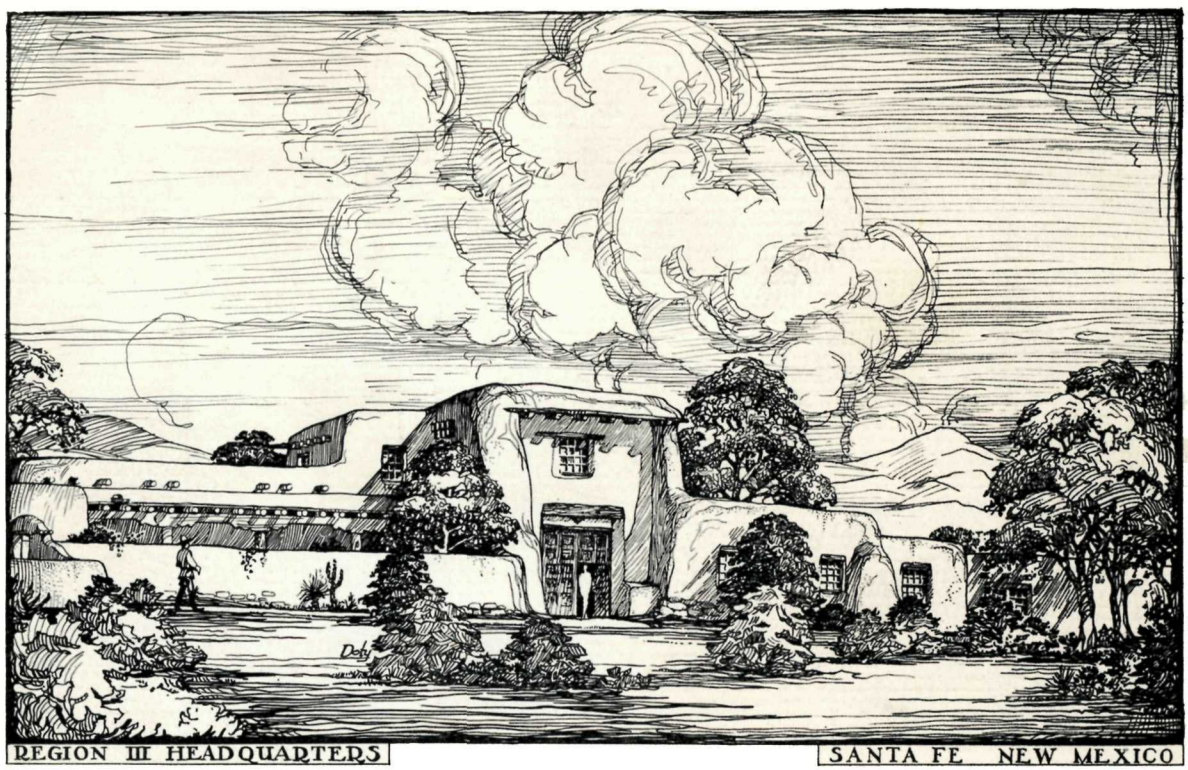
REGION III
QUARTERLY



REGION III HEADQUARTERS SANTA FE NEW MEXICO

NATIONAL PARK SERVICE

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FRANKLIN K. LANE

Secretary of the Interior when the National Park Service was first organized in 1917.

C O N T E N T S

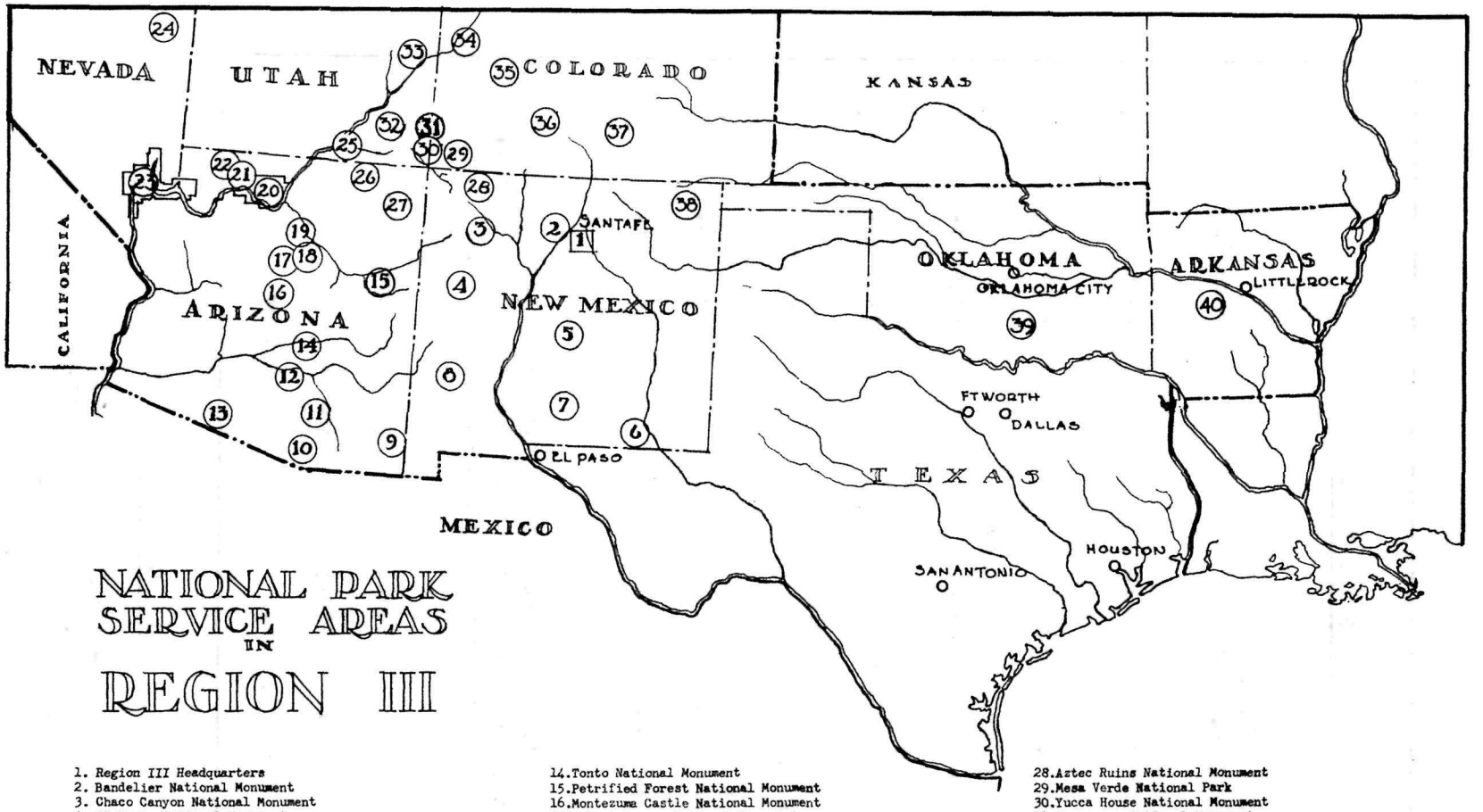
Hillory A. Tolson — Regional Director

Leo A. McClatchy — Editor

Cecil J. Doty — Art Editor

R E G I O N III

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



NATIONAL PARK SERVICE AREAS IN REGION III

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3. Chaco Canyon National Monument
4. El Morro National Monument
5. Gran Quivira National Monument
6. Carlsbad Caverns National Park
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THE REGION III QUARTERLY

The Region III Quarterly, which makes its initial bow with this issue, has for its purpose the dissemination of information which it is hoped will be of practical use to Service personnel and to interested individuals and organizations. The articles will be written in non-technical phraseology with a view to making them interesting and instructive. Their scope will include various phases of geology, forestry, wildlife, archaeology, history, landscaping, engineering, recreational planning, and other subjects concerning National Park Service activities in Region III.

The articles contained in this first issue of the Quarterly have been written by Region III Office personnel to indicate the type and quality of material to be used. The Quarterly can not be published regularly, however, without field cooperation and assistance. It can not succeed without contributions from superintendents, rangers, inspectors, and others. Friendly criticisms and helpful suggestions for the Quarterly's improvement are invited. It is proposed to include, from time to time, pertinent articles written by persons outside of the Service. Such articles will give an outside viewpoint which should be helpful in considering Service problems.

