Capitol Reef National Park

National Park Service
U.S. Department of the Interior

Geologic Features of Capitol Reef

The powerful forces that created and shaped Capitol Reef's landscape have produced a wide variety of geologic features, large and small. Within the Waterpocket Fold, many peculiar sights attract the curiosity of park visitors. Each detail has its own history. The stories combine to explain a unique collection of wonders.

Please help preserve these features for all to discover and enjoy. **Do not leave graffiti or other vandalism. Do not disturb or collect rocks or other park resources.**

Black Boulders

Black boulders found scattered throughout the Fremont River valley and along other drainages are recent geologic arrivals. These volcanic rocks came from 20- to 25-million-year-old lava flows that cap nearby Boulder and Thousand Lakes mountains and areas westward.

During the most recent Ice Age cycles, these high plateaus supported small mountain glaciers. The grinding action of the glaciers eroded into the high hillsides, embedding pieces of the andesitic lava plateaus within the glacial ice. Numerous debris flows and glacial outburst floods sent cascades of meltwater, ice, and rocky debris tumbling from the glaciers into the river valleys below. Pieces of lava rock were transported many miles from their source, and were smoothed and rounded by their violent journeys within the gritty floodwaters.

When floods receded, black boulders were left scattered across the floodplains. These flood deposits were left perched along valley slopes as their respective canyons deepened with continued erosion. This process reoccurred many times over the past 150,000 years. The deposits can still be observed today in the valleys and canyons of Sulphur Creek, Pleasant Creek, and the Fremont River.

The black boulders are black on the inside too! The white coating on the surface of many of the boulders is a mineral crust known as caliche, which is mainly a thin film of calcite and gypsum crystals. Caliche forms when mineral-laden groundwater seeps upward, coats the underside of the boulders, and evaporates from the surface, leaving its dissolved minerals behind.

Rock Colors

Impurities in sedimentary rocks act as pigments. Iron is the most common coloring agent found in Capitol Reef's rocks.

Yellow to orange to rusty brown rocks contain limonite. Example: Navajo Sandstone. Geothite, a mineral similar to limonite, forms brown concretions. Example: Dakota Sandstone.

Light blue, greenish-gray, and off-white rocks show the true colors of the sedimentary particles. Example: Shinarump Member of the Chinle Formation.

Dark gray to brownish-gray to black rocks contain incompletely-decomposed organic matter preserved under conditions such as stagnant marine basins. Example: Mancos Shale.

Dark green rocks contain reduced iron, and were deposited in marine basins, swamps, bogs, and lakes. Example: Morrison Formation.

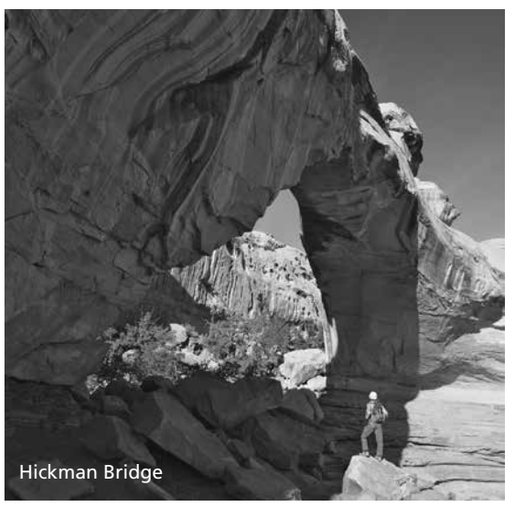
Red to reddish-brown to purple rocks contain hematite which is simple rust or iron oxide. Example: Moenkopi Formation.

Bright white rocks may consist of gypsum. Thin veins, deposited by groundwater circulating through fractured bedrock, are common in the Moenkopi and Carmel Formations. Gypsum also occurs as clear selenite crystals.

Bridges and Arches

In geologic terms, "bridge" and "arch" both refer to naturally occuring spans of stone. The key difference lies in how the span forms.

Erosion by ice, water, wind, rockfall, and other natural processes may combine to form and sculpt bridges and arches. However, flowing water, either a permanent or temporary stream, is influential in sculpting a **bridge** at some point during its formation. An **arch** is formed by natural processes other than flowing water.

