1,700 years of history past the village of Mauterthaler, Austria, on the road from Innsbruck to the Brenner. Traffic between northern Europe and Italy has passed this way for centuries. The author followed the route on foot (pages 378, 388).

"By good luck, I had it painted just the year before," said the owner of the little fruit shop on which it was depicted.

"It will be rebuilt," I suggested; but the woman shook her head sadly.

"Not as it was," she replied. "Too costly."

Mauterthaler was heavily bombed during war years, for it hugs the railroad. Today, however, it is a scene of amazingly cheerful activity.* New houses as picturesque as the old are rising from the ashes; new frescoes decorate their walls. St. Florian, patron of firemen, figures on one bombed-out hotel and watches over the trough in the street where the women bring their washing.

Above the hat shop a gnome in a large bonnet gambols. I looked in to inspect the merchandise. A Tyrolean hat of the finest beaver is now an expensive luxury for Austrians, costing upwards of 120 Austrian schillings (nearly \$5), for the best beaver came from Czechoslovakia and is no longer available.

I slept that night in a pleasant inn with wide hall and paneled dining room. I was the only guest. Arriving early, I found the village on holiday and the town band playing gay dance music. At a table in the garden I

* See "Occupied Austria, Outpost of Democracy," by George W. Long, NATIONAL GEOGRAPHIC MAGAZINE, June, 1951.



Drawn by H. E. Eastwood and Jervis E. Allen.

The Stroll to Venice Started in Austria's Mountains

From Innsbruck, heart of the Austrian Tyrol, the author crossed Brenner Pass, where she saw both relics of Roman times and ruins of World War II. Ancient inns and quiet villages held memories of Goethe, Robert Browning, minnesingers, emperors, and, more recently, of Allied soldiers and airmen hiding or escaping from German patrols.

sat under a big umbrella and ate ice cream with Tyrolese farmers out for the day.

Austrians Protect Wild Flowers

Next night I spent at the pretty village of Gries, three miles from the frontier. I found my way there by a footpath which bordered the rushing Sill, then climbed through steep woods to grassy Alpine meadows where I saw my first blue gentian. There it grew, beside a vivid patch of its smaller sister, *Gentiana bavarica*.

The large gentian, as well as one or two other coveted flowers such as the martagon lily and the auricula, is protected in Austria. Notices in railway stations bear pictures of these flowers, with the request that no roots

be taken and only one or two picked. The Austrians love their wild flowers. They have issued a fine series of postage stamps bearing delicate engravings of ten admired species.

In a gray cool dawn I left Gries next morning for the 15-mile walk across the frontier to the old Roman station of Vipiteno, which belonged to Austria in the days before World War I when that empire stretched beyond Trent (Trento).

The poet Goethe passed by this route in his post chaise on the night of September 10, 1786, as he relates in his *Italian Journey*. Goethe, however, made more rapid headway than I did, for his longing to reach Italy was impetuous.

"It grieved me," he wrote, "to pass this magnificent scenery with such frightful haste, by night, as if in flight; and yet I rejoiced heartily that a favorable wind blew me on, keeping pace with my desire."

Since Italy had come to meet me at the Brenner, I had no such

reason for haste. So I sat down under a fir tree to admire the rather gloomy pass, hemmed by towering wooded cliffs, their tops shrouded in mist.

The Sill, now a mere brook, foamed at my right, getting still narrower as the road spiraled up. At the summit a grim notice board with skull and crossbones reminded motorists of the dangerous descent.

Beside the road is an enclosure paved with large blocks of stone which once formed part of the old Roman road. Still clearly to be seen in the stone are the grooves of wheels. Feeling very young, I planted my hobnailed shoes gingerly on this pavement which had so long outlived Caesar.

I approached the scarlet stripes of the



Here History Lives: Paving of an Old Roman Road Still Shows Ruts Made by Carts

This is a section of the highway that crossed the Brenner Pass in the days of the Roman Empire. An officer of the French occupation forces examines it with the author. Salt from Hall, near Innsbruck, was hauled over the route by the Romans (page 378 and opposite).

Austrian *Zollamt* diffidently. But formalities were negligible. Courteous Austrian officials waved me across to the Italians. These, with equal courtesy, disclaimed any interest in my knapsack and passed me along, my passport stamped, to the bank to change my Austrian schillings into Italian lire.

I was in Italy! I had crossed the watershed which divides the Adriatic from the Black Sea rivers. The cataract which poured over the cliffs and raced down the road beside me was going, like myself, to the Adriatic!

A Trilingual Land

"What do you call it?" I asked an Italian boy on a bicycle.

"Isarco!" he called back. Had he been an Austrian boy, he would have said "Eisak." Place names in this part of Europe are still in some confusion. In railway stations and

elsewhere the Austrian ones are usually printed under the newer Italian ones.

The people, too, for many miles on either side of the Brenner are bilingual, or, rather, trilingual. Their speech is Ladin, a language said to be derived directly from old Latin.

German is still as commonly used as Italian in the northern part of what is now Italian territory. But sympathies continue to lean in a northern direction. The Tyrolese, however, are a very individualistic race and would probably prefer to be independent of both their neighbors.

It was 5 o'clock when I reached Vipiteno. I had diverged to visit the Strassberg ruin, an ancient keep overlooking the plain in which the town lies, ringed by blue mountains and watered by the Isarco and its tributaries, a suitable site for a Roman camp.

Charming Vipiteno is the old Austrian town



Reifenstein Castle, 900 Years Old, Now Boasts Telephone and Electric Lights

Long-time owners of the stronghold once held a private monopoly of Austria's postal system. It is now in Italian territory. Allied bombs falling on the near-by Brenner Pass railroad jarred the castle's masonry (opposite page).

of Sterzing. A tall bell tower frames its arcaded street, and the "patron" of the town, in cloak and hat, stands poised above two angels outside the town hall. The atmosphere is Austrian, but when I asked a citizen to direct me to the Schwarzer Adler she stared. At last a light dawned. "Oh! You mean the Aquila Nerd!" she cried in Italian.

The Aquila Nerd was being painted white, outside and in. I spent my first night in Italy in its only habitable bedroom, a small apartment looking gloomily into the well of the staircase.

Emperor Francis Joseph Slept Here

Early next morning I set out for Fortezza, 15 miles down the valley, but had not gone far when I was diverted by the sight of two medieval castles occupying commanding positions on either side of the valley, Sprechenstein and Reifenstein.

An obliging lady on a bicycle dismounted to inform me that the latter had "once been the bed of the Emperor Francis Joseph."

I decided at once to visit such an interesting spot, now fast tumbling into decay. Up I clambered, to be admitted by an elderly woman carrying an enormous bunch of keys. In the courtyard a cherry tree arduously sustained, by a wire fastened around its trunk, a large portion of the outer wall which would otherwise have collapsed into the road below.

Bombs falling on the Brenner railway close by had shaken the castle. It dates from the 11th century, but, unless something is done, it may not see its 1,000th year.

Up and down the wooden stairs and galleries we clattered, from the torture chamber in the vaults to the bedroom, with its beautifully carved beams, where Francis Joseph and the Empress Elizabeth once slept. A finely carved bed stood there with an old armoire. Portraits of the Thurn and Taxis family, the castle's owners, decorated the walls. Electric light and telephone seemed anachronisms, but here they were.



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Bruno Stefani

Painstaking Fingers Work Exquisite Patterns in Fine Lace

The fame of Venice's handmade lace dates back to the 15th century. A worker in Chioggia, near by, embroiders a design on a special frame. Techniques are part of a family's tradition, often handed down from mother to daughter.

The sun was high and very hot when I left Reifenstein; so, instead of reaching Fortezza, I rested that evening at a charming old inn, the Golden Horn, at Mauls (or Mules), half-way there.

The village stands in a narrow defile. With its church, school, mill, communal bakehouse, weaver and loom, it is self-supporting. Shopkeepers find it hard to earn a living.

Bake Day Once a Year

Mauls housewives bake only once, and sometimes twice, a year. They store the hard bread in a dry place and eat it softened in milk or coffee. Grain is ground at the mill, the inhabitants have their own potatoes, butter, milk, and cheese, and the weaver weaves their clothes.

"We seldom need to buy anything," said one of the women, "except a little coffee or sugar."

There is an old Roman burial stone in the wall of one of the town's houses which the

owner found during alterations. It commemorates one "Aureliae Ruffini—matri aelius." There are others a few miles up the valley.

But the traveler from Mauis to Fortezza follows Napoleon's footsteps rather than Caesar's. At Mezzaselva pinewoods rise steeply on either side of a narrow gorge, still called the Sachsenklemme (Saxon Gorge). Here, in 1809, there was bitter fighting between the Tyrolese and Saxon forces under the French. The Tyrolese were victors.

I took a woodland path to escape the traffic and found amid the May lilies and the first wild strawberries a tombstone erected in 1902 by the Andreas Hofer Society of Vienna in memory of five officers who had lost their lives in this old struggle for freedom.

At Fortezza the country widens into a fertile plain below the solid fort, built over a century ago to command the pass. Perhaps it was my imagination, but I felt that Fortezza was still hostile to strangers. As I sat in the station waiting (let me confess it!) for a train to carry me the last hot 7 miles to Brixen (or Bressanone), a soldier came up and asked where I was going.

How different is Brixen! For more than 1,000 years this friendly town has stood where the brown waters of the Rienza join the gray Isarco (Celtic, "Ice Torrent"). But traces of human settlement in the rich plain go far back into the Bronze and Iron Ages.

About 992, Prichsna (as it was then called) became the seat of a prince-bishop whose authority "no judge, no count, no magistrate" had the right to question. Until the secularization of the principality in 1803, he was the owner of rich possessions and until 1918 had a seat in the Austrian House of Lords.

Perhaps because of its long association with bishops, an atmosphere of spiritual serenity pervaded the cool arcaded streets. The traveler rubs shoulders with Capuchins and Franciscans in their thick brown habits and with black-robed nuns from the church and convent of the Englische Fräulein.

An Elephant at the Inn

As I leaned at night from my balcony overhanging the river I drank in with relish the cool scented air, for a thunderstorm had cleared the fiery heat of the day. I heard men's voices upraised in chorus. They were probably singing the same songs, if not the same words, which their forefathers had sung when the famous elephant passed through Brixen 400 years ago.

Despite its connection with bishops, Brixen is in the popular mind even more closely associated with elephants. Here, in 1551, came a strange guest to the old Herberge am Hohen Feld, as the principal inn was then called.

Suleiman the Magnificent had presented an elephant to Archduke Maximilian of Austria. The first ever seen in these parts, it was stabled at the inn, which in commemoration of this singular event was ever after called the Elephant.

For 200 years this hotel has remained in the same family and has probably lodged more royal guests than any other in Europe. Before World War I scarcely a year passed without such a visit, from the Emperor Joseph II in 1789 to the Duchess of Aosta in 1929.

Peddlers and beggars came also to this comfortable hostelry with its benign and friendly atmosphere, for it lies on the direct route between Italy and Austria. Oswald von Wolkenstein, the minnesinger who died in 1445, undoubtedly knew the old Herberge am Hohen Feld, for he was one of the world's greatest travelers. The wanderlust caught him at an early age, as he himself describes:

There came to me when I was ten years old
The urgent need the wide world to behold,
Nor did I think that I would sorrow seek
In service under Christian, heathen, Greek!

Oswald fought against the Turks in 1396, was present at the storming of Ceuta, traveled in Persia, Asia Minor, Italy and Spain, England, Portugal, and the Holy Land, and took sides with James Douglas against the English at the Battle of Otterburn (1388).

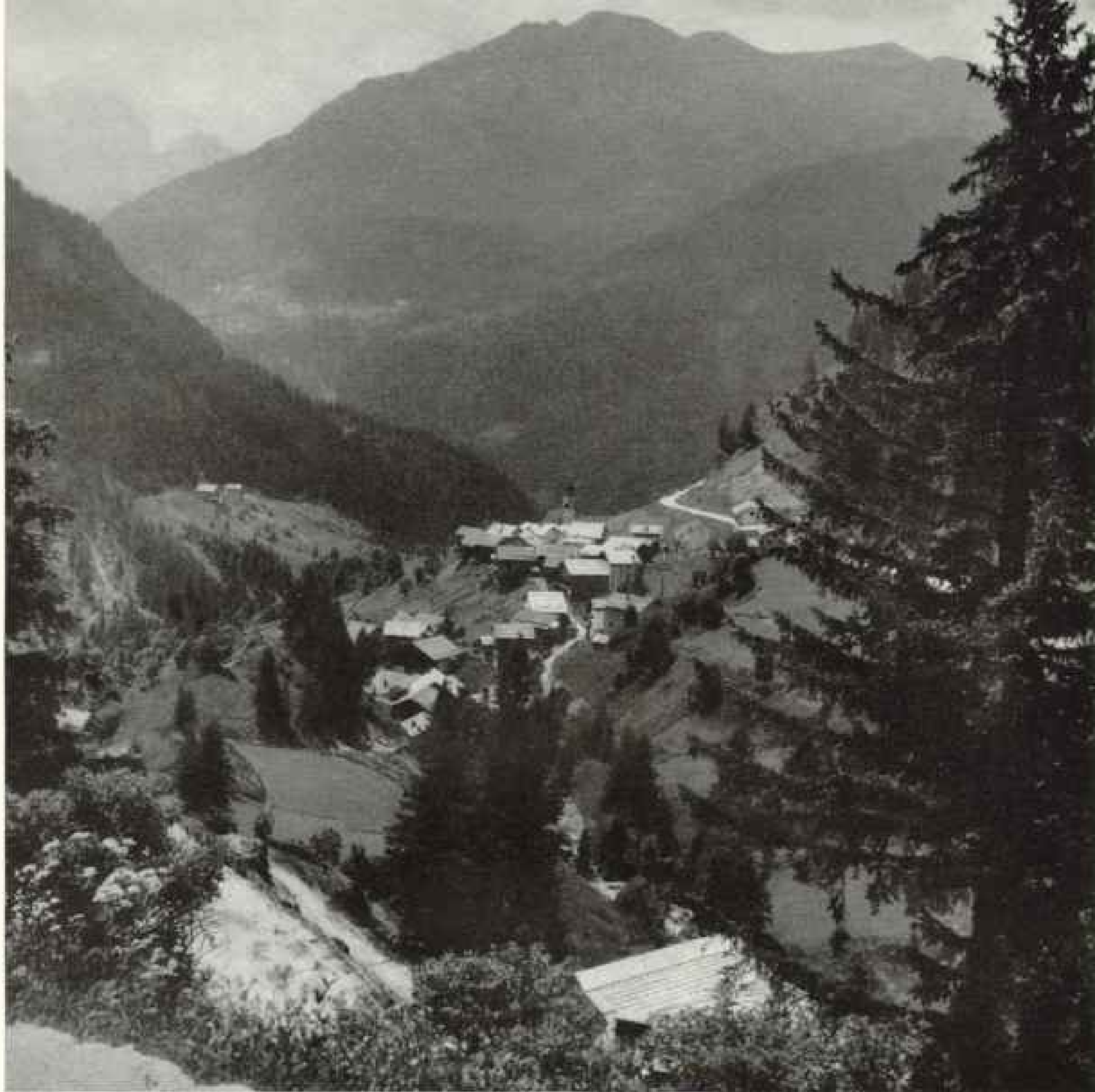
Oswald—Two Versions

On the memorial tablet in the wall of the old cemetery behind the Cathedral, he is depicted as a bearded figure clad in a short skirted garment not unlike the kilt.

Six weeks later I found his portrait at Innsbruck in a magnificently illuminated volume of his poetry. It shows him with one brown eye open and one—lost at an early age—shut. He wears a purple hat trimmed with fur, a red jacket embroidered in gold, and his large benign countenance reminded me of Winston Churchill's.

If poet Von Wolkenstein could revisit today the neighborhood of his family castle of Trostburg, where the Gardena flows into the Isarco, he would be considerably astonished. Beside the highroad a mighty Roman figure on a gigantic horse guards with outflung arm the entrance to the hydroelectric station.

Here the waters of the Isarco and its tributaries are harnessed and led for 10 miles to Cardano, near Bolzano, one of the largest power stations in Europe. The water power is transformed at Cardano into electric energy of 500 million kilowatt-hours yearly. Twenty-five million supply the Brenner railway; the remainder give power to Lombardy and Piedmont industries.



Armies and Traders Have Toiled Through These Mountains Since the Dawn of History

Clustered about its dome-capped church, a village clings to a slope near the Italian side of the Brenner Pass. Roman legions fought invaders in this region nearly 2,000 years ago, Hitler and Mussolini conferred in the pass, and American and Allied troops crossed it in the final campaigns of World War II (page 378).

Up and down I twisted. Looking back, I could see far below the high pile of Säben's convent on its spectacular rock above Chiusa. This pre-Roman fortress was, until the 10th century, the seat of the bishops of Brixen (opposite page).

At Chiusa I had found all the third-class coaches in the little mountain train for Ortisei packed with country folk, and was obliged to take refuge on the red-plush seat of the solitary first-class carriage in one of the oddest little trains in Europe.

It is pulled by a long-necked engine which turns and twists on the horseshoe track. Threading in and out of nine tunnels, it chugs

across the streets of Alpine villages uttering shrill cries of warning. At last it comes to rest at Plan, the end of rails and the head of the valley, under the ramparts of the Sella.

On the open platform outside my coach smutty faces peered at me curiously. I felt like a lion in a zoo until the ticket collector came in to find out all about such a fastidious passenger.

"What Age Do You Give Me?"

"Where have you come from? Where are you going? How old are you?"

This last question is evidently expected in Italy, for it is parried in most phrase books

by the retort, "What age do you give me?"

The ticket collector very gallantly gave me some 30 years, and I told him that I came from Scotland and was walking (an obvious lie!) to Venice.