The reproduction of the line-drawings and halftones in the Region III Quarterly has been made possible by the friendly cooperation of the Region I Office. Such cooperation is another example of that esprit de corps which has always been a major factor in National Park Service accomplishments and is appreciated. The encouragement given by Director Cammerer, Associate Director Demaray, and Editor-in-Chief Story to this Office's proposal to issue the Region III Quarterly also is appreciated.

Hillory A. Tolson

Hillory A. Tolson,
Regional Director.

WHAT MADE GRAND CANYON ?

By Dr. Chas. N. Gould
Regional Geologist

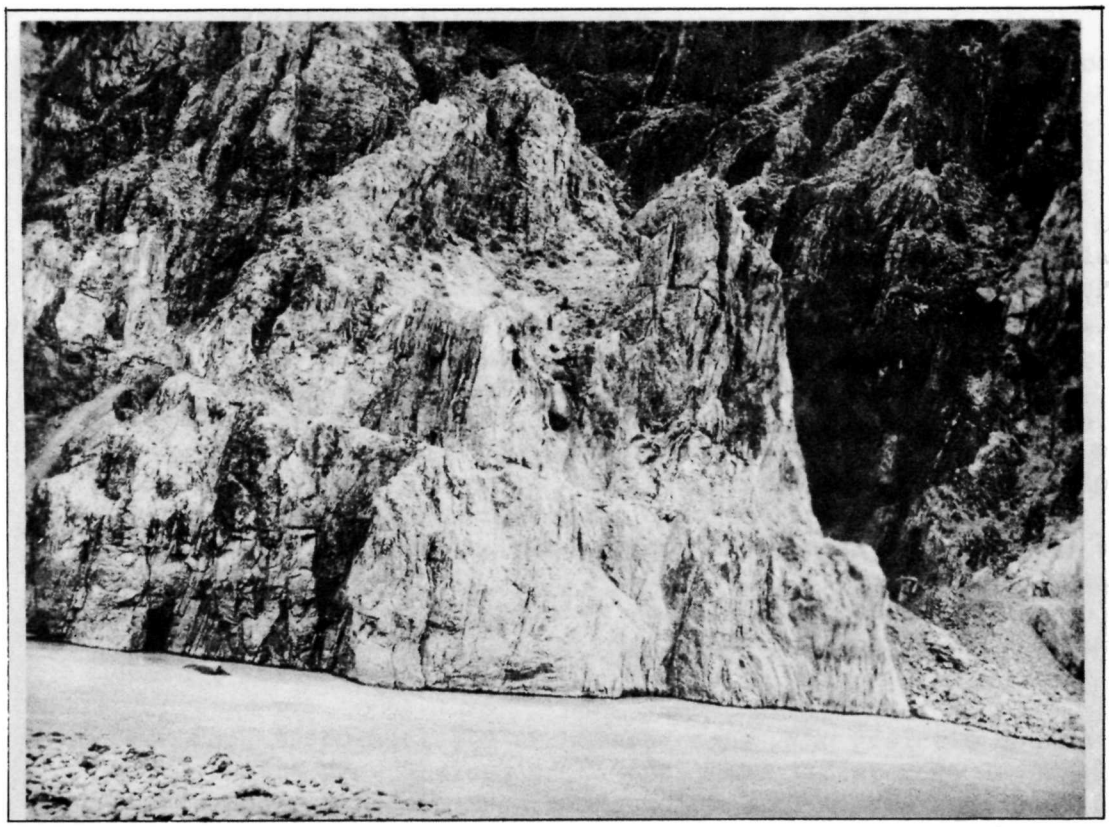
Nowhere on this whirling planet may man see a better demonstration of Nature's three fundamental processes-deposition, elevation, and erosion-than at Grand Canyon National Park. First, the rocks have been deposited or laid down as layers, one above another, in the bottoms of long-gone, prehistoric seas; second, these rock-layers have been elevated or raised by some tremendous force above their original position; and, third, the rocks have been eroded or worn away and their fragments carried to some other place.

These three processes are eternal and fundamental-always in operation, never ceasing, never completed. From the time when "the morning stars sang together", even until time shall be no more, without haste and without rest, these three processes have been constantly at work, making over and reshaping this old earth of ours. But so slowly, so quietly has this work been accomplished that we, "denizens of a second-rate planet belonging to a fourth-rate and moribund star", are rarely conscious of it. We each play our own little part in the drama of life, and leave the stage to others, taking small account of the universal drama which goes on all about us.

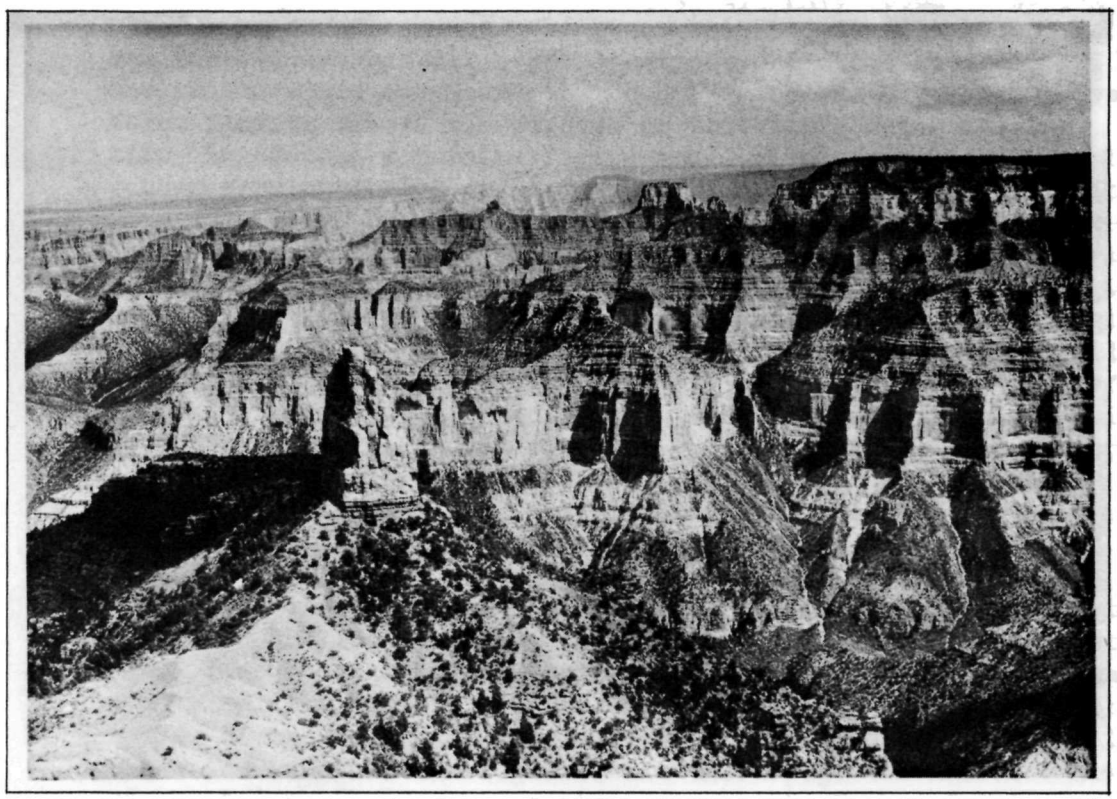
Grand Canyon is 200 miles long, a mile deep, and averages 10 miles in width. There is nothing else like it anywhere. But it didn't just happen; neither has it always been there. The story of the development of Grand Canyon has been written in the rocks so that he who runs may read. All that is needed is the seeing eye and the understanding mind.

When you mount a mule and take the Bright Angel trail from the canyon rim, winding down to the Colorado River, you will see, if your eyes be open, the rock layers that make up the walls of the canyon. The three most abundant kinds of stratified rocks: shales, sandstones, and limestones- are much in evidence, layer after layer, lying level one above another, some hard, some soft, with a total combined thickness of 3,000 feet. In these rock-layers there are fossils, or evidence of extinct life, showing the progressive development from primitive one-celled forms to large lizard-like animals. Finally you come to the inner gorge, and still the trail leads down across another kind of rock. These are all very hard rocks, granites and gneisses and schists, not arranged in level beds or layers, but crumpled, twisted, and contorted, in all sorts of shapes. And so, at last, to the bridge over the Colorado River, a muddy, turbulent stream, flowing swiftly between precipitous cliffs, rushing madly on its way to the western ocean.

