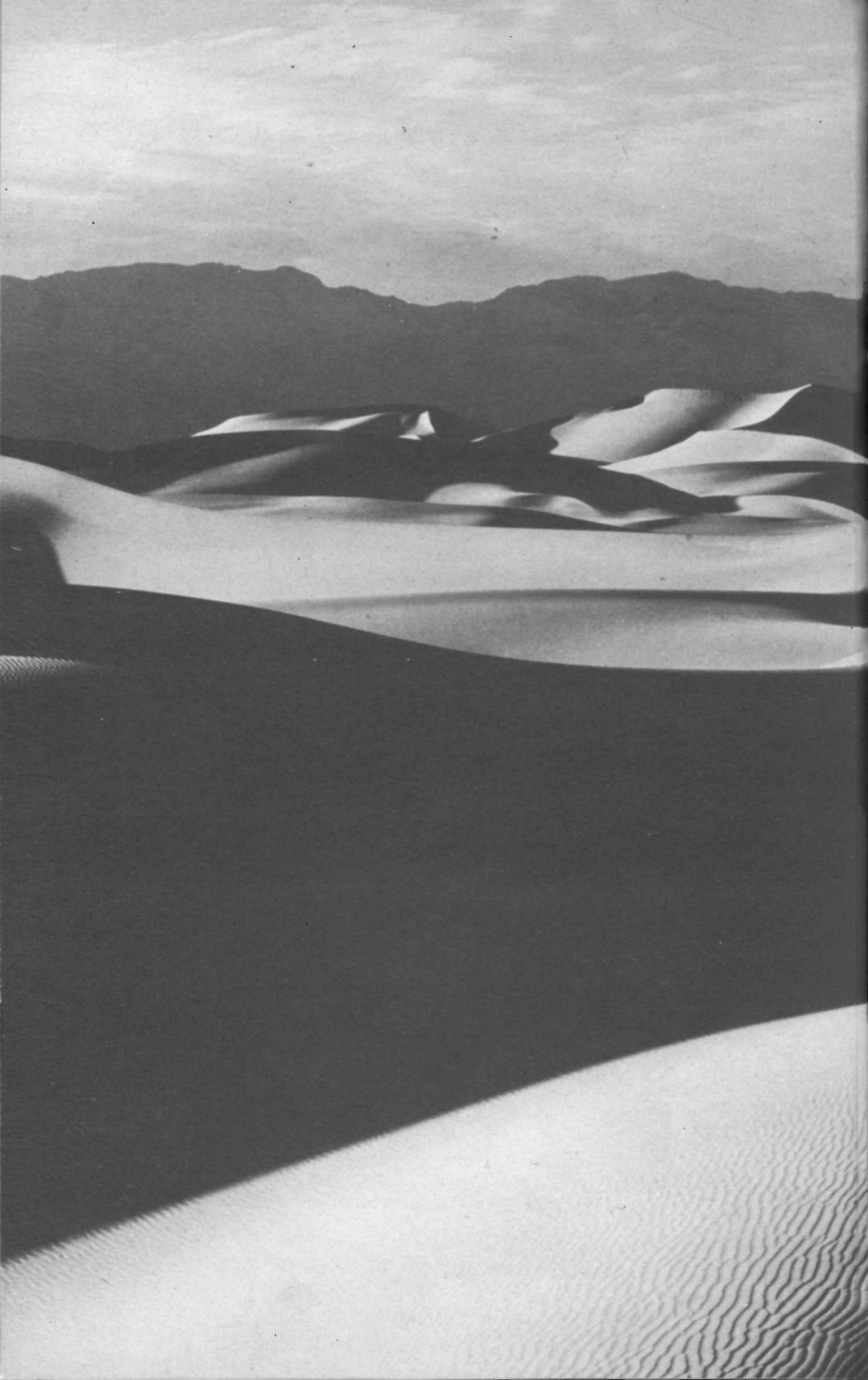


**DEATH
VALLEY**

NATIONAL MONUMENT

California



DEATH VALLEY NATIONAL MONUMENT

California OPEN ALL YEAR

Contents

Scenic Attractions 2

Suggested Trips in Death Valley 4

History 7

Indians 8

Wildlife 9

Plants 12

Geology 18

How To Reach Death Valley 23

 By Automobile 23

 By Airplane, Bus, or Railroad 24

Administration 25

Naturalist Service 25

Free Public Campground 25

Accommodations 25

References 27



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DEATH VALLEY National Monument was created by Presidential proclamation on February 11, 1933, and enlarged to its present dimensions on March 26, 1937. Embracing 2,981 square miles, or nearly 2 million acres of primitive, unspoiled desert country, it is the second largest area administered by the National Park Service in the United States proper.

Famed as the scene of a tragic episode in the gold-rush drama of '49, Death Valley has long been known to scientist and layman alike as a region rich in scientific and human interest. Its distinctive types of scenery, its geological phenomena, its flora, and climate are not duplicated by any other area open to general travel. In all ways it is different and unique.

The monument is situated in the rugged desert region lying east of the High Sierra in eastern California and southwestern Nevada. The valley itself is about 140 miles in length, with the forbidding Panamint Range forming the western wall, and the precipitous slopes of the Funeral Range bounding it on the east. Running in a general northwesterly direction, the valley is narrow in comparison to its length, ranging from 4 miles or less in width at constricted points to perhaps 16 miles at its widest part. It is a region of superlatives. Approximately 550 square miles of the valley floor are below sea level; and Badwater, 280 feet below that datum plane, is the lowest land in the entire Western Hemisphere. Telescope Peak, towering 11,325 feet above the valley floor, probably stands higher above its immediate surroundings than any other mountain in the 48 States. Death Valley held, until quite recently, a world's record for high temperatures, and it is one of the driest places in the West. In a standard thermometer shelter at Furnace Creek a maximum air temperature of 134° F

AN INTERESTING
GEOLOGICAL
FORMATION

in the shade has been recorded. On the salt flats near Badwater, in the deepest part of the valley, it has probably been hotter still. These extreme temperatures, of course, are unknown except during the summer months; through the winter season, from late October until May, the climate is ideal. The days are warm and sunny for the most part, and the nights are cool and invigorating. The valley is famous for consistently fair weather, lack of rainfall, and extremely low humidity. One record for an entire year showed 351 clear days; and the average annual precipitation over a period of many years is 1.4 inches.

The majority of the areas under the jurisdiction of the National Park Service are best known for their summer attractions. Death Valley rounds out the system by providing a vast recreational area with a mild winter climate. It enjoys the same climatic conditions that have made other desert regions famous as health resorts.

SCENIC ATTRACTIONS

The pen of Ruskin could not adequately describe the scenery of Death Valley. It is so vast, so minute in detail, so colorful, so changeable under sunlight and cloud, and time of day and year. The pastel colors of the rocks, intricately carved and bare of vegetation, the browns and hazy purple masses of the distant mountains, the wide, white expanses of salt and alkali, the sweeping curves of sand dunes and alluvial fans—all must be seen and carried in visual memory. Nor can one grasp the whole in one short trip. A day, or even a week does not suffice. People come again and again, finding new thrills and inspiration on each succeeding visit.