He looked astonished.

"You are then apparently used to all this walking," he said. Then to my surprise he remarked, "But the people of Scotland like walking. I have spent six weeks in Glasgow."

"You have been in Glasgow? Then you no doubt saw Edinburgh also, and the Highlands?"

The ticket collector shook his head. "No, I was never out of Glasgow."

"You visited Scotland, and you were never out of Glasgow! Did you not even visit Loch Lomond?"

"No. It was wartime, you see, and I was a prisoner!"

It requires tact to travel in topsy-turvy Europe. But the unembarrassed collector got his own back presently when he rose to move on, and, producing his ticket book, remarked that he would have to charge me 260 lire for riding first class.

Sculptured Tree Trunks

When I arrived in the picturesque Valley of Gardena (Val Gardena), strange sights greeted me. St. Peter, grasping a large key, leaned in an abandoned attitude against a doorway. St. Anthony lay prostrate in the firm grip of a vise pressing the crown of his head to the soles of his feet. The Madonna would probably have smiled a blessing on both, but her smile was still in course of construction under the skilled gouge of a master craftsman.

Gardena is the home of wood sculptors. It is the only valley in Europe—perhaps the world—whose inhabitants turn tree trunks into effigies of saints and angels. They have been doing it for the past three centuries. It began when Christian Trebinger, born in 1580, started the industry by carving picture frames.

In other villages farther up the valley the carving of smaller objects, such as toys and animals, has centered for generations. In Ortisei sculptors make large works of a religious nature, and their carvings are exported to all the Christian world (page 393).

"Come in," said a sculptor hospitably, as I entered his studio. One of the large figures he was working on was destined for Chicago. The sweet, sharp scent of wood shavings filled the room. The trees grow high on the mountains, and the wood must mature for three or four years after felling.

Apprentices must also mature for the same period before they are proficient. They never

set up alone until they have studied their difficult craft for at least 10 years.

Like the carving, the tinting is a matter of exquisite care, and the work is done by different artists in their own studios. A large figure may take three weeks to a month to paint.

"In the days before the world wars," said one artist wistfully, "there were studios in Gardena with 20 to 30 apprentices. This is now, of course, impossible, with taxation and living costs so high. Many boys who would gladly follow the old profession cannot find masters to train them."

Before returning, I went into the church to pay my respects to St. Ulrich, Ortisei's patron, a massive wooden figure with hand upraised in blessing. I was to see him to greater advantage when I returned six weeks later on his name day with National Geographic photographer Volkmar Wentzel.

St. Ulrich is carried in procession around the town, preceded by banners and followed by other saints from the church and a host of people from the Valley of Gardena, many of them in picturesque national costume (page 403). Every year the sight fills the town with visitors.

The *funivia*, a glassed-in elevator dangling from a slender cable, carried me to the heights of the Siusi Plateau, more than 2,000 feet above Ortisei. It is the fastest funivia in Europe, traveling over a mile in seven minutes. At the top, reaching an angle of 76°, I alighted thankfully at the summit platform.

Panorama of the Dolomites

An elderly Englishman stood with hands in pockets gazing at the view of snow-splashed Dolomites which ring the vast plateau.

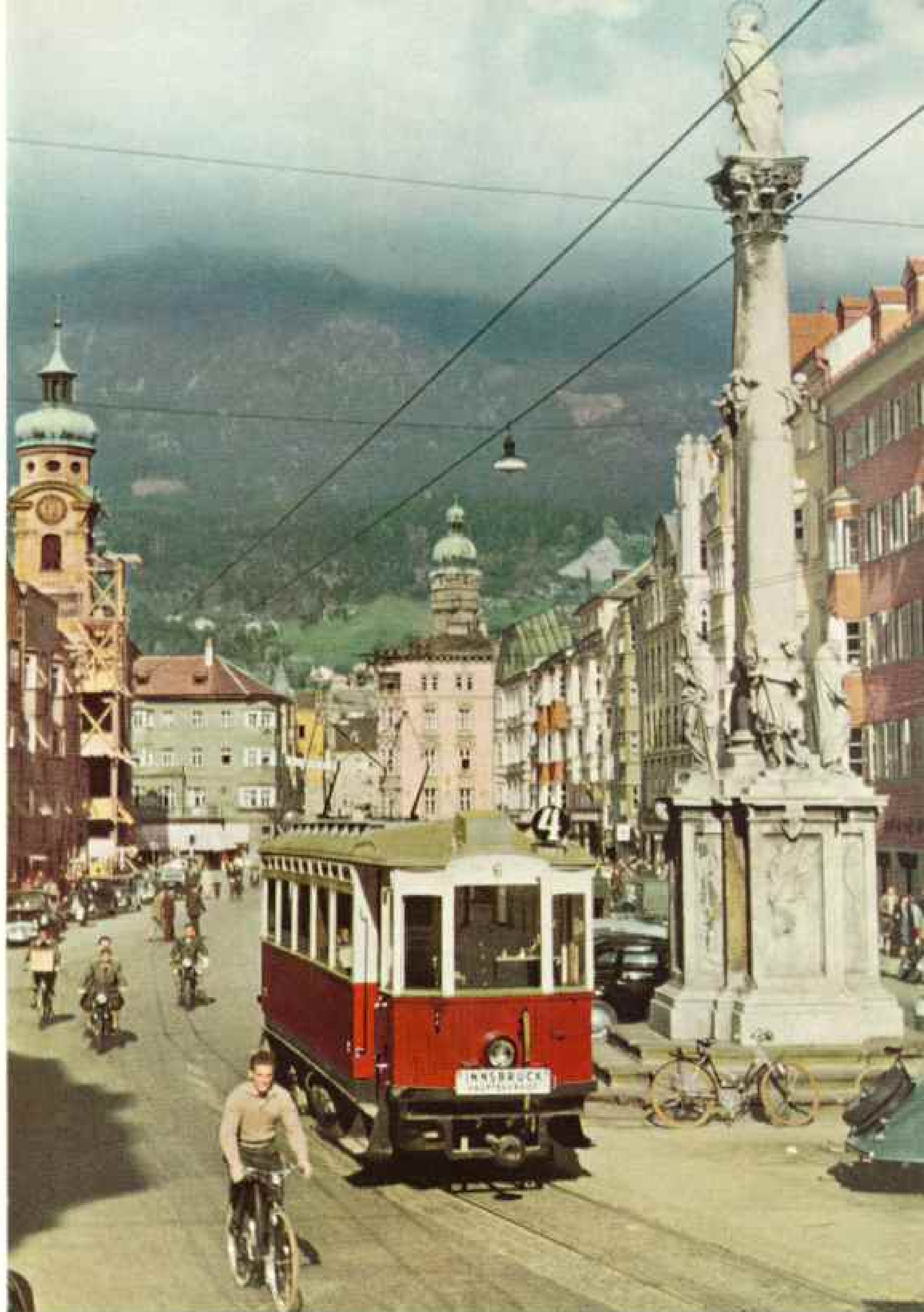
"Incredible, isn't it?" he said.

Climbing along the ridge to a higher point, I found another elderly gentleman, an Italian this time, gazing at the breath-taking panorama which spread from the Sella buttresses to the 10,000-foot giants far behind the Austrian frontier (pages 390, 392).

My Innsbruck friend was correct when she said the Dolomites defied description—that they must be seen to be believed. Yet, apparently, surprisingly few people could afford to look at them at that moment. Owing, perhaps, to the high rate of exchange, I found Italian hotels in the Tyrol largely deserted.

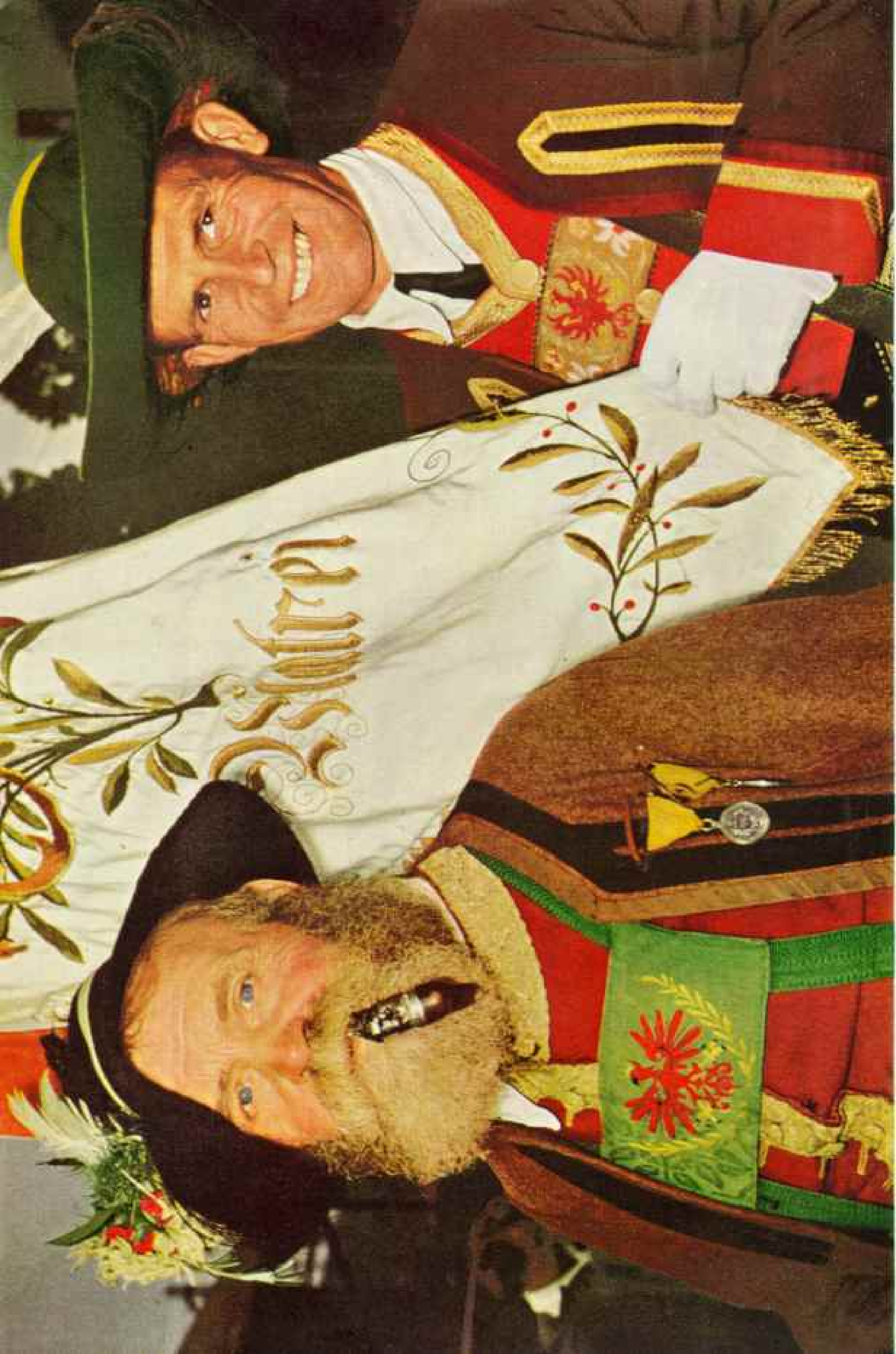
"Such a picture!" cried the forlorn Italian gentleman. "And yet I have been here alone for the last two hours. You are the first to come."

I was now about to scale the Sella Pass, 7,264 feet high (page 404). The motor road was not open yet for the summer. I planned to spend the night in Plan, at the head of the valley, and take the footpath which climbed



Cloud-capped Tyrolese Alps Guard Innsbruck, Austrian Gateway to the Brenner Pass

Cyclists flank a tramcar rattling down Maria-Theresien-Strasse, the city's main thoroughfare. Anna Column (right) commemorates the retreat of Bavarian invaders on St. Anne's Day, 1705. Scaffolding climbs a church (left) under repair for World War II bomb damage. Here the author began her stroll to Venice.



♣ Lushly Bearded Burgher and Beaming Friend Display Matrei's Village Banner in a 1,700th Anniversary Celebration

The beamed oldster puffs a silver-mounted pipe as he walks in a procession. Matrei and other Tyrolean villages reminded the author of fairy-tale scenes.

✦ Near St. Peter, brother and sister, bring home the milk, giving the hearty Austrian greeting "Grüss Gott" (Greet God).

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Resubmitted by Volker Wenzel





▲ Jagged Dolomites
Rise Starkly as
Peaks on the Moon

Light limestone pinnacles contrast sharply with dark-green forests and lush Alpine meadows where Tyrolean graze their cattle in summer.

Old-time superstitions peopled valleys, crags and caves with witches and other malignant creatures. Radio and newspapers have brought enlightenment.

The name comes from Count Déodat de Dolomieu, French geologist who first described the region's mineral structure in 1791.

Northern Italy's Dolomites rise to 10,965 feet. Here, seen from above Ortisei, the mountains (left to right) are Langkofel (Sasso Lungo), Five-finger Peak (page 394), Grohmann Peak, and Plattkofel (Sasso Piatto).

Corpus Christi Day →
Brings Out Valued
Family Heirlooms

Strangely like a Siamese dancer's is the golden head-dress worn by the gymnaestic teacher (left). She and the schoolteacher both wear treasured silver belts. Between them walks the village baker in the uniform of the local band at Selva.

© National Geographic Society
Kodachrome by Volkmar Weipert





▲ Summer's Haymakers Turn to Carving Toys in Winter

With long, oarlike implements these girls turn a fragrant crop sun-curing in a field outside Ortisei, in the Valley of Gardena, Italian Tyrol.

In Gardena villages the author watched wood carvers ply a craft handed down from generation to generation.

High on the surrounding Dolomite slopes are special stands of pine (*Pinus cembra*), reserved for carvers. After felling, the wood must mature for four years before being used.

→ A Lifetime of Carving Lends Sure Skill to Aged Fingers

Apprenticed as children, these Selya women still work deftly with chisels, knives, and gouges at the ages of 53 (left) and 72. Spectacles were laid aside to oblige the photographer.

Valley of Gardena women make toys and small figurines. Men specialize in religious statues, which are exported all over the world. Painting is done by other specialists.

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Illustrations by Volkmar Weitzel





◀ Sturdy Erik Praises
His Tyrol Home in
Three Languages

Surveying a bright world from near Five-finger Peak (background), this Italian youngster wears feathered hat, home-knit socks, and stout mountain boots. He speaks Italian, German, and Ladin, the latter an obscure offshoot of Latin. Edelweiss grows among the rocks at his feet.

Erik, member of a famous wood-carving family, said he planned to be a sculptor when he grew up. He had never heard of the author's home, Scotland, but knew of Mr. Truman as "President of Italy."

Below: Two little girls of San Martino di Castrozza, gathering tiger lilies in a meadow, register interest at the sight of a herd of cows coming down from upland pastures for milking.

© National Geographic Society

Exotismes by Volmar Weitzel



from there to the Albergo Rifugio of the CAI (Club Alpino Italiano) near the summit.

On my way up the valley to Plan I was joined by a pretty young native girl, the daughter of a sacristan at one of the churches. She chatted to me in Italian, but exchanged greetings in the old Ladin tongue with passers-by. In the Valley of Gardena the charming *Grüts Gatt* of the Tyrol becomes the Ladin *Buon di* (good-day).

My companion walked fast. "Let's hurry," she said, "or we may be late for the market. You are going to the market at Santa Cristina?"

A market! Here was a bit of luck. Of course I was going to it.

"It's a fine thing to be free to travel like you," said my friend. "I would also like to do that. Can I come to see you in England and we might travel together?"

"What would your parents say?" I asked a little dubiously. "I expect they want you to marry and settle down."

"Ah! I do not want to marry. Men are all alike."

She doffed her scarlet jacket. "How hot it is! Aren't you thirsty? When we reach the fair, we'll go to the inn and drink wine."

"This Little Pig . . ."

We found Santa Cristina in an uproar. Stalls of merchandise occupied both sides of the road, and traffic was at a standstill. Bianca pushed masterfully through the throng to the inn. Room was made for us at the top of a crowded table, and she ordered wine.

We drank a second glass. But when Bianca suggested a third, I thought of her sacristan father and proposed orange juice instead. She meekly agreed.

"It is not proper," she added primly, "for women to drink too much wine."

I paid the bill and we returned to the fair. A young man in white stockings, Tyrolese dress, and a carnation at the back of his hat caught sight of us and came up. For a spinster of such decided views, Bianca seemed eager to exchange my company for his.

I went off alone to watch a small pig being bargained for. Eventually he changed hands at 8,000 lire (about \$11.21).

I did not stop long at Selva, the next village, but went on to Plan. Here I had meant to rise before the sun, for the first few miles over Sella Pass would be a grueling pull-up with all my luggage to carry. But the day I had picked for my crossing was Corpus Christi, one of the greatest church festivals of the year. It was unthinkable to start without seeing the procession.

The church was thronged. The priest himself led me to a foremost pew, where I sat,

an incongruous figure, beside matrons in tall black caps and blue gowns with lace aprons and silver ornaments. Across the aisle were young women in brilliant lace-covered dresses and high golden tiaras (page 391).

Bandsmen filled the aisle, playing a merry dance tune as they entered. "Wilhelm von Wolkenstein, 1503" is inscribed over the doorway of Selva's old church. Looking around, I felt I might have seen Wilhelm behind me in his pew, so little had time changed the picture in this peaceful glen.

Service over, the procession formed in the sunshine outside. All the saints in the church took part in it, carried on their heavy wooden platforms by helmeted firemen. In the midst walked the priest in magnificent robes under a canopy upheld by perspiring elders.

The villagers fell in behind this colorful pageant, and with the music of the band floating out over the mountains, the procession passed slowly around the meadow and down the road, where all cars had been halted. It paused twice by decorated altars for brief services.

