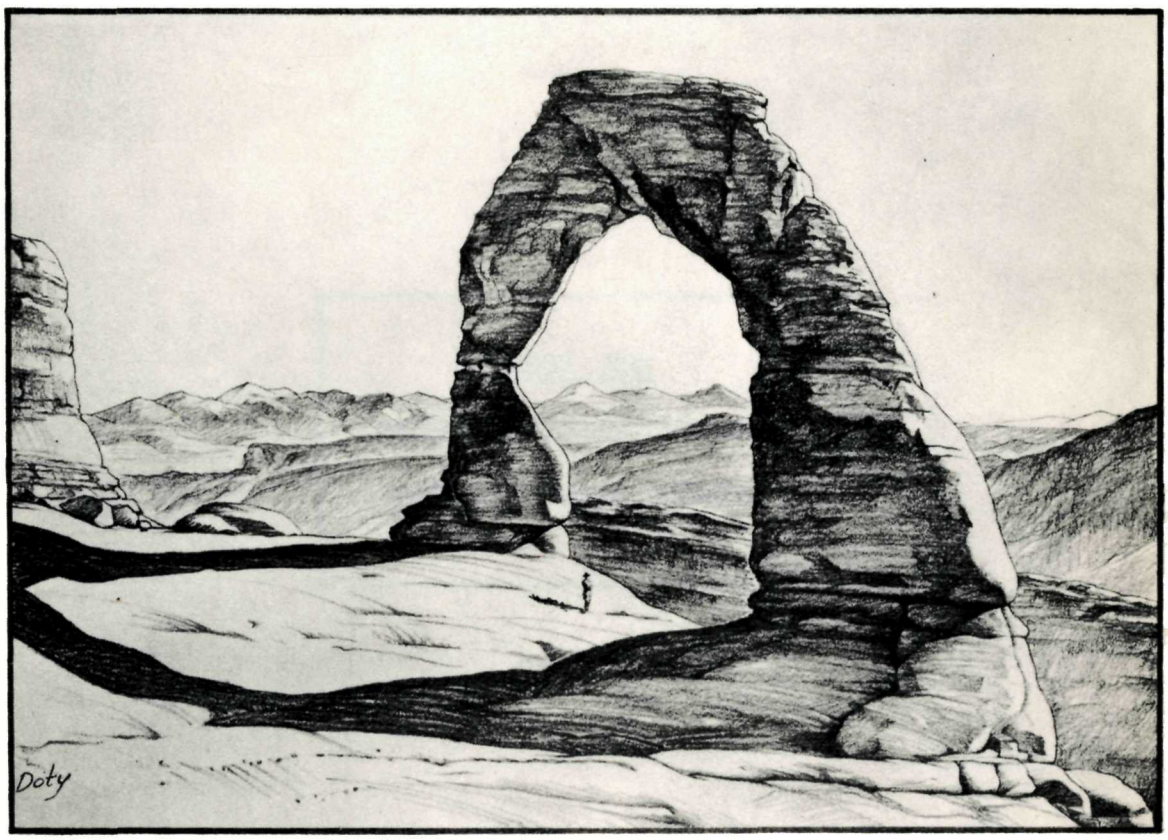
REGION III
QUARTERLY



NATIONAL PARK SERVICE

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THE COVER

DELICATE ARCH, IN ARCHES

NATIONAL MONUMENT, UTAH.

C O N T E N T S

John R. White — Regional Director

Leo A. McClatchy — Editor

Santa Fe, New Mexico

July 1940.

REGION III

ARIZONA - ARKANSAS - NEW MEXICO - OKLAHOMA
TEXAS - UTAH - AND SOUTHERN PARTS
OF COLORADO AND NEVADA

A. E. DEMARAY
ASSOCIATE DIRECTOR

A. E. DEMARAY

Like all big business organizations, the Federal Government recognizes and rewards merit in its employes. A. E. Demaray, Associate Director of the National Park Service, is an example. He entered the government service in 1903 as a messenger in the Department of the Interior. Two years later he was a draftsman in the Bureau of Reclamation. With the exception of an assignment as a civilian draftsman in the U. S. Army of Pacification, in Havana, Cuba, from March 1907 to December, 1908, his entire career in the government has been in the Department of the Interior.

Mr. Demaray "grew up" with the National Park Service, to which he was transferred as a draftsman from the Geological Survey when the Service was being organized in 1917. He has been in the National Park Service ever since, holding such positions as Editor, Assistant in Operations and Public Relations, Administrative Officer, Assistant Director, and Executive Officer. He was appointed Associate Director in August, 1933.

Mr. Demaray has been described as "a tireless workhorse." Only a man of his compact physical build, endowed apparently with inexhaustible reservoirs of energy, could have carried the burden of national park expansion as he has done. Today his hair is silvery iron grey, while his face shows signs of the unremitting toil of building up the National Park Service; but his touch is as firm as ever and his clear mind resolves the multifarious problems which now beset the vastly expanded Service. While he has an exhaustive knowledge of all phases of National Park and cooperative recreational work, his special field has been in fiscal and budgetary matters, in which he is a recognized expert. It is not too much to say that the comparatively generous attitude of the Bureau of the Budget and of the House and Senate Committees, toward National Park appropriations, has been due to the confidence inspired by him. He has also had principal charge of the many millions of dollars of road construction programs in the national parks, undertaken in cooperation with the Public Roads Administration of the Federal Works Agency. The details of these extensive road construction programs in all the national parks, as well as the two great parkway projects in the East - the Blue Ridge and Natchez Trace Parkways - were worked out largely by him.

Particularly outstanding among Mr. Demaray's park achievements was his suggestion which led to creation of the Southern Appalachian National Park Commission. This resulted in establishment of the Great Smoky Mountains National Park, in Tennessee and North Carolina; and in the approval of projects that later became the Shenandoah National Park, in Virginia; and the Mammoth Cave National Park, in Kentucky.

SYMBOLS OF THE DESERT

By Dr. W. B. McDougall,
Regional Biologist.

It has been said that a visit to the desert invariably brings a desire to return. There is a peculiar, unique sort of charm that grips you, especially after you have slept out under the stars among the cacti, ocotillo, and palo verde trees. A love of the desert seems to grow within you and become more intense each time you return.

There are various kinds of desert, such as the sagebrush desert and the creosote bush desert and the spurge desert of Africa, but in certain respects the cactus desert, which reaches its noblest development from southern Arizona southward through Mexico and Central America, is the most unique and the most charming of all. With the exception of a single genus, the members of which grow as epiphytes on other plants in Africa, the cacti are strictly American plants. Every national park and monument in Region III boasts of certain species of cacti, but if you wish to see the most wonderful natural displays of cacti in the United States, go to Saguaro National Monument, east of Tucson; and the Organ Pipe Cactus National Monument, south of Ajo, in Arizona. If you ask the custodian of either of these monuments how many kinds of cacti there are in his monument, he will give you a number that will surprise you, but he will admit that he does not know the exact number because the areas have not been explored thoroughly enough to determine the numbers.

In North and South America together there are now known to be more than 1,200 different species of cacti. They vary in size from the little fishhook cactus that is seldom more than 2 inches high, to the giant cactus, or saguaro, that sometimes reaches nearly 50 feet in height. There are certain characteristics, however, that are common to all cacti. They all have very fleshy stems in which they can store great quantities of water to tide them over periods of drought. The stems are always green, too, so that they can manufacture starches and sugars from water and the carbon dioxide of the atmosphere, just as green leaves do. This is important because most cacti do not have any leaves; those that do have a few small leaves usually lose all of them very soon after the end of a rainy season.

The flowers of most cacti are very showy. The sepals, petals, and stamens are numerous, but there is only one pistil. The ovary is below all of the other parts of the flower so that the other parts appear to be growing from the top of the ovary. After the other parts of the flower have withered and dropped away, the ovary develops into a large edible berry which in many cases is sweet.

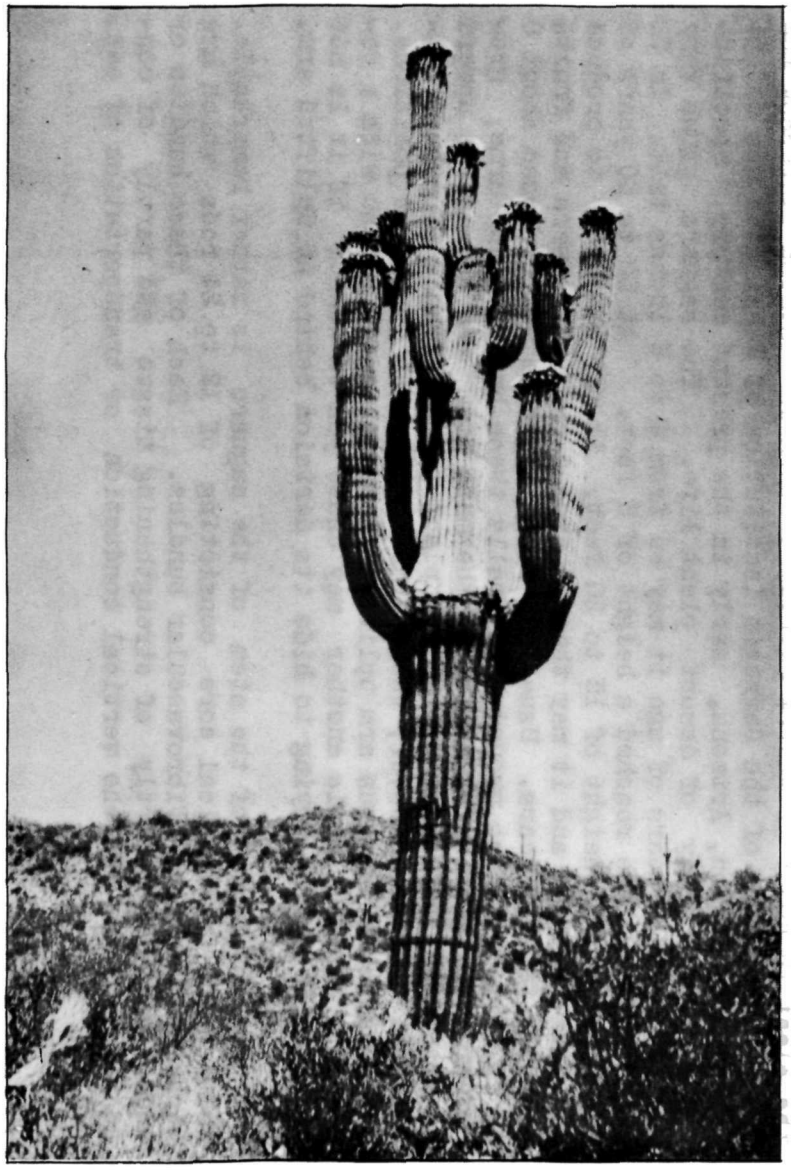
The cacti have no very close relatives. Plant families that are closely related are grouped together into plant orders, but in the or-

der in which the cactus family is placed there are no other families. Probably the nearest relatives of the cacti are such plants as the evening primroses, the myrtles, the begonias, and the pumpkins and melons. It is believed that during the evolution of the plant kingdom the cacti and all of these other plants that I have mentioned as being related to the cacti were developed from roses or rose-like plants.

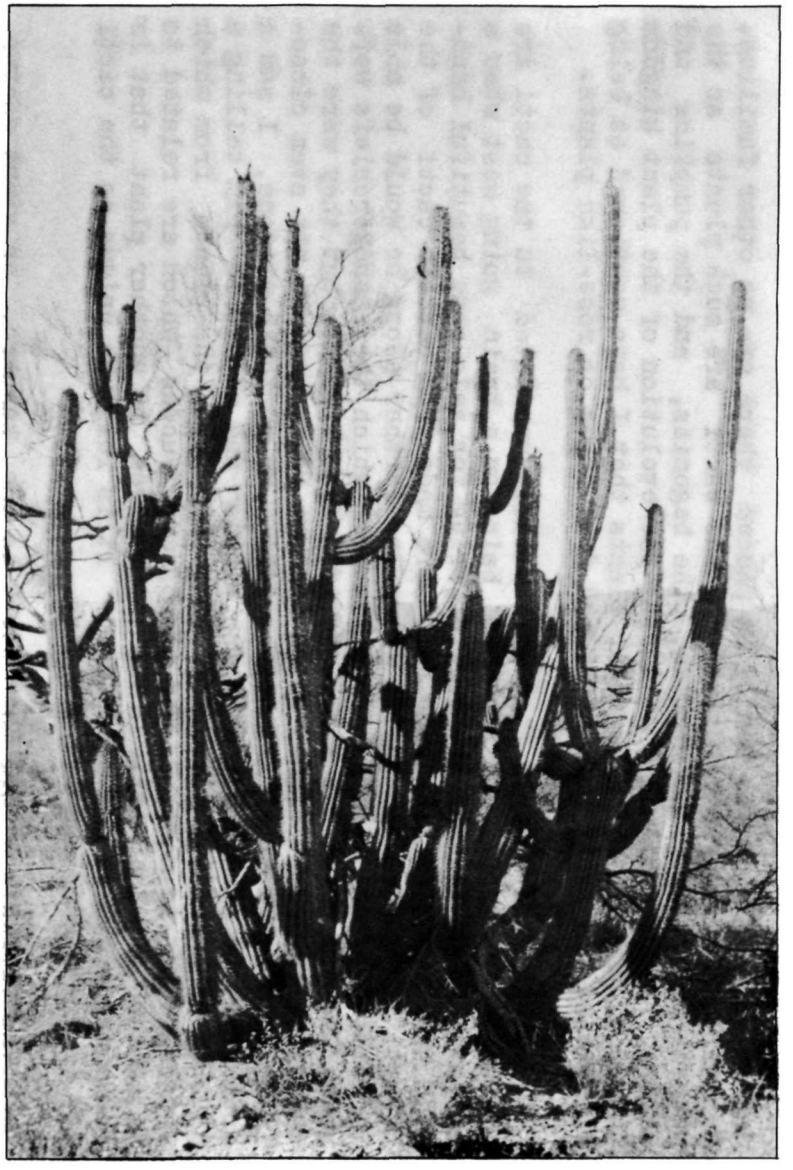
Quite often plants that are totally unrelated to the cacti are mistaken for cacti. I remember being on a train going west when a salesman came through the car offering for sale some beautiful hand-made handkerchiefs which he said were made from certain cacti of the desert. He promised that a few miles farther along he would be able to point out the species of cacti from which the handkerchiefs were made. He did point out some beautiful desert plants but they were the ocotillo, or desert flame, which are not cacti and are not even closely related to cacti. At another time, in northern Arizona, I saw a young man pointing out certain plants and overheard him telling a friend from a foreign country that they were the plants from which cactus candy is made. The plants were yuccas which are related to lilies and not to cacti. The joshua tree is another plant that is sometimes mistaken for a cactus. It is fully as unique as the cacti but it is a yucca and not a cactus.

The largest of all the cacti is the saguaro, or giant cactus, (Carnegia gigantia) the largest specimens of which are nearly 50 feet tall and nearly 250 years old. The genus name, Carnegia, was given to the plant in honor of Andrew Carnegie, through whose philanthropy the Desert Laboratory of the Carnegie Institution of Washington was established near Tucson, Arizona, early in the present century, specifically for the study of desert plant life. The saguaro grows very slowly. At 10 years of age it may be from 4 to 6 inches tall. In 30 years it may have reached a height of 3 feet, At 50 to 60 years of age, and with a height of 15 to 20 feet, it may be ready to produce its first flowers and it may then produce a crop of flowers and fruits annually for 200 years. Usually several branches are produced about 8 to 12 feet above the ground. Normally these branches, or arms, grow outward nearly at right angles to the main stem and then curve upward to a vertical position, giving the plant the appearance of a huge candelabra. Often, however, these arms assume most grotesque positions. One saguaro may have an arm uplifted as though greeting you with a respectful salute, while another may cause you to wonder if it is not laughing at you and trying to hide its derision behind an uplifted arm.

