

Grand Canyon Rocks!



How did Grand Canyon form? By studying **geology** we learn about the Earth's history and how places change over time. What plants or animals lived in your town 150 million years ago? The ancient remains of plants and animals preserved in the rock, called **fossils**, tell stories about the past. Take a look at the chart of common fossils at Grand Canyon on the back page.

Vocabulary:

Fossils: the hardened remains or imprints of plants or animals preserved in rock

Geology: the study of the origin, history and structure of the earth

Think About It

THE OLDEST PANCAKE IN A STACK IS ALWAYS AT THE BOTTOM. THE ROCKS AT GRAND CANYON ARE A LOT LIKE PANCAKES. WHERE DO YOU FIND THE OLDEST ROCKS AT GRAND CANYON?



Cool Canyon Facts

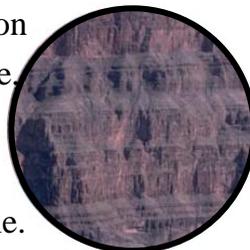
River length: 277 miles
Canyon width: 10 miles
Canyon depth: 1 mile

Rocks come in all colors, shapes, and sizes. They can be very different, but to make sense of what is around us, **geologists** put rocks in groups according to how they form. The three families of rock are: **igneous**, **sedimentary** and **metamorphic**. Natural forces create and destroy rock, changing them over time in the rock cycle.

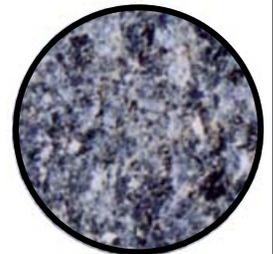


Igneous rocks are formed when rock is super-heated and becomes molten (liquid). There are two kinds of molten rock: magma (found beneath the Earth's surface) and lava (found on the Earth's surface). The molten rock cools and hardens on or beneath the Earth's surface forming a variety of igneous rock. Two examples are granite and basalt.

Sedimentary rocks are made of smaller pieces (like sand or mud), called sediments, that pile into layers. As pressure on the sediment increases over time, minerals act like glue, cementing them into solid rock. The three main types of sedimentary rocks at Grand Canyon are sandstone, shale (or mudstone), and limestone.

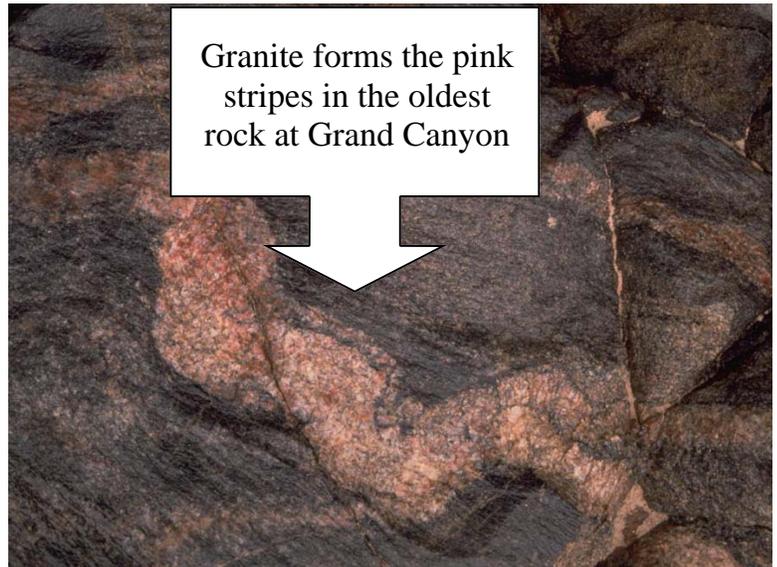


Metamorphic rocks are rocks that have been changed under great heat and pressure. The original rock can be sedimentary, igneous, or even metamorphic. The original rock is changed into something new, just as a caterpillar "metamorphoses" into a butterfly.



Precambrian Basement Rocks

The basement rock formed 1.8 billion years ago when the North American continent collided with an ancient chain of volcanic islands, much like today's Hawaiian Islands. Intense heat and pressure from the collision formed the metamorphic rock called Vishnu Schist. From deep under the earth's surface, molten rock flowed up as magma between the cracks of the Vishnu Schist. As the flowing magma cooled and hardened, it formed igneous rock called Zoroaster Granite. Because of the extreme heat and pressure that folded and changed the metamorphic rock, it is hard to find any fossils in the basement rocks.