A woman at the rear of the crowd turned to me. "Will you walk with me?" she asked.

And so, preceded by the saints and the bandsmen playing a solemn measure, I took my place in the procession before setting out to cross Sella Pass.

Up, Up, Up to Five-finger Peak

The mountain was awakening from its winter sleep. I left the woods and came to the snow. Where it had melted, the wet ground was bright with pale crocuses. Above me, under the massive towers of the Sella, workmen were clearing the road from the debris brought down by winter avalanches.

As I watched, the first motorcar of the year crept cautiously past. Soon it would be followed by innumerable others, including crowded buses from much of Europe.

The roads through the Italian Dolomites are triumphs of engineering skill. They skirt terrifying precipices and climb by hairpin bends and loops to the steepest watersheds.

Gaunt and naked out of the green meadows towered Langkofel (Sasso Lungo), the Five-finger Peak, and Grohmann Peak.

The Five-finger Peak is supposed to resemble the fingers of an open hand. It is one of the most difficult climbs in the Dolomites and will always be associated with the name of L. Norman-Neruda, who scaled it six times and met his death on it in 1898. He and his guide were the first to discover the route up the north side in 1891, though the mountain had already been climbed from the south in 1890 by Robert Hans Schmitt and Johann Santner.



They Make Mountain Music on a Tyrolese Holiday

Almost every town in the Tyrol has its band, which plays at religious festivals and other gala occasions. Costumes vary from valley to valley. These musicians live near Bolzano, Italy.

The comfortable inn near the summit of the pass was filled with a group of geologists who were spending two weeks studying the rocks. After lunch one of them put me on my way for Campitello, warning me to "keep to the left when I reached the wood."

My path now led downhill, avoiding the hairpin bends of the road near which, in 1944, 12 American airmen lost their lives when their plane was shot down. When Mr. Wentzel and I motored up the pass a month later, we were shown this spot by some sunburned youths who deplored the fact that there was still no memorial to mark the place. Italians think so much of such records.

As I descended, I looked down into the Valley of Fassa, thousands of feet below, beyond which soared the Marmolada, highest of the Dolomites, its great glacier clapped like a cold poultice to its chest. As I stood

gazing at these magnificent heights, I saw a strange little figure clambering up to me, tall sticks in each hand.

It was a little herdboys about seven or eight years old, dressed in a tattered pink shirt, patched breeches, big boots, and a battered Tyrolese hat. In a low voice he asked if I had seen two sheep; they had been lost far down the valley the previous day, and he had been sent to look for them.

"Who lost them?" I asked thoughtlessly.

His lip trembled. "I did," he murmured.

"Did they stray from your flock, then?"

"We have no flock. Only two."

Here was a tragedy, but I could do nothing to help the wretched boy; I had seen no sheep at all since leaving Gardena.

He wandered on drearily, murmuring goodbye. Probably, I thought, he is afraid to go home without the sheep.

Pondering the plight of the lost sheep, I too lost my way. Instead of keeping to the left for Campitello, I descended into a village three miles up the valley. A walk along the dusty highroad was an anticlimax to the glories

of the Alpine path, but it brought me to the charming village of Campitello and its comfortable inn, the Agnello. Since I was the sole guest, I was invited to choose my dinner.

I felt that I had crossed my Rubicon and rested all next day at the Agnello. The following morning I rose with the church bell at 5 to reach Predazzo before the sun got high. The Valley of Fassa is fertile and wooded, with pretty villages every few miles. After Moena it becomes the Valley of Fiemme, though the foaming river beside the road is still the Avisio.

Poetry and Geology at Predazzo

As I approached Predazzo, one of the biggest flocks of goats I had ever seen went jingling by in collars and bells. There were over 400 of them, belonging to nearly as many different owners. For six months they

are pastured on the hills and brought home at milking time every night by their vigilant but weary dog.

"The dog works hard," said one of the lads, "but it's not easy for him to keep an eye on them all. They like to lie down and rest on the way home. Today we lost four, but he'll find them. They all know their own stables and sometimes they find their own road back!"

Bread upon butter spread
is rare,
Rare heels up and heads
down,
Grass growing toward the
centre's rare,
Rare under foot a crown,
But of all rarest granite
here
Lying on chalk is seen,
And by some blunder
chalk below
Where granite should have
been.

So runs an entry in the famous visitor's book of the famous Nave d'Oro Hotel in Predazzo, which has been in the same family for more than a century. Its tradition of hospitality remains unchanged in spite of two world wars.

Many other interesting names have been inscribed in this old book.

Predazzo occupies the site of an ancient crater, and its igneous rocks are of such unusual nature that it has been a mecca for geologists from all over the world since that September day in 1822 when Alexander von Humboldt first inscribed his small neat signature in Signor Giacomelli's book.

A tribute of more recent date reads: "We sit in the sun, guests of the Nave d'Oro, have the best room; and when we ask the dinner hour, the reply is, 'When the gentlemen desire it.'"

This was exactly my own experience, with one important difference. The best room was having running water installed when I arrived. When the workmen departed that evening, I was the first of Signor Giacomelli's patrons to turn on the hot tap. It seems unkind to add that no hot water came!

Predazzo is a charming town for others besides geologists. Though it is the terminus



"So That's the Kind of Costume They Wear in India!"

While posing in the local garb of "top hats" and all-black dresses, the women and child admire photographs made in Kashmir by staff photographer Wentzel. The three were on the way to church near Brixen, or Bressanone, on the Italian side of the Brenner Pass (page 384).

of a modern electric railway, its frescoed buildings take one back to the Middle Ages. A swallow in mosaic flies across its spacious market place, for the poetic reason that the people of Predazzo had once to seek their bread from afar, like the swallow.

Besides its goat flock, it possesses a valuable museum, a town band, and an annual vowed procession in honor of the Madonna, who once saved the town from plague. Italian Alpine troops saved it again from destruction by Austrian guns in 1916, when they wrested the heights above the town from Austrian troops and occupied their bitter ridges.

Love—and English—Conquer All

It had its share of thrills also in World War II, when for a time SS troops occupied it and hunted for escaping Allied soldiers.



Reflected Light Makes Venice's Piazza di San Marco Seem Covered with Water

Its pavement of marble and trachyte helps produce the illusion. Gondolas for hire line the Molo (quay) in front of the Palace of the Doges, old-time rulers of the city, beyond the Campanile (pages 402 and 410). The five-domed Church of St. Mark was built originally A. D. 830, later rebuilt and altered.

As I sat in the glass veranda of the Nave d'Oro, an Italian, who had spent many years in America and had worked on the Alaska Railroad at Seward, came to talk to me.

During the war he had been English interpreter to Allied troops, and proudly showed me a certificate signed by General Alexander in gratitude for the help given "to the sailors, soldiers, and airmen of the British Commonwealth of Nations which enabled them to escape from or evade capture by the enemy."

"Mind you," said Mr. Battista candidly, "I was dead scared all the time. One of the first escapes I helped was in 1943, when the SS troops were here. One night we heard a

soft scratching at the window. It was a friend to tell me he had a man who spoke no Italian, and he thought he was English.

"'Bring him along,' I told him. 'But, whatever you do, tell no one else.' At that time the Germans were offering 5,000 lire for information about such soldiers."

For seven nights Mr. Battista and his wife hid this Yorkshire soldier in their home, letting him sleep on the living-room couch. When it was safe for him to go, they made a sketch map of his route for him. He reached home in time for his 25th birthday, and two weeks later married the girl who had been waiting for him.



With Fireworks, Venice Celebrates Deliverance from a Plague in 1576

Spectators in closely packed gondolas watch a fiery, noisy show during the Feast of the Redeemer, third Sunday in July. Gondoliers make a bridge of boats to the island of Giudecca, so that all who wish may visit the Church of the Redeemer, built there in thanks for the termination of the epidemic.

"I've got a letter here from his parents," said Mr. Battista, putting it in my hands. "They said the Lord moves in a mysterious way, and maybe I helped Him a bit.

"I've arranged some weddings, too. Some GF's wanted to marry Italian girls and got me to write their love letters. I sure let myself go!

"There are a few happily settled in America, and there's another in Liverpool. She's got a bambina of her own now, and they wrote the other day to say they were bringing the kid over soon to visit her mother's home. And all because I learned English!"

Sudden summer leaped upon Predazzo. It

was too hot to walk up the dusty valley to Paneveggio. Beyond its pine forest a bus set me down at the head of Rolle Pass, and I descended through woods to San Martino di Castrozza by a footpath which followed the telegraph poles, cutting across the serpentine bends of the road.

Neptunian Landscape

In the woods the solemn stillness of the frightening and fantastic peaks which lowered above the pass was delightfully broken by the song of a bird. Looking upon these strange mountains, rising abruptly out of the green which washes their roots, I felt as if I were

gazing upon a landscape in the planet Neptune. But thrushes were fluting, and I heard again the rare note of a cuckoo.

A little higher than the telegraph poles dangled the empty chairs of the *seggiovia*, the chair lift which carries the brave to the head of the pass. It was not working or I might have been tempted to try it. On my return journey some weeks later I sampled a *seggiovia* at Ortisei. It is not everybody's armchair, but it is a pleasant mode of travel for the level-headed.

A chain or iron rod is all that holds the sitter from the gulf as he dangles from a slender cable. Slipping along at the height of the treetops, he can peep into birds' nests in passing. It is less pleasant to look down and find oneself crossing a foaming river hundreds of feet below.

Poor St. Martin! About a century ago his hospice was a quiet hermitage in a remote glen, approached by a mule track. Today the little church is completely dwarfed by majestic hotels, for San Martino is a favorite tourist resort in winter and summer, and a modern highway runs through it.

I avoided the road next morning, taking instead the old mule track to Fiera di Primiero. It led me through flowery meadows flecked with bright-orange heads of tiger lilies.

At the open door of a cottage I peeped in. One of San Martino's three remaining cheese makers was at work combing the stiffening curd in a huge copper caldron with an immense rake. After the liquid had been reheated, he explained, the curd would settle to the bottom. Then he would get four stout 10-pound cheeses out of it, which he could sell in the neighborhood at the modest price of about 200 lire (32 cents) per pound (407).

An Italian from Texas Spoke French

Leaving the cheese maker to his work, I sought the grateful shade of the forest. Far below I heard the noise of the Cison River, and under the pines I rejoiced to meet an old friend, the single-flowered *pyrola*. The last time I had knelt to smell one of this group, I remembered, was in Kodiak, Alaska.

Crossing a bridge over the Cison, I came at last to the highroad and the village of Siror, on the outskirts of Primiero. Here a sudden thundershower caught me, and I took shelter in a roadside café. The bartender was a gray-haired man who had lived in Texas and spoke to me at first in French.

"You are going to Venice?" he asked. "This man will take you there."

He indicated a bus driver in yellow overalls who had just come in. It was quite true. His bus went from Primiero to Venice in some six hours by way of Feltre and Cornuda.

"Cornuda?" My eyes brightened. Time was wearing short, for I had a date to keep with Mr. Wentzel and his car—not at Venice, for that happy city is still immune from tires—but at Browning's village of Asolo, on a hill above the Venetian plain eight miles from Cornuda. The rain was still pouring down.

"Can he take me to Cornuda?" I asked.

"You bet he can," said the man from Texas.

The bus did not leave till 3 o'clock. I had two hours to visit the fine old market town of Primiero, which deserves better treatment. Like Predazzo (page 397), it stands near the junction of three valleys.

The bus route led down the Cison. Like many rivers on my way, it had been harnessed for Italy's hydroelectric schemes. Not far from the old Austrian boundary at Monte Croce it dammed into a green lake.

Steep, dark, and narrow was the defile through which our driver, with skillful hands and scarcely slackened speed, now hurled his bus. We passed towering crags on the left and a grim precipice with the river at the bottom on the right.

I wished too late I had kept to my feet, and sympathized with a white-faced little boy, blubbering with terror at sight of the abyss. At the worst turn workmen were mending the road, and not even the usual short cement pillars protected us.

"You must trust the driver," shouted that individual genially, turning around at this awkward bend to comfort the little fellow. A notice over his head strictly forbade smoking or talking to the man at the wheel, but a friend who had come on at Primiero leaned familiarly over the back of his seat chatting. Both were smoking.

At last we came out of the grim valley into a wide and beautiful plain surrounding Fonzaso and Feltre. Here were vineyards, fields of golden grain ready for the reaper, chestnuts, and mulberries.

Keats, Browning, and Asolo

Near historic Feltre we turned down the valley of the wide Piave, whose turquoise waters spill between steep heights onto the plain and join the Adriatic northeast of Venice.

Cornuda is a pleasant town with tree-lined streets whose inhabitants are largely engaged in shoemaking. I was the sole passenger to alight. I asked my way to an inn. It was old, primitive, and covered with wisteria. Room with supper included scarcely cost the price of a cup of tea in more sophisticated Italy.

The inn stood at a crossroad, and I was kept awake by the strident horns of every passing car. But another note presently made itself heard above the din. Higher and higher



Crowded Boats Almost Fill the Grand Canal on Venice's Gala Regatta Day

Many participants wear costumes in the special colors of old Venetian families, as in the days of the city's glory. Winners of boat races receive money as first and second prizes. Third prize is a baby pig!

it poured, wilder and more passionate than all—"Jug-jug-jug-chirra-chirra!" It was the nightingale, bringing thoughts of poetry, of Keats and Browning, and of Asolo!

Browning's burly shadow still falls gratefully over the lovely hilltown, scene of *Pippa Passes*, where worked the little orphan silk weaver. Here he wrote parts of *Asolando*, his last volume of poems. Those who care may still finger in the town museum the brown keys of the spinet to which he sang Russian and French songs for his American friend, Mrs. Arthur Bronson.

The school of embroidery founded by his son still flourishes. Dispersed after the son's death, it was reassembled by other lovers of the old art. In a bright workroom overlooking the plain, delicate-fingered girls turn out copies of old Italian designs on tablecloths, cushions, and napery. So exquisite is this workmanship that it is hard to tell front from back (page 407).

There is a school of silk weaving in Asolo also, now owned by Miss Freya Stark, noted British explorer of Iran, Arabia, and the Hadhramaut, and another lover of Asolo. Here the product of the silkworm is dyed all manner of delicate shades and exported to far corners of the world.

Apart from such activities, Asolo is still the dream town it was in the days of Caterina Cornaro, widowed Queen of Cyprus. She retired, on her forced abdication in 1489, to the tower which still dominates the square, signing herself "Queen of Cyprus, and Armenia, Jerusalem, and Lady of Asolo."

"There," writes one of her historians, "she lived, dispensing justice, founding a pawnshop for the assistance of the poor, distributing free corn in years of distress, listening to the courtly conversation of Cardinal Bembo, and amusing herself in the gardens of her summer-house in the plain."

In the Hotel Belvedere I occupied a huge stone-flagged apartment with four windows. From these I could see the high tower of Caterina's castle and the house rebuilt by Browning's son. Below lies the flat country, washing up to the height on which the town stands like the blue waves of a slightly ruffled sea. White steeples rise here and there like the masts of ships. On clear evenings the hills behind Padua (Padova) look like mist-encircled islands. To the left, still invisible behind her waters, is Venice.

"You Cross the Sea to Come Here"

The hill path to Venice climbed up and down past vineyards and little farms. Flowers bordered my path; walnut trees and hazels thick with green fruit hung above. I asked directions from a woman in a farm cart which

two stout oxen slowly dragged up the lane. They halted of their own accord to rest.

"They are old and tired," she explained. "They have been working hard all day. You are from Asolo?"

"I come from Scotland."

"Scotland? Where is that?"

"Well, it is near England."

"Ah, then you had to cross the sea to come here, like Eleonora Duse. Have you seen her tomb in the cemetery? They brought her back in a ship from America to lie in the place she had chosen at Asolo. I knew her well. She always dressed in white. For eight years I was a weaver, and she was very much interested in the weavers. We all received a special card to her funeral. Ah! What a funeral!

"No, I have no time now for weaving. Six children and all the drinking water to be carried from the bottom of the lane. And I have nothing to offer you, for last year's wine is done now. Unless you would like some cherries? My daughter will knock some down for you."

Before I could protest, a barefoot child leaped nimbly into the branches and with magnificent hospitality knocked the last of luscious black fruit onto the grass. Yet these people were so poor that their children had never seen Venice, a mere 20 miles away.

Venice—Good-bye to Automobiles

As I munched my cherries, I remembered my own first arrival in Venice on a moonlit night many years ago, sailing from the railway steps in a gondola! Could such an experience be repeated?