Dantes View is perhaps the most popular of the lookout points, and the country along the way, such as at Zabriskie Point, is colored and carved in infinite variety. From Dantes View, perched on the rim of the valley, 5,700 feet above the floor, one can view Badwater and distant Mount Whitney at a single glance. To the north in the hazy distance, lies a white mass of rock that marks the northern extremity of the valley, nearly 100 miles away. To the south the Avawatz Mountains block the other end. All around are highly colored rocks, and across the valley the comparatively somber Panamints, topped by Telescope Peak, stand out sharply in the thin air.

The complement to Dantes View is Aguerberry Point, on the opposite side of the valley, affording an unequaled view of the brilliantly colored eastern wall. On the same trip one can visit Panamint Valley, Wildrose Canyon, and the charcoal kilns, traveling for the most part over good oiled roads.



CHECKING STATION AT THE ENTRANCE TO THE MONUMENT

Perhaps the most spectacular trip from the point of view of color is that down the east side road to Badwater and beyond. One gains a more intimate knowledge of the country seen from distant views in such side trips as Golden Canyon and the incomparable Volcanic and Artists Drives. At the Salt Pools one can walk out on a trail through the Devils Golf Course to pools of concentrated brine. Nearly pure rock salt, covering thousands of acres, has been dissolved and recrystallized to form myriads of rough, pointed pinnacles from a few inches to more than 4 feet in height. On a still day the salt can be heard to snap with a metallic sound as the pinnacles continue to grow. One can easily imagine the barrier even to foot travel that the Golf Course formed before the present cross-valley road was constructed.

The Natural Bridge, while not spectacular, is well worth a visit. A few miles farther, at the edge of the pool at Badwater, one stands on the lowest dry land surface in three continents; and the third lowest in the world. Seemingly high above the parking space, on the rocky wall of the mountain, is a sign indicating sea level.

On to the south a new vista opens up with every curve of the oiled road. The trip up the west side of the valley completes the "south loop". Here along the line of the old borax freight road, are a number of interesting

stops, such as historical Bennetts Well, graves of Shorty Harris and Jimmy Dayton, and the Eagle Borax Works.

The vast extent of the valley is further appreciated on a trip north to Scotty's Castle and Ubehebe Crater. Standing on the edge of this deep, highly colored bowl formed by a volcanic explosion, one can look nearly 30 miles farther up the valley. Scotty's Castle is a man-made wonder nestled in the weirdly colored rocks of Grapevine Canyon, a few miles from the valley floor. Built by Walter Scott, ex-cowboy of Buffalo Bill fame, and his partner, A. M. Johnson, the castle is an unforgettable sight. Nestled against the dark sun-baked hills, with massive gates blocking the bridge that gives entrance to the grounds over the wash, it has the appearance of a medieval stronghold guarded by its moat and portcullis. All that is lacking is the drawbridge. Of concrete construction in Provincial Spanish architecture, with towers and gardens, pools and plazas, it is as fantastic as the country around it.

The sand dunes area near Stovepipe Wells completes the desert picture. Rippled by the winds, slowly changing in graceful curve and contour, they are best seen when the sun is low. Then their beauty is accentuated by deep shadow and sharpened crest. Mosaic Canyon, close by, is so named because its walls are partially formed by an eroded and polished conglomerate, whose pebbles contrast strongly with the color of the matrix to form a striking natural mosaic. Thin slabs of copper-colored limestone are found here that ring, when struck, like a silver bell.

The oiled road through Hells Gate and Daylight Pass leads to the famous ghost town of Rhyolite, Nev., outside the boundary of the monument. A turn-off on this road swings back through Titus Canyon and into the valley. While the beautifully colored amphitheater at the head of Titus Canyon and its narrow, winding lower part are among the most spectacular portions of the monument, this trip should not be attempted without first consulting National Park Service authorities, as the road is often washed out and impassable.

SUGGESTED TRIPS IN DEATH VALLEY

Below are listed a few of the more popular trips in Death Valley that will permit the visitor to see the most in a limited amount of time. Further information may be obtained by asking a ranger or other National Park Service official.

DANTES VIEW. A half day should be allowed for this trip, preferably the morning. The trip includes colorful vistas of tilted lake beds, tortuous canyons and an abandoned borax mine, climaxing with the awe-inspiring



Fraser, Pomona, Calif.

CACTUS GARDEN AT SCOTTY'S CASTLE

view from Dantes that encompasses the entire valley, 5,700 feet below. A log of important points along the way follows:

- | | | |
|---------------------------|--------------------------|-------------------|
| 0.0 Furnace Creek. | 7.3 20-Mule-Team Canyon. | 24.4 Dantes View. |
| 3.2 Zabriskie Point Road. | 13.5 Ryan Road. | |

BADWATER. A half day is required for this trip, and the afternoon is the most favorable time of the day, hence it can be combined with the Dantes View trip to fill out the day. Included along this route is the most colorful scenery in Death Valley; the barren salt wastes, a natural bridge, and Badwater, the lowest point of land in the Western Hemisphere, 280 feet below sea level.

- | | |
|--------------------------------------|------------------------------|
| 0.0 Furnace Creek. | 6.0 Devils Golf Course Road. |
| 2.0 Golden Canyon Road. | 11.2 Salt Pools Road. |
| 4.6 Mushroom Rock. | 13.3 Natural Bridge Road. |
| 5.0 Volcanic and Artists Drive Road. | 16.8 Badwater. |

SAND DUNES AND MOSAIC CANYON. A half day should be allotted for this tour that takes the visitor to the ruins of an early borax mill, a canyon

carved out of salt by a miniature stream, the gracefully turned sand dunes and the multi-colored rocks of a water-polished canyon.

- | | |
|--|--------------------------|
| 0.0 Furnace Creek. | 4.3 Monument. |
| 2.6 Harmony Borax Works and Mustard Canyon Road. | 19.0 Sand Dunes. |
| 3.4 Gnomes Workshop Road. | 24.6 Mosaic Canyon Road. |

UBEHEBE CRATER AND SCOTTY'S CASTLE. A full day is required for this trip that includes the spectacular crater and the man-made wonder of Death Valley Scotty's Castle, as well as numerous scenic points enroute.

- | | |
|-------------------------------------|---|
| 0.0 Furnace Creek. | 54.0 Grapevine Canyon. From this point the left-hand road leads for 5 miles to Ubehebe Crater. The right-hand fork leads to Scotty's Castle, 3 miles distant. |
| 4.3 Monument Headquarters. | |
| 17.0 Junction of road to Lone Pine. | |
| 34.4 Exit road from Titus Canyon. | |

SOUTH LOOP. Most of the day will be used on this trip. Included along the route are the points mentioned in the Badwater tour, and a continuation beyond Badwater along the foot of the Black Mountains, across the southern neck of the Valley, and return along the base of the Panamint Range where camped a party of early pioneers in 1849.

- | | |
|-------------------------------------|-------------------------------|
| 0.0 Furnace Creek. | 74.0 Tule Spring. |
| 16.8 Badwater. | 82.3 Devils Golf Course. |
| 44.0 Ashford Mill. | 83.8 East-west roads junction |
| 45.0 Ashford junction (turn right). | 89.8 Furnace Creek. |
| 66.7 Bennetts Well. | |

TITUS CANYON. A full day is required for this tour that includes ghost towns, colorful mountains, a spectacular, sheer-walled canyon.

