

• THE GRAND CANYON •

A SLICE OF TIME



GEOLOGIC ERAS OF GRAND CANYON

The Grand Canyon of the Colorado River is one of Nature's most awesome works. As you walk along the South Rim and peer into the chasm you probably wonder how and why the Canyon came to be.

How big? Two hundred seventy-seven miles (446 kilometers) long; ten miles (16 kilometers) across, average; one mile (1.6 kilometers) deep.

How did it come to be? That one is not so easy. The best place to start is at the beginning —

There hasn't always been a canyon here. There hasn't always been a river here. The soil you stand on hasn't always been here. It was brought in from somewhere else by wind and water.

The Canyon is made up of a canyon within a canyon. From most places along the South Rim you readily see down to the Tonto Plateau, about 2500 feet (760 meters) below you. From other places you can view all the way to the river, there you are seeing the Inner Gorge. The canyon within.

The story of the Canyon has two parts. The first part, how the land was built up, is the major one. This part took two billion years. The second part, the forming of the canyon you see today, took somewhere from 6 to 30 million years — in geologic time, an eye-blink.

Go back in time to when there was nothing between where your feet rest and where the river runs today. The earth was young — half as old as it is now and in a state of upheaval. This area of the earth was low lying, covered by shallow coastal waters. There were active volcanoes. For millions of years sediments from the waters and lava accumulated in layers thousands of feet thick. Then about 1.7 billion years ago, tremendous forces from inside the earth caused the layers to buckle and rise up into mountains, mountains five or six miles high. The layers of sediment making up the mountains were changed by heat and pressure from something much like the soil on which you stand to igneous rock. It was melted and changed from grains to crystals. This rock is now called the Vishnu schist. Additionally, molten material from the earth's core intruded into the base of the newly-formed mountains. There it

cooled and hardened into granite, often pink in color. Erosion, the work of wind and water, then began to remove these huge mountains grain by grain, leaving only traces standing.

Again, a shallow sea covered the land and for millions of years more layers of sediment were laid down. These layers would eventually become 12,000 feet (3650 meters) thick.

Once more the earth heaved and the thick crust of rock was fractured and the blocks tilted up, forming a new mountain range. Again the mountains

The Grand Canyon of the Colorado is a canyon composed of many canyons. It is a composite of thousands, of tens of thousands, of gorges. In like manner, each wall of the canyon is a composite structure. A wall composed of many walls, but never a repetition. Every one of these almost innumerable gorges is a world of beauty in itself. . . . Yet all these canyons unite to form one Grand Canyon, the most sublime spectacle on the earth.

Major John Wesley Powell,
The Exploration of the Colorado River and Its Canyons

were assaulted by erosion and their substance carried away until only ridges remained. In many places the erosion was so complete that it removed the entire 12,000 feet (3650 meters) of soil, laying bare the Vishnu schist.

The process up to this point had taken about 500 million years and formed the lower one-third of the land's thickness in this area. But there are still 3500 feet (1000 meters) between you and the surface to be formed.

These horizontal layers you view above the Vishnu schist illustrate the work of 300 million years

of advancing and regressing oceans, perhaps as many as seven. There were periods of desert and erosion. At times the environment was marshy and muddy.

The land was built up to the extent that where you stand was 4000 to 8000 feet (1200 to 2400 meters) below the surface! Erosion removed those upper layers. Two prominent reminders of this period remain, Cedar Mountain near Desert View and Red Butte south of the park entrance on Highway 64. Both of these mountains are capped by resistant layers which prevented their erosion. This period of erosion occurred during the time that dinosaurs lived on the land, and ended about 65 million years ago.