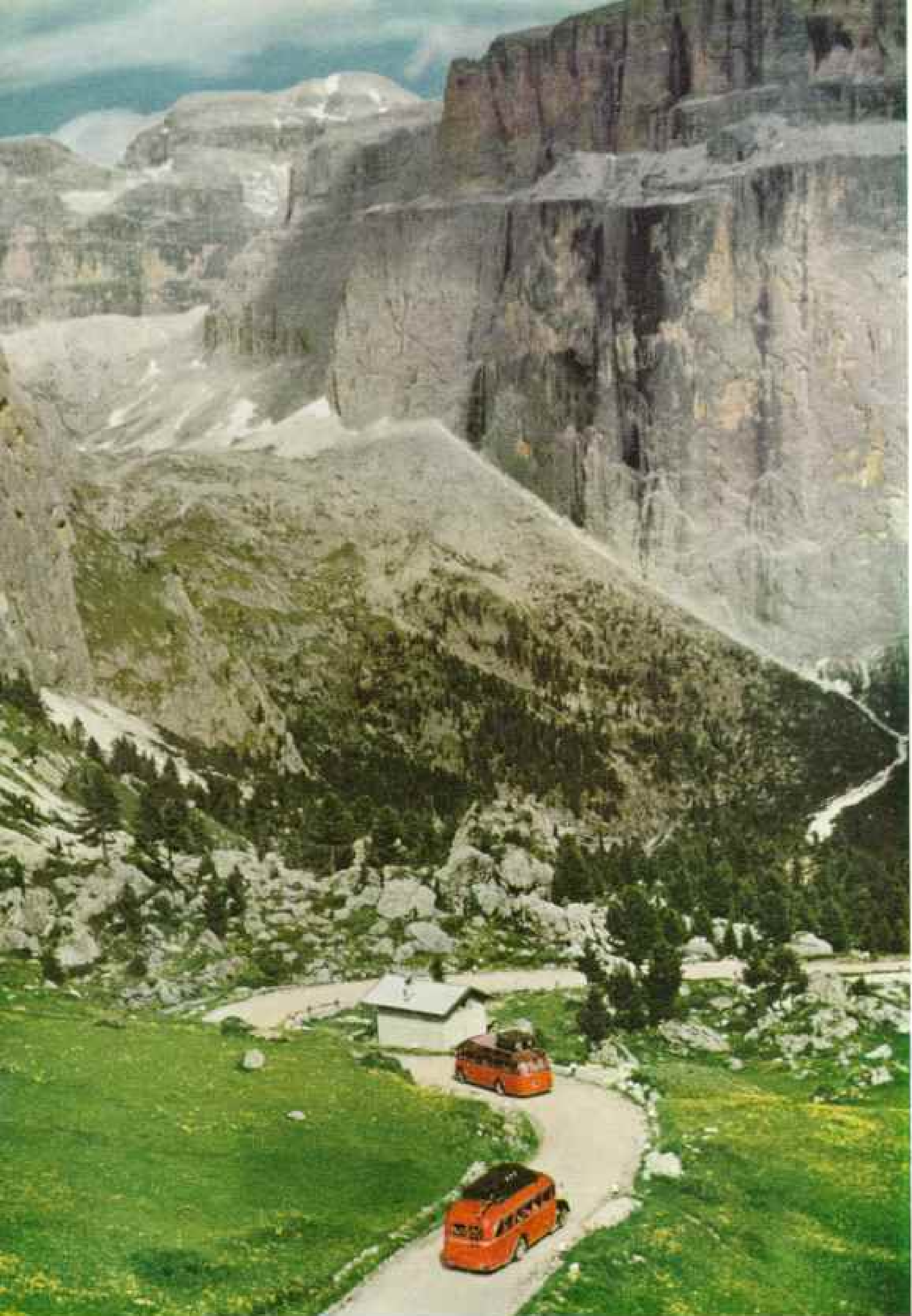
A causeway, completed in 1933, now leads all traffic over a dam into the city. I crossed it in a bus and ended up in the most up-to-date garage in Italy. The large building contained everything that a car or its driver could possibly want. But when the motorist leaves this garage, he says good-bye to cars all the while he is in Venice. It would still be perfectly possible to live in the city and never set eyes on one.

Though motorboats and steamers hurry up and down the Grand Canal and gondolas are fewer, I knew instinctively that Venice had not really changed, that she would probably never change (pages 399, 401, 408, 409).

A steamer landed me with my rucksack at the Piazza di San Marco (pages 398, 410). Fascinated, I watched the Moors beat out the eternal hour from the clock tower beside St. Mark's. And they were still feeding the pigeons in the Square! I pushed my way eagerly through the crowd to buy a bag of grain from the very same old man in the very same old straw hat.

I had reached Venice!





Snow and Avalanches from the Heights Block Sella Pass Except in Summer

Automobile traffic cannot get through the 7,264-foot pass until mid-June. Precipices frown upon buses rounding hairpin turns. Page 403: Gay blades of Ortisei dress up to honor the village patron, St. Ulrich.



Celebrating the Feast of the Visitation, Predazzo Honors Its Madonna

Each July 2 the statue of the Virgin is escorted through the streets by priests, acolytes, and bearers of tapers and torches. Several girls from this Italian town married Americans they met during World War II.



"Hot Dog Stand," Italian Style, Offers Sausage, Dry Bread, and Refreshing Orangeade

The author (seated, right) and photographer Wentzel stop for a snack on the way up Sella Pass. Proprietress, in the doorway, was shy of being photographed. Waitress sits with her customers. On a near-by slope mountaineers pointed out charred bits of an American airplane which crashed there in World War II.

Young Needle-Experts → Ply Their Trade at Asolo

These Italian girls work in a school founded by Robert Wiedemann Barrett Browning, son of the English poet.

Here they learn to embroider old designs on tablecloths, napkins, and cushions. Workmanship is so fine that it is difficult to tell front from back.

A window of the needlework school frames "Pippa's Tower," built by the younger Browning. It overlooks the plain extending toward Venice. Asolo was the setting for the elder Browning's poem, *Pippa Passes*.

Eleonora Duse, the famous Italian actress, is buried in Asolo, where she had a summer home.

✓ Making Cheese, He Combs the Curd Before It Settles

With a wooden crane Simon Domenico swings a copper caldron off the fire in his cottage at San Martino di Castrozza. Each filling of the pot yields four 10-pound cheeses.

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Illustrations by Volkmar Weitzel

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At Venice the Author Enters a Watery Dream City

◀ In a narrow side canal, cargo gondolas rub gunwales. One bears a load of bottled water for a hotel on the Grand Canal.

Nearing such blind corners, gondoliers shout a warning lest they run into a traffic jam.

▶ Gondoliers handle their long sweeps from the *poppa*, a platform on the stern. Posts striped like barber poles are for mooring boats on the Grand Canal.

▼ Miss Hutchinson's gondolier doubles as a sight-seeing guide. He said steamers and powerboats were ruining his business.

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Six Centuries of History Look Down on the U. S. S. *Juneau*, Anchored at Venice

Beyond the cruiser's stern is the Doges' Palace, begun in the early 1300's. The Campanile, or bell tower, replaces the original built in 1329, which collapsed in 1902, but the same gilded angel still stands on top. Winged Lion of St. Mark, emblem of Venice, surmounts the column near its foot.

Folger: Biggest Little Library in the World

BY JOSEPH T. FOSTER

Illustrations by National Geographic Photographers

B. Anthony Stewart and John E. Fletcher

THE WORLD'S largest and finest collection of Shakespeareana doesn't lie in Stratford on Avon, in London, or even in Great Britain. It is housed at the Folger Shakespeare Library, Washington, D. C.

The library has become an outstanding research institution, where almost any significant topic in the history of English civilization in the 16th and 17th centuries can be studied. It is known far and wide as a dynamic center of learning in the English-speaking world.

Last year scholars from 34 States and nine foreign countries used its resources. And more than 60,000 sight-seeing visitors passed through its exhibition hall to see rare documents, musical instruments, paintings, costumes, and mementos on display.

Because of the imagination and foresight of the trustees of Amherst College, Amherst, Massachusetts, who have administered it since its beginning, the library has prospered and grown.

More than a Shrine to Shakespeare

Though it is called Folger Shakespeare Library, it is not, as most persons think, devoted only to the Bard, nor is it only a monument to a great poet.

The Folger includes the Western Hemisphere's greatest historical collections for the study of English civilization before 1641. In fact, it claims more than 53 percent of the titles of all existing books printed in England or in English before that time.

The library hopes in time to procure, in some form, every significant English book published from the invention of printing to the end of the 17th century. The library tries first to get early editions. If originals are not available, it obtains a book in microfilm or photostat.

The 17th century is particularly important for Americans because colonial America was directly descended from the culture of England in the 16th and 17th centuries.*

The library also possesses a surprising amount of early Americana, including rare volumes describing voyages and explorations in the New World, and such books as Capt. John Smith's *Generall Historie of Virginia, New-England, and the Summer Isles*.

Because of this wealth of collateral Renaissance material, scholars do not have to study Shakespeare in a vacuum.

It is no wonder scholars look to the Folger

as "the best and finest Shakespeare collection" and refer to it as "the biggest little library in the world."

The history of the Folger and the man who founded it reads like a success story in the best American tradition. In 1879 Henry Clay Folger, a poor senior at Amherst College, bought a 25-cent lecture ticket to hear Ralph Waldo Emerson. The New England philosopher inspired the student with his beautiful English and fine intellect.†

"Orbit and Sum of Shakespeare's Wit"

Later the young man stumbled on an excerpt from a speech Emerson made in Boston in 1864, the tercentenary of Shakespeare's birth. It read:

England's genius filled all measure
Of heart and soul, of strength and pleasure,
Gave to the mind its Emperor,
And life was larger than before:
Nor sequent centuries could hit
Orbit and sum of Shakespeare's wit.
The men who lived with him became
Poets, for the air was fame.

The eulogy so fired Folger's imagination that he began a thorough study of the poet's works. He left Amherst with a great love for Shakespeare.

After graduation, he took a clerk's job with a New York oil-refining company and studied law in his spare time. He was admitted to the bar in 1881, but chose to stay with the rapidly expanding petroleum industry. It was a wise choice. He rose to be president and later chairman of the board of the Standard Oil Company of New York.

Folger never lost his interest in Shakespeare. Shortly after his marriage to Emily Jordan in 1885, he purchased for \$1.25 a reduced facsimile of the First Folio. "Here you may see Shakespeare's plays as they were actually presented to the world," he told his wife. Mrs. Folger named that volume "the cornerstone of the Shakespeare Library."

He bought his first rare book, a copy of the Fourth Folio, at auction in 1889. He got it for \$107.50 and had to arrange for credit to pay for it.

Later Henry Folger became a millionaire.

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "The British Way," April, 1949, and "Founders of Virginia," April, 1948, both by Sir Evelyn Wrench.

† See "Literary Landmarks of Massachusetts," by William H. Nicholas, NATIONAL GEOGRAPHIC MAGAZINE, March, 1950.



Folger's Gleaming Marble Encloses a Matchless Treasure of 16th-century Lore

The library's modern classic exterior and Elizabethan interior combine to attract more than 60,000 sight-seers every year in Washington, D. C. Inside, scholars find the world's largest and best Shakespearean repository and 130,000 books forming the Western Hemisphere's greatest historical collection for the study of English civilization before 1641.

At a time when many American millionaires were collecting race horses and yachts, he set about buying Shakespeareana with a zeal perhaps unparalleled in the history of book collecting. He found an enthusiastic partner in his wife.

At first other collectors didn't even know he existed. A silent man, he lived up to one motto in both business and private affairs: Never tell what you've done, what you are doing, or what you are going to do. Publicity would have ruined his project anyway.

Despite his wealth, he rented a modest brick row house in Brooklyn. Every evening the Folders went to work in their basement. They read catalogues, wrote orders, unpacked, listed, and repacked books, without even the aid of a secretary.

Gradually Shakespearean items began to get scarce. Then Folger's name and his mission became known to the world.

British newspapers cried out against this

American millionaire who carried off precious national treasures. His books were stored in vaults and warehouses. Nobody ever saw them. Competing collectors tried their best to outsmart and outbid him.

The Royal Tudor Unmentionable

One day Folger met a rival collector on the street. Both had seen Queen Elizabeth's corset advertised in a British antique dealer's catalogue.

"I got ahead of you this time, Henry," crowed the competitor. "I just ordered Elizabeth's corset by special delivery."

"You should have cabled. I did," replied Folger (page 423).

Although his fortune grew into one of the greatest in America, his cash outlay for books often exceeded his income. As a result, he and Mrs. Folger sometimes felt poor.

The British repeatedly urged him to leave his collection as a Shakespeare memorial in



Under a Bust of the Bard, the Director Looks Over New Folger Acquisitions

A memorial to founder Henry Clay Folger as well as to Shakespeare, the library has prospered and grown in its 19 years. It began in 1933 as little more than a storeroom of Shakespeareana. Under the administration of Amherst College trustees, it stands as one of the world's leading centers of learning. Today more scholars than ever use the library's facilities. From his office Dr. Louis B. Wright can view the Capitol.

Stratford on Avon. He refused. His ambition, he wrote in a letter of January 19, 1928, was "to help make the United States a center for literary study and progress."

Later that same year, he quietly announced that he would erect a library in the Nation's Capital to house his collection. Folger picked Washington because he felt that it would inevitably be a great research center one day, and because nearness to the Library of Congress would be an advantage to scholars.*

He had already purchased the site, adjoining the Library of Congress, and approved plans for a 2½-million-dollar building.

The construction contract was secured for the James Baird Company, Washington and New York, by Thomas W. McKnew, then vice president of the Baird firm and now Secretary of the National Geographic Society.

Later Mr. McKnew supervised the construction of the National Geographic Society's main building in Washington.

To design the library, Mr. Folger selected the late Paul Philippe Cret, one of the most distinguished names in contemporary American architecture.

A Bit of England on Capitol Hill

The cornerstone of the Folger Library was laid May 28, 1930. Two weeks later Henry Clay Folger died, never having seen his collection as a whole. It was still stored in more than 2,100 packing cases. Yet he succeeded, beyond his wildest dream, in forming unquestionably the largest and richest accumulation of its kind that the world has ever seen.

His will left the library to the American people and endowed it with adequate funds for upkeep. Its administration he wisely placed in the hands of men aware of educa-

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "The Nation's Library," May, 1930, and "Washington—Storehouse of Knowledge," March, 1942, both by Albert W. Atwood.



Bas-reliefs on the Folger Façade, Sculptured by John Gregory, Portray Famous Scenes from Shakespeare's Plays

Zone of Quiet: Folger Reading Room Is for Scholars Only

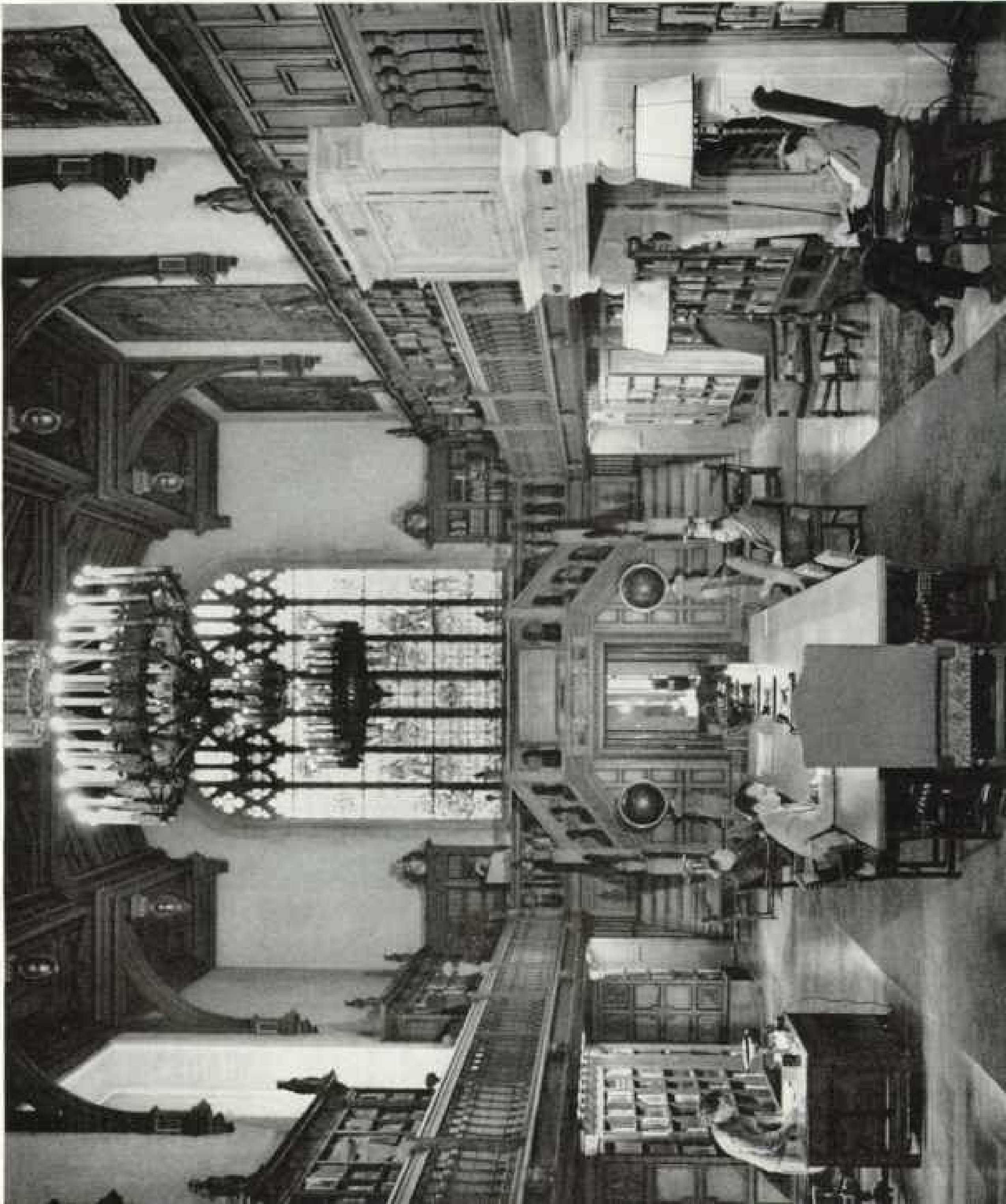
Here, in a peaceful retreat in the heart of the Nation's busy Capital, accredited readers can browse through the library's rich treasure of English literature.

Despite its massive size, the reading room (page 419) has the intimate atmosphere of a private library. Double tiers of shelves lining the room hold many volumes difficult to find elsewhere.

At one end (background), a stained-glass window depicts the "Seven Ages of Man" featured in Shakespeare's *A You Like It*. Panels record the phases of development as "infant, school boy, lover, soldier, justice, pantaloon, and old man."