- | | |
|---|--|
| 0.0 Furnace Creek. | 49.7 Leadfield (ghost town). |
| 11.7 Junction of road to Beatty (turn right). | 52.2 Klare Spring. |
| 28.4 Daylight Pass Ranger Station. | 58.2 Mouth of Titus Canyon. |
| 34.7 Junction of Titus Canyon Road (turn left). | 60.8 Main road (turn left to return to Furnace Creek). |
| 46.5 Bloody Gap. | 95.2 Furnace Creek. |

HIGH PANAMINT. A day will be required for this trip that takes the visitor past the Sand Dunes to a resurrected ghost town, an outstanding view of the valley, ancient charcoal kilns, and finally to the crest of the Panamint Range, from which point a good trail leads to the summit of Telescope Peak, 6.5 miles distant.

- | | |
|---|---|
| 0.0 Furnace Creek. | 45.3 Aguerberry Point Road. |
| 17.0 Junction of Lone Pine and north highway (turn left). | 54.0 Junction Wildrose Canyon Road. |
| 34.0 Emigrant Junction Ranger Station (turn left). | 61.2 Charcoal kilns. |
| 38.4 Emigrant Spring. | 62.0 Thorndykes. |
| 44.3 Skidoo Road. | 62.5 Mahogany Flat and trail to Telescope Peak. |



Grant photo

THE REMAINS OF THE OLD HARMONY BORAX WORKS

HISTORY

The Spaniards of early California may have been in Death Valley, but if so, no record remains. Possibly the aborigines had warned any would-be discoverers to stay away from "Tomesha" (meaning "ground-afire"), the Indian name for Death Valley.

John Charles Frémont, in 1844, probably saw the extreme southern end, but it remained for a band of half-starved emigrants, pushing westward on a supposed short cut to the newly discovered gold fields, actually to discover Death Valley in the winter of 1849. They were lost in the wilderness, hungry and sick of the trail, and the wide salt floor of the valley with the towering Panamints beyond were a last blow to their morale. Losing all semblance of order, the train split up in every direction. Some went up the valley; some turned to the south. The Jayhawker party and a few others, abandoning most of their equipment, found their way eventually over passes in the Panamints, and crossed the Panamint Valley and the Mojave Desert. Suffering tremendous hardships, and losing a number of their members, they finally reached the coast.

The Bennett-Arcane party, however, crossed the salt flats and camped for 3 weeks in the vicinity of what is now called Bennetts Well. Manly and Rogers were sent on ahead in a desperate attempt to find a way to

civilization and to bring help if possible. Making a trip of heroic proportions, they finally returned and led their party through to the coastal region without further loss of life. Pausing on the crest of the Panamints, the weary emigrants looked back across the valley, that tremendous barrier that had caused so much privation and suffering, and cried, "Good-bye, Valley of Death." Thus Death Valley was christened. It has never known another name.

In the next few years some of the Forty-niners came back, paving the way for other prospecting parties. Men searched for the lost Gunsight Lode, the Breyfogle, and other fabulous gold and silver mines. Sometimes they struck it rich in the rugged peaks and barren canyons that shut the valley in from the surrounding, less forbidding desert. Panamint and other picturesque mining camps of the vicinity lived their short lives and died. Itinerant prospectors, prodding their burros from one spring to the next, following Indian trails, or beating out new tracks, crossed and recrossed the range from one end of the valley to the other. Sometimes they were careless, or not acquainted with the country. They wore new boots, lost their burros, or lingered too long on the floor of the valley in summer. Their carcasses, dried and picked clean by kit fox and raven, were found eventually and buried hurriedly beside the trail. Rhyolite, Skidoo, Greenwater, Harrisburg, boomed and passed on, leaving only scattered piles of tin cans and bottles or tumbled adobe walls to mark the site.

Boron minerals (popularly called borax), rare throughout most of the world, were collected by gangs of pig-tailed coolies on the soupy mudflats of the valley floor. "Cotton-ball" borax was refined at the old Harmony Mill and freighted over agonizing miles of desert to Mojave or Barstow, in huge, high-wheeled wagons drawn by strings of 20 mules. The 20-mule team became a trade-mark and a symbol. Death Valley was a hard country still.

Borax was eventually responsible for the partial taming of the valley, however. A railroad was built to its edge when new deposits were developed. Families came to stay. Adventurous visitors drove their cars into the valley, cursed its then abominable roads, but came again. The general public rediscovered Death Valley—found it a region of terrifying distances, riotous colors, warm winter sunshine.

INDIANS

It would seem that in this most arid and inhospitable region in the West, no man could live for long without access to supplies from more favored lands. Certainly no white man could live off the country for any length of time; but for centuries the Death Valley region has been inhab-



ONE OF THE TWENTY-MULE BORAX TEAMS USED IN DEATH VALLEY IN THE 80'S

ited by a small offshoot of the Shoshone Nation, called by Coville the Panamint Indians. Driven from their homes to the North many generations back, the Panamints gravitated to Death Valley, where they were least molested by their more warlike brother. Capable of great endurance, ingenious in the utilization of every edible or otherwise useful plant, eating any animal that they could shoot or catch, following the seasons in incessant migration from valley floor to mountain crest, they managed to survive. With the coming of the white man their numbers were decimated by disease and loss of old customs and arts. At least one still lives that remembers the "dirty-faced men", as they called the bearded forty-niners.

The damage wrought by civilization is being repaired, however; a model Indian village has recently been constructed just south of Furnace Creek ranch. Garden plots are being made available, old arts are being revived, and a trading post will be established. Once more the Panamints will be a self-sustaining tribe.

WILDLIFE

Animal life is surprisingly abundant, in contrast to the popular belief that nothing lives or grows in Death Valley. True, few animals are seen



Grant photo

AN INDIAN RESIDENT OF WILDROSE CANYON



Grant photo

THE WICKIUP OF THIS OLD SHOSHONE INDIAN

by the casual visitor because many are nocturnal, and all are shy. But an occasional antelope-ground squirrel, his tail flattened over his back, scurries in terror across the road. Coyotes sometimes howl at the moon from neighboring hills. The little kit fox, all eyes and ears and tail, can frequently be seen along the roads in the evening. Kangaroo rats, wood or trade rats, and numerous other smaller rodents inhabit the mesquite thickets; and their numbers greatly increase during the spring months of wet years.

In the high country animal life is more varied and abundant. The desert bighorn roams the rocks and is thought to be increasing under careful protection. The big-eared, sonorous burro, disliking the work of packing prospectors' supplies, has long gone wild and increased in numbers. Their hoofprints and criss-crossed trails mark the slopes of nearly every range in the Death Valley region.

Lizards are numerous, except for a few weeks during the height of the winter when most of them go into hibernation. The huge, ugly, vicious appearing, but entirely harmless, chuckawalla can be seen sunning himself among the rocks. At the other extreme is the tiny banded gecko, weak and thin-skinned, looking like the young of some larger form. The gridiron-tailed lizard arches that striped appendage and flashes for cover at your approach. A little brown shouldered lizard is a common camp visitor. Many, such as the several varieties of "horned toads", are usually passed unseen, as they remain motionless and blend with the sand and rocks.

Snakes are comparatively rare, the valley floor being too hot for most species during the summer months.

