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UNITED STATES DEPARTMENT OF THE INTERIOR

HAROLD L. ICKES, SECRETARY

NATIONAL PARK SERVICE

ARNO B. CAMMERER, DIRECTOR



WEST RIM DRIVE

IN

GRAND CANYON NATIONAL PARK

ARIZONA



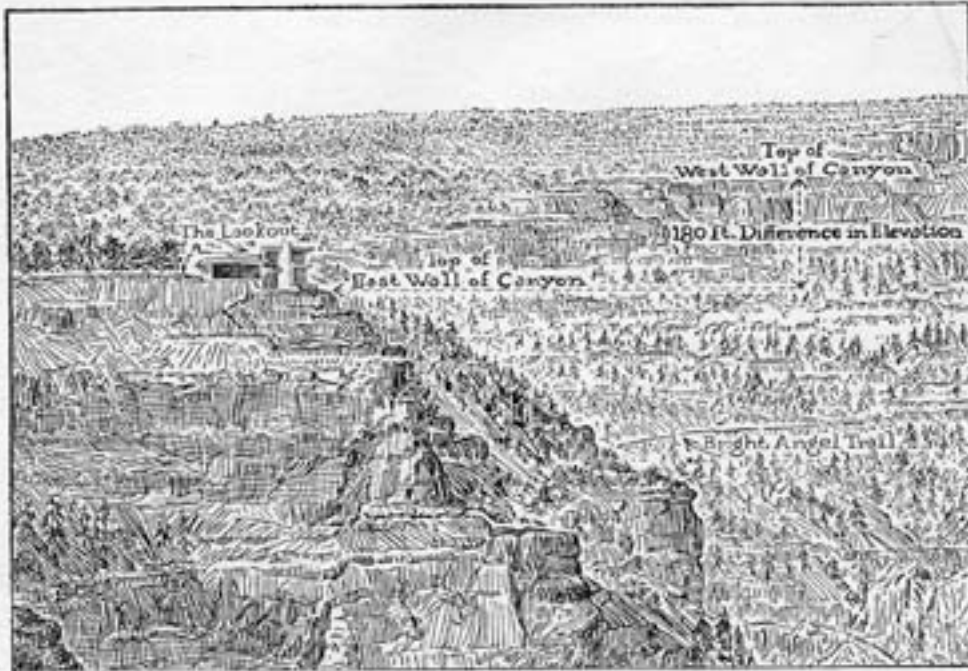
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WEST RIM MOTOR TRIP

This leaflet contains a brief description of each major feature seen from the various places visited on the west rim trip. It is hoped that you will read the contents carefully since herein may be obtained a fuller understanding and better appreciation of this wonderful Grand Canyon region

START OF THE TRIP—FROM EL TOVAR HOTEL AND BRIGHT ANGEL LODGE

Bright Angel Fault. The steep hill about a quarter of a mile west of El Tovar Hotel was formed when a great break occurred in the rocks



Bright Angel Fault

which now form the canyon walls. The rocks on the west side were pushed 180 feet above the corresponding ones to the east. This can be seen by observing the relative positions of similar strata on the two sides. The break or fault extends across the Grand Canyon

and is at least 20 miles long. This example of movement is typical of those which, by elevating the region, made possible the forming of the Grand Canyon.

The valleys along the Bright Angel Fault owe their location to the rupturing and consequent weakening of the rocks. The erosive action of water became more effective in this broken zone than in the unfractured rocks bordering it. Once the cutting started, drainage from the neighboring areas hastened its process.

Bright Angel Creek. In the deep, narrow canyon to the northeast of El Tovar flows Bright Angel Creek, one of the few permanent tributary streams of the Colorado River in this region. In cutting its



Bright Angel Creek and Fault

canyon this stream has followed the line of a great break or fault in the rock strata. This same fracture extends to the south across Grand Canyon, and evidences of it may be readily seen nearby. (See Bright Angel Fault.) This, therefore, explains both the great depth and the remarkably straight course of Bright Angel Canyon.