The window design is a reproduction of one in the apse of the Holy Trinity Church in Stratford on Avon.

[Opposite page] Exterior carvings depict memorable moments from *The Merchant of Venice*, *Macbeth*, *Julius Caesar*, *King Lear*, *Richard III*, *Hamlet*, and three other plays.



Into This Globe Theater Went 24,917 Pieces and 10 Years of Work

Dr. John Cranford Adams, Shakespeare expert and president of Hofstra College, Hempstead, N.Y., made an exact model of the London playhouse where the Bard's plays were performed.

The reproduction, scaled a half-inch to the foot, now is in the Folger exhibition hall. Inner court consists of 6,500 tiny bricks made from ink-eraser rubber; upper roofs contain 9,500 minute tiles. Plaster between the beams was laid with a spoon and an eyedropper.

Reflecting back to the 17th century, Charles Laughton (right), a frequent visitor to the Folger, called the Globe a firetrap. He was not wrong. The famed playhouse—"this wooden O," as it is called in the prologue of *King Henry V*—was destroyed by fire in 1613.

Laughton typifies the many movie and stage celebrities who make ready use of the Folger. With the actor is William Cottrell, organizer of Laughton's Shakespeare classes in Hollywood.

National Geographic Photographs
J. Bayliss Roberts



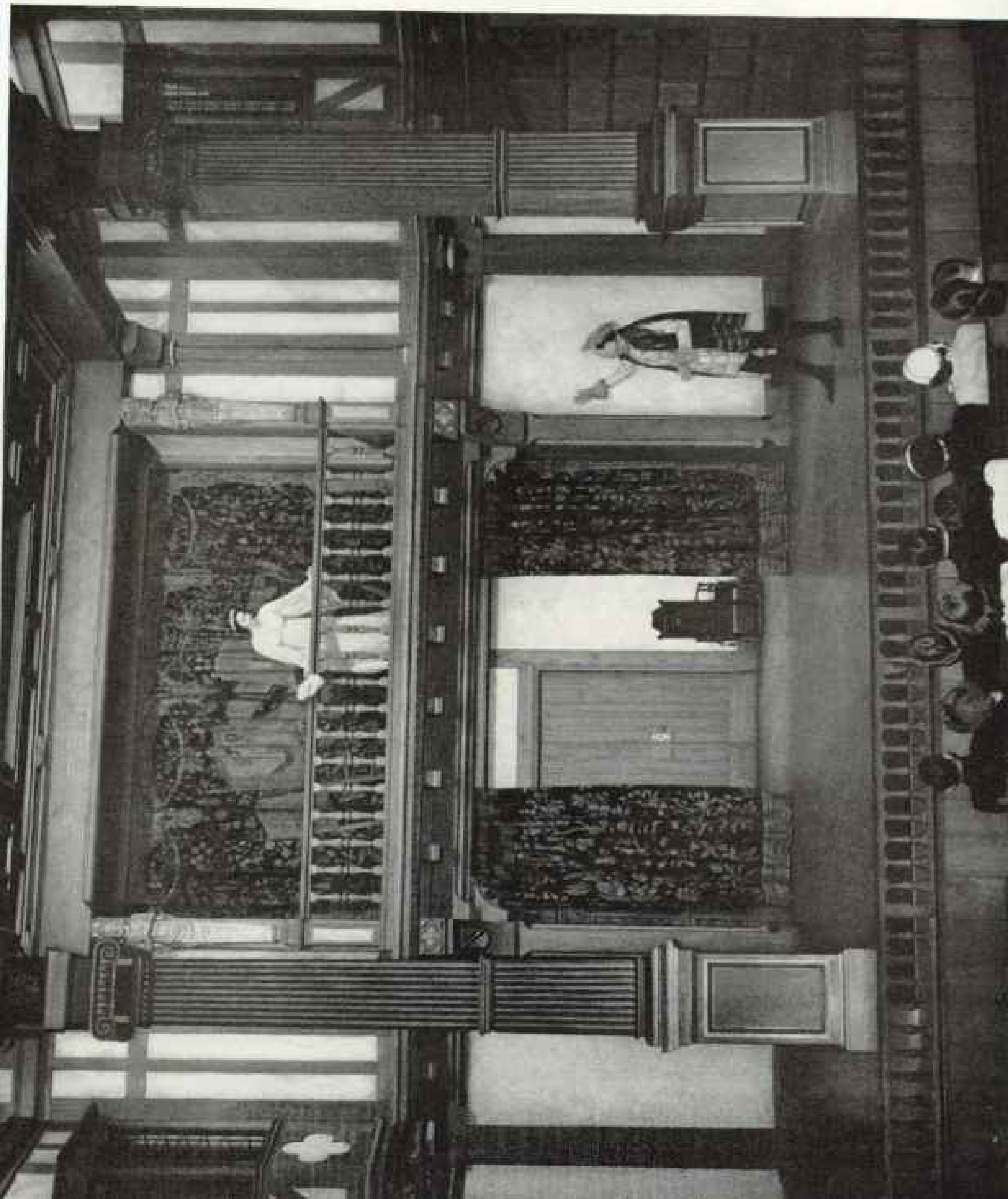
On an Elizabethan
Stage, Romeo and
Juliet Speak
Deathless Lines

One of the biggest attractions at the Folger Library, for scholars, specialists, and sight-seers alike, is its Elizabethan theater (page 418). It combines features of such historic London playhouses as the Swan, Globe (opposite), and Fortune.

Designing an authentic theater to be housed within the library presented many architectural problems. Size had to be limited, since it was to serve as a lecture room, too. Also, some characteristics of old playhouses had to be discarded.

In Shakespeare's day the theater encircled a roofless yard where the audience stood exposed to the weather. The Folger theater suggests this by means of a lighted canopy over the pit. Orchestra seats and artificial lighting are the only concessions to modern design.

The stage retains the original Elizabethan flavor. Actors perform on two levels of the simple, uncurtained platform.





Folger's Binder Specializes in Matching Centuries-old Book Covers

Glancing at rare volumes on library shelves, only experts can tell which have their original boards and which were bound in 1931. When Robert Lunow finishes rebinding this copy of Sir Walter Raleigh's *The History of the World* (1631), it will retain its antique appearance. The German-born expert has followed his trade for 43 years.

tional and scholarly values, the trustees of his alma mater.

Mr. Folger first envisioned an Elizabethan building for his library. But his architects convinced him such design would be out of place on Capitol Hill and would clash sharply with the Library of Congress and other neighboring Government buildings.*

A compromise was reached: an exterior combining modern classic features, and an Elizabethan interior (pages 412 and 415). So it is, then, that a visitor entering the white Georgian marble building steps from 20th-century Washington into 16th-century England.†

The effect of age is carried out all the way from the vestibule to the executive offices (page 413). Marble wainscoting was punctured with holes and stained with acids to make it look old and worn. Stones about the doorways were plastered in the rough to appear weathered by time. Solid bronze fixtures were treated to lend age, and electric lights

were carefully camouflaged in wrought-iron candelabra.

The library has three main divisions: the exhibition hall, theater, and reading room. Four large, bank-type, air-conditioned vaults hold rare books, manuscripts, and mementos (opposite). Modern steel stacks fill the basement and subbasement. Attic rooms contain sculpture, paintings, furniture, and curios not on display.

The large, oak-paneled exhibition hall constitutes a small museum. Exhibits are changed occasionally, though most documents and paintings remain on permanent display.

Beyond this hall lies the Shakespearean theater, never used commercially because of its limited (260) seating capacity (page 417).

* See "Washington, Home City and Show Place," by Leo A. Borah, NATIONAL GEOGRAPHIC MAGAZINE, June, 1937.

† See "Wonders of the New Washington," by Frederick G. Voaburgh, NATIONAL GEOGRAPHIC MAGAZINE, April, 1935.



The Library Guards Its Priceless Rare Volumes Like Gold—in Special Bank Vaults

Four thermatically controlled chambers hold the Folger's most precious items. To preserve books and manuscripts, temperature is maintained at a constant 70°, with relative humidity between 45 and 50 percent. Each vault has a time clock set so that the two-ton, eight-inch-thick doors can be opened only between 9 a.m. and 5 p.m. Here Dorothy Wollon, assistant reference librarian, selects a volume.

In fact, local fire ordinances prohibit its use as a theater because there are no regulation outside fire escapes; such additions would have ruined the beauty of the exterior lines.

Exceptions are made occasionally. In March and April, 1949, the Amherst College Masquers produced *Julius Caesar* in the true Elizabethan, not the generally followed Roman, style. The play was presented seven times, with great success, and telecast throughout the East and Midwest.

Emerson Lines Carved over Fireplace

The giant, two-story reading room resembles a typical great hall of a Tudor or Stuart manor house. Despite its massive size (131 feet long), it retains the character of a private library (page 415).

It was over the fireplace in this room that Mr. Folger wanted carved the lines from the Emerson speech he had read at Amherst.

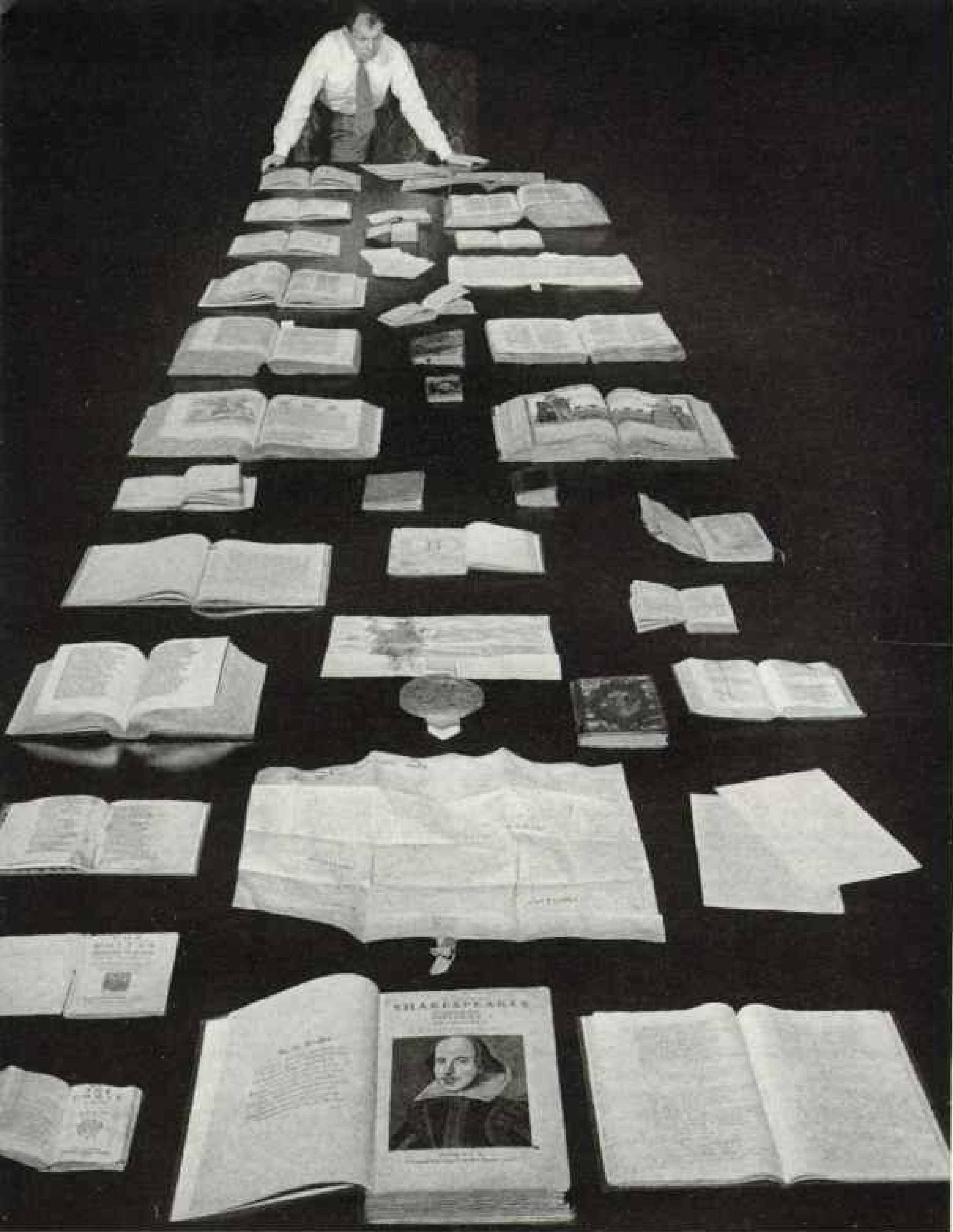
At first the two leaded-glass doors between the exhibition hall and reading room were left

open. Readers complained they were disturbed by visitors peering in and making audible comment. So the doors were closed.

But readers still grumbled; sight-seers rattled the doors and peered in as if readers were part of a zoo. One scholar put up a sign, "Please do not feed the readers." That did it. The doors are now heavily curtained.

The first impression one gains upon seeing the vast amount of material in the Folger Library is of its wide variety. Here are books, pamphlets, documents, manuscripts, relics, curios, oil paintings, drawings, water colors, prints, statues, busts, medals, coins, objets d'art, furniture, tapestries, diaries, memoirs, journals, playbills, theater posters, prompt books, stage properties, and actors' costumes to illustrate Shakespeare and his time.

Of the First Folio (first collected edition of Shakespeare's plays, 1623), the library has 79 of the some 240 copies now known to exist. Its nearest competitor, the British Museum, owns five copies.



No Price Tag Could Possibly Be Placed on the 36 Rare Books and Documents on This Table

Curator Giles E. Dawson displays treasures including a warrant (center, third from bottom) which released Sir Walter Raleigh from the Tower of London in 1616 to lead a gold-seeking voyage to the Orinoco, two years before he was executed. Below it is a deed to Shakespeare's London house. In the foreground (center) lies the largest copy of the First Folio, the first collected edition of the poet's plays (1623). The Burton Volume, an extremely valuable collection of the Bard's nondramatic poems (lower left), turned up in a coach house in Shropshire, England, in 1920.



His Project Entails Eight Volumes, Three Other Scholars, and 80 Years of Research

The road of a scholar at the Folger is long and hard. Dr. George Winchester Stone, Jr., professor of English literature at George Washington University, has been working on *A History of the London Stage, 1660-1800*, since 1935. He and three collaborators face five more years of work. They are preparing a detailed, day-by-day account of what each London theater offered in this period. Dr. Stone's files (foreground) hold 25,000 index cards. Josephine S. Fox (background) works on a Ph.D. in English.

The library also has in its vaults 57 copies of the Second Folio, 25 of the Third, and 37 of the Fourth (opposite).

Of Shakespeare's plays in quarto, the Folger has the greatest collection ever brought together; the most precious prize being, of course, *Titus Andronicus*, first edition, 1594, the earliest of the poet's published plays.

In addition to such monumental volumes, there are also about 1,300 different editions of the collected works of Shakespeare and countless separate play publications. For example, there are more than 800 editions of *Hamlet*, some 500 of *Macbeth*.

There are volumes of Shakespeare once owned by George Washington, King George III, Lincoln, Theodore Roosevelt, Thomas Gray, Shelley, Burns, Hawthorne, Emerson, Lamb, Madame de Pompadour, Napoleon III, and General Tom Thumb—most of them bearing notes in their owner's handwriting.

On the Folger shelves stand rare-book volumes by Ben Jonson, Francis Bacon, and nearly every important or lesser writer of Shakespeare's time.

In all, the library boasts about 130,000 books. This is in addition to the priceless manuscripts, documents, 3,000 prompt books, 250,000 playbills, scrapbooks, and other memorabilia.

The compilation of documents alone is as-

tounding, ranging from King Henry VIII's proclamation declaring himself head of the church to a warrant releasing Sir Walter Raleigh from imprisonment in the Tower of London.

A few of the outstanding documents include various letters and papers signed by Henry VIII, Queen Anne of Cleves, Jane Grey as "Queene," Edward VI, Elizabeth, and James I; a roll of Stratford jurors that names Shakespeare's father, John; a deed to the poet's house in the Blackfriars district of London that is believed to be the only object in the Western Hemisphere which can be said actually to have been handled by Shakespeare.

The Bard's Only Obituary

Also in the Folger's possession is the only known account of the Bard's death. It is in a volume of the diary of the Rev. John Ward, vicar of Stratford.

He wrote: "Shakespear, Drayton and Ben Jhonson had a merry meeting and it seems drank too hard for Shakespear died of a feavour there contracted."

A listing of the prominent books, manuscripts, and documents could go on indefinitely, more than filling every page of this issue of the NATIONAL GEOGRAPHIC MAGAZINE.

Scholars find rich treasure at the Folger Library, right down to the original diagram of

Sir John Harington's invention, an early version of the flush toilet, in *An Anatomie of the Metamorphosed Ajax* (1596).

Folger collected everything from the much-publicized corset of Good Queen Bess to furniture and wooden objects made from the mulberry tree in Shakespeare's garden.

Of such things, the library's director, Dr. Louis B. Wright, candidly says he believes "the corset's a fake"; and "there's enough wood here for two mulberry trees."

"I'm William Shakespeare"

One day after work, Wright was getting into his car when a man with a rich cockney accent came up to him. The man asked to see the library.

Dr. Wright explained the library was closed for the day, but if the man came back the next morning, he'd be happy to show him around.

"I'm very interested in this library," the man said. "You see, I'm William Shakespeare." Wright's eyes popped. It appeared that the man was an indirect descendant of Shakespeare.

When the director recounted the incident the next day at the office, one staff member remarked, "If Henry Clay Folger were alive, he'd have the man stuffed and put in the library!"

The greatest single addition to the Folger was the acquisition in 1938 of Sir Leicester Harmsworth's Renaissance library. The Folger wanted the collection badly and considers itself most fortunate in acquiring it.