Four of the five major divisions of geologic time are represented along the canyon wall. Within the inner gorge we find



GRANITE AT BOTTOM OF GRAND CANYON



ROCK LAYERS IN GRAND CANYON WALL

granites and other associated rocks belonging to the Archaeozoic and proterozoic eras. This is the original earth-stuff, the "basal complex", the material from which all other rocks have been formed, that goes downward to the center of the earth. The level-lying beds that constitute the upper 3,000 feet of the canyon wall belong chiefly to the Paleozoic era, including Cambrian, Devonian, Mississippian, and Permian beds. At one place, there are red sandstones and shales, part of the Moenkopi formation, the lowest member of the Triassic, of the Mesozoic era.

Now these things, which I have attempted to describe so briefly, are very obvious. We can see the rocks, and we can feel them. But constantly our minds are inquiring: how, why, when, what caused all this? The history of Grand Canyon is long-very long. The granite now being exposed in the bottom of the inner gorge is among the oldest rock exposed anywhere on the surface of the earth. How many years? Oh, say eight hundred million to one thousand million years. Nobody knows. Anyhow, it happened before your time, or mine. So why worry? It really doesn't matter.

Then throughout the unnumbered ages the geologic column was slowly built up. Shales, sandstones, and limestones, layer upon layer, were washed in from surrounding land masses and laid down on the bottom of long-departed oceans, or along vanished shore lines. There are eleven different formations or layers exposed in the canyon walls. Some geologists believe that one of these formations, the Coconino sandstone, may have been deposited chiefly as desert sand dunes. Eventually the layer cake was done. The rock layers had all been deposited, one above another. Then the seas drained away, and the country stood as dry land. Rivers began flowing across the surface of this land. Water falling as rain in distant mountains formed small rivulets, which came together forming larger and larger streams. These finally united into a large river, the second largest in the United States, which today we call the Colorado. This stream, taking its rise along the back bone of North America, started on its way to the Pacific. It flowed in a general southwestern course, dodging hills, keeping to the lowest channel, for water runs down hill, you know, cutting its way through soft rocks, avoiding the harder ledges, often twisting about like a tortured snake, and acting as a normal, well-behaved river is supposed to act. The general course of the Colorado, all the way from Long's Peak to the Gulf of California, was established in the dim, dead days beyond recall.

Then something happened. Near the middle course of the Colorado the land surface began "acting up". It wouldn't stay put. Some great internal force of Nature began raising the land; something like a giant blister, right across the well-established course of the Colorado River. Imagine an inverted saucer 100 miles in diameter. Geologists call this bulge the Kaibab Dome, or the Kaibab Plateau. Sometimes we say the Kaibab Uplift.

What could a hard-working river do when things went haywire? Two things: It might either peacefully abandon its course without a fight and flow around the Dome or it might buckle down to cut its way across. If the elevation of the Dome had been rapid, undoubtedly the river would have been deflected either to the north or to the south and its lower course today would have been many hundreds of miles away from its old channel. But, as it happened the land rose slowly, very, very slowly; just how fast we do not know, but probably only a few inches a century. So that the river in its down-cutting has just about been able to keep pace with the elevation of the land. Or, to say it differently, the water in the channel of the Colorado River in Grand Canyon was probably never a great deal higher above sea level than it is today. As throughout the ages the Kaibab Plateau has slowly risen, an inch at a time, just so slowly has the river succeeded in cutting its way downward. In this cutting it has been aided by the sand, pebbles and boulders which are carried in times of flood. These tools of erosion gouge and grind and gnaw and rub and abrade the solid rocks along the banks, and slowly but surely wear them away, constantly widening and deepening the channel.

The Colorado is not a patient, quiet, kindly stream, as is the Mississippi or the Ohio, flowing in gentle meanders through flat valleys. Its disposition has been ruined, and it is today a very impatient river. On its way through the canyon it growls and roars and froths. It tumbles over rapids, throwing spray into the air, and slaps at its banks. In every way possible the Colorado seems to protest at being imprisoned between high walls. But the grim, unheeding walls stand sheer, and its turbulent course continues until, finally, in man-made Lake Mead, extending a hundred miles above Boulder Dam, the troubled waters come to rest.

And so, we may see at Grand Canyon a clear-cut demonstration of Mother Nature's three eternal processes: deposition, elevation, and erosion. It is textbook geology, simple and easy to understand. From the canyon rim, or along the trail, or looking up from the bottom, the rock layers "leap" to the eye. The most unobservant person cannot fail to see them. There is nothing else to see. And so with the Kaibab Uplift. If we know where to look, it is easy to see the outline of the great Dome. Perhaps the best place is along one of the highways on the east side of the Uplift. On the road from Cameron to Desert View south of the Colorado; or between Houserock Valley and Jacobs Lake north of the river, one may see the ledges of limestone, one above another, all dipping to the east along the east flank of the Kaibab Dome. And along the road leading north from Jacobs Lake to Kanab, Utah, the ledges dip sharply down the north slope of the dome. The north rim of Grand Canyon is 1,000 feet higher than the south rim, although the same Kaibab limestone forms the rim rock in both places. The highest point of the Kaibab Dome is near the north entrance to the park, ten miles north of the lodge on the north rim.

Great men of American Science have worked in Grand Canyon. As early as 1857 Dr. J. S. Newberry, afterward of Columbia University, prepared the first geological report on Grand Canyon, in which he set forth the geologic importance of the area.

In 1869 a party under the direction of one-armed Major John Wesley Powell made the first boat trip down the Colorado River and proposed many of the striking names which have since become classic, such as Dirty Devil, Bright Angel, and God's Pocket. Powell was afterwards Director of the United States Geological Survey and at the same time Director of the Bureau of American Ethnology. In the latter capacity he did much to lay the foundations of Southwestern archaeology. There is a monument to Powell on the south rim of Grand Canyon.

Sixty years ago Captain C. E. Dutton, one of Powell's associates, published the first monograph on Grand Canyon. The versatile W. H. Holmes, geologist, ethnologist, and artist, contemporary of Powell and Dutton, succeeded Powell as Director of the Bureau of American Ethnology. Holmes, it was, who made the noted pen sketches of Grand Canyon.

During the early 80's Dr. Charles D. Walcott, Powell's successor as Director of the United States Geological Survey, spent an entire winter in the eastern Grand Canyon, making important contributions to our knowledge of Cambrian and Algonkian rocks and on the subject of the oldest life.

David White, whose ashes repose in the cemetery on the south rim, one of the great paleobotanists of America, first brought to public attention, through his discoveries and writings, the wealth of interesting fossil plant remains buried in various layers of the Grand Canyon walls.

Truly, there were "giants in those days".

The outstanding fact about Grand Canyon is that the elevation of the dome and the down-cutting of the stream have been contemporaneous. In most cases the rocks have first been elevated, and then the processes of erosion have begun. Nature's tools: rain, running water, wind, frost, heat, and chemical agencies, working together, break down the rocks and carry them away. In this manner, most land forms have been produced. Hills valleys, cliffs, canyons, mesas, buttes, and the hundreds of different erosion forms, have been shaped chiefly by the action of the agents of erosion on land already elevated. This is the ordinary procedure, as for instance, in the Black Hills of South Dakota; the Ozarks of Missouri; or the Arbuckle Mountains of Oklahoma, to mention only a few.

But in the case of Grand Canyon, the two processes are going on at the same time. All available evidence points to the fact that the Kaibab Plateau is still rising - very slowly it is true, but rising just the same. We know for a certainty that the Colorado is still sawing its way athwart the slowly-rising dome.

THREATENING ROCK

By James B. Hamilton,
Associate Engineer

One of the interesting features of Chaco Canyon National Monument in New Mexico is "Threatening Rock", so-called because the aboriginal inhabitants of Pueblo Bonito believed it threatened to fall on their 800-room apartment house. This we know, because in about the year 1050, they placed logs and rock walls beneath its overhanging front face to prop it up.

The rock is a mass of sandstone about 100 feet high, 30 feet wide, and 130 feet long. It is about as large as a ten-story building, and weighs around 50,000,000 pounds.

In past geologic ages, the rock was a part of the cliff which walls in Chaco Canyon. For unknown millenniums it has been slowly separating from the cliff behind it, until now it is some five feet from the cliff at its top, and two feet at the ground level. This tilting indicates that the base may extend some fifty feet underground.