The structure of the stem of the saguaro is rather remarkable. There is a cylindrical core consisting of 12 to 24 rods which are technically called fibrovascular bundles. Each of these bundles or rods is composed partly of strengthening tissue and partly of conducting tissue for the vertical conduction or transportation of sap.



SAGUARO, IN FULL BLOOM



ORGAN PIPE CACTUS

Both inside and outside of this cylindrical core of rods is the succulent, water-holding tissue which makes up the bulk of the stem. The rods, which vary in diameter from 1 to 2 inches, make the stem strong enough to resist the violent winds that often sweep across the desert during the short rainy seasons. These rods are used by Papago Indians for fuel and for building materials. The outer surface of the stem is fluted like an accordian, with furrows 1 to 2 inches deep, depending upon the amount of water in the stem. The stem is thus able to expand its diameter during a rainy season as it fills up with water, and then to contract slowly as it uses up the stored water during a prolonged dry season. Because of its remarkable water storage capacity the plant is able to produce flowers and fruits even if an entire year passes without a drop of rain.

The saguaros usually begin blooming in May and continue for a month or so. The fruits ripen in June and July. The flowers are white and 2 or 3 inches across. They bloom only in the night but remain open until sometime during the following forenoon so it is not necessary to stay up all night in order to see them. The flowers are visited for nectar and pollen by both night-flying and day-flying insects which, incidentally, aid the plant in transferring pollen from stamens to stigmas which is necessary before seeds can be produced. The fruits are pear-shaped, about 3 inches long, greenish-purple on the outside and crimson within. These fruits are edible and are as important to the Papago Indian as are pinon nuts to the Navaho.

The saguaro, like practically all cacti, is covered everywhere with spines. These spines contain a considerable amount of resin. If you take one from the plant and touch a match to its end it will burn like a candle. The spines afford considerable protection against certain animals. One of the best and most dense forests of saguaros is found in Saguaro National Monument.

The organ pipe cactus (Lemaireocereus thurberi) is, in many respects, as unique and interesting as the saguaro. Its distribution in the United States is much more restricted than is that of the saguaro. It is believed that more than 90 per cent of all organ pipe cacti in the United States are within the boundaries of the Organ Pipe Cactus National Monument, south of Ajo, Arizona, but the species also extends south into Mexico. It is a large plant but not so large as the saguaro. It branches from the base, usually producing from 5 to 15 upright stems which curve inward at the base and grow from 10 to 15 feet high. The general structure of the stems is similar to that of the saguaro. The large white flowers are produced at about the same time as those of the saguaro. The fruits are gathered by the Papago Indians and mixed with those of the saguaro in order to produce a slightly different flavor to the jam made from them.

The night-blooming cereus (Peniocereus greggii), sometimes called

sweet potato cactus because of its large tuberous root, produces flowers that are among the most beautiful and fragrant of all known flowers. The species is found from southwestern Texas to Arizona and south into Mexico. There are probably many more of these plants within a 100-mile radius about Tucson, Arizona, than in all the rest of the United States together. The stems are 4 or 5-angled and rather slender. The plants are often found growing at the base of the palo verde tree where the weak stems can lean against the tree for support, if necessary.

The night-blooming cereus blooms in June. The blooming date is looked forward to with a great deal of interest each year at Casa Grande National Monument, Arizona. Sometimes more than 90 per cent of the flowers in a given locality bloom on the same night and for that one night the atmosphere is filled with the delicious, spicy fragrance of these exquisite, white blossoms. They open at sundown and one can actually watch the process, for the major part of it takes place within an hour, although it may be two hours more before the flower is fully expanded. When fully open, the flowers are 6 to 8 inches long, including the ovary and tube, and 3 inches or more across. The next morning, shortly after sunrise, the flowers close up almost as rapidly as they opened. The scarlet, fleshy fruits are 1 to 1½ inches long and about 1 inch in diameter. They ripen in September or October and are edible.

I am sometimes asked why Nature spends an entire year in getting ready to produce such perfectly beautiful and fragrant flowers and then causes them to bloom during the night and way out in the desert where they may "blush unseen and waste their fragrance on the desert air." As a matter of fact, the flowers of the night-blooming cereus never blush unseen and their fragrance is never wasted. It must be remembered that Nature does not produce flowers to please the eye of man. She produces them to please the eye of insect. It is our good fortune that the flowers are pleasing to us, but it is the insects that need to be attracted to the flowers because it is the insects that bring about the transfer of pollen from one flower to another which is so necessary in the orderly process of reproduction; and reproduction is the greatest event in the life of a plant, just as it is in the life of an animal. Thousands of moths and other night flying insects are actively at work while these flowers are in bloom, and they both see and smell the flowers.

One of the largest and most widely distributed of the groups of cacti is the genus Opuntia. This is the genus to which the prickly pears and chollas and related forms belong. All members of the genus have jointed stems, but in the prickly pears the joints are flat, while in the chollas they are cylindrical. Like most cacti, the Opuntias all produce beautiful flowers, some of them yellow and some of them rose or pink, and many of them produce edible fruits. Some

of the prickly pears grow upright and may become 6 feet or more in height. Others spread over the ground, take root from those joints that come in contact with the soil, and form an extensive mat. Such plants aid in protecting the soil from surface erosion.

The jumping cactus (Opuntia fulgida) is the spiniest and most aggressive of the larger cacti. The joints do not actually jump at you but they separate from the plant very easily and if you accidentally touch the plant you are likely to regret it. I well remember one personal experience when I was standing near one of these plants in Organ Pipe Cactus National Monument, talking with a couple of friends. As I talked, I motioned with my hands, as a Scotchman will, and suddenly I found a cholla joint clinging to the back of my right hand. I used a stick to pry the cholla from my hand, painfully, but it left behind about a hundred spines sticking into my flesh. They had to be pulled out one by one and, since each spine has a barb at the end, it was just like pulling a hundred little fish hooks from the back of my hand. The joints of the cholla serve as a means of reproduction. Each one, under favorable conditions, will take root and grow into a new plant. More new plants are produced by this means than from seed.

The barrel cactus (Ferocactus), of which there are several species, has saved many a man from death by thirst, in olden days when travel was slow. The barrel cactus produces a single upright stem and may become several feet high and a foot or more in diameter. If the stem is broken open and the pulp crushed, a considerable amount of juice is obtained. This juice is not particularly palatable. It reminds one somewhat of the taste of a raw cucumber. But when one is sufficiently thirsty, he does not quibble over the flavor of the only liquid available.

I have described only a few of the numerous kinds of cacti to be found in our southwestern national parks and monuments. There are the rainbow cactus, which produces such beautiful pink flowers with white centers; and the strawberry cactus, whose fruits are so highly prized, and many others. But lack of space prohibits further discussion at this time. And, anyway, the only way to acquire a full appreciation of this unique and charming family of plants is to go and see its members in their natural homes. It cannot be obtained by reading about them.

BIRDS OF THE ARID REGIONS

By Harold J. Brodrick,
Assistant Chief Ranger,
Carlsbad Caverns National Park.

Far out in the sand hills, on the brush covered flats, in the dry rocky canyons, or on the high ridges, there is birdlife. Sometimes quiet watching is necessary to detect the birds and again they are the first thing that you see. Frequently the park visitors, upon hearing some bird-song or catching a glimpse of a bird in the bushes, remark: "I didn't suppose you had any birds up here. What do they do for water in this dry country?"

Water is the principal problem of desert life. Many of the birds fly long distances for water; others stay reasonably close to hidden seeps or springs. Some birds are accustomed to remaining in a small area and yet are found far from any known water source. Do they get along without it? Do they make occasional long trips for it, or do they have a closer source unknown to us? Many such questions cannot be answered satisfactorily. In any event, the birds' existence in such a region must be hard.

The following are some of the most common birds of Carlsbad Caverns National Park and the other arid regions of southeastern New Mexico:

The Turkey Vulture is possibly the bird most commonly associated with stories of the desert. He soars and circles on nearly motionless wings, high above the ground, patiently watching for some unfortunate victim of the hard life in a dry land. Common here in the summer, the Turkey Vultures frequently collect in large numbers to roost along some rock ledge of a canyon.

The Western Red-tailed Hawk is a common sight all through the year. Frequently seen circling about, his red tail gleams as he turns into the sunlight and suddenly swoops on some unsuspecting prey which may be carried to the nest in a Spanish dagger plant, or on some rock ledge.

Ferruginous Rough-leg Hawks are common in the winter. They are most frequently seen perched on fence posts near the roadside, apparently waiting for some motorist to run down a rabbit.

The Marsh Hawks, Desert Sparrow Hawks, and Prairie Falcons are frequently seen, as well as the occasional Swainson, Rough-leg, and the rarer Harris Hawks.

DESERT BIRDS

Golden Eagles are common but are seldom seen very far from the cliffs where they make their homes.

Arizona Scaled Quail, locally known as "Cotton Tops", are very common, in some cases even a considerable distance from water. Their animal-like barking-call frequently gives notice of their hiding places. The less common but very colorful little Mearns Quail is found only in the higher elevations.

The woodpeckers are not very numerous in the arid sections. The Red-shafted Flicker, being accustomed to feeding almost as much on the ground as in the trees, is common even in comparatively barren sections. Cactus Woodpeckers are sometimes seen in the stands of cane cactus and ocotillo, as well as in the scrub trees and bushes in the canyon bottoms. They sometimes hollow out a mescal stalk for a nest site.

"Ranger, I saw a funny looking bird with a long neck and tail, running through the bushes. Can you tell me what it was?" is a recurrent question from park visitors. It is a Roadrunner, or paisano (Pie-sah'-no), the clown of the desert, and, to many of us, the most interesting bird of the southwest. Sometimes he is accused of killing quail and destroying their eggs, but I know of no authentic evidence. His food consists primarily of insects, mice, rats, lizards and snakes. Frequently he tackles a large lizard or snake and then sits, an unhappy expression on his face, and with six or eight inches of lizard tail hanging out of his mouth, as he waits for digestion to be completed.

A person usually associates orioles with gardens and orchards, but here we have the beautiful Scott Oriole, his brilliant black and yellow gleaming among the dull colors of the hillside. In the spring these birds can be seen stripping fiber from the yucca leaves for use in making their artistically woven nests, usually fastened in a Spanish dagger. Bullock Orioles are generally seen in the occasional groups of larger trees, as also is the showy Cooper Tanager.

Meadow Larks are common throughout the year, especially in the lower elevations. This is true of their relatives, the Nevada Redwing and the Brewer Blackbirds. The latter are usually in the vicinity of springs and seeps and the resultant growth of rushes and tamarix, or along the Pecos River.

Out of the quiet of the desert night comes the hoot of the Horned Owl as he drifts along on silent wings searching for his evening meal. He usually appears at dusk to make repeated forays into the column of bats, as they pour out of the mouth of the great caverns.

Other frequenters of the dusk and darkness are the Nighthawks. With eyes gleaming red in the car lights, they fly up suddenly from the road, and sometimes startle motorists.

The White-necked Raven is a solemn dweller of the arid wastes. His neck only shows white when the feathers are blown the wrong way, since only the basal half of each neck feather is white. A person tramping across the wastes is frequently startled by the harsh croak of this black fellow. You will find him peering out from scrubby bushes, seemingly inquiring: "Brother are you lost; what are you doing here?"

Trouping across the brush-covered flats are the flocks of pale-colored Desert Horned Larks; and during the winter, the smaller groups of Mountain and Chestnut-backed Bluebirds, the light reflected from their blue backs and wings contrasting sharply with the drab background.

The wrens are among the happiest little songsters of the arid regions. However bleak the area, the little Rock Wrens may suddenly appear among the rocks, giving their tinkling song as they frequently come close to you in a friendly manner, their grayish backs and lightly streaked breasts blending well with the drab background of their homes. The Canyon Wren is typical of the country for which it is named. With its ringing song tripping rapidly down the scale, this bird is worth going miles to hear and see. Cactus Wrens are the most un-wrenlike of the wrens. Their large size and dark color; their grating, rather monotonous call, have little to suggest their relationship to the other two. The ball-like enclosed nest of grass is usually seen in the yuccas or cane cactus. These birds either build new, or repair old nests, for winter roosts.

Sparrows are the most numerous but least known of the birds of this section. Western Chipping and Field Sparrows, Vesper, and White-crowned Sparrows, are common in the winter. Sage Sparrows, Desert Sparrows, Shufeldt Juncos, Mountain Song Sparrows and the rarer Rock Sparrows are seen during most of the year; the western Lark Sparrow, in late spring and summer. The tame and noisy Canyon Towhee appears more like a big brown sparrow, while the shy but beautiful Spurred Towhee is much like the Towhee or Chewink of the east. Both are common all year.

Arizona Pyrrhuloxias are frequently seen in the low, mesquite country. Similar in size and shape to the Cardinal, or redbird, they are clad in gray with a rose red tinge to face, crest, and throat, and underside of wings. They achieve a charm that the cardinals lack.

The Say Phoebe is the most industrious and versatile of the

desert birds. He nests about every cattle ranch and camp, cave or cliff of the southwest, and to the Arctic circle as well. Year after year there has been at least one pair nesting in the entrance to the Carlsbad Caverns. Nearby is the handsome Black Phoebe, showing more preference in his choice of nesting site, as he usually stays near water.

The White-throated Swifts are other dwellers of the cliffs and canyons. They nest in the crevasses of the canyon walls or back at the farthest limit of daylight in the many caves. Preferring the companionship of large numbers of their kind, they circle and dart with arrow-like speed.

The White-rumped Shrike frequents the flats and the sandhill country, where he is usually perched on some crooked bush or mesquite clump, watching for a passing insect. Generally solitary except during nesting season, he is frequently far from water.

The brilliant repertoire of the Western Mockingbird comes from the cottonwoods by the river, the juniper covered hillsides or the higher ridges. He sings as if he is trying his best to out-do his nearest rival, the Sage Thrasher. Both are addicted to night-singing. Songs of the Curve-billed and Crissal Thrashers are less frequent. The birds are common in their respective types of habitat, the curve-billed, in the cactus, yucca and thornbush covered flats, canyons or ridges; while the Crissal prefers the rocky, juniper-covered sides of canyons.

Least in size of all the dwellers of the region are the tiny Black-chinned Hummingbirds. It is a great surprise to the visitors to see these little mites fussing and fighting with others of their kind about the mescal and cactus blossoms near the entrance to the caverns. They are usually seen from early April to October. I have never been able to locate their nests.

There are other birds, not as common perhaps, but just as interesting, found in the same areas. To include all of them would require too much space. For that reason the many birds that live near the running streams and permanent bodies of water were also omitted from this list. Birds anywhere are interesting, but the desert birds living under the conditions that they do, are even more so.

ROCKS TELL STORIES

By Dr. Ross A. Maxwell,
Regional Geologist.

How many of us really are observant, when we are hiking? Of course we take notice of some of the flowers and bugs; even the sand, if it impedes our progress, but few of us pay any heed to such commonplace things as rocks. The next time you are on an outing, examine the rocks and fossils, collect a few specimens and try to read the story they tell. This may be the beginning of an interesting hobby that will lead you over thousands of miles of beautiful country, and open your eyes to a new and exciting world that is waiting to be explored.