Much of this good luck was due to a young Englishwoman who came to the library in 1936 on a regular Washington sight-seeing tour. She asked the guide to obtain permission for her to enter the reading room. A staff official willingly obliged.

Just before she left, he learned she was a Miss Harmsworth. He asked if she was any relation to Sir Leicester Harmsworth, the book collector. She was his daughter, and pleased to know that the staffman knew of her father.

On her return to England, she told her family of the Folger and how much impressed she was by the attentive care given rare books and manuscripts.

When the Folger began negotiations to buy the collection after Sir Leicester's death, the trustees of his estate remembered his daughter's impressions of her visit and were favorably disposed toward the Folger Library. The family was further induced by the library's offer to put in each volume a name plate reading, "From the library of Sir R. Leicester Harmsworth, Baronet."

The collection is supposed to have cost

Harmsworth more than two million dollars. It was sold to the Folger for less than one-tenth of its original cost because Lady Harmsworth wanted it placed in the Folger, where it could serve as a nucleus of a research library in English history.

Sir Leicester did not collect Shakespeare and drama. But in nearly every other phase of Elizabethan culture—history, exploration, theology, music, poetry, and printing—his library was remarkably rich.

The purchase of it by the Folger brought together the two greatest private collections on the Elizabethan period. It immediately changed the focus of the Folger from a library shrine to the Western World's most valuable historical library on English civilization of the 16th and early 17th centuries.

Actually, only one institution in the world now outranks the Folger in this field—the British Museum. The Bodleian Library at Oxford and the Huntington Library in California are close runners-up.

The library recently received an extraordinary shipment of books, which it purchased in London at the sale of the Shipdham Church library, a parish church in Norwich.

Most of the books, all 17th-century titles, apparently had remained unopened since that time. Some of their pages were uncut and were as bright inside as on the day they were printed, though stained and soiled on the outside from the dust and damp of 300 years.

Old Books for New Roof

The catalogue advertising the sale explained the church's decision to sell the old library: "It may be added that the sum realized will be used to meet the heavy expense of repairs to the roof and the additional cost of £175 for new heating apparatus—both of which are of great urgency at the present time."

The Folger was glad to help provide for the comfort of the good parishioners, but even more pleased to get the fine books.

Though the staff is quick to claim the library is no ivory tower, persons who wish to carry on research there must have proper identification and proof that their work can best be done at Folger.

It was once generally believed that to get into the Folger you had to have a Ph.D. This is not true, though most readers do have that degree.

The library does not encourage students who could find references elsewhere. These are politely but quickly shooed across the street to the Library of Congress.

Louis B. (for Booker, appropriately enough) Wright came on from Huntington Library, San Marino, California, in 1948 to take the Folger reins. The South Carolinian spends



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It's a Tight Squeeze to Struggle into Queen Elizabeth's 20-inch-waistline Corset

One of the library's most publicized curios is an undergarment bought by Henry Folger in the belief it once belonged to Good Queen Bess (page 412). However, director Louis B. Wright says he believes "it's a fake." The corset consists of bone stays encased in cloth and edged with red leather. Here, cataloguer Lilly Stone laces up Betty Jo Hanna, whose waistline measures 23 inches.

a good bit of his time picking worthy students for the 12 to 15 annual Folger fellowships and grants-in-aid.

Periodically, Dr. Wright writes a lively mimeographed newsletter that goes out to former readers and other interested parties. He has been highly complimented on his knack for handling news and events at the library with such a light touch.

He was understandably proud of a letter he received recently from Wilhelm Munthe, director of the National Library of Norway and author of *American Librarianship from a European Angle*.

"Fountain of Knowledge at the Folger"

Dr. Munthe wrote, "Let me tell you how much I enjoyed your New Year's report. It is often a sour duty for us librarians to peruse library reports. So, great is the joy to come across one which can be read with pleasure and a smile. Your report proves that information need not be given in a dusty and impersonal language. . . . Let the Capitol ever make laws and the Library of Congress be growing, if they only leave a place between them for the flower bed and the fountain of knowledge at the Folger."

These days the Folger welcomes about 30 scholars each month, plus a goodly sprinkling of stage and movie people (such as Maurice Evans, Charles Laughton, Lawrence Langner) and other celebrities (such as Leopold Stokowski, and an occasional Senator).

Most perennial and greatest thorn in the side of the Folger Library is the small but unwavering group who are convinced that William Shakespeare didn't write those plays at all but that Sir Francis Bacon did. However, these Baconians are welcome to enter the library too.

Some years ago a guard found a middle-aged woman in the exhibition hall screaming, "Tear down this building! It is a monument to a lie."

She was finally calmed down and shown to the door. The director urged her to go home and write him at length all the facts supporting her theory. She promised she would, but was never heard from again.

One aging academician horrified the staff another day by stating he had finally decided King Edward VI was really Bacon and had written the works of Bacon, Shakespeare, and Spenser. The good king, he claimed, did not die at the tender age of 15 in 1553, but went



"In Sweet Music Is Such Art, Killing Care and Grief of Heart," Wrote Shakespeare

Sixteenth-century scenes can be recreated in minute detail almost anywhere in the Folger. Library assistant Elizabeth Niemyer strums an original Padua lute, using a rare volume of Elizabethan music as her score. One of a number of musical antiques owned by the library, this lute is believed to be the oldest in existence today. It was made in 1598. Miss Niemyer's ermine-rolled costume was worn by Ida Vernon as the ill-fated Queen Gertrude in Edwin Booth's production of *Hamlet*.

into retirement and produced these literary masterpieces.

The Folger takes no official stand in the many controversies on authorship. Because of this, Baconians often unjustly accuse the institution of withholding evidence.

"They think we know the real truth," Dr. Giles Dawson, curator of books and manuscripts, declared, "but don't dare admit it."

Once the Folger made an outright conversion. One doubting man, a retired attorney, came to the library armed with Oxfordian reports from New York papers. He argued his point and then thoughtfully listened to what Dr. James B. McManaway, consultant in literature and bibliography, had to say.

"Can you," he asked, "in 10 minutes show me documents that substantiate the Stratfordian claim?"

By the time he left, he announced he was "for Shakespeare 100 percent."

The Folger carries on a brisk correspondence with Shakespearean scholars and students all over the world.

A South African professor sent in his manuscript for the library to check. A British soldier who wrote a study of *Hamlet* while in a German prison camp asked for and was furnished some photostats from Folger to help in his research.

Shakespeare in Pidgin English

A GI in the Pacific in World War II proudly sent in the "Friends, Romans, countrymen" speech from *Julius Caesar* in South Sea pidgin English. He had heard a mission-trained boy recite it and copied it down phonetically. The library exhibited it.

Occasionally the Folger staff gets a letter that really stumps them all. It usually comes from a schoolboy or girl. And it is usually short and to the point. It asks: "Please tell me all you know about Shakespeare."

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

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

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

In Mexico, The Society and the Smithsonian Institution, January 16, 1930, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 201 B. C. (Spinden Correlation). It antedates by 200 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 72,705 feet. Capt. Albert W. Stevens and Capt. Cyril A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

A notable undertaking in the history of astronomy was launched in 1949 by The Society in cooperation with the Palomar Observatory of the California Institute of Technology. This project will require four years to photomap the vast reaches of space, and will provide the first sky atlas for observatories all over the world.

In 1948 The Society sent out seven expeditions to study the eclipse of the sun along a 5,320-mile arc from Burma to the Aleutians. The fruitful results helped link geodetic surveys of North America and Asia.

The Society granted \$35,000, and in addition \$75,000 was contributed by individual members, to help preserve for the American people the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California.

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



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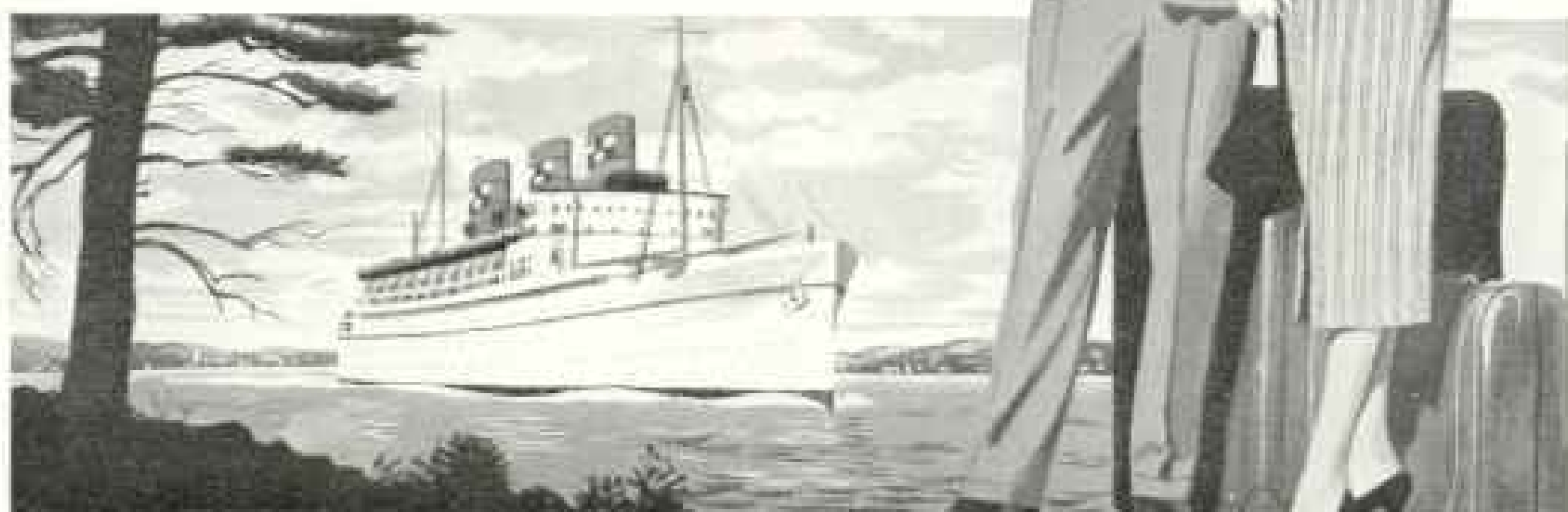
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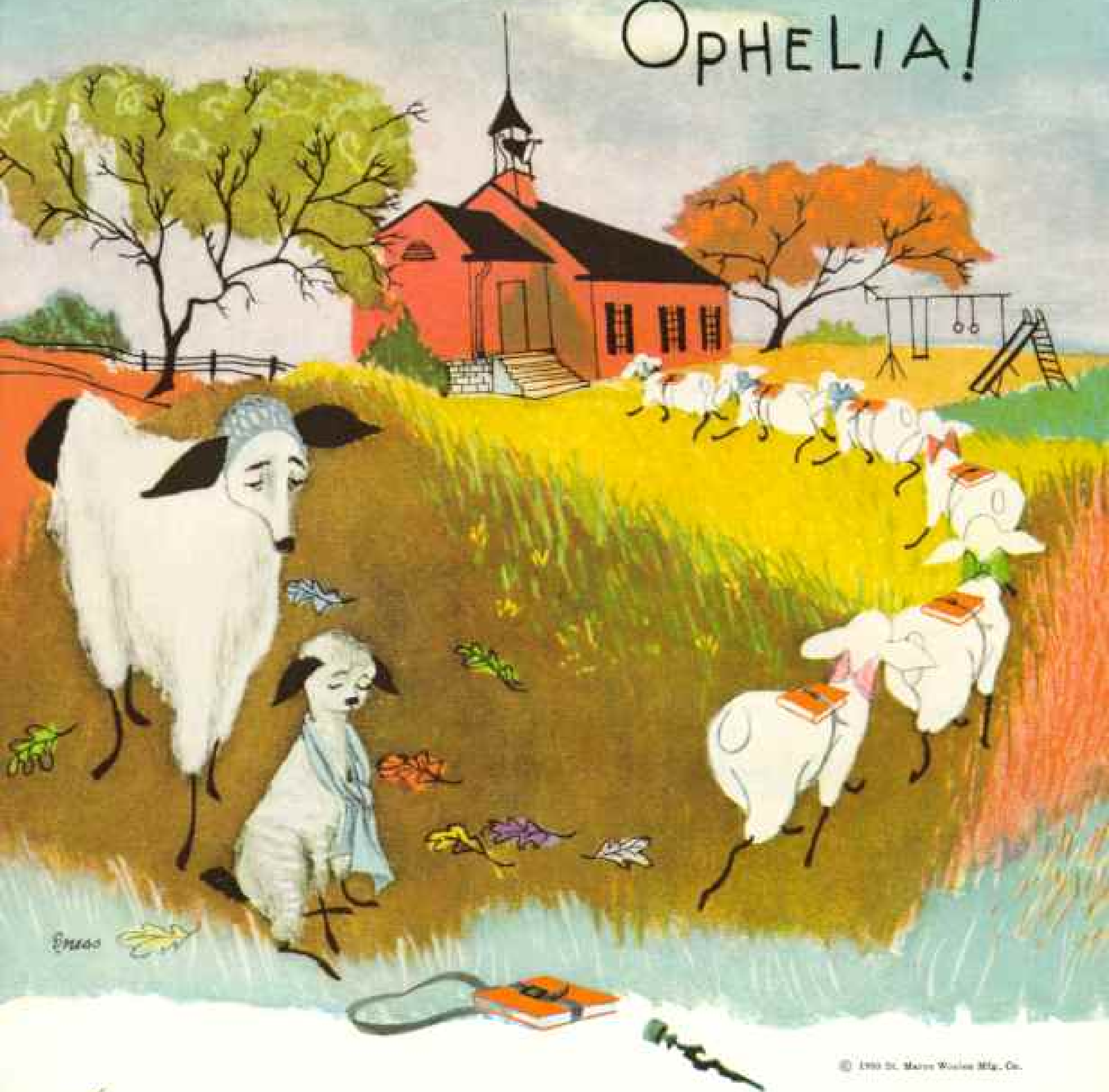
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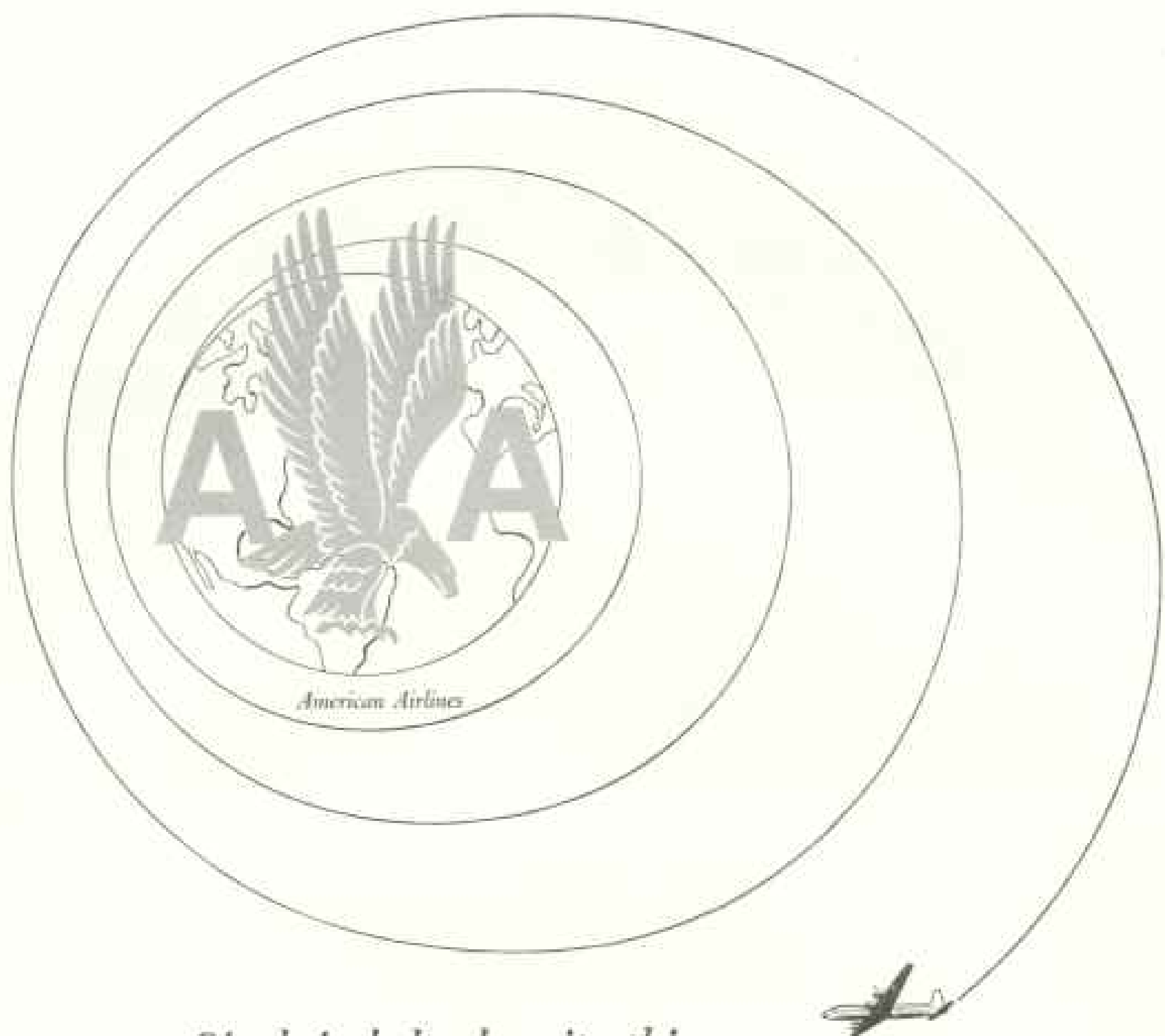
"That's top billing, darling. . . ."