Trinity Creek—Dry Stream Bed. Across the Colorado River and to the northwest of El Tovar is a dry stream bed known as "Trinity Creek." Its wide valley is an excellent illustration of the cutting power of running water in this region of little vegetation. Erosion is periodic, due to the aridity of the climate, yet it is none the less effective. Desert plants grow far apart, leaving the slopes partially bare,



Trinity Creek—Dry Stream Bed

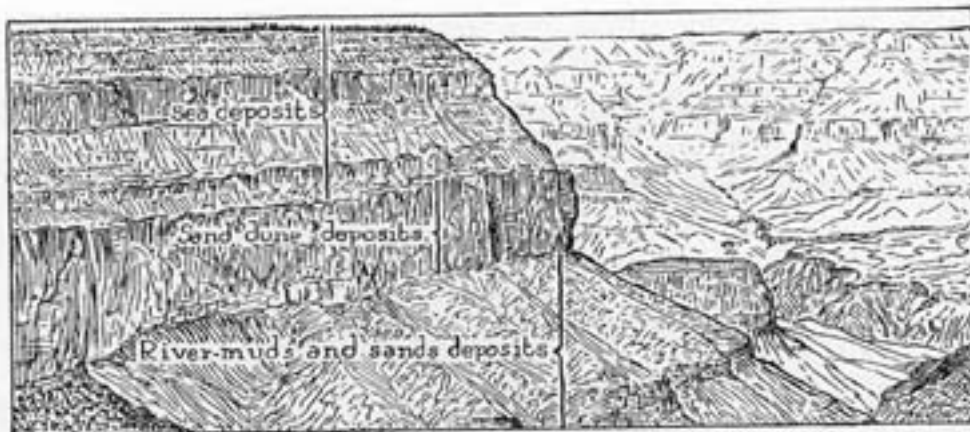
and the concentrated energy of a single torrential shower here often does more destruction than a season's rainfall on the densely covered slopes of a humid region.

Indian Gardens. In the valley below El Tovar is a green patch of trees and shrubs known as "Indian Gardens." Here a small spring flows from the base of the cliffs, and the luxuriant vegetation about it contrasts strongly with the surrounding arid area. As the name indicates, this spot was formerly used by the Indians as a home and garden plot.



Indian Gardens

Upper Canyon Strata. Each of the great layers of rock exposed in the upper canyon walls has a distinct and interesting history. They were formed as vast accumulations of sediments—sands, muds, and limes. Several times this region was beneath the sea where plant and



Upper Canyon Strata

animal remains gradually built up layers which formed limestones. At other times sands accumulated on beaches or were piled up by winds into dunes; and today these appear as sandstone cliffs. At still other times mud was deposited here by ancient rivers to make the shale formations of the present. The history of the region has been one of continual change. Throughout time its surface has alternated between high altitudes, where great erosion or wearing away took place, and low altitudes—accompanied by the building up of great layers of sediments.



Major Powell

FIRST STOP—POWELL MEMORIAL

Maj. John Wesley Powell. Maj. John Wesley Powell, one-armed veteran of the Civil War, was the first man to explore the perilous

waters of the Colorado River through the Grand Canyon. In 1869 he left Green River City, Wyo., and traveled with his party in small boats to the lower end of the river. He encountered several hundred plunging rapids in descending through a 6,000-foot difference in altitude. His boats were often upset and the entire passage was perilous to a degree. Despite all hardships and dangers, however, Major Powell kept accurate records and made very great contributions to science and to knowledge in general.

Fallen Rock Masses. The huge rock fragments scattered along the red slopes below have come from the walls of the canyon. Their breaking-off was due to the combined effects of rain, frost, plant action, temperature changes, and other forces which have been constantly at



Fallen Rock Masses

work cracking and prying off parts of the walls. It is by such ordinary processes of nature, working slowly but steadily, that the great width of the canyon is accounted for. As the Colorado River has cut its way downward through all of the layers now exposed in the walls, its sides have been constantly breaking down and washing away.