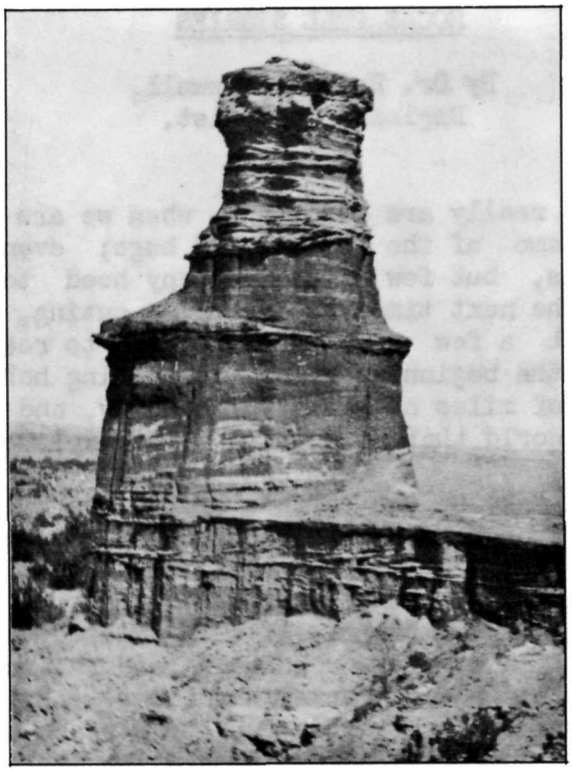
The rocks that make up the earth's crusts are all around us; each rock tells its own story, and their combined stories are the history of the earth. Scientists have told us that a long time ago the earth was very hot and that perhaps the surface was molten. As time elapsed, the surface cooled and molten material, if such existed, became hardened to form a rigid shell. In time the rain fell and the runoff collected in depressions to form the oceans, seas, and lakes. Rainfall and melting snow on the land surfaces provided water for streams that flowed gently or surged with rapid currents onward toward the sea, and each of these streams carried a load of gravel, sand, and silt that was eventually deposited on the floor of the ocean.

The stream water, as well as the water in the ocean, contains invisible mineral matter in solution, just as limited amounts of sugar become invisible in a cup of steaming coffee. The muds and sands that lie on the bottom of the ocean are saturated with water containing these invisible minerals. When certain conditions are brought about, the water gives up the minerals as a mineral cement or glue that binds the sand and mud particles together to form solid rock. In this manner the coarser materials are bound into a rock that in general appearance is much like slabs of concrete. This type of rock is called conglomerate, and rightly so, for it consists of a conglomeration of all kinds of rock fragments.

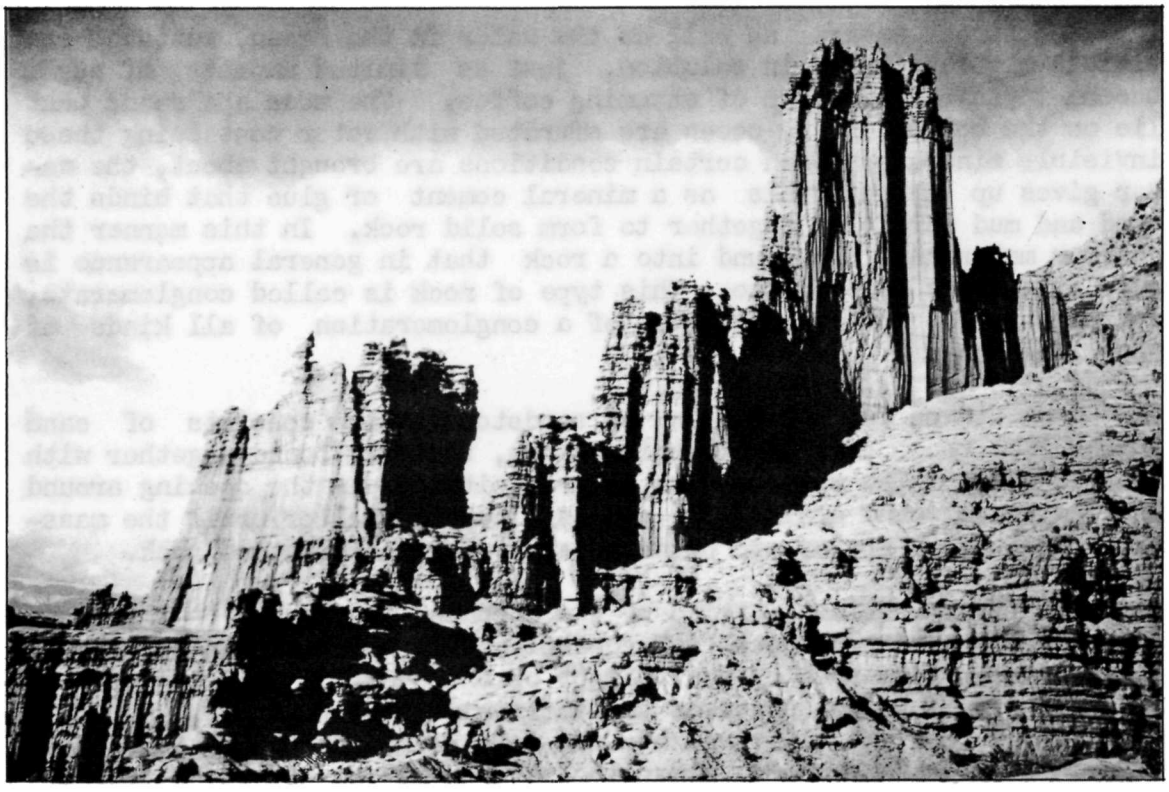
Then there is the origin of sandstone which consists of sand grains like those seen on a bathing beach, that are bound together with mineral glue. The mineral glue is precipitated in the opening around the individual sand grains; the openings become smaller until the masses of individual grains are bound together into a resistant rock.

The fine material carried by the streams and dumped on the ocean floor may become solid rock. Frequently, this material can be in part consolidated into rock by the weight of the overlying layers of sand and mud. This weight squeezes the small particles together, but this force alone does not always change mud into rock, for there is usually a good supply of Nature's mineral glue present to aid in holding the silt particles together. These types of rock, called shale, or clay,

ERODED ROCK



IN TEXAS



ROCK TOWERS, UTAH.

frequently disintegrate rapidly and when wet, form mud and often cause the motorist plenty of trouble.

What is this peculiar mineral glue that Mother Nature uses to bind small insignificant rock fragments together to make massive ledges of solid and resistant rock? Probably one of the most common mineral cements is lime. Most stream water, as does the water in the lakes, the seas, and the oceans, contains varying amounts of lime. It is probably more common in water obtained from wells and springs that have their source in the rocks below the earth's surface. This mineral is invisible in solution, but the drinking glass that stands near the water faucet may have a thin coating of gray or yellowish gray mineral matter that is likely to be lime. The teakettle that used to sing as it stood on the back of the cook stove soon had a thick coating of lime scale. Many of us who are accustomed to drinking hard water are familiar with the taste of lime. Lime isn't the only kind of mineral cement. Iron, silica, and some other minerals have all had a part in this cementing process, but lime is probably the most common.

There is a fourth kind of rock - limestone - that is common in many parts of our continent. It consists of lime plus various kinds of impurities. The impurities may be sand grains, mud particles, volcanic ash, small masses of iron, humus, and various other things. Limestone is likewise deposited in the ocean or in other bodies of water. Sometimes its deposition is due to chemical reactions that cause the lime to go out of solution and settle as a scum or ooze on the bottom of the ocean. Perhaps more frequently the lime is given up as a precipitate from the water by organic action. Corals are important limestone builders and large coral reefs and islands are frequently built in this manner. Microscopic plants and animals, and some of the varieties of shell fish play an important part in the precipitation of the lime scum on the ocean floor that in turn becomes consolidated to form limestone.

So far we have been considering only the sedimentary rocks, so named because they are formed by the accumulation of sediment on the floor of the ocean. Another important characteristic of the entire class is that they are stratified or occur in layers. Many of the rocks of this class contain fossils, and they are usually reddish-brown, yellowish-brown, gray, bluish-gray, and less frequently almost white or almost black. Impurities give them their variable colors. Pure lime is white, but oxidized iron in the limestone usually produces the various shades of yellow, brown, and red. Organic material frequently produces blue, green, or blackish tints. These same substances give similar colors to the shales, clays, and sandstones. White sand grains cemented with relatively pure lime will form a white or light colored sandstone, but the addition of iron stains will produce various colors.

These types of rock are rather easy to identify. A rock that is yellow, brown, or red; has a gritty surface, and the appearance of a mass of sand grains, is probably a sandstone. Shales may be any color; they are usually thin-bedded and remind one of layers of compressed mud. Clays are also variable in color, are normally poorly stratified, and

have a distinctive mud-like appearance. Conglomerate looks similar to slabs of concrete, and its color is usually controlled by the color of the pebbles in the rock itself. Limestone is frequently well stratified, of uniform texture, and effervesces freely when a drop of dilute hydrochloric (muriatic) acid is applied.

One of the most interesting secondary features of many sedimentary rocks is their fossil content. These fossils are petrified forms of life from a past geological age. These may be pieces of petrified wood, fossil snails, oysters, or other shell fish, fern leaves, fish, dinosaur bones, and even tracks and trails of animals. Some fossils were preserved quite by accident, but usually they became petrified in the following manner:

A snail, for example, is suddenly buried alive with muds that are being transported by waves. This prevents normal decay and protects the snail's shell and body from the scavengers in the sea. Thus protected, the snail remains intact for some time, and during this interval, the water which contains mineral matter comes in contact with the snail. There may be a chemical reaction produced by the presence of the organic matter or it may be that the water is nearing the saturation point of a certain mineral and about ready to give up that particular mineral. In either case there is an exchange or replacement of organic substances with the inorganic. Thus, the water removes minute particles of the snail's body and replaces these minute particles of organic matter with minerals. This process does not always take place in the ocean. It may occur in lakes, swamps, marshes, or along streams. During the past geological ages the giant dinosaurs roamed over the North American continent. Sometimes these large fellows ventured too far into a swamp and mired down, becoming buried in the quagmire. The water and mud which covered their bodies prevented normal decay. Similar processes of replacement followed and in turn the bones and hard portions of their anatomy became petrified. In a similar manner huge logs, limbs, twigs, and leaves of trees have been preserved from the ages past.

The igneous rocks represent a second large class. They differ from the sedimentary rocks in that they were originally a molten mass that cooled to become hard and rigid. They are not stratified, and do not contain fossils. The environment in which these molten masses cooled and hardened controlled their physical appearance. Some of the masses were buried thousands of feet below the earth's surface. Naturally, the rate of cooling was slow and as a result such rocks are coarsely crystalline. Other masses cooled near the surface, the rate of cooling was more rapid and the crystals did not have time to grow large; consequently, such rocks are fine grained. In other instances the lava poured out on the surface, and in many rocks of this type, one is unable without the aid of a magnifying lens to see any crystalline structure. More rarely, lavas were chilled immediately to form volcanic glass (obsidian).

By following a few simple rules, igneous rocks can be classified and named. Granites are coarse-grained and usually flesh-colored, pink,

or gray. If the rock is coarse but composed predominantly of dark-colored minerals, it may pass with the trade name "granite" but technically would be called a diorite. All of the coarse-grained rock cooled very slowly at great depths, and it required ages to form the large crystals. If this be true, why do we now find acres and acres of granite exposed at the earth's surface? These masses were uncovered by erosion and although it took ages for the molten lava to cool, it also took ages for the streams to uncover these areas of coarse-grained rocks and expose them to our view. Consequently, when we look at a piece of granite, we should remember that a story of earth history, many chapters in length, has been written since that piece of granite was a molten mass.

The fine-grained rocks are also conveniently classified according to their color. The light-colored ones are generally called rhyolite, or in some cases, felsite. The dark-colored rocks are usually basalts. These types of fine-grained rock cooled more quickly, relatively speaking, than did the granitic types. Also, they may have been uncovered more quickly by the processes of erosion, but we must not get the idea that all granites are older than all rhyolites or basalts. The earth is very old, and there have been numerous periods when igneous rocks were formed. Consequently, some of the fine-grained rocks like basalt are older than some granites, but this is not always the case. Before we can compare the relative age of igneous rocks, we must be trained to read the history as it is told in the rocks themselves.

You will find that rock collecting is interesting. It gives further purpose to short outings and it may lead to an absorbing hobby. Don't seek especially for the rare and showy specimens. The simple ones are more suitable for study. It will not be long before you will have a collection of considerable size. The collecting, too, will lead you into interesting scenic areas, off the beaten path, that you otherwise would probably never see.

Rocks tell stories that contain cold and interesting facts. A little study will develop increased understanding and appreciation of the world in which you live.

CAMELCADE

By Charles J. Smith,
Superintendent,
Grand Teton National Park.

As one travels through Petrified Forest National Monument, in eastern Arizona, just south of U. S. Highway No. 66, he may notice the wheel tracks of the old transcontinental route. In some places the ruts are a foot or more deep. This is the early route to California along the thirty-fifth parallel, which was followed in the 50's by Lieutenant E.F. Beale and others. About 1858, Lieutenant Beale stated: "I presume there can be no further question as to the practicability of the country near the thirty-fifth parallel for a wagon road, since Aubrey, Whipple and myself have all travelled it successfully with wagon."

Believe it or not, had one been standing near this spot on a fall day in 1857, a strange sight would have appeared on the horizon to the east. Swinging along came a cavalcade of heavily laden camels under the charge of Hadji Ali, or "Hi Jolly", and "Greek George", who had been brought with them from the Orient. These camels were a portion of the herd which Secretary of War Jefferson Davis imported from the East in 1856. The animals were to be used as beasts of burden in transportation across what was then known as the "Great American Desert." The usual load carried by a camel was from 600 to 800 pounds; the dromedaries were to be used for express purposes. A daily journey for a camel was about 30 miles, but the dromedaries could go 75. The camels could, upon occasion, for a day or so at a time, carry burdens of 800 to 1,000 pounds. These animals were brought from Cairo and Smyrna in 1855 on the United States vessel Supply, commanded by Lieutenant D. D. Porter, afterwards an Admiral in the United States Navy. He brought back another herd, from Africa, in February, 1856, which was landed at Indianola, Texas.

In the summer of 1856 Lieutenant Beale, U. S. Topographical Engineers, was ordered to open a wagon road from Fort Defiance, Arizona, to the eastern frontier of California. A part of the herd of camels was put at his disposal. The journey was "through a wilderness of forest, plain and desert, and occupied forty-eight days, when the Colorado River was reached on October 18th." They passed through what is now a part of the Petrified Forest National Monument soon after September 1, 1857. The route then led south of the San Francisco Peaks and crossed the Colorado River about 125 miles above The Needles.

Lieutenant Beale, reporting on the camels after this trip, said that they saved the members of the party many hardships, and excited the admiration of the whole party by their willingness and ability to perform the tasks set them. They carried water on the desert for the mules; they traversed stretches of country covered with the sharpest

volcanic rocks, without injury to their feet; with heavy packs they climbed over mountains where the mules found it difficult to go, even with the assistance of their dismounted drivers; and to the surprise of all the party, the camels plunged into rivers without hesitation and swam them with ease.

What became of the camels? After this expedition they were used in various capacities during the time of the overland stages, but they turned out to be useless, probably because inexperienced men were left to handle them. The true Westerner had no use for the ugly beasts, and the horses and mules had an unconquerable fear of them. Packers and soldiers hated them, and finally, in about 1863, what was left of the camels was turned loose in Arizona and left to make their own living.