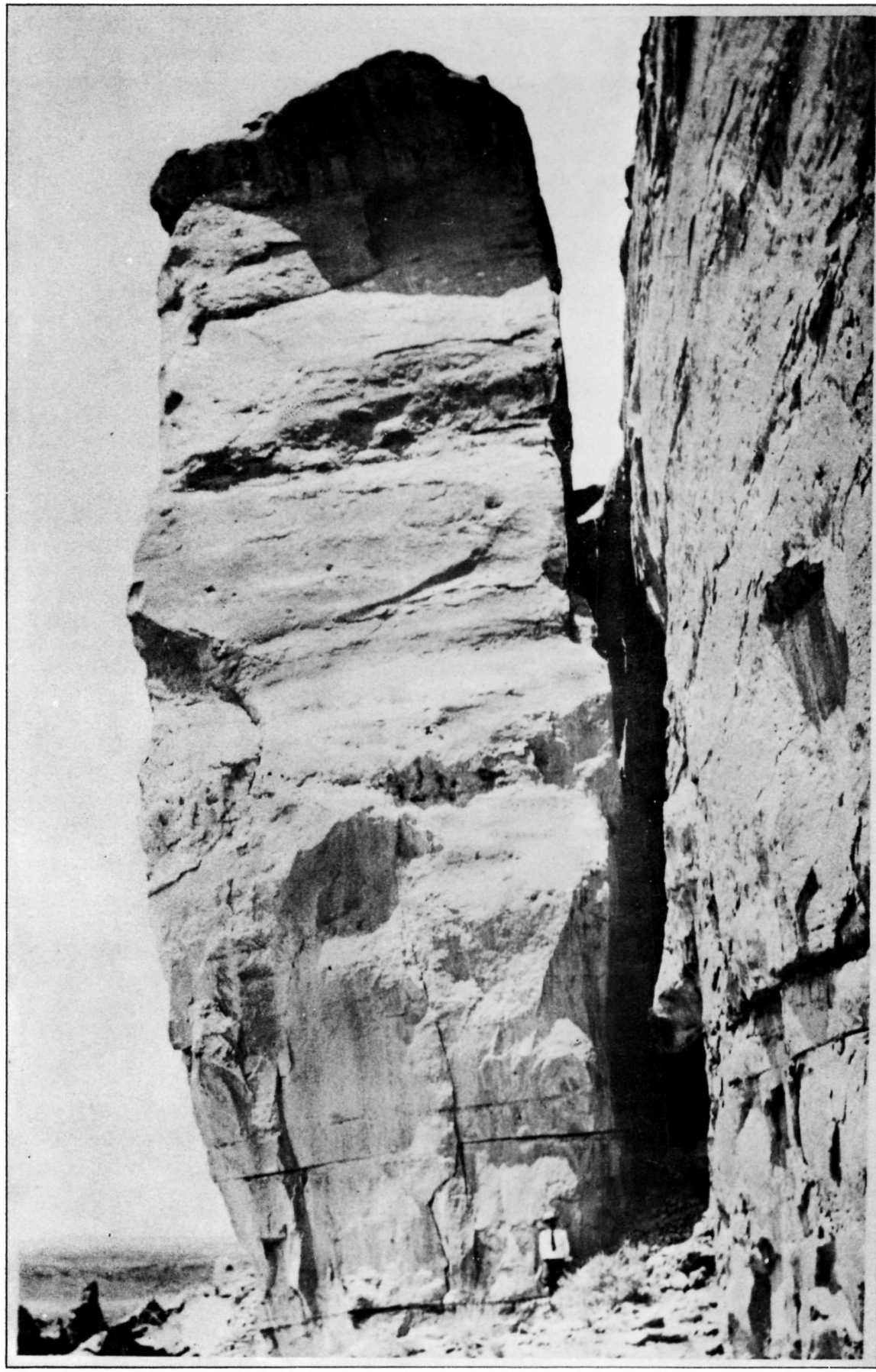
From excavations around Chettro Kettle, a companion ruin a mile up the canyon from Pueblo Bonito, we know that the valley floor was some fifteen feet lower there when the foundations of that structure were laid, than now.

It is certain that Threatening Rock looked considerably more menacing to the Bonitans than it does to us, because it probably towered fifteen or twenty feet higher than now. The walls and terrace they built in front of it, and the sand and soil that have blown in, have reduced its apparent height. Even so, when viewed from a short distance up the canyon, it seems about to fall on the ruins of Pueblo Bonito.

Immediately to the west of the rock against the base of the cliff, is a mass of angular boulders. There is evidence that at one time the rock extended fifty feet or more to the west, and that this portion of the rock fell. Excavations indicate that in falling it crushed some small structures built against the cliff. Possibly it killed people living in them.

Whether by example of this rock fall, or by others along the canyon; or simply because it looked as if it would fall, the ancients expended a great deal of effort to keep it propped up. Exploratory digging in front of it showed that they built up at its base enough material to fill a room with a ceiling height of sixteen feet, width of thirty-two feet and a lenght of 180 feet--a room bigger than many moving-picture halls. Picture doing that with no tools as we know them today, and no power except that of human muscles.

They first piled clay against the base of the rock to a



THREATENING ROCK

height of fifteen or twenty feet, and six to sixteen feet wide; the greater width at the bottom. Then in front of that they built a wall sixteen feet thick of flagstones laid in adobe. On the front face of this they built a veneer of small stones to form a wall looking much like the ruin walls nearby. Then the wedged-shaped space between the sloping bank of clay and the massive stone adobe wall was filled with sand. This construction has been traced to the west and east of the rock, part of it for a total length of 185 feet.

Even all that did not satisfy the Chief Engineer, Mayor, or very possibly, the pottery-making circle that wanted this mass propped up forever. In the base of the rock at the top of the terrace, are two rather large caves. These extend into the rock perhaps a third of its width and at the front are six to twelve feet high. In the mouths of these caves they placed upright logs reaching from the roof of the cave to some as yet unseen foundation. These logs were encased in a wall of stone and mud mortar about five feet wide at the base to two and one-half feet at the top. This last is about the only portion of their work the casual visitor notices, although the top of the veneer facing their terrace can be seen in several places. The centuries have pretty well filled with blown sand the space between what has not fallen down and the ruin walls of Pueblo Bonito. The veneer has been traced by tunneling eight feet under the rock fall to the west. How much further it extends we do not know. It is evident that their construction did not stop the westerly portion of the rock from falling.

Modern engineers smile at the ancients' use of a few small logs and a relatively thin wall of stone and mud to prop up this enormous weight. The mass of material piled in front of the rock has not much supporting power, as the portion against the rock is composed largely of clay which, under pressure, flows very slowly, like tar--especially if it becomes damp.

It is pretty well believed that the upstanding portion of the rock has been preserved to a certain extent by the work they did. The caves seem to have been formed largely by the blowing away of the more easily erodible portions of the rock. If the Bonitans had not blanketed the gales away from these softer portions of the rock, it is possible this undercutting would be considerably more extensive than it is today.

Were they unduly alarmed? We can say now that they were prematurely alarmed. But we know the rock is falling. Its top is moving toward the ruins--about an inch a year for the last four years.

In 1935, the engineers set a pipe in a horizontal hole in the rock near its top. The top half of this pipe for a few inches was removed. In the cliff opposite, an iron rod was grouted. Its outer end extends into the pipe. On the edge of the trough formed by the half pipe and on the rod, a mark was cut by a hack saw. Now the mark on the pipe and the mark on the rod are over four inches apart. Measurements which are regularly made by the Custodian of

Chaco Canyon National Monument, show a little outward movement every month.

Given the problem of a falling rock, what shall we do to stop it? Some say blast it down before it falls on the ruins and more or less wrecks them. Some say block it up, as the ancients did, only use concrete instead of clay, sand, and rock. Others would tie it to the cliff, with rods of steel. The unique archeological exhibit at the base of it must be saved. That is fundamental. Nothing like it exists elsewhere in the world. That being accepted, the first two solutions are ruled out. If we remove the rock, we destroy the visual evidence of why the Bonitans did all that work. If we build a buttress of concrete, we have to remove the work they did. True, we might replace some of it as a veneer over the concrete, but then we would have only a restoration job.

Most engineers who are familiar with the rock believe the best solution is to make use of the discoveries of modern science, and to use steel, air-hammers, treading machines, cement grout, the principle of the lever and the wheel, and many other skills and processes unknown to the Bonitans. Briefly, it is tentatively planned to drill holes in the back of the rock and face of the cliff near the top, exactly opposite, and to grout steel rods into these holes. The outer ends of these rods would be threaded and these connected by a turnbuckle. As this is turned the rods would be drawn together.