Granite forms the pink stripes in the oldest rock at Grand Canyon



What rock family does the Bright Angel Shale belong to?

Bright Angel Shale

If you came to Grand Canyon area 515 million years ago when the Bright Angel Shale was forming, everything was covered by a very muddy, warm, shallow sea. Trilobites, brachiopods, crinoids and worm-like creatures that burrowed in the sea-floor thrived in the nutrient-rich water. This greenish-colored shale forms the broad, flat area known as the Tonto Platform in Grand Canyon.



Redwall Limestone

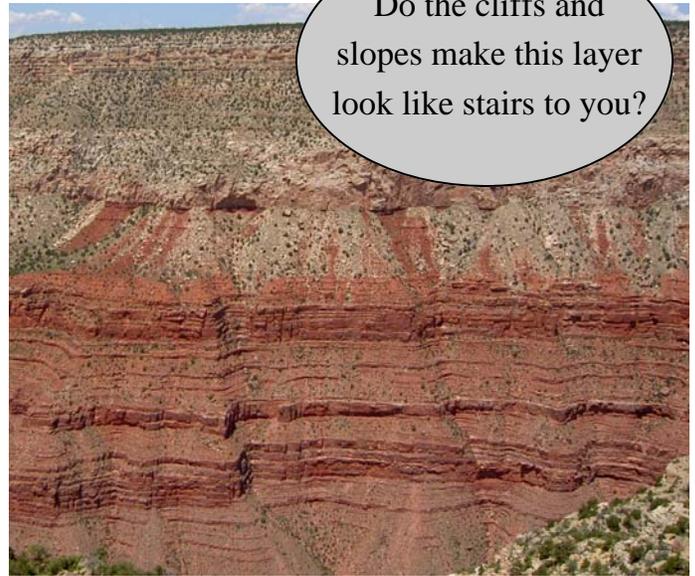
About 340 million years ago, North America lay close to the equator when the Redwall Limestone formed. Grand Canyon was covered by a shallow, warm, clear and well-lit sea where many crinoids lived. Fossils in the rock tell us that corals, cephalopods, bryozoans, and brachiopods lived here. While the limestone itself is gray in color, the surfaces of the exposed cliffs are stained red by iron in rock eroding from the layers above with rain and snow melt.



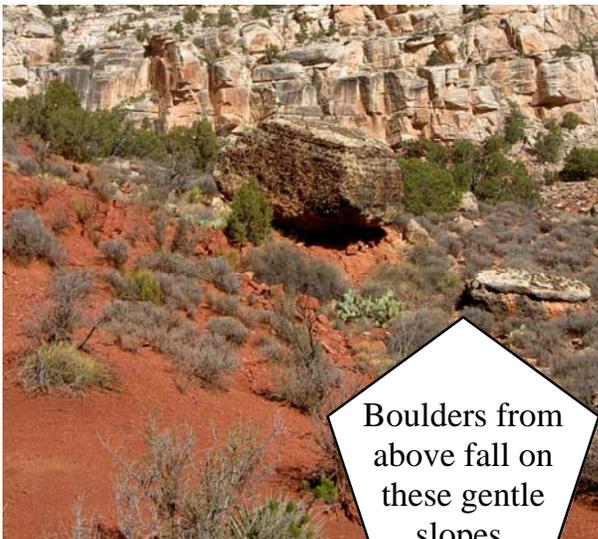
This limestone layer is 500 feet thick and creates the tallest cliff in Grand Canyon.

Supai Group

How do you feel about a trip to the beach? About 300 million years ago, the Grand Canyon area was covered by rapidly changing coastlines as sea levels rose and fell. The Supai group has limestone, sandstone, and shale in it, sharing the story of beaches, dunes, and sometimes oceans that were found here. The ocean environments left behind fossils of brachiopods, while the land environments left various plant fossils for geologists to find. Both environments contained multiple types of burrowing creatures.



Do the cliffs and slopes make this layer look like stairs to you?



Boulders from above fall on these gentle slopes.

Hermit Shale

Are you ready to go wading through the mud? 280 million years ago The Grand Canyon area was covered by a broad coastal plain fed by multiple slowly meandering streams. The environment was prime habitat for an abundance of ferns and conifers, along with reptiles and insects, including dragonflies with three-foot wingspans. This layer consists of siltstones, mudstones, and fine grained sandstones rich in iron that create a gentle, red slope in most parts of Grand Canyon National Park.