ST. MARYS BLANKETS

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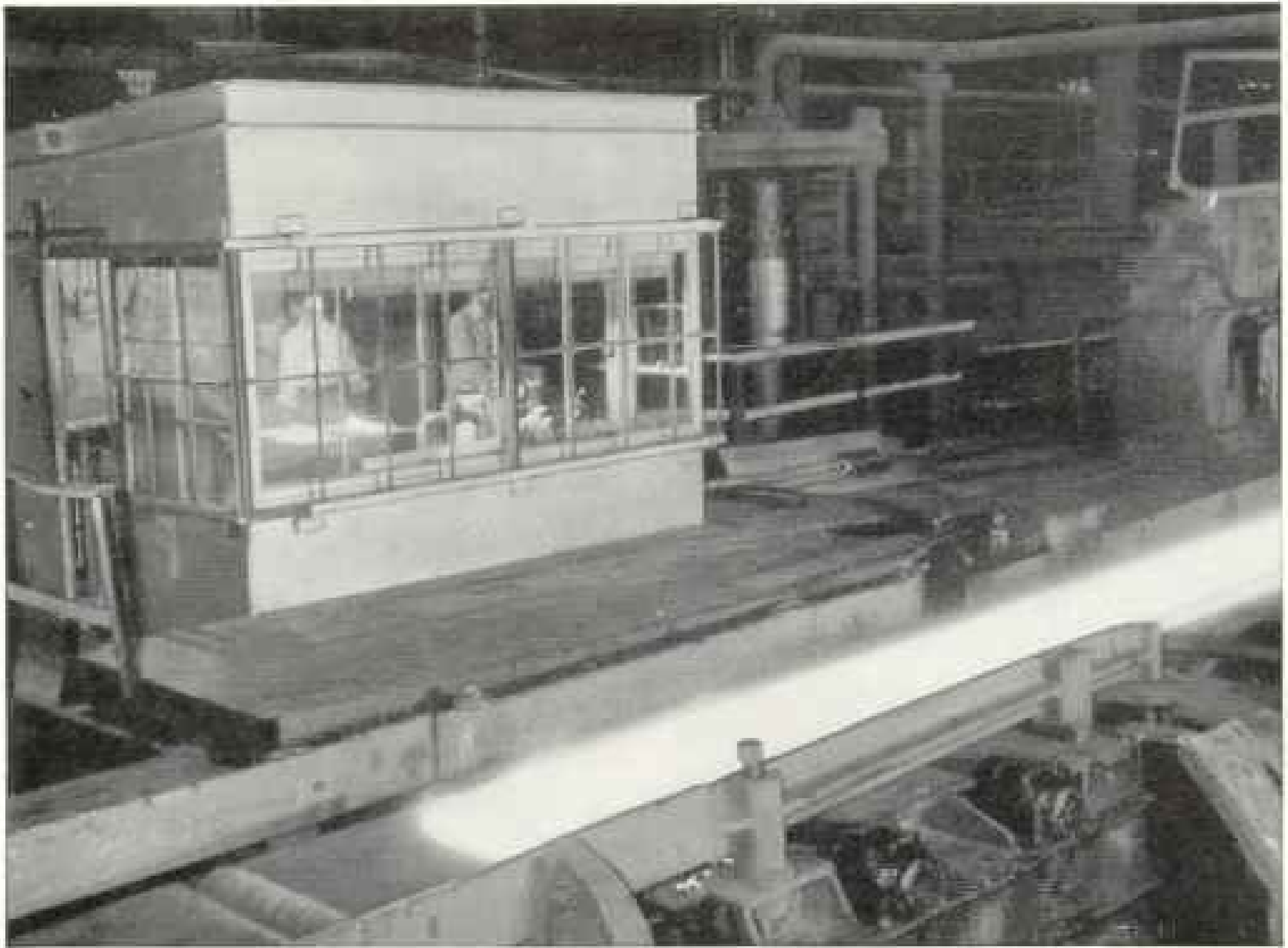
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Every time a huge, white-hot steel bar passes through this shear pulpit, it sends forth almost unbearable waves of heat.

Yet, the shear operator works in comparative coolness, despite blast after blast of heat—thanks to shields of special glass set up between his cage and the hot steel.

A thin film permanently bonded to the outer side of the glass panels turns back about 60% of the hot infrared rays from the fiery steel. Yet, the panels are transparent so the operator can see and control the bar as it moves through the shear.

As a transparent shield for banks of powerful spotlights, this glass may provide an answer to television's "hot-light" problem. It may have a use as a windshield for vehicles used in steel furnace rooms, or as a transparent floor for cabs of overhead cranes handling hot ingots or molten metal.

Strange as it may seem, this new kind of glass—Pyrex brand infrared reflecting E-C glass—was originally developed to produce heat. The

film bonded to the glass conducts electricity and when current is applied through electrodes, the glass becomes a heating element for a variety of industrial drying applications.

Throughout industry, Corning means research in glass because a multitude of Corning developments—such as this E-C glass—have helped improve many a product, many a process. So we suggest, if you are thinking in terms of product or process improvement, that you let us tell you more about Corning's many kinds of glass. Write Box N6, before your planning reaches the blueprint stage. *Corning Glass Works, Corning, New York.*

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1851 — 100 YEARS OF MAKING GLASS BETTER AND MORE USEFUL — 1951

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They take workmen where jobs are. They deliver materials that keep machines humming.

The transportation feats of the railroads are justly famous; feats in which The Budd Company has had an important part.

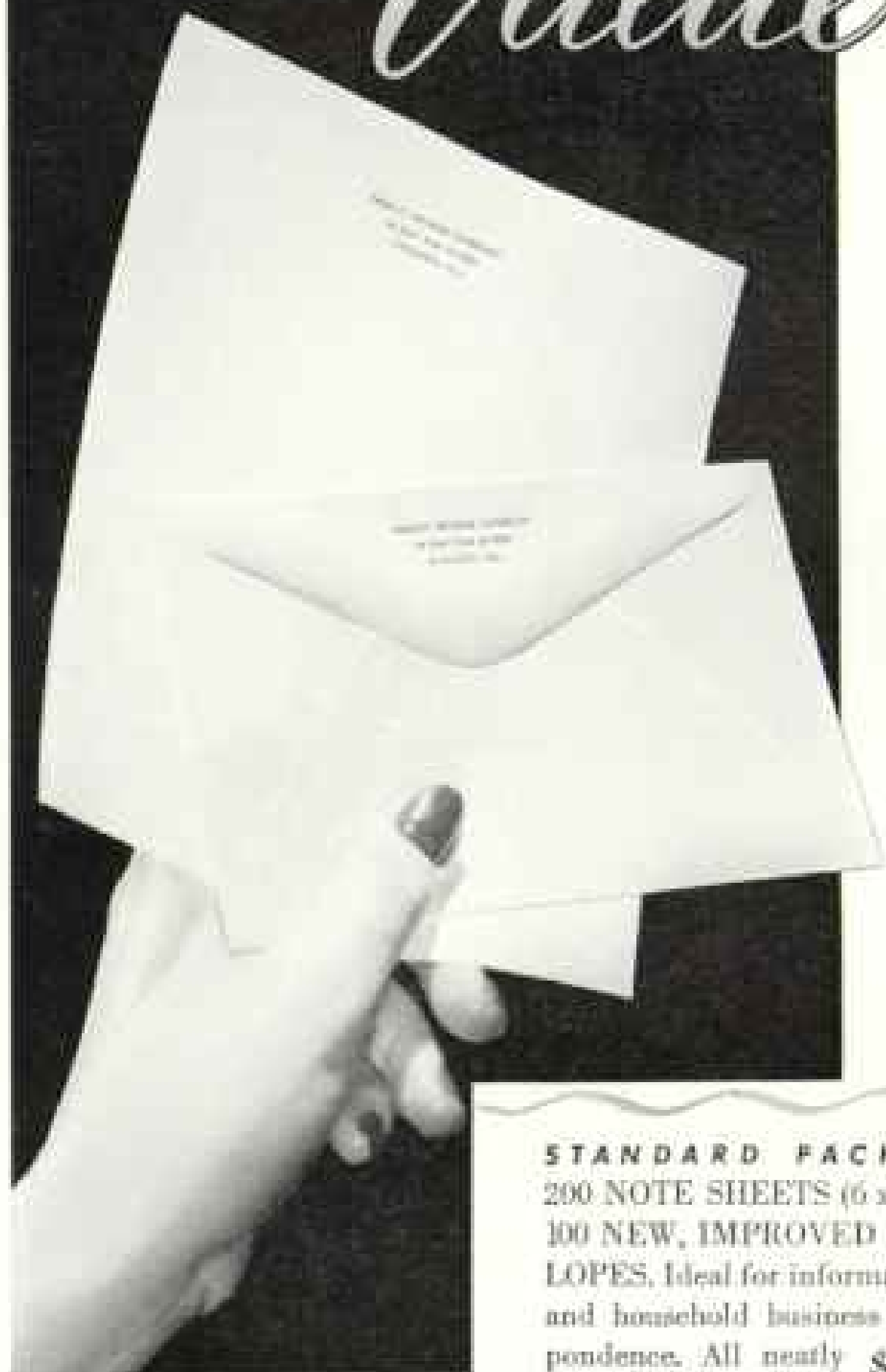
Equally significant are the accomplishments of the automobile industry, which has made universal ownership of cars possible in this country alone.

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Model 17C109

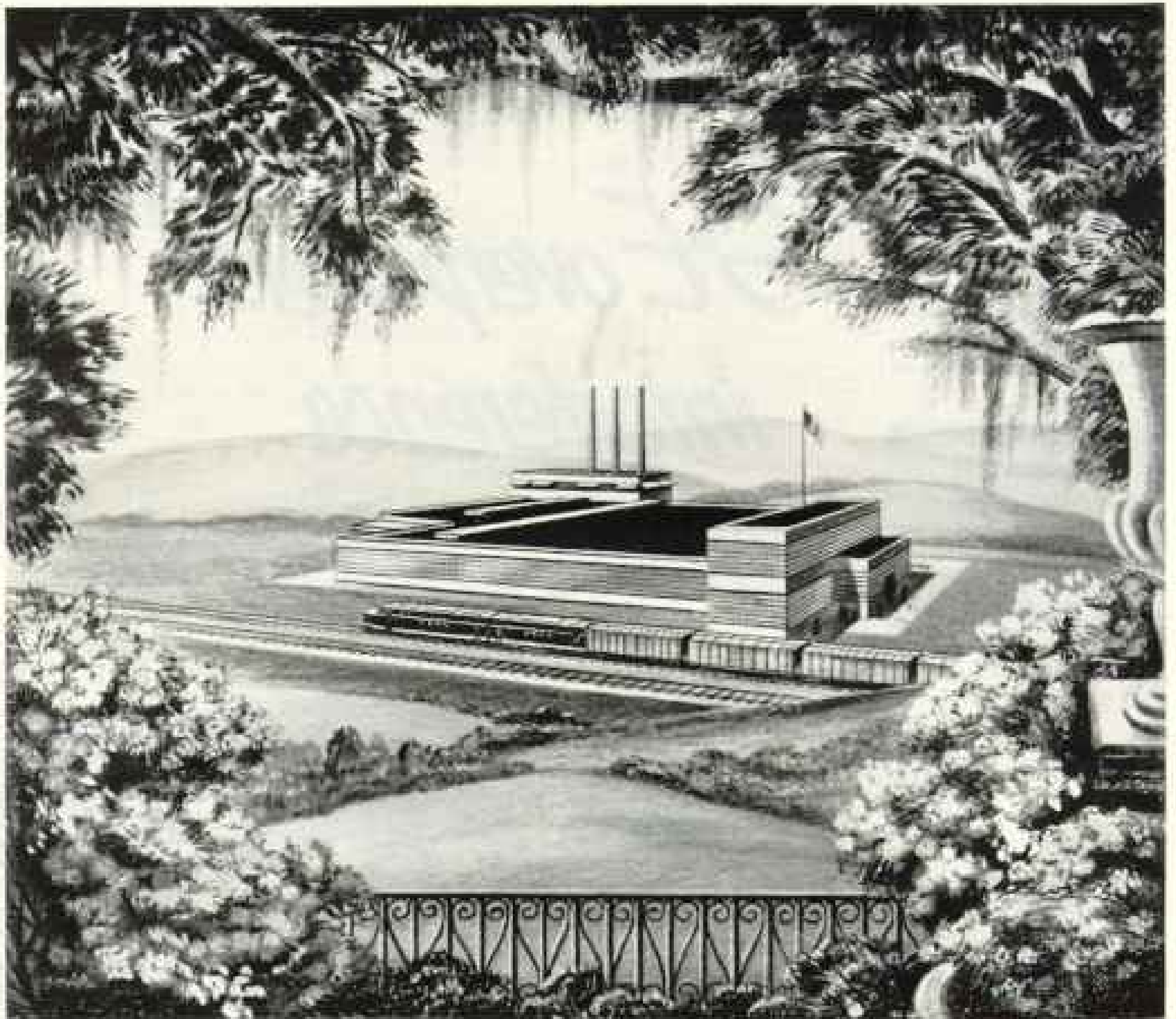
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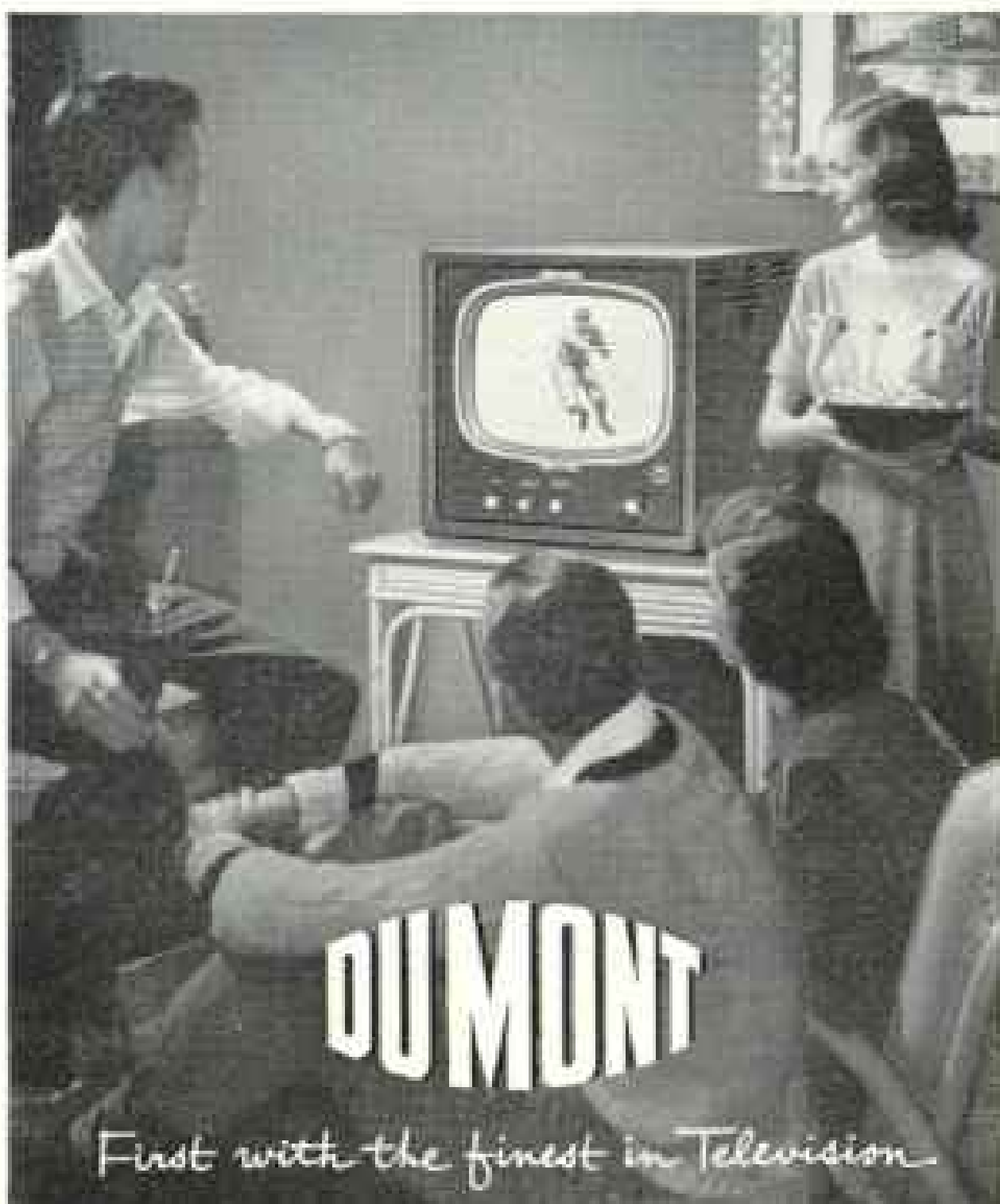
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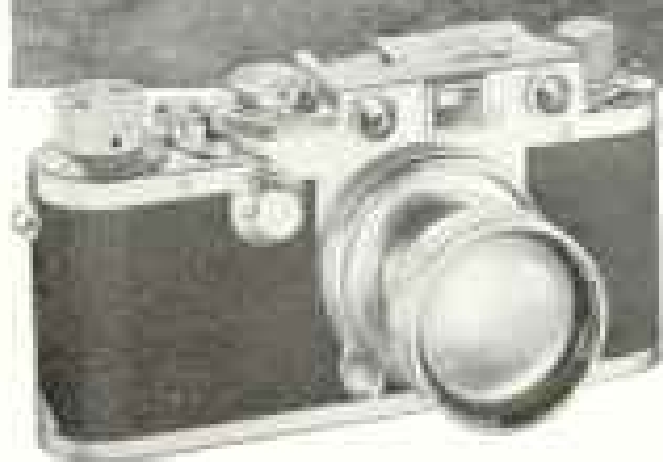
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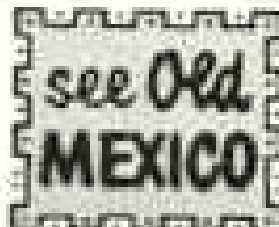
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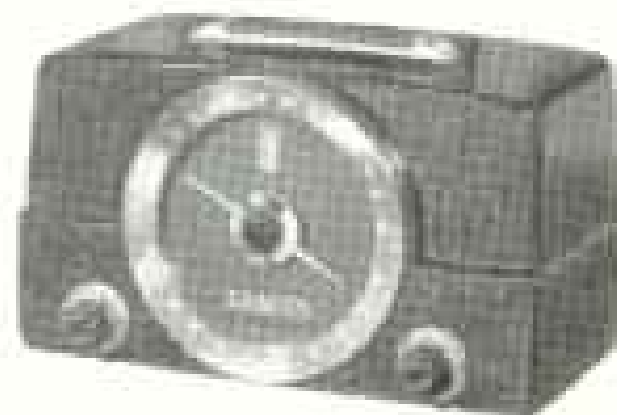
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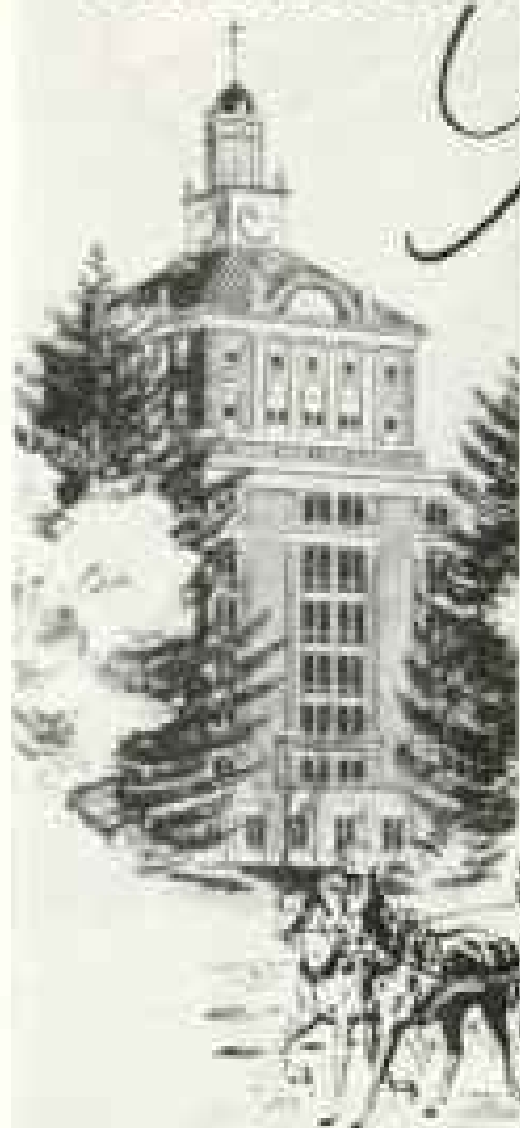
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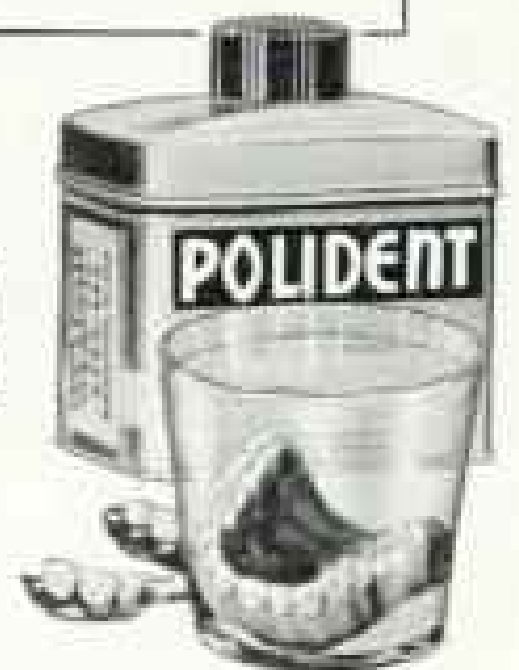
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The child's eyes...