Approximately 160 species of birds have been recorded below the sea level contour. Most of them are only migrants, or winter visitors, but 14 species make the valley floor their permanent home. The ludicrous road-runner, long and skinny, stalks among the mesquite bushes in search of lizards or insects. The big black desert raven circles gracefully overhead, or flaps along awkwardly if the day is still. His raucous croak can sometimes be heard for miles. The ubiquitous rock wren makes his home from Badwater to Telescope Peak. Quail frequent the campgrounds, a wary eye cocked for the several types of hawks. On moonlit spring evenings the killdeer screams his eerie call across the flats. The Say phoebe, western meadowlark, mourning dove, and several sparrows can also be seen any time of year; and water birds rest from their migrations at any open pool.

Insects abound, but almost never prove annoying. Even fish are not left out of the faunal picture. In Salt Creek and at Saratoga Springs are found thousands of "hell carp" or "desert sardines", *Cyprinodon macularius*, tiny fish subsisting in salty water. This is a "relict" fish—all that is left

of the once abundant ichthyological life of the great inland sea that is now Death Valley.

PLANTS

More than 560 species of native plants are known from the Death Valley watershed in the monument. Since the Death Valley Expedition of 1891 this region has been famous for the numbers of new and rare species discovered here; and more are being found as time goes on. In spite of extreme desert conditions it is only on the Devils Golf Course and the alkali flats that nothing whatever grows. Over most of the area there is a scattered growth of drought-resisting shrubs, interspersed with some herbaceous perennials. Under the right conditions, during the springs following heavy winter rains, the Death Valley flower show is worth traveling many miles to see. Then the desert blossoms like a garden. Dozens of varieties of annuals carpet the washes and canyons, sometimes literally scenting the air. They spring up quickly, bloom and produce their seeds, to wither and dry with the coming of summer. The scattered seeds lie in the dust-dry soil to await the favoring rains of some following year.

TREES

The mesquite occurs in abundance in or near the bottom of the valley where its roots can reach ground water that is not too salty. Some of the sand dunes are partially anchored by its scraggly growth, and it often marks springs of open water. The screwbean, with its tightly twisted pod, is often found with the common mesquite, which it superficially resembles. At successively higher levels in the Panamint Mountains, beginning at about 5,000 feet, occur the Utah juniper, singleleaf piñon, curleaf mountain-mahogany, Rocky Mountain maple, and western juniper; and near the top of Telescope Peak are found the bristlecone and limber pines. Two plants that are classed as trees, the Joshua-tree and the Mojave yucca, occur as rarities in a few places within the monument.

SHRUBS

One of the most typical shrubs of the valley is the desert holly, with its holly-shaped but light gray or pinkish leaves. Another is the covillea, or creosote-bush, bright green in color, with its leaves and branches varnished to resist the extreme heat and dryness. Sprucebush, or desert fir, also bright green but not a conifer, is seen growing as a tree-like bush in the gravelly beds of canyons. The stingbush, paper-bag bush, and brittlebush have names that indicate their chief characteristics. The beautiful Death Valley sage, found only in this region, grows in shady, dry canyons. There are four species of ephedra, or so-called "Mormon-tea", with curiously

leafless, jointed stems, and a great many other species that space does not permit mentioning.

CACTI

Eleven species of cactus are known from Death Valley. The strawtop, cottontop, beavertail, and calico cactus are the more common varieties. Rarer species include the Mojave mound-cactus, and the beehive, corkseed, grizzly, and polly-anns-sister.

HERBACEOUS PERENNIALS

Among the herbaceous perennials native to the monument are the rare bear-poppy, with its delicate, crapelike white blossoms and peculiar bluish foliage covered with long white hairs. The wetleaf has begonialike leaves that are always wet, even under the burning sun of the dry washes in which it grows. The turtleback is a low, gray-leaved plant that has a turpentine scent and gets its name from its peculiar shape. Dried specimens of the desert trumpet, its hollow stalk inflated below each joint, are a common sight on the fans and in the washes. Several species of the desert mariposas bloom in the high country. One plant, the rocklady, is known from a few specimens in Titus Canyon and nowhere else in the world.

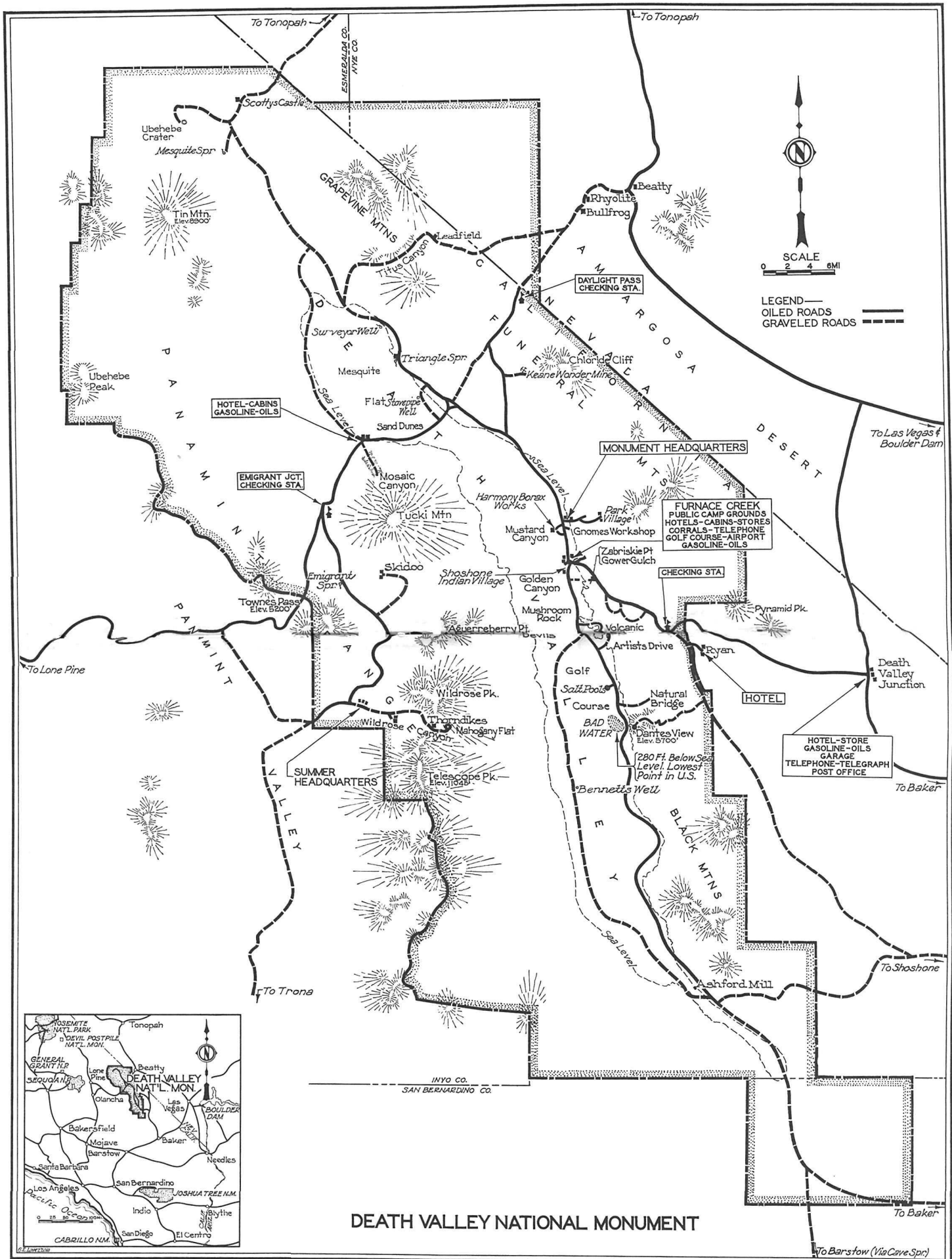
ANNUALS

Only in years of exceptional precipitation can the annuals be seen in any great abundance. Among these are nine species of evening primrose, including the beautiful and sweet scented golden primrose. Eleven species of phacelia or curlybloom are found, with blue, lavender, purple, violet, and even white flowers. The five-spot, or Chinese-lantern, with a dark red spot on the inside base of each petal of the pink, globe-shaped bloom, is one of the most exquisite flowers of the valley. The desert sunflower is perhaps the earliest to bloom in the spring and sometimes colors the fans a golden yellow, particularly when viewed from a distance.