The question of how many rods to use, what size to make them, and how deeply to place them in the rock, has not been settled. Some experiments on pulling rods from sandstone will have to be made so that the engineers can be sure we will use rods enough, long enough and placed deep enough.

Two of the best examples of extinct volcanoes in the Southwest, each with a perfect crater, are now national monuments. Capulin Mountain, in northeastern New Mexico, has a winding road leading to the summit. There is no road to the top of Sunset Crater, one of several cinder cones in the San Francisco Mountains, northeast of Flagstaff, Arizona. The surface of this volcano is covered with fine, loose volcanic ash and cinders.

Sunset Crater is the only one of these Southwestern volcanoes that can be definitely dated. Lava and ashes from one or more of its eruptions completely covered the homes of Pueblo Indians living in the area. Some of these homes have been excavated, and by the tree-ring method, logs used in their construction have been dated at about 860 A. D. Houses built after the eruption are dated after 900 A. D. Hence the last eruption of Sunset Crater is believed to have occurred in the neighborhood of 885 A. D.

MODERN MAN AND THE PRIMITIVE AREA

By Dr. W. B. McDougall,
Regional Wildlife Technician.

One of the unique services that the National Park Service is required by law to perform is the preservation of primitive areas for the use and enjoyment of modern man. Now modern man, no matter how modern he may be, is still an animal. He is born, he grows, develops, matures, reproduces, and dies like any other animal. But he differs from other animals in his habits. He likes to have a comfortable house in which to live. He likes to have a telephone and a radio handy. He likes to take a bath in a porcelain bathtub, or under a shower, with hot and cold water, anywhere from twice a day to once a week, according to how modern he is, or thinks he is. And he likes to do all his traveling on wheels rather than by the natural method used by all other so-called higher animals.

Primitive man was quite a different animal, so far as habits are concerned. He needed only a very simple type of house, or none at all, and he knew nothing of telephones, radios, bathtubs, and automobiles. He obtained his food and clothing and other necessities of life from the native plants and animals of the region in which he lived. He was a native of the primitive area in which he resided, just as much as any other animals were native. Modern man, on the other hand, is not native to any primitive area. He is native to a sort of artificial environment that he has largely created himself, and in any other environment he is exotic.

The problem of the National Park Service is to permit this exotic animal, modern man, to use and enjoy primitive areas without changing the primitive nature of the areas. By primitive areas we mean areas in which the wildlife communities are unmodified by any activities of modern man. But that definition introduces another term that may need defining, namely, wildlife community. During the past two or three years, we have been hearing a great deal about the conservation of wildlife. Too often, however, we find that the conservation of wildlife means merely the conservation of game animals. To the personnel of the National Park Service it means much more than that. To us it means the conservation of all native species of both plants and animals. When we speak of a wildlife community, we mean a community of all native species of plants and animals living together in a natural habitat.

I would like to elaborate a little more on the characteristics of a wildlife community. Perhaps it can best be done by comparing it with a human community. In the latter, man is the dominant organism. He is so dominant that he controls the environment to such an extent that he determines almost absolutely what other organisms may live in the same community with him. Man, of course, is not the only kind of organism that lives in a human community. There are always some other kinds of animals, such as horses, dogs,

cats, mice, flies, and maybe cockroaches; and there are trees, shrubs, grasses, and flowers. These various kinds of organisms are not all present because man wants them to be present. He does not care particularly for the flies and mice, but they are all present because man is controlling the environment in such a way as to make a congenial place for all of these other organisms to live.

If, now, we compare this human community with a wildlife community, taking as an example a forest community, we will find that in a forest the trees are the dominant organisms. The trees control the environment almost as completely as man controls his environment, and they determine almost as completely what other organisms may live in the same community with them. There are, of course, many other kinds of plants and many kinds of animals living in the forest community with the trees and, again they are not all there because they are of any benefit to the trees. There are parasitic fungi and destructive insects, for example, which are far from beneficial to the trees. But they are all there because the trees are controlling the environment in such a way as to make a suitable environment for all of the various kinds of organisms.

In a human community, too, we have a more or less definite division of labor. Certain individuals in a human community have the function of growing food plants for the entire community. Others have the function of providing markets for the foods so that the other members of the community can get them. Still others take care of money in banks, and teach the young. And so we might go on with a long list of functions performed by the various individuals in a human community. Likewise in the wildlife, or forest community, there is a similar division of labor. The green plants manufacture food for the entire community. They are the only organisms that can actually manufacture food from raw materials. Certain mosses and other low organisms have the function of forming a ground cover to prevent too great a loss of water from the soil. Certain other organisms act as scavengers to get rid of the dead bodies of both plants and animals. And so we might go on with a long list of functions of the various individuals in this community, just as in the human community.

Perhaps the greatest difference between the human community and the wildlife community is in the fact that in the latter there is no such thing as altruism. In a human community there are always individuals who devote their lives to activities that are intended to benefit the community as a whole, or certain individuals in particular. In the wildlife community,on the other hand, it is each individual for himself, except, perhaps, in those cases in which a mother animal, for a time, takes care of her young. But this difference is due primarily to the lack of consciousness in the plant world, and the lack of what we commonly call intelligence in most animals. If we disregard these two lacking features, however, we find a striking resemblance between the two types of

communities. In spite of the fact that in the wildlife community every individual seems to exist for itself alone, the various kinds of organisms have lived together so long in the same community, generation after generation, that they have become adjusted into a sort of harmonious balance--balance between plants and animals; between hosts and parasites; between predators and those preyed upon; which is so near perfection that it is called the balance of nature. The interrelations and interdependence between the various kinds of organisms in such a community are so intimate and so intricate that no single species of either plant or animal can be removed; and no exotic species can be introduced, without upsetting the balance and initiating a whole series of disturbances. Such is the nature of the wildlife community as it was seen in primitive areas by the early pioneers who came into this country, and can still be seen today in some of our national parks and monuments. There remain two questions which I would like briefly to answer: Why should we preserve primitive areas for modern man, and how can modern man use primitive areas without spoiling them?

During the pioneer days of America, wildlife still had its greatest value as a source of food, clothing, and other necessities of life. These values still remain to a certain extent but they are far surpassed in modern times by esthetic, educational, and recreational values. As a means of enabling modern man to build up his health, his intellect, and his esthetic sense, the value of primitive areas can scarcely be overestimated. Our older national parks were in all cases set aside primarily to rescue from the immediate dangers of private exploitation, certain climax examples of nature's scenic achievement or geologic wonders. Little thought was given to plant and animal life. Soon, however, it began to be realized that the beauty of almost all park areas is due largely to plant life. In general, this is no more and no less true in parks than everywhere else. The whole surface of the earth is made beautiful by the plants that grow on it. Practically every object of interest in nature has its beauty enhanced by plant life. If it is a canyon or a stream, you will invariably find it placed in a green frame, formed by the green vegetation on either side, and much more beautiful than it would be without the frame. Furthermore, one of the most interesting things about this type of beauty, I think, is that it is constantly changing.

I remember one time I was standing at the top of Jupiter Terrace in Yellowstone National Park, talking to a group of tourists. This beautiful terrace is being rapidly built up by deposits of travertine and so is constantly changing. It is brilliantly colored by myriads of microscopic plants, the blue-green algae, that grow in the hot waters flowing over the terrace. As we stood there, I noticed an artist sitting up on the bank making a painting of the terrace. I called the attention of the tourists to the artist, and told them he was performing a very valuable service because never again would that terrace look the same as it did that day. The artist was preserving it for us on canvas as it was at that particular time, and that was a valuable service. But

I also called attention to another fact, namely, that Nature is the only artist that can paint a picture that will change every day and be beautiful all the time.

Plant life, then, is perhaps the greatest source of beauty in the universe. Add to this, animal life, and you have Nature's highest expression of esthetic beauty and charm. There is probably no normal modern human being who, before he becomes too fixed in his habits, cannot learn to enjoy the beauty of the primeval forest with its age - old trees, its undergrowth of flowering shrubs, and its moss-covered ground that bespeaks long years in making; none who cannot learn to enjoy studying the wood warblers and their calls as they seek their food high in the forest ceiling; or to seek out and become acquainted with the mammals that dwell in such a place, from the tiny shrew to the huge black bear or the lumbering moose. For such purposes as these, all plants and all animals have equal values, except, perhaps, that rare ones are more alluring because harder to find.