In 1876, two Frenchmen rounded up about thirty of the animals which were roaming north of the Salt and Gila Rivers and took them to Nevada for use in the region of the Comstock mines. They were considered such a nuisance that the old Comstock freighters ordered the two Frenchmen to take the camels out of the country. They were then taken to a mining camp in Sonora, Mexico, which was the last seen of this particular herd. As late as 1879, the "Expositor" stated that a great number of camels were running wild on the banks of the Gila in Arizona. In the Prescott Democrat of December 30, 1881, there is a reference to the Arizona camels. It was stated that a capture had been made by the Indians, and a carload of camels passed through on the way East. They were in charge of an Egyptian, Al Zol, who had been sent out expressly to get them, the camels having been purchased for a "trifling sum, the Indians being very anxious to get rid of them as their cattle and horses were greatly frightened."

Of the abilities of the camel and his habits, J. M. Guinn wrote: "He could travel sixteen miles an hour. That was a virtue, but when camp was struck in the evening, and he was turned loose to sup off the succulent sage brush, either to escape the noise and profanity of the camp or to view the country, he was always seized with a desire to take a paseur of 25 or 30 miles before supper. While this took only an hour or so of his time, it involved upon his unfortunate driver the necessity of spending half the night in camel chasing. He could carry a ton - this was a commendable virtue, but when two ships of the desert collided on a narrow trail, as they always did whenever an opportunity offered, and tons of supplies were scattered over the landscape and the unfortunate pilots had to gather up the flotsam of the wreck, it is not strange that the mariners of the arid wastes anathematized the whole camel race from the beast the Prophet rode, down to the smallest Imp of Jefferson Davis importation."

Greek George, who accompanied Lieutenant Beale, left Arizona when the Civil War started. He died in California. Hi Jolly made his home in Arizona and died in 1902. He is buried near Salome, Arizona.

SOUTHWESTERN INDIANS IN CORONADO'S TIME

By Erik K. Reed,
Regional Archaeologist.

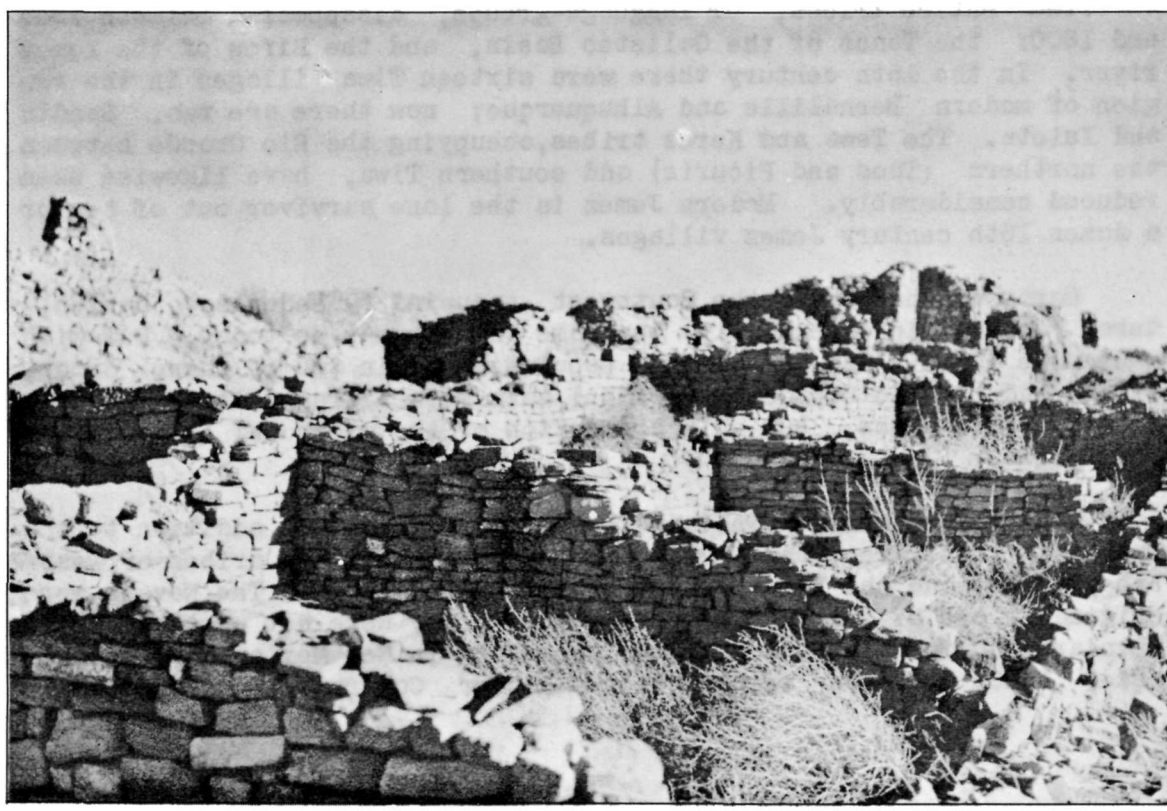
In the summer of A.D. 1540, Francisco Vasquez de Coronado found the Pueblo Indians living in three areas: in the Zuni country, or Cibola; in the Hopi country, then known as Tusayan; and in central New Mexico, scattered from north to south along the Rio Grande and its tributaries. In prehistoric times the Pueblo Indians had occupied a far greater extent of country. Drought, disease, attacks of enemy peoples, and other factors, caused a great decline of population and forced the relinquishment of one region after another, until by Coronado's time the Pueblos had concentrated into these three provinces where - after still more reduction - they are found today.

The great urban centers of the Chaco Canyon, in New Mexico, had been among the first to be deserted, in the 12th century. At the time of the great drought in the last quarter of the 13th century, 250 years before the coming of Coronado, the cliff-dwellings of the Mesa Verde and the Tsegi country (including Navajo National Monument), Wupatki, and other northern sites were abandoned. Finally, about a century and a half before Coronado's time, the surviving sites outside the three historical pueblo areas were deserted. The people of the great pueblos of Chaves Pass (southeast of Flagstaff), Homolovi (near Winslow, Arizona), and the Verde Valley (such as Montezuma Castle, Tuzigoot, and the Clear Creek ruin), moved in to join the Hopi; the people of the White Mountains and of four late-surviving sites in the Petrified Forest joined the Zuni. Even after this concentration into the three provinces, further reduction and retraction went on.

Cibola in 1540 comprised six Zuni towns, of which Hawikuh, the first pueblo settlement seen by Europeans, is the best-known. Matsaki was, however, the largest. One of the six, Halona, survives as the present pueblo of Zuni, having been the only town reoccupied after the twelve-year retreat of the Zuni to Corn Mountain during the Pueblo Rebellion of 1680.

Tusayan, or Totonteac, as the Spaniards called the Hopi country, was visited from Hawikuh in July, 1540, by Don Pedro de Tobar, Fray Juan de Padilla, and twenty soldiers, of Coronado's expedition. There were apparently seven Hopi pueblos at that time: Oraibi, on Third Mesa; Old Shongopovi and Old Mishongnovi, in Polacca Valley at the foot of second Mesa; old Walpi, at the foot of First Mesa; Sikyatki, atop First Mesa; and Awatovi and Kawaioku, on the edge of Antelope Mesa above the Jeddito Valley. There seems to be some question as to whether Sikyatki actually was still occupied; there is the possibility that, as in Cibola, there were actually only six towns of Tusayan and that the Spaniards were mistaken or misled in saying there were seven.

STREET IN ACOMA PUEBLO



EXCAVATED ROOMS IN HAWIKUH

Oraibi is still in the same location, though nearly deserted now. Shongopovi, Mishongnovi, and Walpi moved up onto the mesa-tops in the 17th century. Awatovi, the last of the Jeddito pueblos, was destroyed by the Hopis in the winter of 1700-1701. Sikyatki and Kawaioku evidently were abandoned during the second half of the 16th century. Kawaioku apparently was destroyed by Tobar in 1540, and must have been reoccupied, as Espejo found it inhabited in the spring of 1583. Kawaioku was finally abandoned sometime before the arrival of Onate in 1598. In contrast to Zuni, there are now several additional Hopi villages which were not in existence in the 16th and 17th centuries.

The Rio Grande area was far more intensively and extensively inhabited in the 16th century than today. There were some sixty villages, of which only sixteen survive (plus one pueblo, Laguna, established after the Pueblo Rebellion of 1680; and plus little farming villages seasonally occupied from Zuni, Acoma, and Laguna). These protohistoric villages extended from Acoma on the west to Pecos on the east, from Taos on the north to below San Marcial on the south.

Acoma, on its high mesa, still thrives, vying with Oraibi for the title of the oldest continuously inhabited town in the United States. Pecos was finally abandoned, in 1838, by the remnant of its once large population, the seventeen survivors joining their congeners at Jemez. Taos, with its two great terraced houses, still prospers, but the area south of Isleta from Belen through Socorro to San Marcial, was abandoned 265 years ago.

Two entire tribes, or language-groups, disappeared between 1540 and 1800: the Tanos of the Galisteo Basin, and the Piros of the lower river. In the 16th century there were sixteen Tiwa villages in the region of modern Bernalillo and Albuquerque; now there are two, Sandia and Isleta. The Tewa and Keres tribes, occupying the Rio Grande between the northern (Taos and Picuris) and southern Tiwa, have likewise been reduced considerably. Modern Jemez is the lone survivor out of ten or a dozen 16th century Jemez villages.

Coronado then found the Southwest occupied by sedentary, agricultural Pueblos in essentially the same three areas as today, but with many more towns, and much larger populations, in two of those areas, Cibola and the Rio Grande. The Hopi have more villages today than in protohistoric times, but only a fraction of the 16th and 17th century population.

Modern Southwestern Indians include four groups in addition to the Pueblos. These are: the Navaho, the Apache, the Yuman tribes of western Arizona, and the Piman tribes of southern Arizona. The Navaho were originally one of the many Apache tribes. They were not encountered by Spaniards during the 16th century, appearing in New Mexico history only after 1620. Yuman tribes on the lower Colorado were visited by

Alarcon in his naval excursion up the Gulf of California and the Colorado River in 1540, but none of Coronado's main party went into Yuman territory in western Arizona. Real information about the Yumans begins with the expeditions to western Arizona of Antonio de Espejo in 1583, and of Don Juan de Onate in the winter of 1604-1605. Coronado did pass through southern Arizona, of course. Incidentally, after his return to Mexico in 1542 the Pimans (Pima, Papago, Sobaipuri, etc.), were not visited again by Spaniards for almost exactly 150 years. The Coronado documents give us very little information about the Pima. There evidently was considerable contact and intercourse between the Pima and the Zuni.

The report of Melchior Diaz, on his reconnaissance in advance of Coronado's army, makes it clear that not only had Pimas gone to Hawikuh with the negro Esteban earlier in 1539, but there were individuals among the Pima who had spent years in Cibola. Fray Marcos de Niza talked in southern Arizona in 1539 with an old Zuni living among the Pima (or Sobaipuri).

Coronado neither encountered nor heard of Apaches in Arizona or western New Mexico, unless possibly the primitive folk of Chichilticalli "the most barbarous people yet seen", were, as has been suggested, western Apaches. In the plains of eastern New Mexico, however, on the way to Quivira, he passed settlements of the Querechos, very possibly eastern Apaches. The Teyas, also nomads on the plains of eastern New Mexico, perhaps were Jumano Indians. These non-pueblo peoples are not well known in early times. Considerable information is given about the Pueblos, however, by the Coronado documents and by narratives of later 16th century explorers. This ethnological knowledge can be supplemented by archaeological data, from excavations and surveys at sites occupied in that period.

The Pueblos in the 16th century lived in large, compact, flat-roofed, several-storied villages. They were farmers, growing corn, pumpkins, and beans. They also hunted deer and other game. They made a good deal of pottery of various sorts; they had stone axes, grinding-stones, knives, scrapers, and other tools, and used the bow and arrow. They wore garments of cotton and of skins, and ornaments of turquoise and sea-shell. They had no metal, no wheels or vehicles, no fruit trees, and no livestock, though dogs and turkeys were kept. The Pueblos are not all just alike today, and they were not all alike in the 16th century. Each of the Pueblo groups spoke a different dialect or language; there are today six different Pueblo Indian languages, of which at least one is not at all related to the others.

The Hopi and Zuni villages of Cibola and Tusayan, Acoma, and sites east of the Rio Grande - Pecos and sites in the Galisteo Basin and the Salinas - were of stone masonry, plastered over with mud. Most Rio Grande villages were built entirely of adobe. The Zuni were cremating their dead at this time. The others, as has always been normal

among the Pueblos, buried the dead, usually in a contracted position.

Cotton apparently was grown only by the Hopi and,to a less extent, in Tiguex, the other villages trading for it. The Zuni did their own weaving, though getting their cotton from the Hopi. A later explorer, however, in 1583, says the Zuni are poor, with little cotton, using yucca-fibre blankets. Taos and Pecos, specifically, raised no cotton and kept no turkeys. An interesting point, not mentioned in the Coronado documents, is that the Hopi were using coal for fuel at this time, and had been since the 13th century, earlier than coal was generally used in Europe.

Pottery differed between tribes or groups, as it does between villages, or groups of villages today. Sixteenth-century Tusayan pottery was very much like modern Hopi pottery,since the latter is an imitation of the former. A Hopi woman was inspired by the pottery found by Dr. Fewkes in the excavation of Sikyatki in the 1890's. The Zuni, having given up glaze-decoration of pottery, were making polychrome ware similar to that of the Hopi. Acoma was making glaze-painted ware such as the Zuni had formerly made, and again made in the 17th century. The Piro, Tiwa, Keres, Tano, and Pecos were all making the same sort of pottery, with minor differences between groups: yellowish-white ware decorated in slipshod manner with dark red paint and greenish to dark brown glaze. The Jemez were making black-on-white pottery in the old, prehistoric, Chaco-Mesa Verde tradition, and the Tewa were making a black-on-gray ware of similar derivation. There was considerable trading of pottery between villages, even over considerable distances.

Pueblo religion and ceremonial evidently were much the same 400 years ago as today. Prayersticks and offerings to springs are mentioned in the Coronado documents. The kivas of Hawikuh, however, are described in all the Coronado documents as "hothouses" (estufas) used in winter for protection from the cold. There is little mention of religious use of kivas; but use as men's "clubhouses" is indicated. Castaneda says: "There are estufas, or places where they gather for consultation....It is a sacrilege for the women to go into the estufas to sleep." He adds that the young men sleep in them, also any divorced men, and that the women enter them only to bring food to the men. In an account written 200 years afterward, but based on the notes of Pedro de Tobar, the men's-club idea is more fully stated: "The Indian men stayed there days and nights gaming, and the women brought them food." There is little discussion in the Coronado documents of kivas of other pueblos, although they are mentioned for Pecos, for Taos ("the largest and finest estufas in the whole country"),and for Tiguex, the Tiwa villages around Bernalillo and Albuquerque. Use of kivas for dances is, however, mentioned for the Piros and for villages east of Rio Grande by Luxan 40 years later, in his narrative of the expedition of Antonio de Espejo in 1582-1583. Espejo also saw a snake-dance at Acoma, apparently comparable to the modern Hopi snake-dance. Luxan describes shrines among the

Hopi and Zuni, and idols among the Jemez and in villages east of the Rio Grande.

Coronado and his men 400 years ago evidently were forced to consider the Pueblo Indians a fairly civilized people, despite their paganism and despite the Spaniards' disappointment at finding no gold or jewels. Coronado wrote the viceroy from Hawikuh, "The people of the towns seem to me to be of ordinary size and intelligent, although I do not think that they have the judgment and intelligence which they ought to have to build these houses the way they have.....They are very good houses, where there are very good apartments and good rooms with corridors...." Another document says, "The houses are too good for Indians, especially for these, since they are brutish and have no decency in anything except in their houses." These remarks, and statements by later explorers, are pretty restrained, all things considered; more tolerant than those made by many modern Americans.