SALT-TOLERANT PLANTS

In some areas on the floor of the valley are such concentrations of salt and alkali that no plants can live. At first the covillea and other shrubs of the higher portions of the valley give way to species of saltbush such as the desert holly, and these, with increasing alkalinity, yield to tussocks of alkali sacaton, a coarse grass, and to Cooper rush, with areas of desert saltgrass and arrowweed. Finally, at the very edge of the salt flats grows iodine-bush, the plant that is more resistant than any other to salt and alkali.

On the north cross-valley road is an area covered with curious clumps of arrowweed, with salty sand lodged at the base and with the upper



branches alive and green. This is the Devils Cornfield, so-called because the arrowweed clumps strongly resemble shocks of corn.

PLANTS USED BY THE INDIANS

The Panamint Indians cultivated no food plants, but they utilized the roasted seeds of many wild plants, such as piñon, Indian ricegrass, cotton-top cactus, the ephedras and the golden evening-primrose. They made bread from the ground pods of mesquite, and the new joints of the beaver-tail cactus were eaten roasted, or dried and boiled. The sugar deposited upon the stems of reeds by certain insects was collected and used for food as well as the roasted stem tips of the Joshua-tree, taken just before the flower clusters pushed out from the leaves.

Plants played a large part in Indian arts and crafts. Bows were made of Utah juniper, arrows of reed and willow, and rabbit nets and bowstrings of the fiber from hemp dogbane. They wove many kinds of baskets, both for everyday use and for ceremonial purposes, using withes of willow and of lemonade sumac, with black patterns of the tough roots of the unicorn plant and the red from the roots of the Joshua-tree. In the old days their baskets were among the best made by any tribe, and it is hoped that this art can be revived.

ADAPTATIONS TO HEAT AND DROUGHT

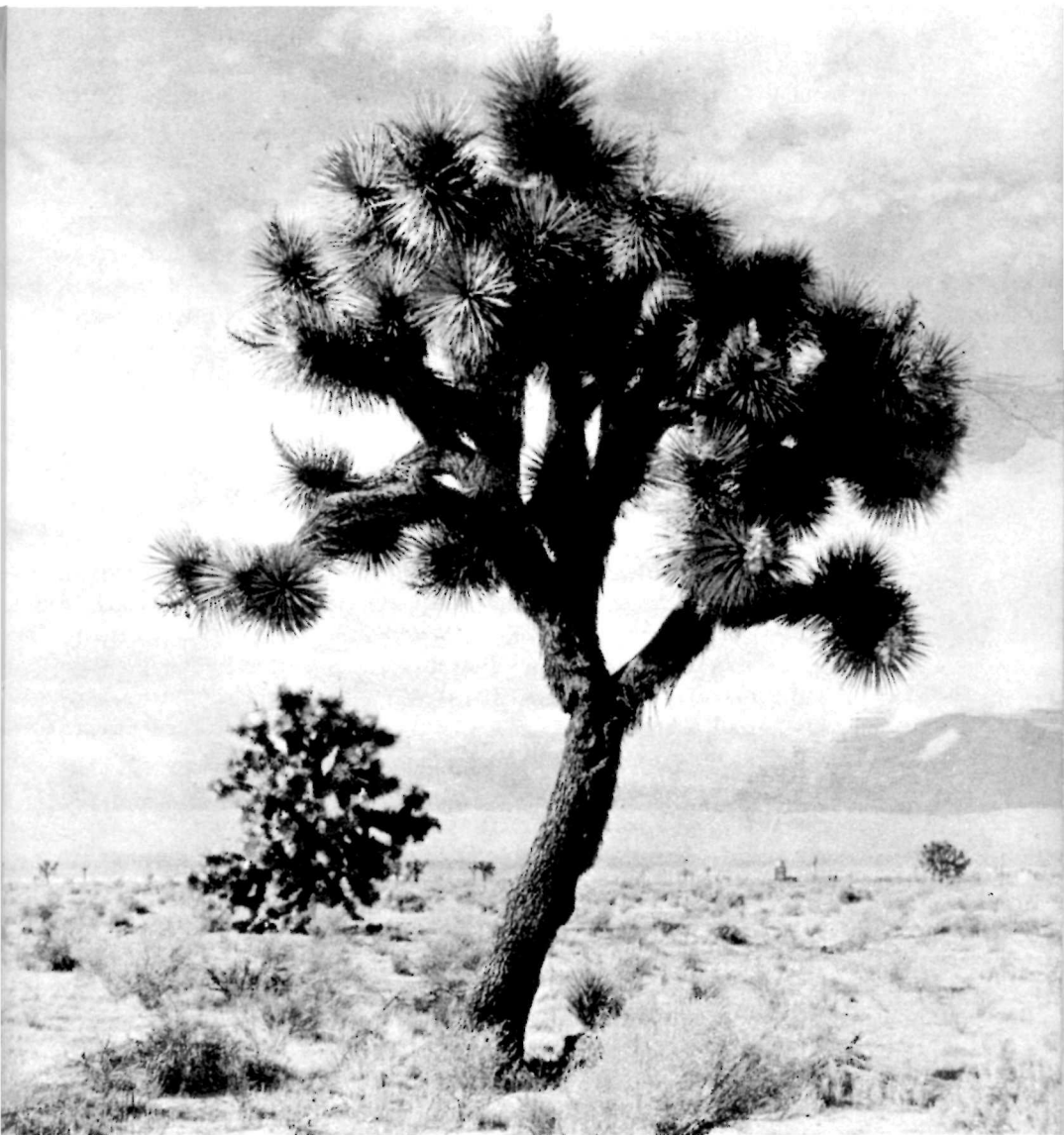
The most extraordinary thing about Death Valley plants is the strange provisions by which the upland shrubs keep alive through the burning heat and dryness of the summers. They reduce the evaporation of moisture from their surface in many ways: by having no leaves, as in all the cacti except *Opuntia*; leaves reduced to scales, as in ephedra; very small leaves; leaves that drop off in the heat of the summer; leaves that are varnished; and leaves that have a dense covering of hairs as in the saltbushes, Death Valley sage, and many others. A number of the shrubs have two or three of these adaptations combined.

Some of the cacti, such as the strawtop, have a very large root system spread out close to the surface of the ground, by which they take up water very quickly after a rain and store it in their pulpy stems for very slow use during the long months of no rainfall.