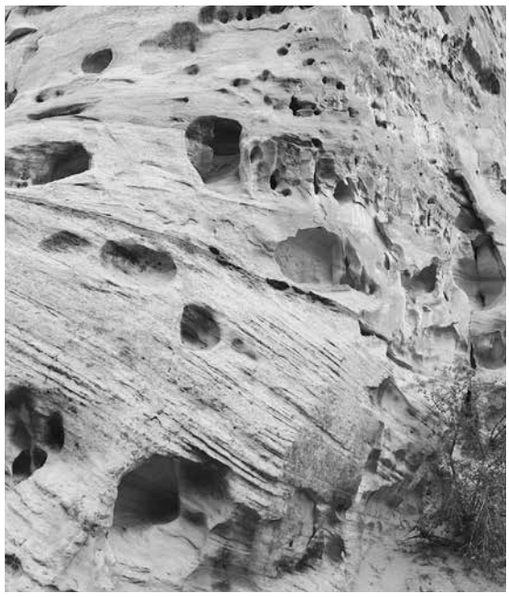


Hickman Bridge

Solution Cavities

Solution cavities can be seen in many rock surfaces at Capitol Reef. Also known as tafoni or honeycomb weathering, these concentrations of surface holes are caused by the weathering effects of wind, water, and ice. The cavities are only on the surface; that is, there are no holes hidden within the rock layer behind the surface.

What causes solution cavities to form in the first place? Sandstone, in which the cavities often form, is made of sand grains cemented together with minerals, commonly calcite or silica. Some of the sandstone may have areas that are weakly cemented together, creating softer rock. These soft areas erode easily and more quickly when exposed to surface weathering, creating cavities and leaving behind harder portions of rock.



Excellent examples of solution cavities can be seen in the walls of Capitol Gorge, and along the trail in the upper reaches of Cohab Canyon (shown here).

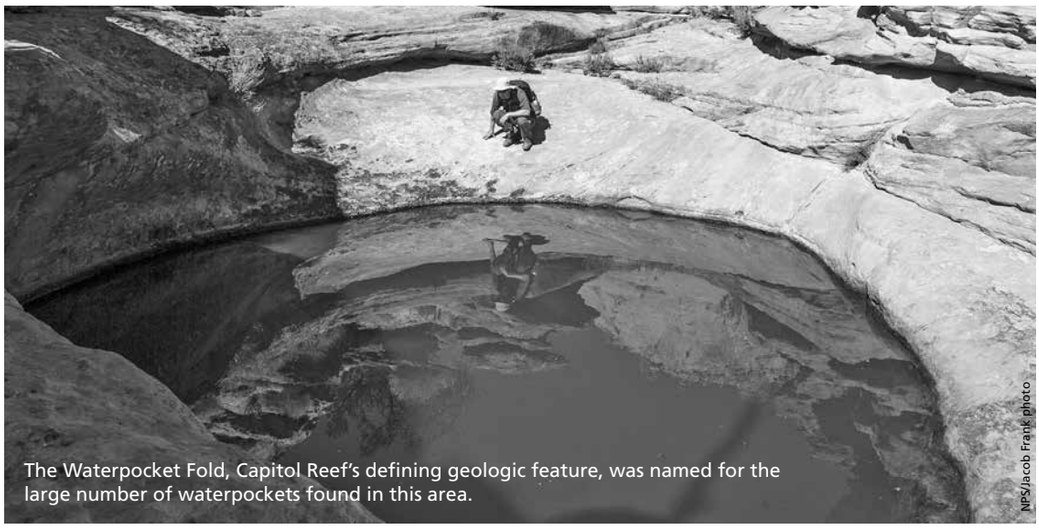
Waterpockets

Long after intermittent streams dry up in this desert environment, waterpockets often serve as precious sources of water for wildlife. Lush vegetation may be seen growing around a waterpocket, its water creating a small oasis of life.

Also known as potholes, tanks, or *tinajas*, waterpockets are depressions that form where water erodes into solid bedrock (usually sandstone).

The circulating action of flowing water, and the abrasive sand and other debris it carries, gradually wear away stone, often forming circular holes along the stream channel. These depressions often occur below waterfalls and in steeper drainages where water flows directly over smooth bedrock. Much of the erosion takes place during flash floods when large amounts of gritty water scour the potholes. Loose rocks trapped within deeper waterpockets act as scraping tools when floodwaters stir them around, accelerating the erosion and enlarging and deepening the basins.

Please help preserve these delicate resources by not polluting waterpockets. *Swimming, wading, bathing, or washing in waterpockets is prohibited in Capitol Reef National Park.*



The Waterpocket Fold, Capitol Reef's defining geologic feature, was named for the large number of waterpockets found in this area.

NPS/Jacob Frank photo