Coconino Sandstone

Have you ever wanted to visit the Sahara desert? 275 million years ago the Grand Canyon area was covered with coastal dune-fields that reached as far north as present day Monument Valley, and as far south as Sedona. The ocean lay to the west. Reptiles, spiders, scorpions, and other insects dwelled on the sand dunes of this extensive desert, leaving their tracks fossilized in the sandstone. This sandstone layer creates a broad, light-colored



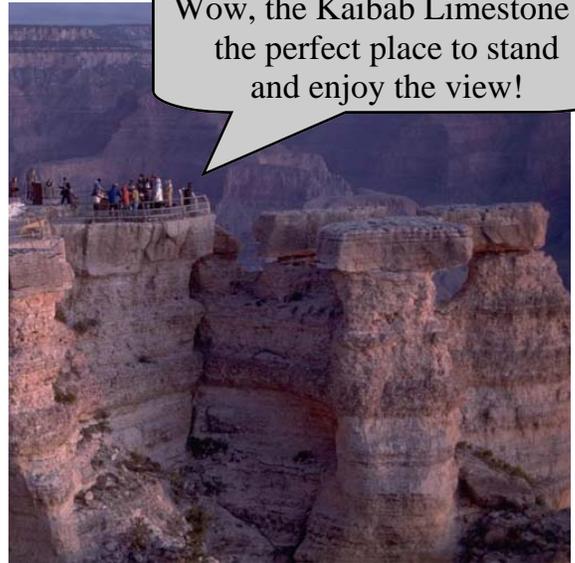
This striking white cliff earns the name "bathtub ring" of Grand Canyon.

cliff a few hundred feet below the rim of Grand Canyon. Cross-bedding (lines that run at steep angles to one-another) can be seen in the rock, giving evidence to the sand dunes that once covered the area.

Kaibab Limestone

270 million years ago North America was the western part of the super-continent Pangaea. The Grand Canyon region was once again covered by a shallow, warm, and well-lit clear sea with a sandy/muddy floor. The coast was nearby and to the northeast. Brachiopods and sponges dominated these waters. Other species included crinoids, corals, bryozoans, cephalopods, sharks and fish.

This limestone is the youngest rock found at Grand Canyon National Park.



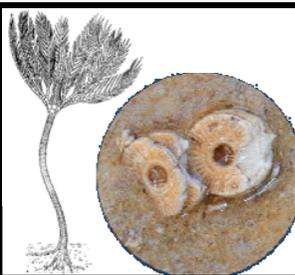
Wow, the Kaibab Limestone is the perfect place to stand and enjoy the view!

Are any of these fossils found in your backyard?

Fossils of Grand Canyon Here are some of the more common fossils found in the sedimentary layers of Grand Canyon...

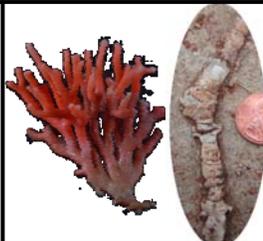


Brachiopods– A variety of shells lived in clear ocean waters.



Crinoids– Tiny disks made the stem and arms of this animal, that was rooted to the sea floor.

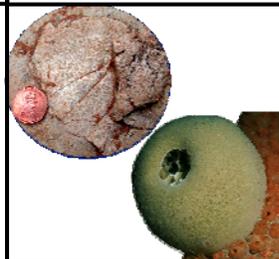
Bryozoans– These are apartment complexes for microscopic (that's really small!) animals.



Ferns– These fossils are the imprints of where leaves fell into the mud thousands of years ago.

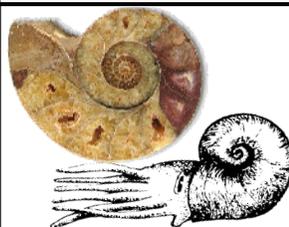


Burrows of animals– Worms and trilobites dug tunnels in the soft muddy sediment under the sea floor.



Sponges– Sea sponges are one of the most common fossils in the youngest layer at Grand Canyon.

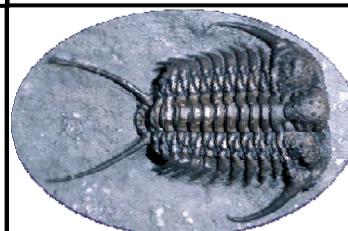
Cephalopods– These creatures roamed the sea and are related to the squid in today's oceans.



Tracks– Reptiles and other animals left their mark in the mud and sand where they lived.



Coral– This predator was rooted to the sea floor. Descendants of this animal still live in today's oceans.



Trilobites– These segmented animals could be the size of your thumb or a dinner plate!