Most of the desert shrubs, however, have long deep roots which penetrate the cooler, moister soil far below the surface and provide sufficient moisture to keep them alive through the severest drought. As an example, a saltbush 26 inches high was observed, the roots of which were laid bare to a depth of 14 feet. At this point, one of the roots, five-eighths of an inch in diameter, was still penetrating further unknown depths.

MONUMENT NURSERY

Many of the plants native to the valley may be seen at the monument nursery at Cow Creek. Here plants are grown for use in replanting and in landscaping activities. It is open to the public at hours posted on the Government bulletin boards.



A DESERT SENTINEL

GEOLOGY

Death Valley has often been described as a vast geological museum and certainly its geological aspects alone would make it worthy of national monument status. Formerly so inaccessible and forbidding, it has been little studied, and it will be many years before more than a superficial understanding of its geological phenomena can be obtained. Dr. Levi F. Noble, of the United States Geological Survey, among others, has been carrying on research in this area, and this geological account is based largely on his work. For a more complete account consult his paper, *Rock Formations of Death Valley, California* (Science, Aug. 24, 1934, Vol. 80, No. 2069, pp. 173-178).

Rocks of all the major divisions of geologic time—Archean, Algonkian, Paleozoic, Mesozoic, Tertiary and Quaternary—occur in the Death Valley region. If the strata were pieced together and restored in their proper sequence as deposited originally, their aggregate thickness would exceed 40,000 feet. Earth movements have been so intense and so numerous, however, that the rock masses form a veritable jumble of crustal blocks isolated from each other by folding, faulting, tilting, igneous intrusion, erosion and burial under the more recent alluvium. At any one locality, therefore, the sequence is incomplete and it can be pieced together only by examining the different parts of the area.

The oldest known time—the Archean—is represented by the basal rocks of the region. Although chiefly schists and gneisses, these contain some masses of quartzite and limestone. Originally deposited as sedimentary rocks, the quartzite and limestone like the other Archean rocks have been so altered by heat and pressure that even if fossils ever existed in them there are now no recognizable traces of life.

These Archean rocks may be seen best from the road that follows the base of the steep mountain wall along the east side of Death Valley from Badwater southward. At many places above the road the mountain slopes are composed of them through a vertical distance of more than 5,000 feet.

The next younger group of rocks is of Algonkian age. This series was laid down after the underlying Archean rocks had been tilted by earth movements and planed by a long period of erosion so that the contact between the two is represented by a break in the rock record known as an unconformity. The Algonkian rocks consist of limestone, slates, and quartzites, and in places contain bodies of dark volcanic rocks now altered to greenstones. They are interesting for their odd coloring, conspicuous banding, and deposits of talc that occur along the contacts of greenstone and limestone. Some of the limestone beds contain fossil remains of primitive plants (algae). Exposures may be seen in the mountain front just south of Ashford Mill by following the road along the east side of Death

Valley. The Paleozoic rocks which are younger than either of the groups described above consist chiefly of limestone and quartzite of marine origin.

The Paleozoic rocks also are separated from the underlying rocks by a profound unconformity. Their dominant color is somber gray but a broad zebra-like banding makes many sets of beds conspicuous from great distances, as for example in Pyramid Peak, which is visible from the Furnace Creek Road. All of the great rock systems of the Paleozoic era are represented at one place or another in the monument. Many strata contain fossil remains of sea animals by means of which the geologic age of the formations is determined. The more abundant fossils in the Lower and Middle Cambrian beds are trilobites which give way to gastropods in the Ordovician while the Devonian and Silurian are characterized by corals, and the Carboniferous rocks by crinoids. A good view of the Paleozoic rocks may be had from many places on the road between Death Valley Junction and Furnace Creek Inn, where they form the slopes of the Funeral Mountains several miles north of the road. Echo, Boundary, Titus, Cottonwood, Trail, Hanaupah, and upper Warm Springs Canyons, which are all reached or traversed by roads, are eroded in Paleozoic rocks.

The Mesozoic era is represented by granite which forced its way through the Paleozoic and older rocks as a molten mass, and by sediments and volcanics whose exact age has not been determined. A large body of the granite is exposed near the head of Cottonwood Canyon, but is not accessible by road.

The close of the Mesozoic era was accompanied by another occurrence of intense earth movements followed by long continued erosion so that the Tertiary rocks were deposited on the beveled edges of the older rock systems. With the exception of the Quaternary deposits the Tertiary rocks are more nearly horizontal, and in their original state, than any of the others. Even they have been profoundly disturbed, however, as can be noticed along the road down the valley of Furnace Creek which is bordered by them. They include large amounts of volcanic rock; such as lava, tuff, and ash, as well as shale, limestone, sandstone, and conglomerate. Much of the volcanic rock is rhyolite and andesite; some of it is basalt. The rhyolites and rhyolite tuffs are particularly conspicuous for their coloring, exhibiting many shades of red, pink, yellow, green, and white; the basalts are black. The shales were deposited as mud and clay in intermittent lakes similar to those existing at the present time; the sandstones and conglomerates were deposited as sand and gravel on alluvial fans similar to those which may be seen at the present time. The basins of deposition during Tertiary time were probably very similar to the present Death Valley trough, but the region has been so completely modified by earth move-



Grant photo

BADWATER, THE LOWEST POINT IN NORTH AMERICA

ments since the beds were deposited that no trace of the Tertiary basins is preserved in the present topography.

Almost the only remains of animal life that have been found to date in the Tertiary beds are those of several types of mammals of early Oligocene age occurring in the Titus Canyon formation near Leadfield. These include a Titanotherium, a large animal distantly related to the modern rhinoceros; a small horse; some primitive rodents; and fossil bones of other animals that have not definitely been identified. The relationship of these fossil-bearing red sandstones of the Titus Canyon formation to the other formations of the Tertiary is not yet fully known, but it is believed that many Tertiary beds elsewhere in the monument are of Miocene and Pliocene age. Other fossils found in the Tertiary, such as the fossil fish, gastropods and petrified wood, are unfortunately of indeterminate age.

The Tertiary rocks are interesting for their weird and in places brilliant colors, and for the deposits of borax, salt, gypsum, and celestite that they contain. Throughout the region they are widely but irregularly distributed, lying indifferently upon the mountain ranges and in the valley troughs. They are readily accessible by road at many places. The road from Furnace Creek to Dantes View lies through the largest area of them in the monument, an area which extends southward from the Funeral Mountains to far beyond Dantes View. The viewpoint itself is on a hill of Tertiary rhyolite. The rhyolite lies on Archean gneiss which forms the precipitous slope to the floor of Death Valley. Zabriskie Point is in a remarkable area

of Tertiary lake beds; and Twenty-Mule-Team Canyon, Golden Canyon, the Natural Bridge and the Artist Drive region are all in highly colored Tertiary rocks.