We can only guess at the impression that was made on the natives by these conquistadores, the first Europeans ever seen by the Pueblo Indians. The Indians undoubtedly were amazed, probably frightened, or at least made uneasy, by the strange pale men with beards, wearing unheard-of clothing, carrying strange and effective weapons, and traveling by riding on huge dog-like creatures. Often the Indians resisted the Spaniards, always unsuccessfully; sometimes they cordially invited them to visit. We may imagine that they all heaved sighs of relief at Coronado's departure, and after a few years, thought no longer about the strangers, except as a subject for reminiscing to the youngsters. The visit of Coronado probably had very little effect on Pueblo culture, even though a small number of Mexican Indians remained. Even after the visits of Espejo and others later in the century, the Indians probably never envisioned the two and one-half century domination of the Southwest by the Spaniards, which lasted from around 1600 until the arrival at Santa Fe of General Stephen W. Kearney with the Army of the West, in the summer of 1846.

NATURE ON THE AIR

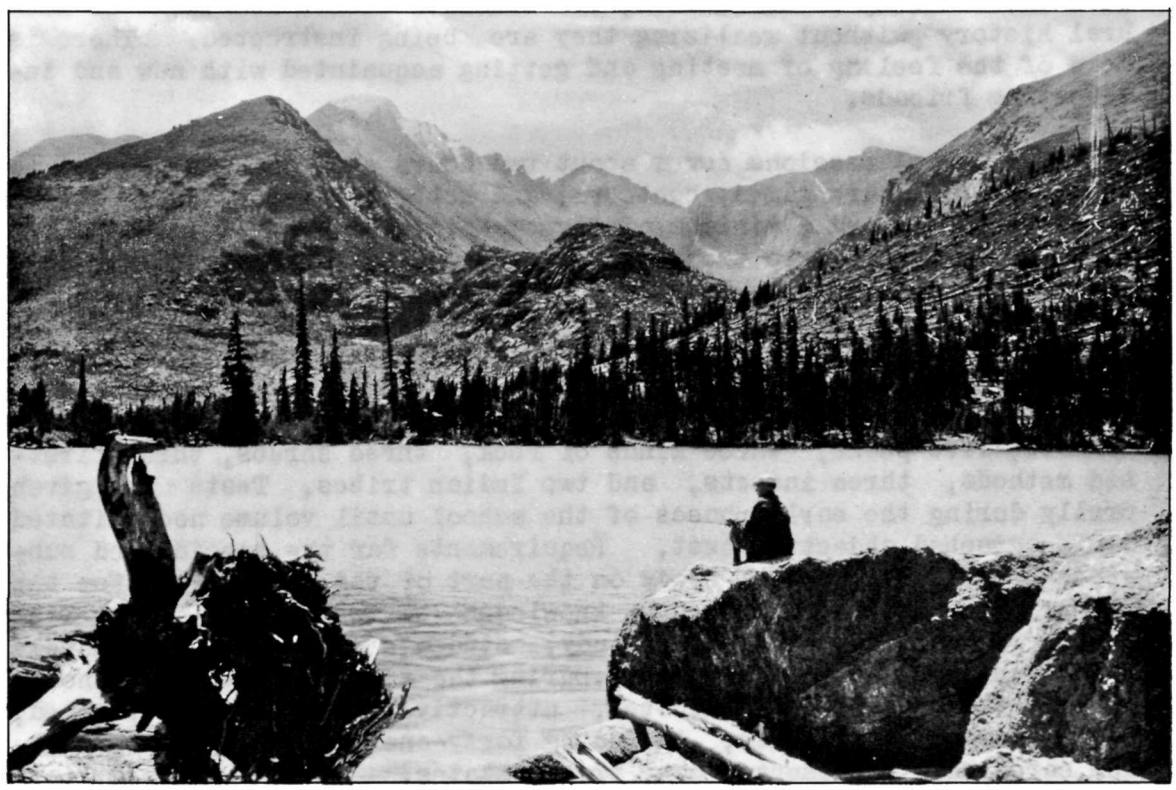
By Ernest A. Rostel,
Information Specialist,
Rocky Mountain National Park.

While the National Park Service, for a number of years, has offered naturalist programs to adult visitors, no special provision was made for children and other youthful visitors to the parks until Park Naturalist Raymond Gregg, of Rocky Mountain National Park, Colorado, started a free junior nature school in June, 1938. The response was immediate. Here not only was a solution of parents' problems to keep children occupied, but here, better yet, was an opportunity under capable leadership to absorb knowledge of and develop wholesome interest in the outdoors. The school was initiated on a thrice-weekly schedule with a beginning enrollment of nineteen students whose avid interest assured success from the start. Much of this was due to the complete absence of classroom atmosphere, and to actual visual and physical contact with the outdoor subjects. They learned how glaciers came into existence and how U-shaped valleys were carved down the slopes of towering peaks. They were told how mountains were uplifted through the ages to produce the present landscapes. They learned the secrets of trees and flowers and of the habits of the elk, deer, porcupine, and other mammals. They made acquaintance with the birds and were told how to identify them.

The Indians, who roamed the park lands years ago, became a legendary part of the present when students delved into the fascinating story of the aborigines of the Rockies. Visits were made to old camp sites frequented by Arapahoe and Ute hunting parties in days before white men came to the unexplored wildernesses of the West. The students were shown old Indian forts used when tribes made war on each other for possession of choice hunting grounds. There they saw rock fortifications in place, much as they were when red-skinned warriors built them so many years ago. In contrast to the towering heights of the Rockies, the youngsters studied the tiny denizens of the insect world and learned how "bugs" carried on their short but active lives. Such inanimate subjects as rocks became living symbols of nature's unending industry.

It soon became apparent that the teaching plus entertainment quality had value too great to be confined to the outdoor classrooms. The National Broadcasting Company, through Station KOA, in Denver, asked whether the National Park Service would be willing to cooperate in the production of a network program. A preliminary audition transcribed for New York City and Denver NBC officials was sufficiently convincing to have the programs scheduled for ten weeks from coast to coast. Entirely unrehearsed and presented without the preparation of advance script, the spontaneous, lively radio presentations were enthusiastically received in all parts of the United States, especially in the larger centers of population, such as New York City, Chicago,

EMBRYO NATURALISTS



BEAR LAKE - LONGS PEAK

and Boston. During the present season the broadcasts are given every Saturday morning, from 9:15 to 9:30 (MST) over the NBC Red networks. The series will continue through September 7. Back-pack portable short wave radio transmitters "pick up" the class as it studies natural history subjects along the streams, through mountain forests, across flowered meadows, or even on mountain summits. Radio listeners are theoretically "eavesdropping" on the interesting informal discussions between the students and the park naturalist. Recently, Naturalist Gregg was discussing the habits of packrats and how they occasionally drive a hard bargain in trading objects. This "animal with a hobby" was compared to David Harum who was described as a "sharp horse-trader" who frequently put over a "slick" deal. Immediately one youngster piped up: "My Grand-dad is just like that." During one broadcast, the park naturalist was describing the Alpine Fir, bearing upright cones, as "a Christmas tree with its own candles." A girl in the group interrupted to tell how her grandmother had set a Christmas tree afire by using candles. The little student was told that the fir's "candles" do not start fires, but that man's carelessness with fire has resulted in the destruction of many thousands of forest acres.

Much of the success of the program in holding audience interest, and a large measure of its educational quality results from the naturalist's apt use of metaphors, such as, the limber pine, "with no bones in its arms"; morning primroses, "flowers that blush"; badgers, "flat as a pancake"; martens that "look like a fox and act like a squirrel"; blue spruces that "powder their noses"; golden banners, flowers that bear "gold above ground and gold below." Through use of such entertaining illustrations, the students absorb knowledge of natural history without realizing they are being instructed. There is more of the feeling of meeting and getting acquainted with new and interesting friends.

The school sessions cover about two hours each and are devoted to short hikes, nature games, contests, and hobby studies. Students are required to attend a minimum of five meetings or hikes to qualify for certificates awarded to those who have acquired a satisfactory fundamental knowledge of various nature subjects. Certificates are awarded for such subjects as general nature study, trees, flowers, insects, mammals, birds, glaciers, park geography, first-aid, and Indian study. For the general nature study certificate a student must present a satisfactory knowledge of five trees, five flowers, five birds, five mammals, five peaks, three kinds of rock, three shrubs, three first-aid methods, three insects, and two Indian tribes. Tests were given orally during the early phases of the school until volume necessitated a mimeographed objective test. Requirements for the specialized subjects necessitate special study on the part of the students. For the Flower Study Award, a thorough knowledge of twenty-five flowering plants is required. In tree study, students must know intimately eight conifers and four hardwoods. During the first year of the school, 1938, a total of 110 certificates, attractively prepared and printed, was awarded to students, including forty-one for the general test. The enrollment represented over twenty states.

The school was planned to present nature subjects in a novel and unorthodox manner. This approach has not only been successful from the standpoint of children in actual attendance, but also in connection with the un-numbered radio "students." While the classes are gauged to the interests of children, the radio presentations have proved that they have definite interest for grownups. Typical of the comments received were the following:

"I have been in your unseen audience on several occasions and each time I felt as if I were out on the hillside or meadow with you."

"Mr. Gregg has rare ability in putting the facts of nature in an attractive way that catches and holds the attention of the boys and girls. And also they are of interest to the boys and girls of more years."

"They are very educational and so interesting to adults as well as to children. I am 74 years old but learned things about the grasshopper today. I hope the program continues."

"I have listened with keen interest....and wish to thank you for all the new facts in nature brought to attention....I am a teacher in the Chicago Elementary Schools and use your material to good advantage."

From an inmate in a Pennsylvania penitentiary: "Being an amateur naturalist, I find that the Nature Sketches will be a great help to me, and many others. I also want to thank you for bringing nature closer to man."

Mimeographed material related to the radio programs is being distributed to listeners who send a request to the Rocky Mountain National Park, Estes Park, Colorado.

In addition to the Junior Nature School, Naturalist Gregg has initiated another educational service for young visitors -- boys of 'teen age interested in nature hobbies and outdoor interests. Nature scouting was introduced during the 1939 travel season. The idea is based upon graduated achievements in mountaineering, nature study, first aid, pathfinding, camping, woodcraft and technical skills. Boys from 12 to 18 years of age are eligible, with no cost involved except a minimum expense connected with special handicraft work. The latter is optional among requirements for advancement in the organization. The park naturalist and his staff are assisted by a group of counsellors, certified examiners for the Boy Scouts of America, thus enabling boys to continue regular Scout advancement work parallel with achievements in the degrees offered by Nature Scouts. Activities are primarily out-of-doors. Last year plans called for a half-day hike or similar outdoor activity each Tuesday. On most Thursdays, all-day hikes were conducted. Occasional overnight hikes were scheduled, and a feature trip for those properly prepared was the ascent to the

14,255-foot summit of Longs Peak. Saturday afternoons were devoted to individual activities under the supervision of counsellors, with opportunity for craft, museum, nature-trail, hobby, test, and advancement work.

"While the amount of time devoted to this program, with two hikes each week and Saturday afternoon work may seem excessive for the number of persons served," Naturalist Gregg reports, "it may be well to say that this program has every indication of growing until it assumes important stature, since it has strong appeal to boy interests."

In addition to the special programs prepared for young visitors, Rocky Mountain National Park has complete schedules for adults. A talk on glaciers is given each day at the Moraine Park Museum. The building is situated among some of the most remarkable glacial remains in the Rocky Mountains. Textbook examples of lateral moraines, hanging valleys,U-shaped valleys,glacier lake-beds, roches moutonnees, vacated cirques, and small remnant glaciers are visible from the porch of the museum. Thus is made possible a clear, comprehensive laboratory demonstration using nature's works as models. Increasingly popular are the guided hiking trips. On early morning bird walks, ranger-naturalists introduce the birds and their songs. Leisurely two-hour nature study walks are scheduled regularly; to provide for special study of trees, flowers, geologic features, or other natural history subjects. Half-day and all-day hikes to points of scenic and scientific interest draw by far the largest following of any of the field activities conducted by the naturalists. In great favor is a strenuous hike to Tyndall and Andrews Glaciers. It is not uncommon for the naturalist to be accompanied by as many as seventy hikers who get a great thrill from sliding over the face of Andrews Glacier. They learn about glaciers first hand by visiting them.

In the cool of summer evenings, "wildlife watch parties" are popular, especially those attempting observations of the wily beaver, whose dams are familiar sights throughout the park, but who, themselves, are not commonly seen. Often following campfire programs, ranger-naturalists lead game-stalking caravans to meadows where deer, elk, and occasional coyotes and bob-cats may be watched at night with the aid of spot lights. On other evenings, lectures are followed by "star gazing", under the leadership of naturalists familiar with astronomy.

Naturalist services start in early June, reach their greatest activity in July and August, and are discontinued in late September.

INSCRIPTION ROCK

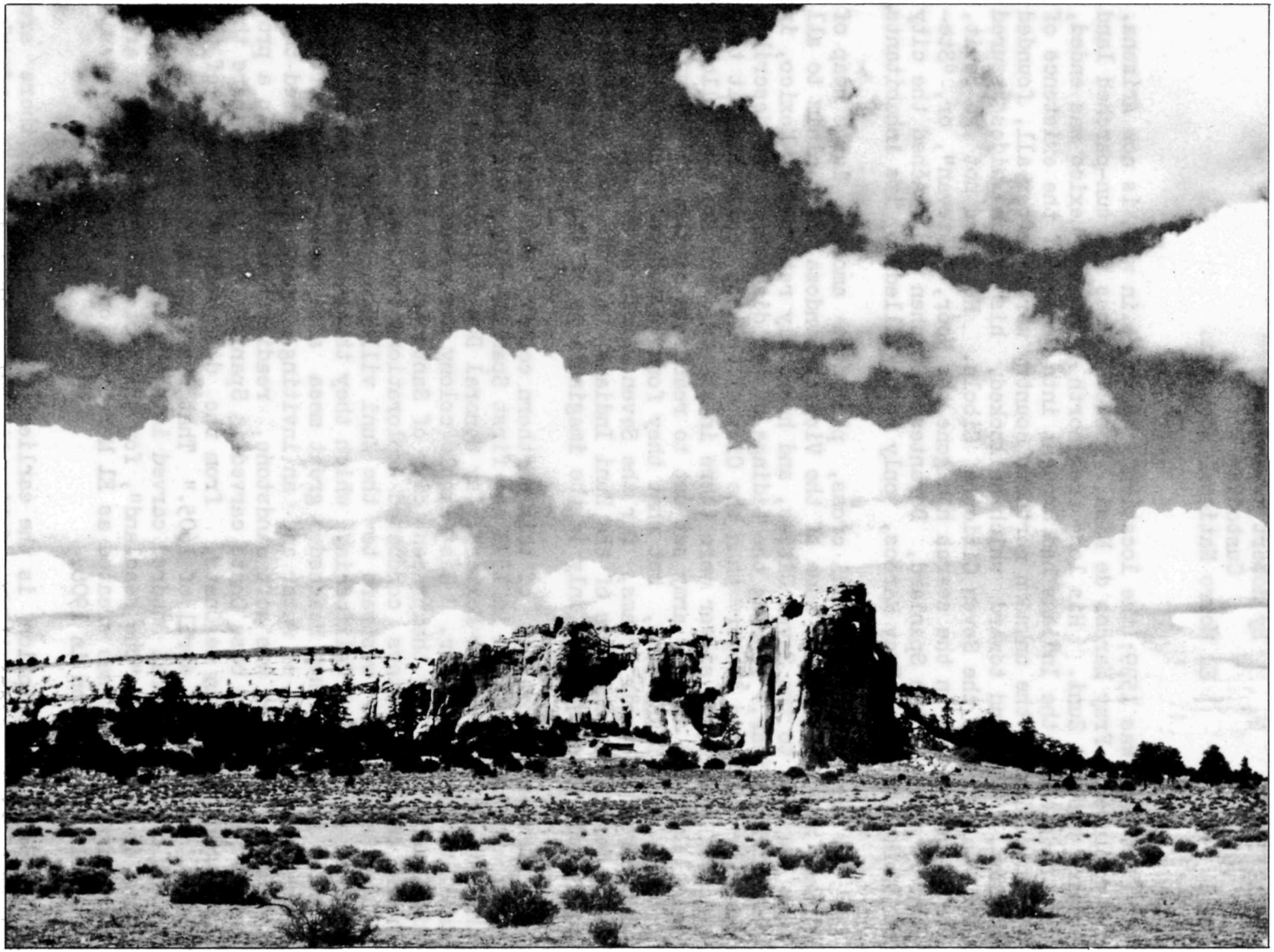
By Robert R. Budlong,
Custodian,
El Morro National Monument.