In the National Park Service we do not speak of "game animals", because we hunt with cameras instead of guns, and all animals and all plants are equally fair game. We stalk an animal, or seek an elusive wild flower, sometimes for days before we are able to get the sort of "shot" at it that we want. When we finally get it we get a much greater thrill than we could ever get by killing something. It takes all species of native plants and animals to make up a complete wildlife community, and for that reason we often find it necessary to give special protection to predatory animals in our park areas because they are so much persecuted elsewhere. I remember one good friend who was deploring the extermination of predatory animals in many places and who said to me: "Mac, it makes me mad to think that when my son gets a little older I will not be able to take him somewhere and show him a timber wolf running wild in its natural habitat". He was right in feeling that way, for the educational value of being able to see and study a wolf would be just as great as in the case of a deer.

I think I have sufficiently answered the question as to why we want to save some of the primitive areas with their wildlife communities intact for the use of modern man. The other question as to how modern man can use primitive areas without spoiling them, has also been partially answered. He must hunt with nothing more formidable than a camera; he must travel within the area on foot rather than on wheels; and he must leave nothing in the area that he took in with him and bring out nothing that he did not take in.

Proper land use is always a moot question in park areas. Some of our park lands have to be opened to intensive use of the automobile traveling public, but some of our primitive areas must be left intact in order that those who wish to do so may see and study complete wildlife communities just as those communities might have been seen and studied 150 years ago.

THE CAVALCADE OF THE SOUTHWEST

By Dr. Aubrey Neasham,
Regional Historian.

The National Park Service is recognized today as the federal agency having as its duty the preservation of the outstanding historic sites of the nation. Legally, by virtue of authority in the Historic Sites Act of 1935, this Service is obligated to do all in its power to insure that the heritage of the past, as exemplified in those sites, be passed on to the generations of the future.

Region III of the Service, comprising the States of Arizona, New Mexico, Texas, Oklahoma, Arkansas, and parts of the southern portions of Nevada, Utah, and Colorado, plays an important part in this national program of preservation. Here, in the southwestern portion of the United States, the white man has been active for 400 years. With such a background in an area almost untouched by the large population centers of the present day, the material evidences of the past are unusually abundant and varied.

"The Cavalcade of the Southwest", if we may think of those four centuries as such, is indeed an inspiring and dramatic parade, as depicted and centered in these historic sites. Before our vision pass in turn the stolid Indian, the Spaniard and the Frenchman, permanently leaving their marks in a land little known and often bewildering; and finally the citizens of Mexico and the United States, later comers, who through revolution, purchase, and war are able to expand in the directions and to the degree ordained by what some termed "Manifest Destiny".

The Spaniards were the first of the white men to come into these areas. Within half a century after the discovery of America by Christopher Columbus in 1492, they were well on their way. Pineda, Cabeza de Vaca, Friar Marcos de Niza, Francisco Vasquez de Coronado, and Hernando de Soto were among them. Anxious to solve the "Northern Mystery" and to find the riches which were thought to be there, each emblazoned his name in the pages of history. These explorations are commemorated today in historic sites.

Permanent colonization of the Southwest by the Spaniard did not occur until 1598, when Don Juan de Onate founded New Mexico. He established his capital at San Gabriel, north of present Santa Fe, near the Indian pueblo of San Juan. From that time onward, there was no stopping the advance of settlement. The touch of the Spaniard may be seen today in Indian pueblos, often in ruins, such as Awatovi in Arizona; and Hawikuh, Puaray, Pecos, Acoma, and Taos in New Mexico. Spanish-founded towns include Santa Fe in New Mexico, while among world famed missions are Tumacacori, San Xavier del Bac, and Guevavi in Arizona; Tabira (Gran Quivira) Pecos, and Quarai in New Mexico; and the Alamo, San Jose,

Espiritu Santo, San Juan Capistrano, la Purisima Concepcion, San Francisco, and Nuestra Senora de Guadalupe in Texas. Tubac and Tucson in Arizona, and la Bahia in Texas, were important presidios built for protection. In addition, ranchos were created, trade with Mexico was furthered, and some mining was done. Generally, the life of the Spaniard followed the grooves patterned by the civilizations of Europe, becoming in time tempered by the hardships of a far away frontier and strange peoples.

After the sixteenth century, the French began to follow the steps of the Spaniard into the Mississippi country. In 1685, La Salle founded Fort St. Louis in Texas, after exploring the Mississippi River. Arkansas Post was established in 1686 by Henri de Tonti in what is now Arkansas. John Law's famous "Mississippi Bubble" colony was settled at Dumas, Arkansas, in the second decade of the 1700's, and a fur-trading post was built by Francis D'Armand at Montgomery's Point in 1766. In 1802 Pierre Chouteau erected his post among the Osage Indians in the Oklahoma region. These and other sites like them left a French imprint which will never be erased.

The Mexican period, lasting hardly a quarter of a century, was in reality a continuation of the Spanish period in many ways, except for sovereignty and control by Mexico instead of Spain. The United States domination of the nineteenth century brought entirely new changes in the Southwest. Peoples of Anglo-Saxon heritage for the first time pushed on in numbers to these frontiers, established by Spain centuries earlier. Wherever they were, they too, left their imprints permanently in historic sites.

The enumeration of those sites would be almost endless. Some of importance would include: Indian battlegrounds, such as the Big Dry Wash in Arizona, Adobe Walls in Texas, and the Washita and Rush Springs in Oklahoma; Protestant missions- the Old Dwight Mission in Arkansas, and Union, Park Hill, Tallahassee and Council Hill missions in Oklahoma; Mexican Revolution sites- the Battle of Medina in Texas; Texas Revolution sites - the battles of the Alamo, San Jacinto, and Perdido in Texas; Mexican war sites - the battles of Palo Alto and Resaca de la Palma in Texas; Civil War battle sites - the battles of Val Verde and Glorieta Pass in New Mexico, Palmito Ranch in Texas, and Pea Ridge, Fourche Bayou, and Prairie Grove in Arkansas; forts - Bowie, Defiance, Apache, McDowell, Whipple, and Crittenden in Arizona; Marcy, Union, Sumner, and Stanton in New Mexico; Parker, Davis, Griffin, and Belknap in Texas; Towson, Gibson, Washita, Cobb, and Wayne in Oklahoma; and Fort Smith in Arkansas.

Boom or ghost towns would include - Tombstone in Arizona, Elizabethtown in New Mexico, Mobeetie and Tascosa in Texas, and old Perryville in Oklahoma. Among cattle trails are the

Chisholm, Goodnight, and Chisum; while trade and transportation routes would list the Santa Fe Trail and the Butterfield Stage route. The Old Stage Coach Inn in Texas, and the Etter and Log Cabin Taverns in Arkansas, could be grouped under taverns. Among houses of famous personages are Kit Carson's home and the Maxwell ranch house in New Mexico; the home of Stephen Austin and the Charles Goodnight ranch house in Texas; and the houses of Stand Watie and Sequoyah in Oklahoma.

Those sites of the Indian, the Spaniard, the Frenchman, the Mexican, and the American all played important parts in the "Cavalcade of the Southwest". Their influence is to be seen today in the widespread cultures which are here. To quote from an earlier paper. "This land of the Southwest, where many cultures are discerned but not easily separated, is unique in the United States. The evolution of the past, from prehistoric times to the present, may still be traced here in the living present."

Sand verbena plants, not known to occur anywhere else in the world, are growing in White Sands National Monument, New Mexico. The plants are botanically described as Abronia angustifolia.

A report on "Vegetation of the White Sands National Monument" has been written by Dr. W. B. McDougall, Regional Wildlife Technician. He says:

> "This (sand verbena)is one of the two endemic species of the White Sands. It is a member of the four o'clock family and not a true verbena. The flowers lack petals, but the calyx is colored like a corolla, and,since several flowers are clustered in a common involucre (wrapper), the plant is very beautiful when in bloom. This is one of the two plants that occur on the alkali flats west of the gypsum sand dunes and it also occurs abundantly in the valleys between the dunes, but it is not known to occur anywhere else in the world."

Evening primrose, the other local species, is described by Dr. McDougall as "a most gorgeous plant when in bloom". It occurs only in the intervening valleys between dunes.