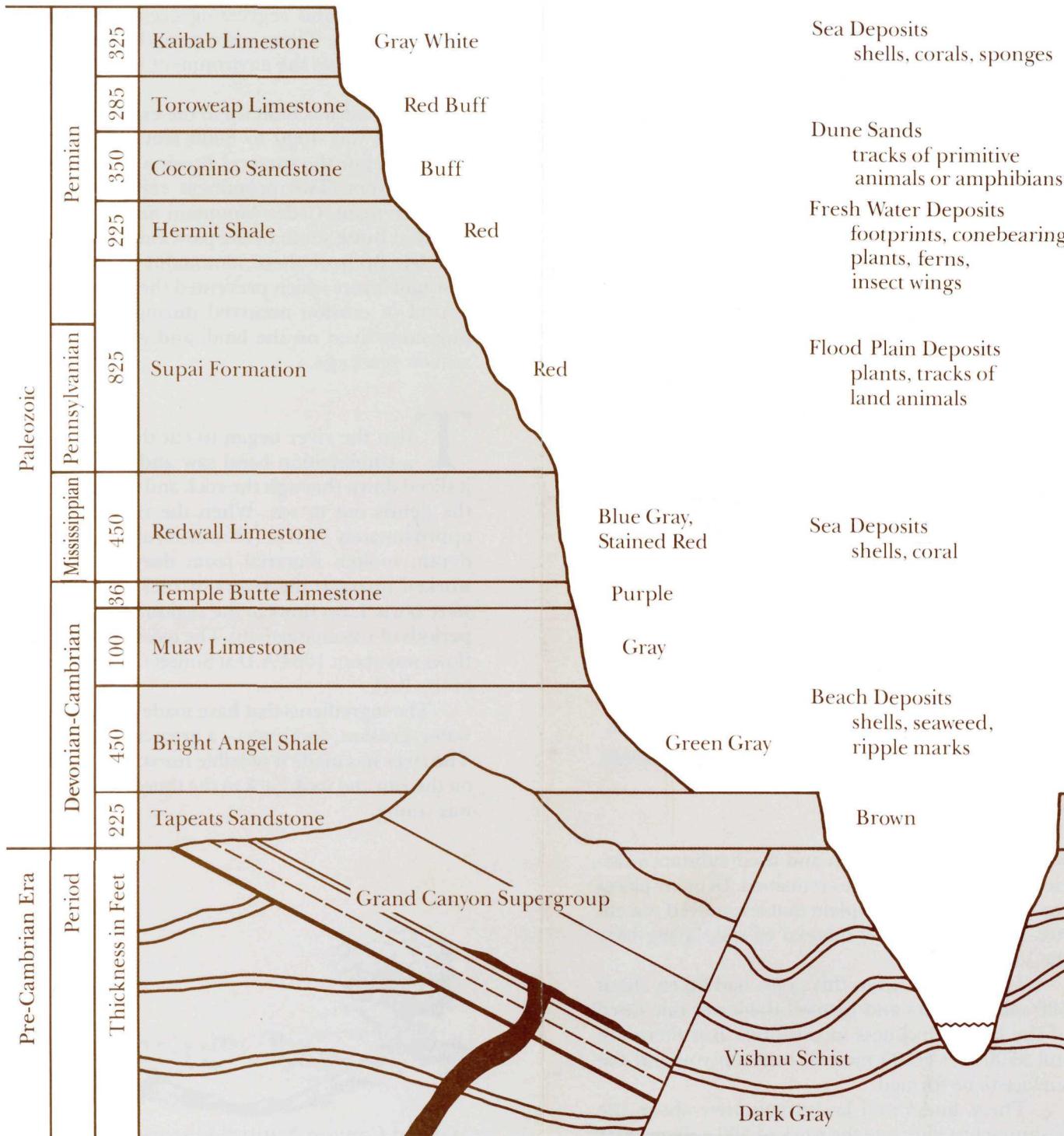
Then the river began to cut the canyon. Like a combination band saw and conveyor belt, it sliced down through the rock and soil and carried the debris out to sea. When the river had cut to approximately 50 feet (15 meters) above its present depth, molten material from deep in the earth worked through the layers of rock and volcanoes were born. Lava flows in the region indicate several periods of volcanic activity. The most recent of these flows was about 1064 A.D at Sunset Crater southeast of the Park.

The ingredients that have made the Canyon are water, erosion, and time — a great amount of time. The river has made it possible for you to stand here on the rim and look back to the time when the earth was young.

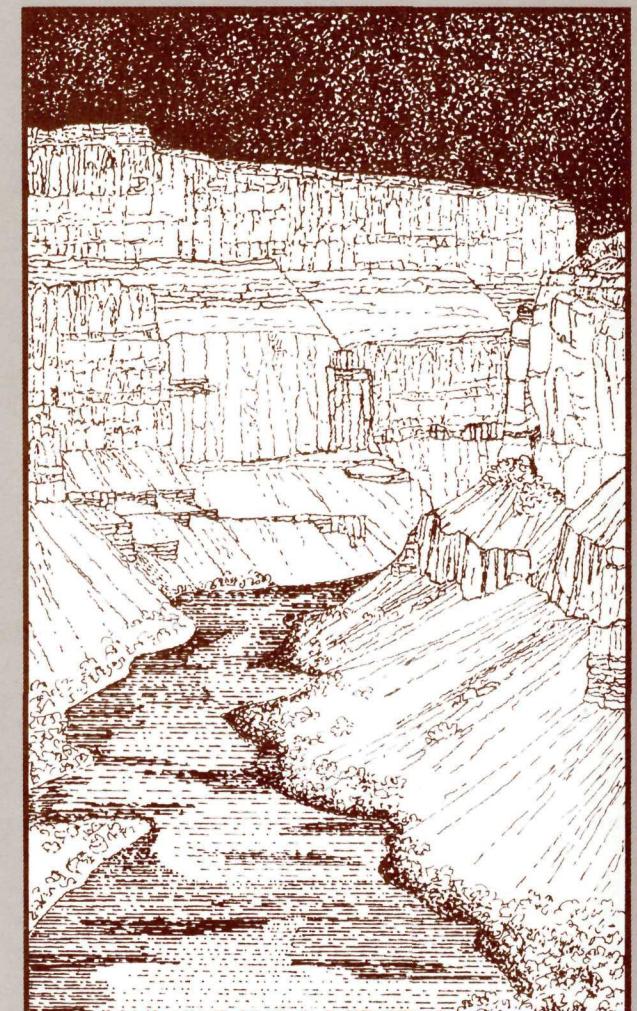


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