The year was 1539; the location, somewhere in what is now Arizona. The explorer, Fray Marcos de Niza, looked across the sun-parched land toward distant Zuni. His long trek north from old Mexico was ended, and the stories the Indians had brought into Mexico of the existence of walled cities in the unknown northern country were, after all, founded on fact. The land toward which he looked, his Indian guides assured him, was that of the Seven Cities of Cibola. He dared not go to it, for,preceding him in the search had gone the Moor, "Estevan", or, "Stephen", slave to the Spaniard, Dorantes. Stephen had reached the city of Hawikuh ahead of Fray Marcos, only to be killed by its inhabitants.

The Friar made a small cross, placed it among a large heap of stones, and then, in the name of the Viceroy Mendoza, laid claim to all that land and to the Seven Cities, and hurriedly returned to Mexico, in considerable fear, bearing the tidings of his discovery. He described the city as being larger than the City of Mexico; rumor had it that precious stones and silver were there in plenty, and so, the following year, Coronado and his army set out to reach the cities, guided by the Friar. They found them, but what they found shattered the glittering structures of their dreams, for the Seven Cities of Cibola were only small farming communities of the Zuni Indians, and the gold and silver and jewels existed there only in the imaginations of the Spaniards.

Further exploration of this northern country was made by subsequent expeditions, and in 1598 the first Spanish colony was founded in the new land, the "new Mexico", by General Don Juan de Onate. He became its first governor. His little colony was established near the Rio Grande, north of the present city of Santa Fe, and from this colony Onate and his soldiers conducted explorations far into the land. In 1604 they marched westward to the Zuni villages, and on until they reached the Gulf of California, which they thought was the ocean. Returning in 1605, they reached a great mesa a day's march east of Zuni where a large pool of water and an inviting camping spot tempted them to camp. The Rock was soft sandstone, readily scratched. In a protected place on its base Onate carved in Spanish: "Passed by here the Adelantado Don Juan de Onate, from the discovery of the Sea of the South, the 16th of April of 1605." That inscription still exists. It is but one of several hundred carved into the stone of the great mesa known as El Morro, "the headland", for the protection of which an area embracing the Rock was created as El Morro National Monument, by presidential proclamation in 1906.

Onate's inscription is the earliest to be found, but there are other Spanish inscriptions, dating to 1774. This striking landmark, some 200 feet high, with its pool of water to refresh the weary travel-



INSCRIPTION ROCK

er, lay directly on the road developed by the Spaniards, leading from Santa Fe to the Zuni villages. The inscriptions were probably carved with the points of poniards, and many of the Spanish soldiers, missionaries, and explorers thus recorded their trips. Some only carved their names, some their names and the date; others laboriously carved detailed records of their journeys, as had Onate. Many of these names undoubtedly disappeared years ago, especially those carved in more exposed locations, but today nearly 100 may still be seen.

Long before the coming of the Spaniards, other men had inscribed various symbols, and these also are still to be seen. They are petroglyphs chipped into the stone by prehistoric Indians, probably early Zunis. On top of the Rock lie two large ruins, covered with vegeta - tion -- all that remains of two pueblos once inhabited by these prehistoric people. They, too, drank of the water from the pool at the base of the Rock, and their hand-and-foot trails leading down the face of the Rock are still to be seen. A modern trail leads to the Rock top and the visitor who climbs to it will see, scattered about among the stones and traces of old walls, hundreds of fragments of pottery. The ruins have not been excavated.

While many of the Spanish inscriptions consist only of names and dates, some are detailed accounts of early events of historical importance. The Zuni villages figure prominently in these accounts. Spanish soldiers went to Zuni to maintain order, for the Indians had been conquered by the Spaniards, and revolt was never far beneath the surface. A Franciscan mission was founded at the Zuni village of Hawikuh, the "Cibola" of Fray Marcos, in 1629. Governor Silva Nieto left an inscription in the form of a poem, carved in the Rock that year, relative to the founding of that mission. In 1632, Father Letrado was murdered there, as he attempted to persuade the Indians to attend Mass the morning of February 22. The brief inscription carved by one of the soldiers sent from Santa Fe to avenge the Padre's death is still legible: "They passed on the 23rd of March of the year 1632, to the avenging of the death of the Father Letrado."

Growing resentment among the conquered Pueblo Indians resulted in the Pueblo Rebellion of 1680, when the Spaniards were driven back to Santa Fe. Many of them had been killed; Santa Fe was besieged by Indian hordes and finally abandoned, and the Spaniards retreated to El Paso to remain there for twelve years. Then came the reconquest of the Pueblos, under General Don Diego de Vargas. He, too, stopped by the Rock, and left this inscription: "Here was the General Don Diego De Vargas, who conquered to our Holy Faith and to the Royal Crown all of the new Mexico at his (own) expense, year of 1692."

Hundreds of American names, beginning with 1836, are on the base of the Rock. In 1849 members of a military expedition from Santa Fe into the Navajo country found the Rock and made sketches of many of the early Spanish inscriptions. These were later reproduced by lithography as illustrations in the government report published concerning

this expedition. Among the American names we find those of early explorers, soldiers, and settlers of historical importance. The name of Lieutenant Beale recalls the experiment conducted by the government prior to the outbreak of the Civil War to develop a new type of transportation across the dry country -- the introduction of camels and the use of camel trains. Lieutenant Beale was in charge of this experiment which did not prove successful. Some of the escaped or abandoned camels wandered for years over the western desert country.

Back of every name lies some history, and the National Park Service is slowly tracing these people. Sometimes visitors will identify a name, where the person who carved it left a date and the name of his home city. Many persons believe that these inscriptions, some of them over 300 years old, will last indefinitely. But erosion goes on constantly, and names that have been carved where they are exposed to severe weathering are rapidly disappearing. Perhaps the early Spanish inscriptions will last for a great many years, for they have lasted as long as they have because they were carved in protected places, where erosion takes place very slowly. Nevertheless, rock-falls occur with regularity, especially during the spring and fall months, and it is always possible that some inscription may be destroyed. Each inscription is being photographed and these photographs are filed, but a picture does not give an accurate idea of just how the inscriptions appear upon the stone.

The Service is making exact duplicates of the oldest of these inscriptions, cast in plaster from moulds made of latex. These casts are so perfect that every sand grain is reproduced in the mould. Liquid latex is applied to the surface of the Rock and successive layers are built-up until the desired thickness is obtained. After about 48 hours this hardens sufficiently to be stripped from the stone, and there results a perfect rubber mould of the surface of the stone and of the inscription. Methods are being devised to bring out dim traces of old inscriptions that are hidden by the drip of clay down the face of the cliff. A wealth of history is recorded here. Who knows what new inscription may some day be found, and what new stories the Rock may yet tell?

With the creation of the national monument in 1906, further carving of names became illegal, but in spite of this, vandals destroyed many old inscriptions. Some of this destruction seems to have been deliberate; some was just the result of thoughtlessness on the part of people who carved their own names into the stone, or who scratched the Rock to test its hardness.

CANYON WONDERLAND

By Norman D. Nevills.

(Mr. Nevills, a resident of Bluff, Utah, is a veteran explorer of the canyons of the Colorado, Green, and San Juan Rivers. He planned to lead an expedition down these streams in three specially designed boats, leaving Green River, Wyoming, in late June, and hoping to arrive at Boulder Dam the latter part of August. The purpose of the trip is to make botanical and geological observations and collections, and to endeavor to locate a huge natural bridge in Utah which Mr. Nevills says he has been led to believe will "dwarf" the natural Rainbow Bridge in that state. The Rainbow Bridge is 309 feet high--Editor.)

It has been my good fortune to cover rather thoroughly the proposed Escalante National Recreational Area in Utah. This area, in one of the most roadless sections in the United States, is a part of the Colorado River Basin, which includes Grand Canyon National Park, Boulder Dam National Recreational Area, and Dinosaur National Monument. The 2,000 square miles are directly associated with the Colorado, Green, and San Juan Rivers. Commencing on the Green River, at influent San Raphael River, a rough parallel to the Green extends to the confluence with the Colorado River. The line on each side is approximately 6 miles from the Green River at all points. From Moab, Utah, bridge crossing of the Colorado River, commences another parallel similar in bounds to that on the Green, extending also to the Green-Colorado junction, 68 miles below. From the junction, the line extends from 6 to 10 miles on each side of the combined rivers, and on the east, goes south to a point on the San Juan River at the Clay Hills. The boundary then follows the north bank of the San Juan River to its junction with the Colorado River in Glen Canyon. The west line, south from the Green-Colorado junction, extends back 6 to 10 miles, and goes as far down as the point below influent San Juan, known as the "Crossing of the Fathers." Here, in 1776, Father Silvestre Velez de Escalante, guided by Indians, made the first crossing of the Colorado River by white men. From this early Spanish padre-explorer comes the name suggested as the most fitting for this proposed national recreational area.

My explorations by boat through the canyons and gorges of the Colorado, Green and San Juan Rivers, lead me to believe that there is no section adjacent to any of these streams that offers such a tremendous field of scenic and general interest. Look down, up, or straight

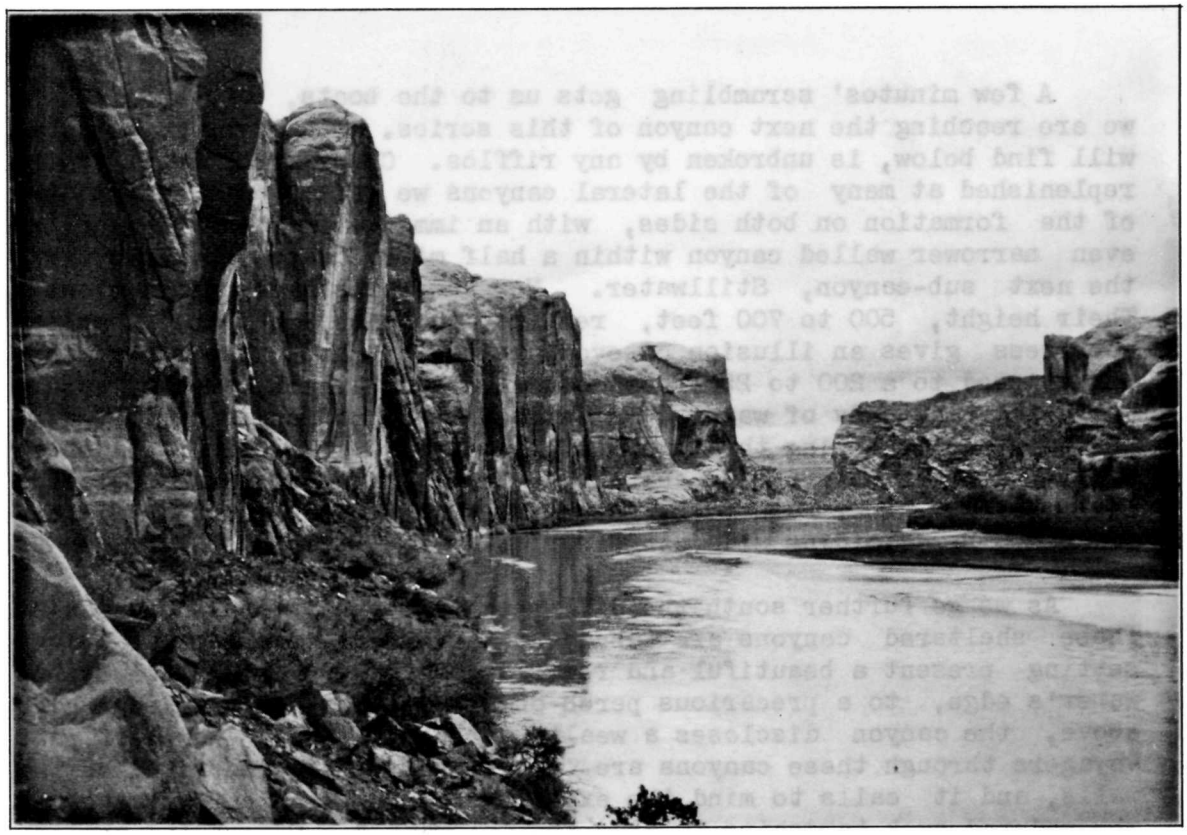
ahead - there is a combination of all possible types of views and formations.

The road problem has received considerable study, and preliminary surveys indicate construction is feasible. The great mesas that reach out to all strategic points are well adapted to road building. Navigation of the streams is safe and practical. Between the junction of the Colorado and Green Rivers, and Glen Canyon, lies 54-mile-long Cataract Canyon. This is the only stretch that requires a specialized type of organized boating, equipped to handle rapids and rough water. On all the other sections many types of craft are practical, and right now are actually in use.

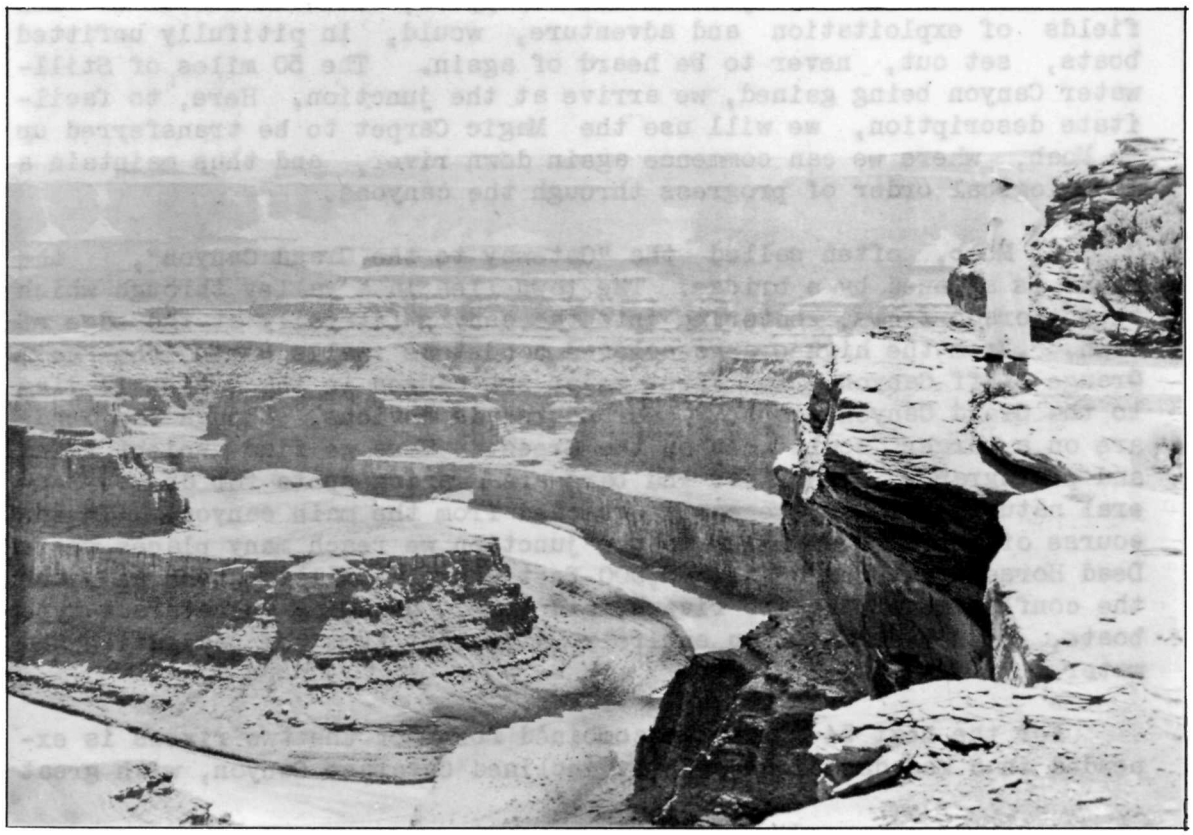
Few places in the world have the high, sheer, orange-colored walls found in these canyons. Their complicated twists and windings make for constant wonder in their ever-changing tapestries, formations and colorings. Mountains, desert, formidable canyons; natural bridges and arches of stone; prehistoric paintings and dwellings; glorious canyon-desert flora;mountain sheep and innumerable deer; vast panoramic displays and intriguing historic interests -- there is a bewildering array of attractions.