Faulty visual habits are often formed during childhood which may lead to defects in later years when correction may be more difficult.

A child's eyes should be examined at age three or four, again before entering school and after starting to read—even though no signs of eye trouble are evident.

There are many common diseases that affect the eyes of children. Most of them are mild—but some may be serious. Both may start in the same way—with redness, flow of tears, blinking, squinting, or scowling, accompanied by little or no pain. So, if these or other signs of eye trouble appear, it is wise to see a doctor.

Specialists caution against delay in the use of glasses if a child needs them. Glasses generally help the child to improve his vision, or overcome other eye defects—often within a relatively short time.

The adult's eyes...

After age 40, periodic examinations of the eyes are especially important. They provide a *double* safeguard. First, by discovering defects and diseases of the eye itself. Second, by helping to detect conditions such as high blood pressure, diabetes, and

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Three common eye defects—nearsightedness, farsightedness, and astigmatism—can usually be corrected by properly fitted glasses. Only an eye specialist is qualified to prescribe glasses or other special eye treatments.

Under proper medical care, most of the threats to good vision can be corrected or cured so that the eyes may be used efficiently throughout life.

To help keep the eyes in good condition:

1. Read with a clear, good light falling from above and behind you.
2. Rest your eyes at frequent intervals when reading or doing close work.
3. Except for easily removable particles, trust only to expert help for removing a foreign body from the eye.
4. Be alert to the warnings of eye trouble—headaches, eye fatigue, blurred vision, inflammation of the eyes or lids, spots before the eyes and colored halos around lights.
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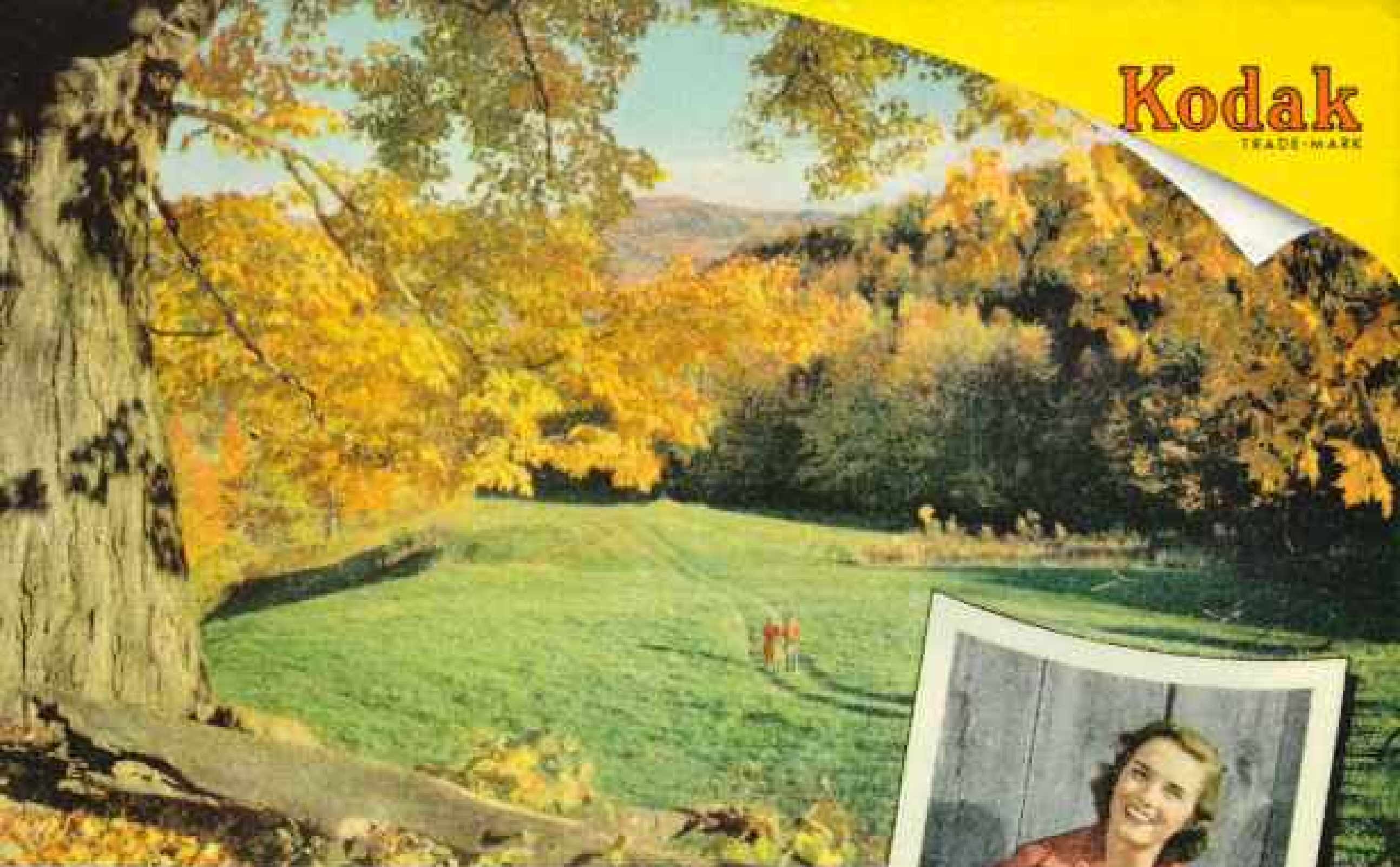
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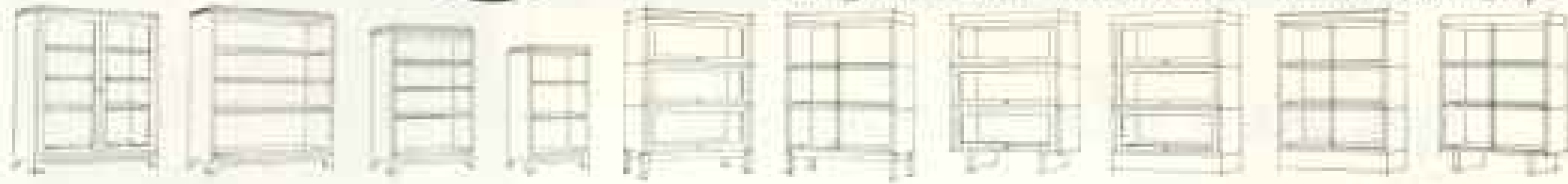
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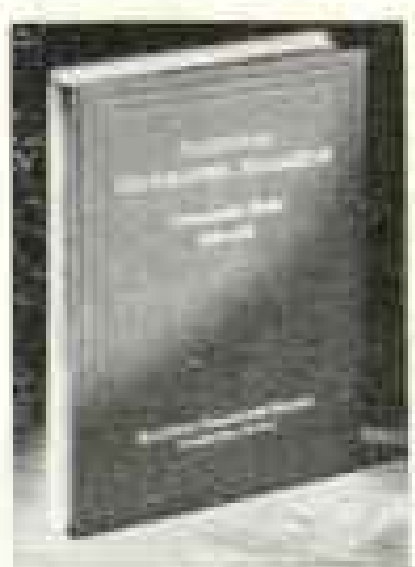
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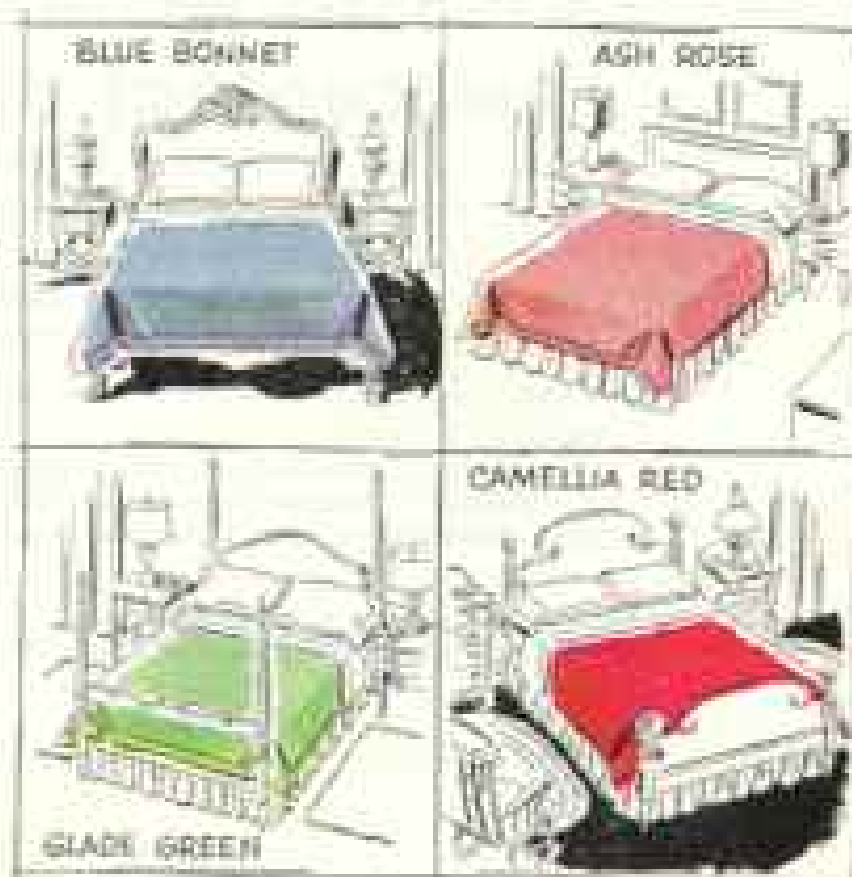
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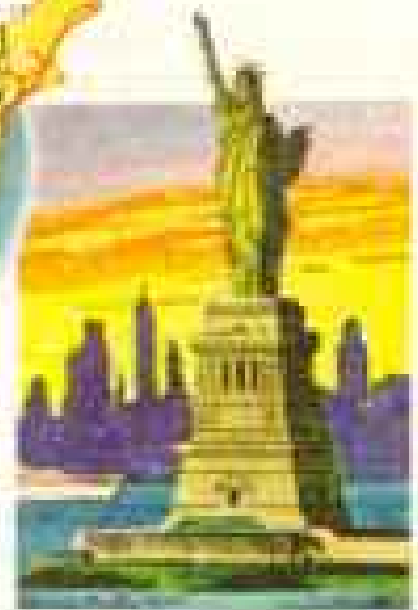
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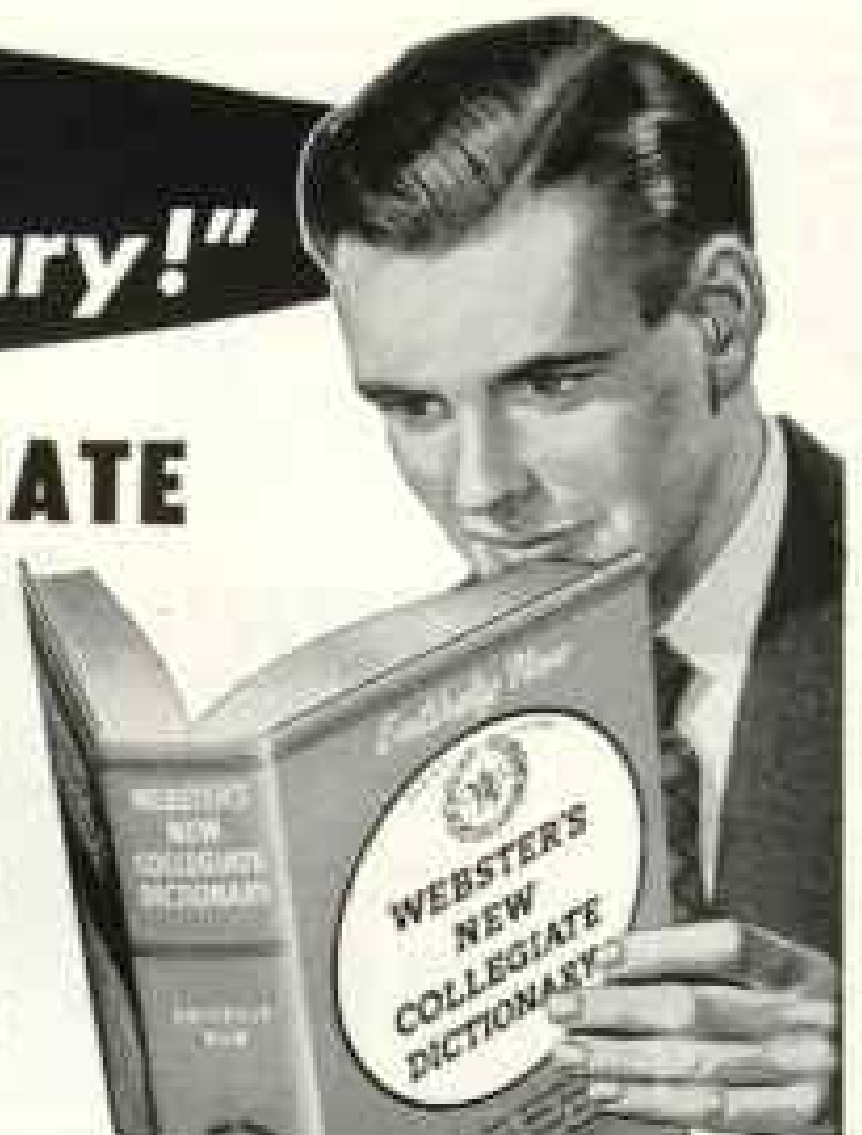
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