SECOND STOP—HOPI POINT

The Working River. A considerable extent of the Colorado River is seen from Hopi Point. Even though it is several miles away, its muddiness is plainly visible as it flows its swift and tumultuous course. The mighty power of this river, with boulders and sand as its tools, has cut downward through many layers of rock to form the

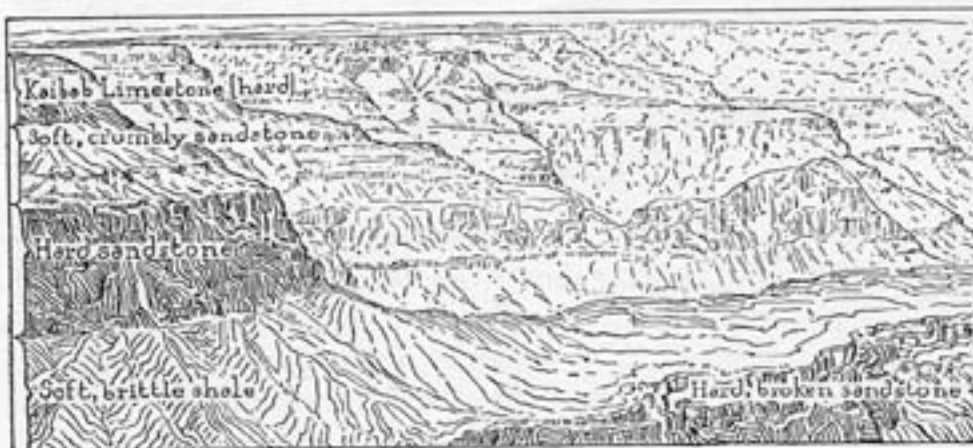
canyon. Likewise this power has enabled it to carry off the mud, sand, and other materials resulting from excavation. Measurements show that the rate of flow of the river in this section varies between



Working River

2½ and 20 miles an hour, and that it averages 300 feet in width and 18 feet in depth.

Cliffs and Slopes. The alternation of cliff and slope in the walls of the Grand Canyon is an interesting and conspicuous feature. It bears



Cliffs and Slopes

a definite relationship to the kinds of rocks found in the various horizontal formations, and therefore is an important factor in the peculiar sculpturing of the canyon walls.

The Grand Canyon is the result of erosion. The downward wear of the Colorado River explains its depth. Its width is due to the break-

ing down and washing away of the sides. Rain, frost, and other such agencies accomplish this and the difference in rate of erosion in various types of strata is the result of the peculiar individual characteristics of each.

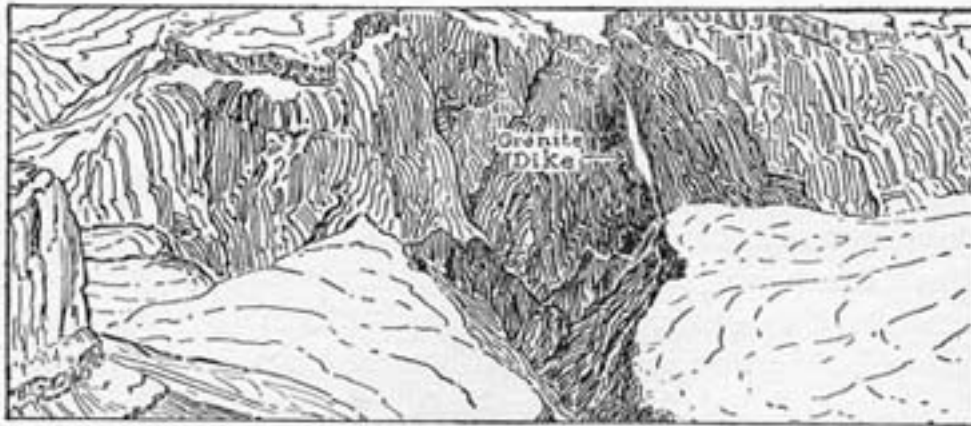
Cliffs are due to resistant rocks such as sandstones and limestones. Slopes represent soft layers of shale which break down more rapidly. **The Tonto Platform.** The Tonto Platform is the wide, flat shelf separating the inner gorge from the high walls of the upper canyon. Its bench-like nature provides the only natural route of travel through the canyon. Its relative flatness affords a pleasant rest in the difficult ascent from the river to the rim. This platform has been cut from a thick layer of very soft rock. Eight hundred feet of hardened mud or shale occur here between the resistant rocks which form the cliffs above and below. These shales are readily washed down and eaten back by running water and other elements. The flat Tonto shelf is the result of this erosion.