Dead Horse Point is accessible by road from Moab, Utah. This promontory on a great mesa, towering over the Green and Colorado Rivers from a height of 3,000 feet, gives an unequalled view of the canyon country. Here, in one encompassing panorama we can see the great gorges of the two rivers for 70 miles. From the La Sal Mountains on the east, to the Henry Mountains on the west, lie these canyons, the adjoining country broken up and criss-crossed by other canyons where sandstones and shales have been eroded into spires, caves, and other formations. Exploration has revealed that the whole of the proposed Escalante area is made up of this and similar types of formation.

The canyons of the three rivers are subdivided into groups of canyons. These subdivisions are marked by geographical changes that range from 10 miles to several hundred miles in length. Thus, leaving the influent San Raphael River, on the lower Green River in Gray Canyon, we immediately enter Labyrinth Canyon, marked by its 50 odd miles of windings and turns between sheer sandstone walls. The bends approximately double the distance the river has to travel in its southerly course. The general effect, with the orange-colored walls, interspersed with layers of variegated shale, is beautiful and interesting. There are many deer to be seen, and all along are evidences of the ancient cliff dwellers and their work. In this section of Labyrinth Canyon lies famed Bow Knot Bend, where the river, over a circular course, doubles back to within a few hundred feet of itself. This thin wall dividing the stream has been cut to form a saddle which a few minutes' climbing easily conquers. Here an exceptionally fine view of the river and canyon is afforded, and it is most interesting to see the boats finally heave in sight after taking 7 miles to gain a point that took us but a few minutes of climbing.



COLORADO RIVER CANYON



DEAD HORSE POINT

A few minutes' scrambling gets us to the boats, and before long we are reaching the next canyon of this series. The river here, as we will find below, is unbroken by any riffles. Clear fresh water can be replenished at many of the lateral canyons we pass. A breaking down of the formation on both sides, with an immediate resumption of an even narrower walled canyon within a half mile, marks the entry into the next sub-canyon, Stillwater. Now the walls have grown closer. Their height, 500 to 700 feet, remains the same, but the complete sheerness gives an illusion of even greater height. The river, now constricted to a 200 to 250-foot channel, is a silent, smooth, apparently unmoving body of water. The effect of no motion is swiftly dispelled upon observing the banks of the stream. The river slides by effortlessly as the 6-mile current hurries on to join the Colorado River below. Deer are to be seen in this canyon, on the willow-fringed bars adjoining side canyons.

As we go further south the difference in vegetation is noticeable. These sheltered canyons are abundant in desert flora whose unique setting present a beautiful and remarkable sight. From close by the water's edge, to a precarious perch on a small projecting ledge high above, the canyon discloses a wealth of plant life. Names of past voyagers through these canyons are occasionally seen inscribed on the walls, and it calls to mind the experiences of these early travelers who endured such hardships to "run the Colorado." Before the perfection of the present type of cataract boats, canyons such as the Cataract below, offered dangerous and more often impassable obstructions to boats and men. Prospectors and trappers, both in search of new fields of exploitation and adventure, would, in pitifully unfitted boats, set out, never to be heard of again. The 50 miles of Stillwater Canyon being gained, we arrive at the junction. Here, to facilitate description, we will use the Magic Carpet to be transferred up to Moab, where we can commence again down river, and thus maintain a more logical order of progress through the canyons.

At Moab, often called the "Gateway to the Grand Canyon", the river is spanned by a bridge. The town lies in a valley through which the Colorado flows, entering into the canyon literally at the edge of town. From the high orange-colored sandstone walls comes the name Orange Cliff Canyon, the first major sub-canyon in the series leading to the Grand Canyon proper. Our course is devious, though the bends are on a larger scale than on the Green. Here we find ancient ruins and pictographs. The flats and bars are grazing spots for deer. Several natural bridges are easily reached from the main canyon. In the course of our next 68 miles to the junction we reach many places where Dead Horse Point can be seen 3,000 feet above. All too soon we reach the confluence of the two rivers, and here, changing to cataract-type boats, we set forth on an entirely different type of navigation and water.

For the next 54 miles the combined force of the two rivers is expended in a mad dash down steeply inclined Cataract Canyon, with great

roaring cataracts and rapids every mile or so. Only well equipped parties with good leadership can make the descent. Eight days are generally used in going through. The compensations for the efforts expended are tremendous. Here limestone formations predominate, and their jagged, bold escarpments, combined with the sandstones and shales, make a deep setting for this big river. Mountain sheep are now found, and, startled, they bound up the series of ledges with amazing speed and grace. Nowhere in the whole series of canyons, lest it be the San Juan, are the walls so towering, rugged, and splashed with color. Some of the lateral canyons of Cataract are densely filled with cliff dwellings, their very remoteness having kept them inviolate all these years.

At Mille Crag Bend, so named by Major J. W. Powell in 1869, because of its outstanding number of crags and spires, the foot of Cataract Canyon is terraced from the water's edge to the top of the cliffs. Comes now a 10-mile stretch of closely walled sandstone canyon called Narrow Canyon. The water has lost its desire to be wild, and again we float on a smooth-flowing stream. The terminus of Narrow Canyon is at influent Dirty Devil, or Fremont River, also the head of 175-mile long Glen Canyon, whose stretch of smooth water extends to Lees Ferry, at the head of Marble Canyon. For the next 140 miles, to the Crossing of the Fathers, and the southern boundary line for the proposed Escalante National Recreational Area, the Navajo sandstone is predominant. There are arches, dells, glens, natural bridges, towering spires, and brilliant redbud trees. The water is smooth, and we are often stopping to explore some of the mystic-looking side canyons that extend back considerable distances with high walls that can be spanned by extending one's arms. Hidden Passage Canyon and Music Temple are but two of the side canyons that never fail to thrill a visitor. At Hole-in-the-Rock we see the river crossing of the Old Mormon Trail from Escalante to Bluff. Throughout the length of Glen Canyon there are innumerable prehistoric ruins and pictographs. Occasionally the canyon enlarges to permit views of the Blue, Henry, and Navajo Mountains.

After the San Juan River is passed, a striking picture of Navajo Mountain warns us of approach to Forbidden Canyon, easy trail to the Rainbow Bridge. From here, an hour's walk along a clear stream brings us to Nonneshozie. Returning to the river, it isn't long before we approach the El Vado de los Padres, or Crossing of the Fathers. It was a well-chosen place to ford animals, for but few places in these canyons are subject to approach from two sides at a common point. From here we see the high mesas capped with great chocolate-brown buttes that look down on us from 3,000 feet.

The trip from Mexican Hat, Utah, down the San Juan and Colorado Rivers is the best approach to that part of the San Juan Canyon included in the proposed Escalante National Recreational Area. The San Juan River, second largest tributary of the Colorado River, has, in its course of 113 miles to the junction in Glen Canyon, a combination of all the features found in the other two rivers. Not even the Grand

Canyon can boast of one unbroken wall rising 2,000 feet sheer from the water's edge. There are mountain sheep here.

Our boundary line commences 50 miles up from the junction in Glen Canyon, so, at Clay Hills we will take up the journey. The little explored Clay Hill country is composed of the variegated shales of the Chin Lee formation, making literal hills of color. Around them are isolated, unclimbable mesas, sheer walls rising abruptly a thousand or more feet. Leaving the Clay Hills, the river enters a narrow sheer-walled canyon of brilliant rose color. Directly the canyon gives way to another open stretch made prominent by the Clay Hill formation. Again the river enters a canyon, enclosing it to the junction. This time we are between the walls of Navajo sandstone, the canyon much narrower than in Glen. The formations lend themselves to a scenic display of coloring and architecture that is unlimited in form and design. Great arches and caves look out upon the river, flanked by towering monoliths, with sometimes a natural bridge seen on the very rim of the canyon. Redbud trees are plentiful, and the desert-canyon vegetation is abundant. The redbud trees, blue sky, rose walls, and tannish water combine to form a glorious combination of color. Rounding a bend, high walls are seen ahead, followed by a sight of the Colorado River flowing majestically past.

This is the canyon wonderland - a huge roadless area that is superbly beautiful. It is almost entirely publicly-owned. The public, though, is deriving scarcely any benefit, for only a very few people have been there. Roads are needed to make it accessible, just as roads had to be provided before the Grand Canyon could be "opened." People from throughout the world - several millions of them - have gained inspiration and education from viewing the Grand Canyon. The same will be true of the Escalante region, after accessibility is provided. Roads will come when the area is linked into the National Park System, as it should be, to prevent commercialization and to assure its preservation in a natural state. It should be kept unspoiled and it should be made available to all the people.

I have merely touched on the many interests that are here and I have attempted to describe, only very briefly, the seemingly unlimited combinations of scenery. It is my belief, though, that these 2,000 square miles in Utah comprise a potential national recreational area that will surpass anything of the kind anywhere.

THE GOLIAD RESTORATION

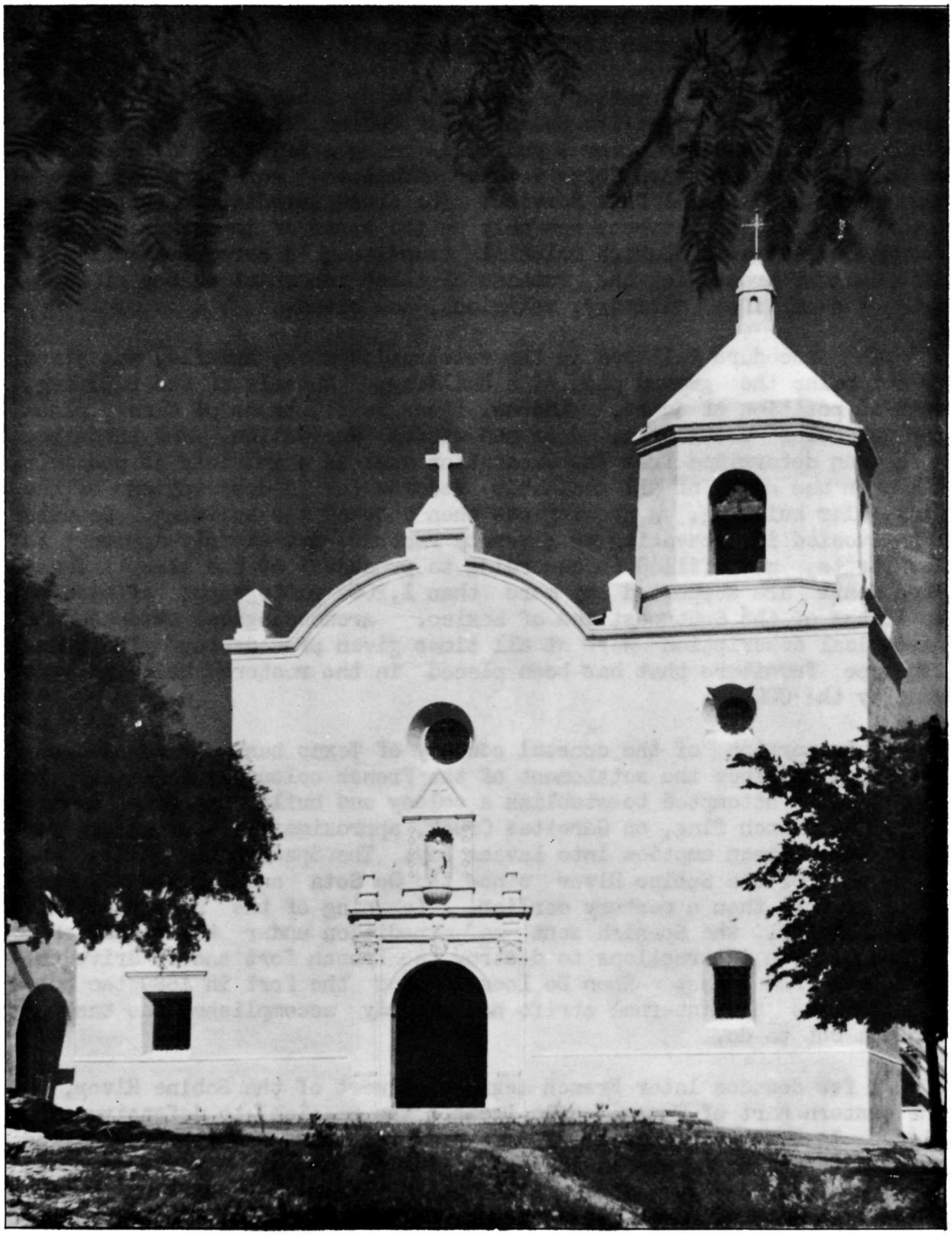
By Roland E. Beard,
Senior Foreman Archaeologist.

An 18th century frontier picture is being recaptured, in restoration of the Mission Espiritu Santo, near Goliad, Texas. The project, which has been under way for 5 years, is being carried out by a company of Civilian Conservation Corps veteran enrollees, working under supervision of the National Park Service. The areas immediately surrounding the mission are of interest not only as the scene of important military struggles but as a Spanish Colonial townsite. A rare opportunity is afforded for preserving the remains of three important phases of Spanish colonial life: military, religious, and civic.

The procedure followed in the restoration work, briefly, was first to determine the ground plan of a building. Details of the building, such as position of doors, windows, floor level, types of floor, plaster and color decoration, door and window decoration, and hardware, were then determined from the excavation work as completely as possible. A search was made of all available records for a description of the particular building. A drawing was then made of the building. Details not revealed in excavating or given by records, but clearly apparent to architects, were filled in according to precedent of the time. These precedents are supported by more than 1,200 photographs of mission buildings of the Southwest and of Mexico. Archaeological evidence and historical description were at all times given precedence. The Spanish type furniture that has been placed in the restored buildings was made by the CCC.

This portion of the coastal country of Texas has been of historical interest since the settlement of the French colony by LaSalle. In 1685 LaSalle attempted to establish a colony and built Fort Saint Louis, under the French flag, on Garcitas Creek, approximately four miles from where that stream empties into Lavaca Bay. The Spanish had claimed the land west of the Sabine River since the De Sota and Coronado expeditions of more than a century earlier. Learning of the French activities in Texas, the Spanish sent an expedition under the direction of De Leon, with instructions to destroy the French fort and to drive the Frenchmen from Texas. When De Leon located the fort in 1689 the hostile Indians and internal strife had already accomplished the task he had set out to do.