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THE MEANING OF ARCHAEOLOGY

By Erik K. Reed,
Regional Archaeologist.

Some people like to collect arrowheads; others, ancient pottery. More than a few are fascinated by old skeletons, and vast numbers enjoy seeing the ruins of ancient cities. Archaeologists are interested in all these things, because of the collective story.

Archaeology is not merely the collecting of relics, nor the excavation of ancient ruins. It is the study of human history. Its aims are to discover the mode of life and the cultural equipment of every ancient people or tribe, at each period of its existence. This is done by establishing cultural continuities and time-relationships between groups and types of relics and remains. Eventually we shall piece together a complete picture-- a full story of the development of human civilization. The ultimate objective, like that of history, is to interpret this classification and narrative in terms of human, cultural, and ecological problems; to know or surmise, eventually, not only what happened but why it happened; and to determine what psychological and environmental factors cause the rise and decline of civilizations.

Ethnography attempts much the same thing as archaeology, with present-day or with recently primitive peoples. It deals not only with the bare facts of the economic, social, and religious life of primitive peoples, but also with the ecological and psychological reasons for these facts, and with the degree of success or utility of these facts. From this and from the results of archaeology, generalizations will some day be established covering all human behavior and human culture. These generalizations will-- or should-- profoundly affect our handling of the future. Problems of individual adjustment to society and to culture, of societal control of diversity of interests and desires, and of adaptation of society to environment, can best be solved when we know how other peoples in other times attempted to solve them, and to what extent their solutions succeeded or failed. Archaeology and ethnography have not reached the point where we can safely make generalizations. The tremendous mass of facts accumulated has not been thoroughly digested and synthesized; and there are more facts to be gathered. A concrete example of the usefulness of these two sciences is their importance in colonial administration, as in African and Asiatic possessions of England and France, and in the comparable case of Indian reservations in this country. It is impossible to handle a subject people successfully without fairly extensive knowledge of their social organization, religious beliefs, economic life, and past history.

In addition to broadening our own horizons, by gaining added knowledge of our past and the pasts of other peoples, archaeology affects specific major problems of today. As the broad facts of human

history become more generally known, there will be less of this nonsense about racial superiority and the alleged importance of racial purity. Interest in, and tolerance or friendship for various people alien to us, will increase with our added knowledge of their history and of the cultural achievements of their ancestors. Lin Yu-tang, the contemporary Chinese writer, has said that, as psychiatrists cure people by making them review their past, so mankind can profit by reviewing its own past.

There is justification for archaeology simply in the fact that people are interested in the subject and want to know about it. Spectacular finds of objects of high intrinsic or aesthetic value arouse public interest. Consider such cases as the tomb of the Pharaoh Tutankhamen, in Egypt's Valley of the Kings; Monte Alban, in southwestern Mexico; and Chiriqui province, Panama. We are, after all, interested in ourselves, and that includes our past. "The proper study of mankind is mankind."

The methods by which evidence is gathered are, in the case of ethnography, going out and living among a primitive people, observing things and asking questions; in archaeology, by collection of relics on the surface or by digging. It is not a matter of simply scooping up things, or haphazardly shoveling into a site. Meticulous care must be exercised in digging, to avoid breaking objects or destroying evidence. What is most important, detailed notes must be made of just how and where everything is found; the relation of each object found to other artifacts, and to walls and floors; the depth to which things are buried by accumulation of silt or refuse. Only by such detailed records can associations between trails be established, and historical developments discovered. The oldest material will normally be found at the bottom of an accumulation of silt or refuse, or in the deepest portion of a site; and the latest, on the surface. Consequently, the depths of all objects must be recorded, and material from different layers and from different rooms must be kept separate. Even in collection of objects from the surface, accurate record must be made of the location and circumstances in which each object is found.

The material found and features observed must then be exhaustively studied in the laboratory. Each class of artifact must be sorted into types, and any possible temporal relations between these types must be established. Comparisons then are made between these types of artifacts and types found elsewhere. Only after extensive research in the laboratory and in the library, and by preparation of a full report for publication, is an archaeological job completed. The actual excavation is less than half of it. Further, there is laboratory work of the nature of museum preparation--preservation and restoration of specimens for purposes of more thorough study and of exhibition.

Pottery is relatively easy, requiring merely washing, sort-

ing, and-- as far as possible-- putting together broken vessels. Thousands of potsherds are found in every southwestern excavation; only a small proportion can be put together to restore vessels, but the fragments themselves are extremely important in study, perhaps the most useful single thing. Stone objects seldom require any treatment other than gluing together broken fragments. Artifacts of bone or wood, textiles and basketry, etc., often require very careful cleaning and treatment with a solution in acetone or a paraffin or celluloid preparation. Skeletons usually require similar treatment. Charcoal and fragments of wood are always saved, in the hope that they may yield tree-ring dates.

Buildings themselves can receive preservation measures. Ruins of masonry can be stabilized by re-laying the upper courses of walls in bitudobe mortar and other measures, as the National Park Service has done and is doing at Bandelier and Chaco Canyon National Monuments, in New Mexico. Preservative treatments for plaster and for adobe buildings are being tested by the Service.

A great deal can be learned from each class of find. For instance, the extent and arrangement of buildings give some indications of the population and, in a most general way, the social organizations. Various otherwise incomprehensible objects can, when correlated with ethnological knowledge, give clues to religious life. Skeletal material can be utilized to indicate not only the racial affinities of a group, but their approximate average life expectancy, and the approximate incidence of infant mortality. Stone and bone artifacts indicate various aspects of economic life.

Pottery is the most useful single class of find to the archaeologist in establishing chronological sequences and other relationships, because of its great variation between periods and between areas. Types of buildings, of arrowpoints and stone axes, of bone awls and shell ornaments, change relatively little spatially or temporally compared to pottery, and overlap greatly. But the pottery of any area in any period is quite distinct. An example of the importance of the study of pottery is easily given: If we excavate a ruin in southern Arizona, treering material is not usable in establishing dates; but if we find in that ruin, sherds of a type of pottery made in northern Arizona and traded to the people in the south, we can approximate the date of our site, since pottery-types are fairly well correlated with tree-ring chronology in Northern Arizona. At least we know that our site was roughly contemporary with a certain period and a certain type of life in the north. Further, one does not ordinarily find tree-ring material associated with burials;but one does find very frequently, offerings of pottery with each skeleton. Only by knowing the development and succession of pottery types at a site can we ascertain the period to which each burial belongs.

PINON-JUNIPER FORESTS

By W. Ward Yeager,
Associate Forester.

The forest of the semi-arid Southwest is composed primarily of only two trees, pinon pine (Pinus edulis) and Utah juniper (Juniperus utahensis). In some parts of the forest the Pinus edulis is replaced by Pinus cembroides or Pinus monophylla, and the Utah juniper is replaced by Juniperus monosperma (one-seeded juniper) or Juniperus pachyphloea (alligator bark juniper). This change of species does not change the general character of the forest, but it does increase the range of the forest type. The pinon-juniper forest is the typical forest cover of the semi-arid portions of Arizona, New Mexico, southwestern Colorado, southern Utah, and southern Nevada. Within this range its occurrence is determined by elevation and precipitation. The usual elevation of occurrence is between 4,000 and 8,000 feet above sea level. On the lower fringe of the range where temperatures are high and precipitation low, the forest is associated with desert vegetation. On the high limits of the range where lower temperatures and higher precipation are suitable, the associated forest cover is composed primarily of yellow pine (Pinus ponderosa). Within the extreme range limits are extensive pure stands of pinon-juniper.

The individual trees of the forest are short and much branched with a dense low crown. Seldom do the trees exceed a height of thirty feet or a diameter of two feet. The stand is most dense in the upper elevation limits. At Mesa Verde National Park, in Colorado, there are about 730 trees to the acre, pinon pine making up about two-thirds of the number, and juniper one-third. In the lower range limits where the juniper predominates, the number may drop to 200 trees per acre. Such a forest is dwarfed by comparison with other pine forests of the West, and for this reason there is some tendency to ignore its forest character. When compared to adjacent desert vegetation of the lower elevations, the pinon-juniper attains its rightful place in the scheme of nature.

To commerce and the lumber industry, pinon and juniper are of low values because at best they can furnish only fence posts and fuel wood for local comsumption. The pinon nuts, or seeds, have a certain relative value as food for the Indians and Mexicans who live within the forest, but the commercial possibilities have been developed only slightly. Within our national parks and monuments we are not concerned with commercial aspects but rather with recreation and conservation values. This forest protects a great proportion of the Southwest from excessive wind and water erosion, and improves the recreational attractiveness of all areas where it occurs.