Tonto Platform

Granite Dike. The dark rocks at the bottom of the canyon are noticeably different from those which form the horizontal layers in the canyon walls above. Their irregular vertical structure is the result of extreme pressures and accompanying heat. They are among the oldest rocks known on the earth, and represent the base of mountains which were later worn to a flat surface.

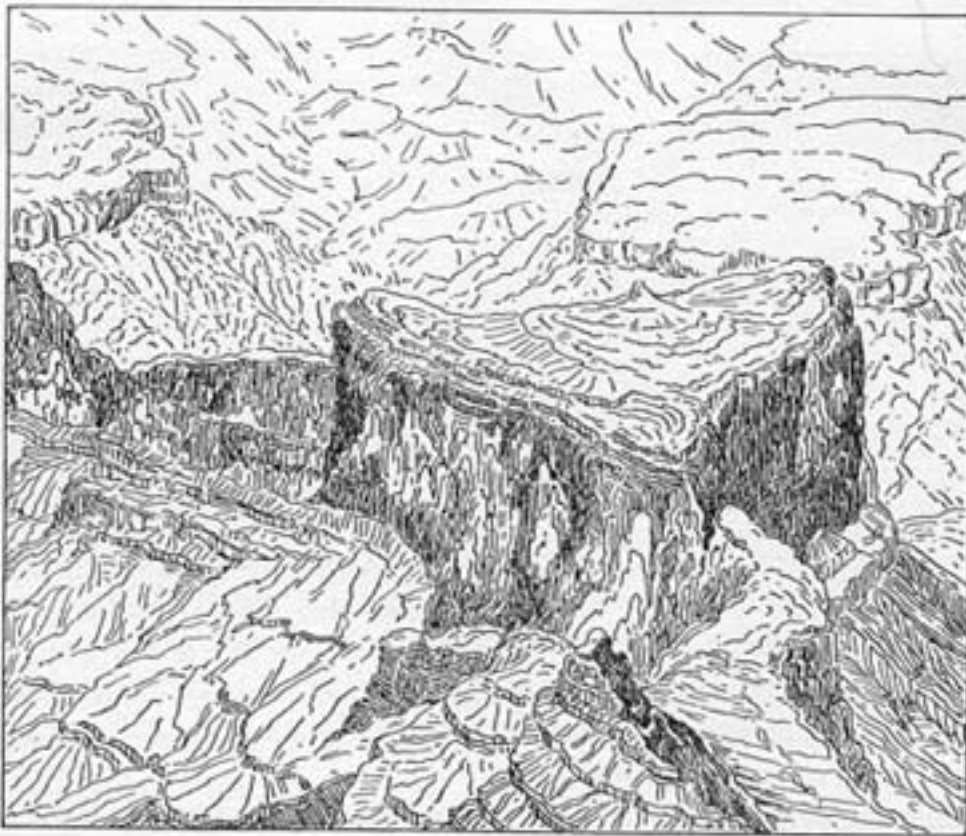
In many places light colored streaks and bands can be seen in the dark rocks of the Inner Gorge. These are intrusions of granite—formed when molten masses were forced up from below into cracks and cooled very slowly far beneath the surface of the ground.