A few decades later French aggression west of the Sabine River, in the eastern part of Texas, again incited the Spanish to defensive action. In 1722 the Marquis de Aguayo established a presidio called Nuestra Senora de Loreto on the exact site of Fort Saint Louis. A short distance from this presidio, on the opposite side of the river, a mission was built and named Mission Espiritu Santa de Zuniga. The presid-



MISSION ESPIRITU SANTO

io and mission remained there until 1726, when they were moved to a site on the Guadalupe River, twelve miles above the present city of Victoria. Although only 30 miles from the original location, the Indians were less hostile, the farming conditions better, and a more desirable site was secured for the buildings. Stone buildings were constructed and an attempt was made to dam the river. Irrigation canals were dug for the wide fertile valley. Many old stone walls and traces of canals may still be found. They are protected from relic-hunters by the present land owners. In 1749 the presidio and mission were moved to the San Antonio River, and finally located a mile south of the present town of Goliad. The latter location of Presidio La Bahia (Nuestra Senora de Loreto) and Mission Espiritu Santa (de Zuniga) placed them in the bounds of the Spanish colony of Nuevo Santander.

Jose de Escandon, the Colonial Governor of Nuevo Santander, exercised a rigid policy toward subduing the Indians. Because Father Juan Joseph Gonzales, principal missionary at Mission Espiritu Santo, failed to accomplish the purpose of the Governor, an effort was made to move the Karankawa tribes to San Antonio. A controversy arose which resulted in the establishment in 1754 of another mission, Nuestra Senora del Rosario, four miles to the west of Mission Espiritu Santo on the San Antonio River. Thus the early settlement of Goliad was made up of civilian population, Presidio La Bahia, Mission Espiritu Santo, and Mission Rosario. Presidio La Bahia had a garrison of approximately 300 soldiers. Mission Espiritu Santo administered to some 300 Indians of the Aranama, Tamique, Piquiane, and Manos de Perro tribes. Mission Rosario administered to some 400 Indians of the Coxane, Guapite, Carancaguase, and Copane tribes. The civilian population was made up of traders and adventurers who were normally found nearby. There is little doubt as to the importance exercised by that settlement in the economic and social development of Texas. Although the climate was dry for a long period of the year, an attempt was made to grow grain and vegetables during the wet season. The good grass of the broad rolling plains which extended almost to the river banks, afforded ample forage for stock and cattle raising. Ranching became the chief industry of the mission. In two decades after the establishment of Mission Espiritu Santo on the San Antonio River "the herds of cattle numbered more than 15,000 branded animals, and there was a considerably larger number running wild and unbranded."

During the first 20 years on the San Antonio River the two missions and the presidio showed continued progress. From 1750 to 1770 conditions for raising cattle were favorable, and the hostile tribes of Indians were roaming elsewhere. Cooperation from the presidio commanders and aid from the Spanish government were sufficient and the missions prospered. Following 1770 the pendulum began to swing in the other direction. The mission priests and the captains of the presidio became unfriendly and quarrelsome among themselves; each incident at either the presidio or the mission resulted in "passing the buck." The Indians, tiring of the restricted life at the mission, would wander away to the seacoast in small bands for long periods of the year, and

the herds were left unattended. In the name of His Majesty, the King of Spain, the presidio commander laid claim to all unbranded stock. Citizens, army captains, soldiers, and Indians began a general "grab" of all unbranded stock. Marauding bands of Lipan and of Comanche Indians drove away or killed many cattle, sheep, goats, and horses. By 1784 the chapel of Mission Espiritu Santo was in such a poor state of repair that it was abandoned for religious services. Money for the upkeep of the mission was slow in arriving, if at all. The padres pleaded in vain for aid in the task of trying to Christianize the Indians and in carrying on other work of the mission. In 1794 Mission Espiritu Santo and Mission Rosario were officially abandoned. The Fathers, however, continued to administer to the spiritual needs of the Indians for more than a decade longer at Mission Espiritu Santo. The Indians of Mission Rosario were moved to the Mission of Refugio.

For two decades following the turn of the century Spain was involved in European trouble to such an extent that her colonies in the western hemisphere were neglected. Louisiana had fallen into Spanish possession and the French were no longer a threat from that direction. Discontent grew, and was cultivated, among the colonies. Many colonies seized the opportunity for attaining independence. "Liberators" began to appear in Texas as early as 1812. La Bahia, being an important military objective, was the scene of four engagements. Gutierrez and Magee, on the Texans' side, engaged the Spanish under Salcedo, in 1812. Colonel Perry, supposedly for the Texans, was defeated by the Spanish under De La Hóz near La Bahia in 1817. In 1821 Dr. James Long unsuccessfully sought to set up an independent Republic of Texas and made La Bahia the first objective in that, his second campaign. The battle of greatest importance took place in 1836. In the early part of that year a group of approximately 350 Texans, under Colonel Fannin, was defeated, taken prisoner, and executed. An appropriate monument now marks their common grave.

The historical facts and importance of the town of La Bahia, and the civilian population around the old Presidio La Bahia, have received far less attention from historians than have the military and religious sides of the picture. The town consisted of soldiers' families, traders, frontiersmen of questionable past, and adventurous ranchmen. The peak of its population, estimated in various documents as from 800 to 2,500, was reached before the Texas Revolution. The foundations of many stone houses, and the crumbling walls of a few, still border the dim street lines. Records, however, show that most of the houses were of wood and adobe. One of the sites is by legend the birthplace of General Ignacio Zaragoza, who led the Mexicans against the French in 1862, liberating Mexico from the invaders. Census and property records date back to 1791. Archaeological work has revealed that necessary tools of the time, such as guns, powder measures, knives, dishes, spurs, etc., were often of the best quality, tastefully decorated.

Since the end of the Texas Revolution the history of Goliad and the adjacent area is the history of any small Texas town. During the

days of the Republic a new settlement was formed a mile to the north of Old Goliad (La Bahia) where the Anglo-American population laid out a townsite, to which most of the Mexican population moved. In 1933 the only remains of the mission were the four quadrangle walls, a room approximately 15 by 15 feet of one stone building, and a portion of the wall of the same building. All the other buildings and portions of the walls of the quadrangle had been reduced below ground level by treasure hunters and by people with the rock-garden complex. The prior owner stated, after the area had become a state historical park, that his father sold the rocks of the old buildings, even to the foundations.

The local park board, with the aid of the federal government, made a start in 1933 in the preservation of the site by erecting a building on the remaining visible foundations. The portions of the original building, mentioned before, were incorporated, intact, with this building. When the National Park Service, with a company of Civilian Conservation Corps enrollees, took over the work in 1935, means were made available to approach the problem from the research angle. A careful excavation was made of the entire area. Complete records were made of progress of the work and of old foundation lines and artifacts. Photographs were made of all important finds and of progress and methods of excavation. Historians searched records of the library of the University of Texas, the Bexar Archives in San Antonio, private library documents, and the records in Mexico City and in the old churches of Mexico.

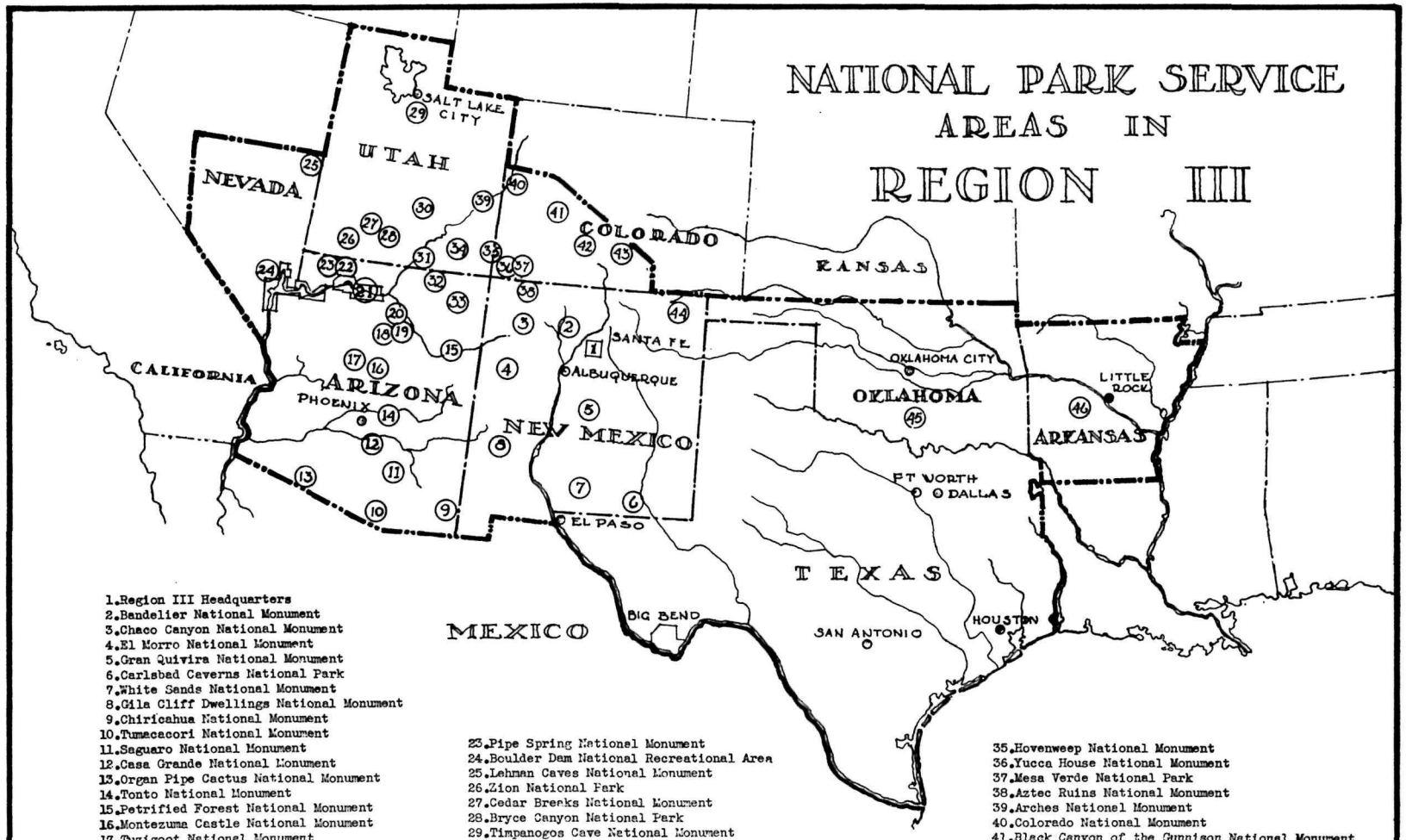
The only building, or group of rooms, left standing a century ago was described by a traveler who stopped at the mission in the early part of the 19th century. Two rooms of this group of rooms were still standing, and used as a barn within the memory of living men. The plan of some buildings was sufficient to identify them as to original use. Documents have been found giving the relative position of most of the buildings, as well as their size. Thus one by one the structures were identified. When the excavations were completed and records pieced together, the story of the occupation of the site unfolded. Wooden structures of Espiritu Santo enclosed by a roughly built, double-walled, wooden stockade approximately 100 varas square were first built. Later as the mission prospered and time allowed, the wooden buildings began to be replaced by more permanent stone structures. The first stone structures were in alignment with the wooden stockade walls. While the wooden buildings were being replaced by stone construction a new plan was initiated whereby the quadrangle walls enclosing the buildings would run north and south, east and west. Stone walls of buildings already completed were left in alignment with the old wooden stockade walls. Walls of buildings constructed later were skewed around to run north, south, east and west, in alignment with the newer stone quadrangle walls.

When at its height of prosperity the m sion was "in the form of a quadrangle, with its corresponding protec ng walls entirely enclosing it (the whole mission). Adjoining (these walls) are houses, or living quarters, for the Indians, which are s milar to those of the other

missions, and are made of stone. Some have flat roofs, (flat roofs of mud and brush), and others with roofs of grass or straw. The house for the priest, with corresponding rooms and offices of the community, and the church and sacristy adjacent to it are all made of stone and mortar."

The Mission Rosario, although under different management, was closely associated with Mission Espiritu Santo, and a record of its rise and decline closely parallels that of Mission Espiritu Santo. The Mission Rosario buildings were of stone, large and well constructed. Since practically no archaeological work has been done there, little can be said concerning the ground plan of buildings and cultural remains. As early as 1830 the only remains of Mission Espiritu Santo were "six rooms of stone almost in ruin, without any doors. They are used as a house for the Padre: living room, zaguan (granary), and a patio with a stone wall. All was about 20 varas long and 15 varas wide. A stone wall in a square around the whole fabrica (the entire establishment)." In 1850 the largest of these rooms had been repaired and was used as a dwelling. Most of the stone of the crumbled ruins was used for the construction of Aranama College, 200 feet eastward from the quadrangle of the mission. The only building then remaining was renovated and used by the college, which ceased operation in 1861. This building was used from 1861 until about 1920 as a residence and as a hay barn. After 1920 it fell into complete ruin.

A cross-section of the various phases of life at Espiritu Santo Mission was pieced together from the excavations. Industrial life of the mission hinged around ranching, as suggested by tons of cattle bones covering the area at the occupation level of the mission period. Hundreds of flint hide-dressing tools, bone awls, flint knives, several dozen steel knives, Spanish bridle bits, and Spanish-type spurs, were found. Features of domestic life included fire-pits lined with baked clay, large tile-lined ovens, crude Indian pottery in profusion, and decorated Spanish pottery of the 18th century. Hammered copper kettles, copper ornaments of various uses, including finger rings, bracelets, anulets, and pendants, were unearthed. Quantities of beads and a few crucifixes were found associated with many of the seventy-five human skeletons discovered and removed. Some of these articles are significant because of their scarcity. A human tooth pendant was of interest, there being only two known to be on record in the state; and also the baked clay whistles, rare Indian artifacts in this part of Texas.



1. Region III Headquarters
2. Bandelier National Monument
3. Chaco Canyon National Monument
4. El Morro National Monument
5. Gran Quivira National Monument
6. Carlsbad Caverns National Park
7. White Sands National Monument
8. Gila Cliff Dwellings National Monument
9. Chiricahua National Monument
10. Tumacacori National Monument
11. Saguaro National Monument
12. Casa Grande National Monument
13. Organ Pipe Cactus National Monument
14. Tonto National Monument
15. Petrified Forest National Monument
16. Montezuma Castle National Monument
17. Tuzigoot National Monument
18. Walnut Canyon National Monument
19. Sunset Crater National Monument
20. Wupatki National Monument
21. Grand Canyon National Park
22. Grand Canyon National Monument
23. Pipe Spring National Monument
24. Boulder Dam National Recreational Area
25. Lehman Caves National Monument
26. Zion National Park
27. Cedar Breaks National Monument
28. Bryce Canyon National Park
29. Timpanogos Cave National Monument
30. Capitol Reef National Monument
31. Rainbow Bridge National Monument
32. Navajo National Monument
33. Canyon de Chelly National Monument
34. Natural Bridges National Monument
35. Hovenweep National Monument
36. Yucca House National Monument
37. Mesa Verde National Park
38. Aztec Ruins National Monument
39. Arches National Monument
40. Colorado National Monument
41. Black Canyon of the Gunnison National Monument
42. Wheeler National Monument
43. Great Sand Dunes National Monument
44. Capulin Mountain National Monument
45. Platt National Park
46. Hot Springs National Park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