The development of parks often has a far-reaching influence on the forests of our high-use areas -- an influence that is more pronounced in a pinon-juniper forest. The delicate balance of nature which permits this forest to grow is so fine that extreme caution must be used in making adjustments. Minor changes in drainage and exposure caused by construction of roads, parking areas, sewer lines, water lines, etc., may so reduce the vitality of existing trees that they succumb to insect and disease attack, and are broken or uprooted by wind. The pinon can rarely readjust itself to physical changes or abuse. The juniper, on the other hand, is able to do so. Along a trench or bank slope a third of the roots of a pinon may be cut off, and the pinon will usually die. Under similar conditions some of the branches of a juniper will die and some will live. Thus the crown balances the roots and life continues. Pinon grows comparatively rapidly, and dies young (200 years). After death, it quickly disintegrates. The juniper grows slowly, lives for centuries, and after death may remain standing for fifty years. It is slow to deteriorate even when actually in contact with the soil. Where this forest type is subject to physical abuse, we must expect tree loss. Major control projects of Ips species in pinon pine have been carried out in Mesa Verde and Grand Canyon National Parks, where the insect condition now appears endemic. Insect loss is a normal condition and our aim is only to prevent the abnormal.

The tree loss from human influence, and from insects and disease, is far overshadowed by fire, even though fire occurrence in the Southwest is comparatively low. Man-caused fires are exceedingly few, but they usually occur in areas of high use where individual tree values are great. Lightning fires are not numerous compared to the Northwest where one lightning storm has been known to start 96 fires within a national forest. It was not intended that the pinon-juniper forest should burn over and no provision was made by Nature for natural reforestation.

Neither pinon nor juniper can reestablish itself by root sprouts or coppice. All seeds are readily burned in any hot fire. Pinon produces an abundant seed crop only once in five to seven years. The juniper produces only one seed to the berry, and a small percentage of each year's seed is viable. Rodents destroy most of the seeds produced in normal years. The seed of either species is too large to be scattered over a burned area by wind. Neither birds nor rodents scatter seed into a burned area, except on a narrow strip around the margin. Natural reforestation of a burn is negligible. Artificial reforestation is slow and expensive.

Because fires are controlled while small, and occurrence is infrequent, no spectacular display is before the public to make the people conscious of the fire danger. The 4500-acre fire which occurred on the west boundary of Mesa Verde National Park in 1934 furnished convincing proof that a pinon-juniper forest can burn with a vengeance. The fire occurred when the thermometer register-

ed 102°, the humidity was below 8 per cent, and a strong wind was blowing from the southwest. These conditions are not uncommon. The fire burned every living thing within its perimeter. Heat was so intense that the sandstone rocks on the surface were burned until they flaked off to a depth of an inch, and soil retained no humus in the upper four inches. The first season following the fire, wind and water erosion was excessive. Now, five years later, only annual plants and shrubs which can sprout from their roots, make up the ground cover. No pinon or juniper exists within the area to reestablish a forest cover. Artificial reforestation is being attempted, but the process is slow.

The very fact that fires do not occur frequently adds to the problems of protection because personnel organization is difficult to maintain, and experienced fire bosses are not to be had locally. The Grand Canyon National Park has enough fires each year to keep fire fighting personnel trained and experienced, but the majority of Southwestern park areas have so few fires and, in some cases, such a small personnel that, should a forest fire occur either in or near the park and not be confined to a small area, a disaster could occur which would destroy for generations the forest cover of the entire area. This potential disaster occasionally causes adequate fire protection to appear unreasonably high, but we must, if we are to protect that which is entrusted to us, prepare for the fire which we hope will never occur.

Golden eagles that are so large they have been captured by lassos thrown by cowboys are reported from the Mexican section along the Rio Grande included in the proposed Big Bend International Park of Texas and Mexico.

The golden eagle, common in Mexico, southern Texas, and New Mexico, sometimes attains a wingspread in excess of seven feet. It feeds largely on jackrabbits, ground squirrels, and carcasses of animals.

Occasionally, according to reports the National Park Service has received from Mexico, one of these large birds is roped by a cowboy who, after allowing the eagle to gorge itself on an animal carcass, suddenly comes from under cover to run down the confused bird, which can take to the air only with the greatest effort.

This practice would be illegal after establishment of the park because national parks in Mexico, as in the United States, are sanctuaries for wildlife.

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TUMACACORI MUSEUM

Talk Given by Hillory A. Tolson, Regional Director,
at the Dedication of the Tumacacori National Monument Museum
near Nogales, Arizona, on April 23, 1939.

We are assembled here today to dedicate the Tumacacori National Monument museum. Secretary of the Interior Harold L. Ickes; United States Senator Carl Hayden; Director Arno B. Cammerer, Associate Director A. E. Demaray, Dr. Carl P. Russell, and Frank Pinkley, and other officials of the National Park Service; Miss Mary F. Lesley of Phoenix, Arizona; local civic organizations; and certain educational and religious institutions are responsible for its planning, financing, and construction.

This museum symbolizes the passage of some 400 years since the coming of the white man to the Southwest. It emphasizes the part played by the Tumacacori Mission in the chain of missions founded by Father Kino some 250 years ago.

Why does the Government desire to interpret, through the medium of exhibit material, what occurred here in the past? Why has it been deemed worthwhile to spend funds to build this structure? These questions can be answered by noting the importance of Tumacacori National Monument.

The American people are beginning to realize that the material remains of their predecessors, as evidenced by historic buildings and sites, are worth saving. Such sites tend to keep alive the great and dramatic events of our history and to indicate to us the economic, political, and social phases through which our forefathers passed.

The citizens of the United States have delegated to their Congress and to their President the duty of preserving these sites. The Congress and the President, in turn, have made the National Park Service of the Department of the Interior the Federal Agency responsible for carrying out the will of the people in this matter. Tumacacori Mission, as a nationally important historic site, is being preserved and administered by that Service for this and future generations.

What a story is told by the ancient walls of Tumacacori Mission! It symbolizes the cavalcade of the Southwest. Desert Indians--Pima and Papago--living through periods of peace and war before the coming of the white man. The Spaniards--de Vaca, de Niza, and Coronada--constituting the 16th Century exploring vanguard of later legions to come. Father Kino- on the trail from Sonora, surrounded by soldiers, Indians, pack animals, and stock; and con-

structing, during the early 1700's, the Tumacacori Mission as one of many. The people of the Mission--their daily life portrayed here in the implements of mining, gardening, harvesting, manufacturing, and trading. The neophyte Indians--kneeling at mass in awed reverence. Soldiers--protecting the outposts of empire for the King of Spain. The Franciscan missionaries--succeeding the Jesuits in 1767, and building a new mission upon the site of the old. Indians in attack--evidenced by the burning of Tumacacori by Apaches in 1824. Successors to the Mission fathers--crumbling walls, treasure hunters, and United States citizens. Finally, the National Park Service with its program of preservation and informative exhibits.

These have been the highlights of Tumacacori's past as portrayed by the Mission and the exhibits installed in this building. Posterity will know the story more fully.

As a representative of the National Park Service of the Department of the Interior, I hereby dedicate this museum to the service of the people of the United States.

Whipsnakes are catching sharp-toothed bats and swallowing them head first without being bitten, in the prehistoric ruins at Casa Grande National Monument, Arizona. The method of capture has not been determined. On three occasions, when an approaching Ranger frightened the snakes, the bats were released but were so badly crippled they could not fly.

Many of these bats, during the day, remain in large cracks in the walls and above doorways of the ruins. It is possible the snakes lie in wait for the bats to return from the night flight, and then capture them as one or more enter particular cracks.

Mummy Cave, in Canyon de Chelly National Monument, Arizona, contains more than 100 skeletons which have lain there undisturbed since 1804. In that year, a band of Navajo warriors had gone on a raid, leaving the old men, women, and children, as they thought, safely sheltered in a large cave high on the canyon wall. But a band of Mexicans on a raid into the Navajo country discovered the cave, laid siege to it, and massacred all the Navajos.

When the Navajo warriors returned, they found all their relatives had been killed. Navajos have since avoided the cave. Only a comparatively few white people have seen it.


DEPARTMENT OF THE INTERIOR