The Quaternary, or youngest deposits of Death Valley, include all the alluvial fans and the salt and clay deposits in the bottom of the valley. The alluvial fans are built up of rock material (boulders, sand, and clay) eroded from the mountain slopes and swept down the canyons by intermittent floods until the material is spread out with even slope from the canyon mouths into the valley trough. So obvious is the process in Death Valley that the most casual observer can picture the fans ultimately filling the valley trough and creeping up the canyons until the mountains are finally buried under the products of their own decay. The fans on the west side of the deeper part of Death Valley are in striking contrast to those on the east side, as one may see in traveling over the roads along the sides of the valley. The fans on the west side are great, sloping plains of coarse boulder gravel that extend several miles out from the Panamint Mountain front and rise as much as 2,000 feet between the salt flat and the mouths of the canyons. The fans on the east side of the valley, south of Badwater, are, in comparison, mere tiny dumps of boulders spilled out on the salt flat at the base of the steep front of Black Mountain. This tremendous contrast in size of the fans on opposite sides of the valley is significant in a study of its origin. The extreme youth of the fans on the east side suggests that the precipitous mountain slope back of them marks a break in the earth's crust, called a fault, along which the valley has sunk so recently that the newly born fans have just begun to grow. At some places, as may be seen from the road, the fan gravels are broken by small scarps which face Death Valley, features which suggest that the faulting is still going on. Small fault scarps on alluvial fans may be seen in other parts of Death Valley, as, for example, at a point on the road down the east side of the Valley, about a mile south of Furnace Creek Inn. The scarp lies just east of the road and extends parallel to it for some distance. On the west side of the Valley a prominent scarp on the Hanaupah Canyon fan is crossed by the road leading to the canyon.

On the floor of Death Valley a considerable area covered by a deposit of rock salt (Devils Golf Course) represents the saline residue of an evaporated lake. A well, 1,000 feet deep, drilled in the rock salt on the road across the Devils Golf Course went through alternating beds of clay and salt without reaching bedrock, from which it is evident that the rock floor of the valley at this place must lie more than 1,250 feet below sea level. Each pair of salt and clay beds probably represents the evaporation of a lake, the uppermost representing the last lake. Sets of faint terraces here

and there, as at Mormon Point and on Shore Line Butte (a hill of black basalt which rises above the west valley road, a mile northwest of Ashford Mill), probably mark the shores of this lake. At the stage indicated by the highest shore line the lake may have been 100 miles long and 600 feet deep.¹ In the northern part of Death Valley are the Ubehebe Craters. Of recent age, perhaps not more than a few hundred years old, this volcanic manifestation includes a number of cinder cones.

An unusual type of fossils which is probably of Quaternary age was recently discovered in the center of the valley. The Salt Creek Hills, lying south of the sand dunes, and the Devils Cornfield, contain some slabby sandstones on which the fossil tracks of several types of birds and mammals were found. They represent wading birds of several sizes, a large camel, and what were probably horse, elk, and antelope or peccary. These hoofprints were left in wet sand around a water hole by animals that inhabited Death Valley many thousands of years ago, but since have become extinct. The tracks were buried, the sand hardened to sandstone, and more recently the prints have been reexposed by erosion.

Structural studies of Death Valley are incomplete, but it is known that Death Valley and the bordering mountain ranges owe their existence primarily to fracturing and dislocation of the earth's crust and not, like the Grand Canyon, to stream erosion. It also is evident that the region has undergone many periods of profound disturbance, including folding and faulting, from earliest to most recent times. Long periods of erosion have intervened between successive disturbances. Even different parts of Death Valley have had a different structural history. The story is far too long and complex to present here.

The deep part of Death Valley lying between the Panamint and Black Mountains is a trough, formed originally by faulting, which now is being filled by alluvial-fan material washed from the mountains. The age of the trough is not definitely known because no determinable fossils have yet been found in the sedimentary beds involved in the faulting, but it is believed that the trough was formed in late Tertiary or early Quaternary time. The precipitous face of the Black Mountains on the eastern side of the valley marks the major line of faulting along which the trough has sunk. It has been subjected to considerable erosion but is still one of the freshest and most spectacular examples of a fault scarp in the United States. The fault is not a single, continuous straight break but is a complex zone of intersecting faults. Some of these are parallel to Death Valley while others extend into the mountain range. Hence the pattern of the mountain front is irregular in detail. The planes of many of the

¹ Eliot Blackwelder, "Lake Manly: An Extinct Lake of Death Valley." *Geog. Rev.*, 23:3, 464-471, July 1933.

faults are curiously curved or warped on a huge scale, usually steepening as they approach Death Valley. The most recent faults lie directly at the base of the mountain front and as a rule are nearly vertical.

The road along the east side of Death Valley south of Furnace Creek extends the length of the great fault scarp and affords a magnificent opportunity to examine the faulting. For 15 miles south of Furnace Creek the faults involve only Tertiary rocks, as may be seen from Artists Drive. South of this area the long precipitous slopes of Archean gneiss in the mountain front, although deeply ripped by erosion gullies, outline roughly the planes of faults. Three miles north of Badwater a fault between Tertiary and Archean rocks is clearly exposed for many thousands of feet where it extends upward into the mountain mass and the fault plane is seen to be continuous with the long steep slope of Archean gneiss south of the fault. This fault may be reached by walking from the road leading to the Natural Bridge. Another fault which exhibits almost identical features may be seen just east of Copper Canyon fan, where the Tertiary beds that occupy the Copper Canyon Amphitheater are faulted against Archean gneiss.

The geology of Death Valley is extremely complicated, but enough of it has been deciphered to reveal that rocks of all the major divisions of geologic time are present. Intense earth movements have produced this down-faulted trough with the lowest elevation in North America which is bordered by a jumble of dislocated earth blocks. Fossils are found in some of the beds, and evaporation of prehistoric lakes left mineral deposits such as borax and salt. The geology is extremely interesting and enough is known to encourage research to decipher the complete story of this fascinating area.

HOW TO REACH DEATH VALLEY

BY AUTOMOBILE

Most of the highways leading into Death Valley are oiled, and all the main roads are in good condition. Within the monument the main traveled roads are oiled and the others are being rapidly improved. Automobile travelers are advised to enter by one of the following routes:

By United States Highway No. 66 to Barstow, thence United States Highway No. 91 (Arrowhead Trail) to Baker; thence north on a good oiled road through Shoshone and Death Valley Junction into Death Valley at Furnace Creek. The driving time from Los Angeles to Death Valley by this route is from 7 to 8 hours.

An alternate route from Los Angeles leads through Palmdale and Lancaster to Mojave and the Owens Valley Highway. Turn off at Olancho or Lone Pine, cross the Panamint Valley and Townes Pass into the monument. Travelers from northern or central California can take either the

Walker or Tehachapi Pass Roads at Bakersfield and join the Owens Valley Highway in the Mojave Desert, following the route given above from then on into the monument. The driving time from Los Angeles is approximately the same as on the route through Baker.

From points north or east, or from Las Vegas, turn off on the excellent highway through Indian Springs and Death Valley Junction. From central Nevada, take United States Highway No. 50 south from Ely to Beatty, Nev., thence through Rhyolite and over Daylight Pass into the Valley.

Service stations are to be found at intervals along the route, but it is wise for the automobile traveler to carry extra supplies of gasoline, oil, and water, particularly if leaving the main highways outlined above.

BY AIRPLANE, BUS, OR RAILROAD

Scheduled airplane service is maintained between the Grand Central Airport at Glendale, Calif., and the Furnace Creek Airport. Planes may be chartered to or from any point.

Bus transportation can be arranged from Las Vegas, Nev., through the Union Pacific Railroad, and that line connects with the Tonopah and Tidewater Railroad at Crucero, Calif. The Tonopah and Tidewater maintains a 5-day weekly schedule to Death Valley Junction, and stage service to Death Valley from that point is available.