Granite Dike

THIRD STOP—MOHAVE POINT

Forming and Coloring of the Redwall. The highest cliffs in the Grand Canyon are formed by the redwall limestone about half way



Forming and Coloring of the Redwall

down. This wall is continuous for many miles in every direction and has an average height of 550 feet. A brilliant red color characterizes it in most places, but fades into a gray or blue at the ends of promontories where there are no overlying strata. The red is due to iron oxides which are washed down from the rocks above, staining the face of the wall.

Curving and rounded surfaces, amphitheatres, caves, and cavities also characterize the redwall limestone. These are due to its limy character which allows rain and snow water to reach its surface. Because of its resistance to the breaking and cutting powers of water, wind, and frost, however, it forms massive walls.

Mount Trumbull and Mount Logan. About 60 miles to the west two dark cone-shaped mountains are visible on clear days. Their tops contrast strongly with the flat-topped hills and mesas so charac-



Mount Trumbull and Mount Logan

teristic of this region. The dark color differs from the brilliant red and yellow hues of the surrounding country. These mountains are volcanoes. Molten lavas were forced up through the level plateau surface and in cooling formed these cones.

Monument in Monument Creek. Just west of Mohave Point, in the side canyon formed by Monument Creek, stand several isolated rock pillars. The largest is appropriately named The Monument. It is composed of hard brown sandstone. Of similar material are the cliffs forming the canyon walls on each side of it. The unusual hardness of this sandstone enabled it to remain, while rocks about it were worn away. The Monument represents a last stand against the forces of erosion.



Monument in Monument Creek

FOURTH STOP—PIMA POINT

Monument Rapids. Something of the power of the Colorado, the force which has enabled it to cut down a mile through layers of hard rock, can be visualized in seeing Monument Rapids. Here the river



Monument Rapids

cascades downgrade at a rate of 20 feet in half a mile and many of its waves are several feet in height. Even from the canyon rim some miles away, the fury of the waves is plainly visible, and at times their roar is audible. This rapids is only one of many in the canyon.

The Granite Gorge. From Pima Point a large extent of the winding river course, entrenched in the Granite Gorge, is visible. The rocks of this lowest section are upturned and badly shattered. They are the roots of mountains, the upper parts of which were worn

away millions of years ago. In these rocks the great alterations of both texture and composition could only have developed under conditions of pressure and heat, requiring an overlying mass of rock many thou-



The Granite Gorge

sands of feet thick. This great covering layer was furnished by the mountains that were washed away.

The Fold to the Northwest. Across the Grand Canyon northwest from Pima Point the level upper surface of the plateau is broken by a single great notch. Careful examination will show that this gap is more than a mere V-shaped cut in the horizontal layers. It is the ex-



The Fold to the Northwest

pression of great movement of those rock layers. To the left or west a distinct downward bending is visible, while on the other side the layers, although horizontal, appear to be raised. Thus in this place are

seen the results of two movements—a bending, followed by a vertical breaking. One or both of these movements so weakened the surface in that area that the forces of erosion cut the notch.

Cataract Plains. The extensive flat surface of the plateau to the west is especially remarkable when one realizes that this area is 6,000 to 7,000 feet above sea level. The surface is a great plain formed from



Cataract Plains

the wearing away of many overlying layers of rock. This erosion involved a tremendously long period and was mainly accomplished before the cutting of the present Grand Canyon began.

FIFTH STOP—HERMIT REST

Hermit Basin. In Hermit Basin, just west of Hermit Rest, the forces of erosion which have formed the Grand Canyon, have been es-



Hermit Basin

pecially effective. An unusually long and wide canyon is the result. There is evidence of much breaking and slipping of the rocks forming the walls of this basin. Evidently these fractures greatly weakened the area and so allowed rapid excavation.