A 4-day all-expense motor tour is operated from Los Angeles to Death Valley. The rate, with accommodations at the Furnace Creek Inn, is \$64.50 for one person occupying a room and \$60 each for two.

A combination rail and motor tour is available for Union Pacific passengers, leaving the train at Las Vegas going west and Crucero going east. Information regarding these trips may be obtained from the Tanner Motor Tours, 324 South Beaudry, Los Angeles.



Fraser, Pomona, Calif.

UBEHEBE CRATER

ADMINISTRATION

The officer of the National Park Service in charge of the monument is Superintendent John R. White, Sequoia National Park, Calif. His field representative is T. R. Goodwin, senior project superintendent in charge, Death Valley National Monument, Death Valley, Calif.

Park rangers patrol the roads, enforce rules and regulations, and protect the monument and visitors. For accurate information, ask a ranger or other National Park Service official.

NATURALIST SERVICE

Evening lectures on the history and natural phenomena of the monument are given at Furnace Creek Inn, Furnace Creek Camp, and Stovepipe Wells Hotel. Inquire of a ranger or consult the Government bulletins at these places for schedules of naturalist activities and special events.

FREE PUBLIC CAMPGROUND

Located near the mouth of Furnace Creek in a side canyon surrounded by colorful hills, the Texas Spring Campground has been developed for those who bring their own camping equipment. Camping is free, but is limited to 30 days. Toilet facilities, running water, stone tables and benches, oiled and graveled roads, camp sites and parking spaces for automobiles and trailers, give accommodations for several hundred visitors.

Inquire of a ranger for further camping information.

ACCOMMODATIONS

FURNACE CREEK INN

Open November 1 to May 1

This luxurious resort hotel is located in the central part of the monument where Furnace Creek sends its gravel fan into Death Valley. Commanding a magnificent view of the valley floor and distant mountains, it offers every recreational advantage, including a swimming pool. The pool is fed by natural warm water, and its constant temperature of about 70° makes it enjoyable even when the weather is cool. Badminton and tennis courts also are available at the inn. The minimum rates for accommodations are \$10 a day for one and \$16 for two persons, American plan.

FURNACE CREEK AUTO CAMP

Open September 1 to May 31—Emergency accommodations all summer

At historic old Furnace Creek Ranch, long headquarters for the 20-mule-team outfits, are found accommodations to suit all tastes, from the simplest

sleeping cabins to de luxe housekeeping quarters. Rates are \$2 a day and up, European plan. There are an excellent restaurant and fountain, a camp store, gas station, and a large recreation hall.

A fine 9-hole golf course may be enjoyed during the winter at the ranch, and saddle horses, with or without guide, may be hired at reasonable rates.

STOVEPIPE WELLS HOTEL

Open November 20 to May 1—Emergency lodging available and service station open all year

Taking its name from the famous old water hole, this charming desert hostelry is situated at sea level on the Townes Pass Road. It has an enviable view of the ever-changing sand dunes and the purple mountains to the north. Hotel accommodations, a restaurant, gas station, and a number of attractive cabins are available. Rates are from \$2 and up, per day, per person. Requests for reservations should be addressed to the Stovepipe Wells Hotel, Death Valley, Calif.

AMARGOSA HOTEL (OUTSIDE THE MONUMENT)

Open all year

Located at Death Valley Junction, this hotel offers a wide variety of accommodations, with prices ranging from \$2 a day and up, European plan. A dining room and restaurant, gas station, service garage, and a store stocked with all camping needs are available.

DEATH VALLEY VIEW HOTEL (OUTSIDE THE MONUMENT)

Open during season of heavy travel

This modern hostelry is located at the old mining camp of Ryan, 15 miles from Furnace Creek, and overlooks Death Valley from a distance. Comfortable hotel accommodations, a dining room, and a lounge are provided. The "Baby Gauge" Railroad carries passengers through the old borax workings, operating out of Ryan. Rates range from \$3 up, European plan.

It is advisable to make reservations for accommodations in advance. All of these facilities, with the exception of the Stovepipe Wells Hotel, are operated by the Death Valley Hotel Co., with offices at 409 West Fifth Street, Los Angeles. They may also be reached direct by wire, mail, or telephone at Death Valley.

The aforementioned accommodations are operated on private property, and the National Park Service exercises no control over them.

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RULES AND REGULATIONS

[Briefed]

THE MONUMENT REGULATIONS are designed for the protection of the natural features and scenery as well as for the comfort and convenience of visitors. The following synopsis is for the general guidance of visitors who are requested to assist the administration by observing the rules. The monument belongs to the future generations as well as the present. Help us take care of it. Complete regulations may be seen at monument headquarters.

The disturbance, destruction, defacement, or injury of any ruins, relics, buildings, signs, or other property is prohibited.

Camps may be made at designated localities only, and must be kept clean. Place garbage and tin cans in receptacles provided for that purpose. Use gasoline or kerosene camp stoves or bring your own wood, as none is available. Do not throw refuse or trash on roads, trails, or elsewhere. Carry it until you can deposit it in a garbage can.

Do not pick, cut or otherwise destroy any flower, plant, shrub or cactus. Cutting of trees or shrubs for firewood, or any other purpose, is strictly prohibited.

Hunting, killing, wounding, capturing, or attempting to capture any wild bird or animal in the monument is prohibited, except in cases of poisonous snakes or dangerous animals, and then only to prevent them from destroying life or inflicting injury.

Use of firearms within the monument is strictly prohibited. Persons bringing firearms into the monument may be required to surrender them to any monument officer.

Gambling in any form is prohibited.

Private notices or advertisements shall not be posted or displayed in the monument except when authorized.

Vehicular and other traffic within the Death Valley National Monument will be governed by the current State of California Vehicle Code.

The penalty for violation of any of these regulations is a fine not exceeding \$500, or 6 months imprisonment, or both.

EVENTS

OF HISTORICAL IMPORTANCE

- 1844— Fremont party camped within sight of the south end of Death Valley, but did not enter it. Fremont was following the old Spanish Trail, but previous explorers had left no record.
- 1849— The Jayhawkers, the Georgians, the Bennett party, and others entered the valley through Furnace Creek on Christmas Day.
- 1860— The Darwin French and S. G. George prospecting parties explored the Panamints and parts of the valley, giving many place names that are still in use.
- 1861— Lieutenant Ives explored the region for the California Boundary Commission, using camels as pack animals. Prospecting parties active.
- 1864— Jacob Breyfogle lost the famed Breyfogle mine.
- 1870— Bellerin Tex Bennett started Furnace Creek Ranch.
- 1871— Further explorations for the Government by Wheeler and Lyle.
- 1872— Panamint mines discovered. Panamint booms in 1874.
- 1873— First borax discovered in valley.
- 1875— Further exploration by Lt. Rogers Birnie.
- 1880— Aaron Winters sold borax claims for \$20,000. Borax industry in the valley started.
- 1891— Coville-Merriam scientific expedition.
- 1904-08— The Goldfield mining boom, resulting in the mining camps of Rhyolite, Skidoo, Greenwater, etc.
- 1926-27— Stovepipe Wells and Furnace Creek Inn established. Eichbaum toll road built from Darwin. Beginning of tourist traffic to valley.
- 1933— Death Valley National Monument established.
- 1937— Boundaries of the monument extended.