The Higher North Rim. The North Rim of Grand Canyon is about 1,000 feet higher than the South Rim. The strata which appear horizontal in the Grand Canyon walls actually slope upward to the



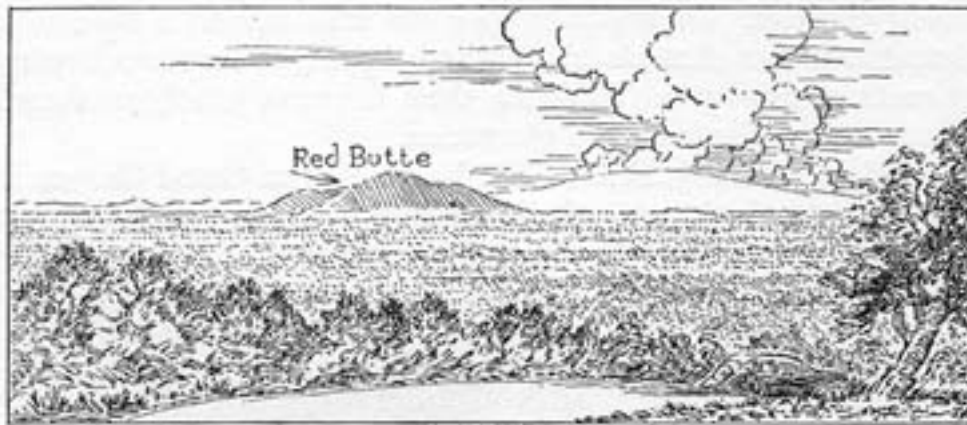
The Higher North Rim

north—a noticeable feature in approaching the canyon from the south. The sloping strata reach a high point at about 9,000 feet some 15 miles back from the North Rim. Beyond this point the layers bend downward toward the Utah border. It is because of the southward drainage of the plateau surface and because of the greater rainfall at the higher altitude of the North Rim that the canyon walls have receded further from the river on the north side.

RETURN TRIP—TOP OF HOPI HILL

Red Butte. About 15 miles to the south is a hill known as "Red Butte", rising above the plateau. This is a remnant of widespread formations that once covered the present surface. A hard cap of lava has protected the layers of rock beneath it, while those immediately surrounding were carried away by erosion.

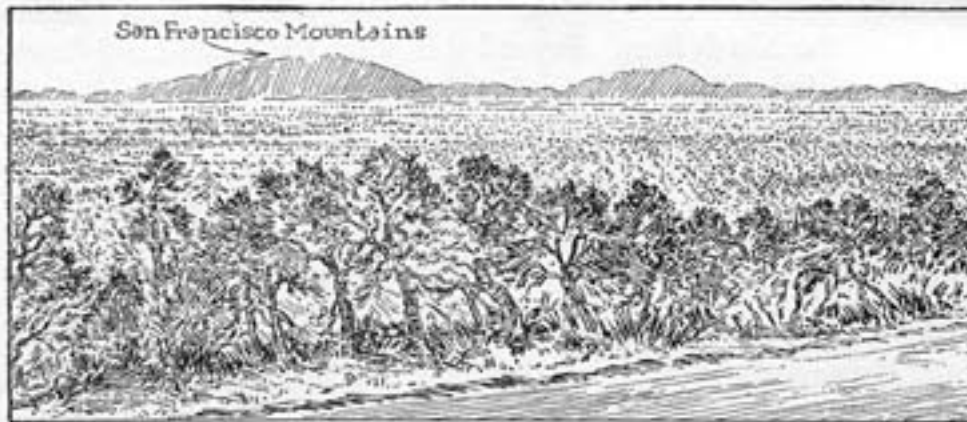
This period of cutting away the land surface occurred long before the cutting of Grand Canyon, as we see it today.



Red Butte

San Francisco Mountains. Fifty miles to the southeast the San Francisco Mountains rise to a height of more than 5,000 feet above the plateau, or about 12,500 feet above sea level. These dark conical peaks contrast strongly with the flat, colorful features so characteristic of the region.

These mountains are ancient volcanoes. For many miles around their bases may be seen the lavas which flowed from them. The Grand



San Francisco Mountains

Canyon itself is remarkably free from volcanic material, yet here, close by is found a large area of eruptive activity.

Though extremely old, compared with the works of man, the action of these molten masses appears recent when compared to the age of the ancient plateau through which they have been ejected.