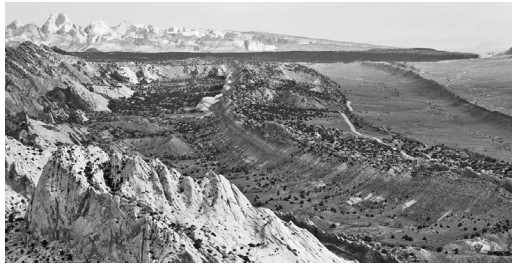




# Geology



“Geology knows no such word as forever.” —Wallace Stegner

Capitol Reef National Park’s geologic story reveals a nearly complete set of Mesozoic-era sedimentary layers. For 200 million years, rock layers formed at or near sea level. About 75-35 million years ago tectonic forces uplifted them, forming the Waterpocket Fold. Forces of erosion have been sculpting this spectacular landscape ever since.

## Deposition

If you could travel in time and visit Capitol Reef 245 million years ago, you would not recognize the landscape. Imagine a coastal park, with beaches and tidal flats; the water moves in and out gently, shaping ripple marks in the wet sand. This is the environment in which the sediments of the Moenkopi Formation were deposited.

Now jump ahead 20 million years, to 225 million years ago. The tidal flats are gone and the climate supports a tropical jungle, filled with swamps, primitive trees, and giant ferns. The water is stagnant and a humid breeze brushes your face. Oxygen-rich river water oxidized the iron in the sediments, giving the Chinle Formation its lavender and red colors, while the reducing environment of stagnant bogs gave it the greens and grays.

Visiting Capitol Reef 180 million years ago, when the Navajo Sandstone was deposited, you would have been surrounded by a giant sand sea, the largest in Earth’s history. In this hot, dry climate, wind blew over sand dunes, creating large, sweeping crossbeds now preserved in the sandstone of Capitol Dome and Fern’s Nipple.

All the sedimentary rock layers were laid down at or near sea level. Younger layers were deposited on top of older layers. The Moenkopi is the oldest layer visible from the visitor center, with the younger Chinle Formation above it. The Castle is Wingate Sandstone; the Kayenta Formation that formerly capped it has eroded away, but is still visible atop the red cliffs behind it. White domes of Navajo Sandstone comprise the highest and youngest layer seen from the visitor center.

## Uplift

The movement of, and the interaction between, Earth’s tectonic plates created the different environments in which Capitol Reef’s nineteen rock layers were formed. Few of these sedimentary layers would be visible, however, if not for the Laramide Orogeny, a massive mountain building event that likely reactivated an ancient buried fault between 75 and 35 million years ago. The compression associated with the Laramide Orogeny gave rise to a one-sided fold, or monocline, in the earth’s crust within the Colorado Plateau.

The Waterpocket Fold is a classic monocline: an elongated fold with one steep side in an

area of otherwise nearly horizontal layers. The layers on the west side of the Fold have been lifted more than 7,000 feet (2134 m) higher than corresponding layers on the east. The Waterpocket Fold is the longest exposed monocline in North America and is nearly 90 miles in length. It is the main reason Capitol Reef National Monument was established in 1937.

The folding and tilting of the rock layers allow you to travel through 280 million years of Capitol Reef’s geologic history in just fifteen miles by driving through the park on State Route 24.

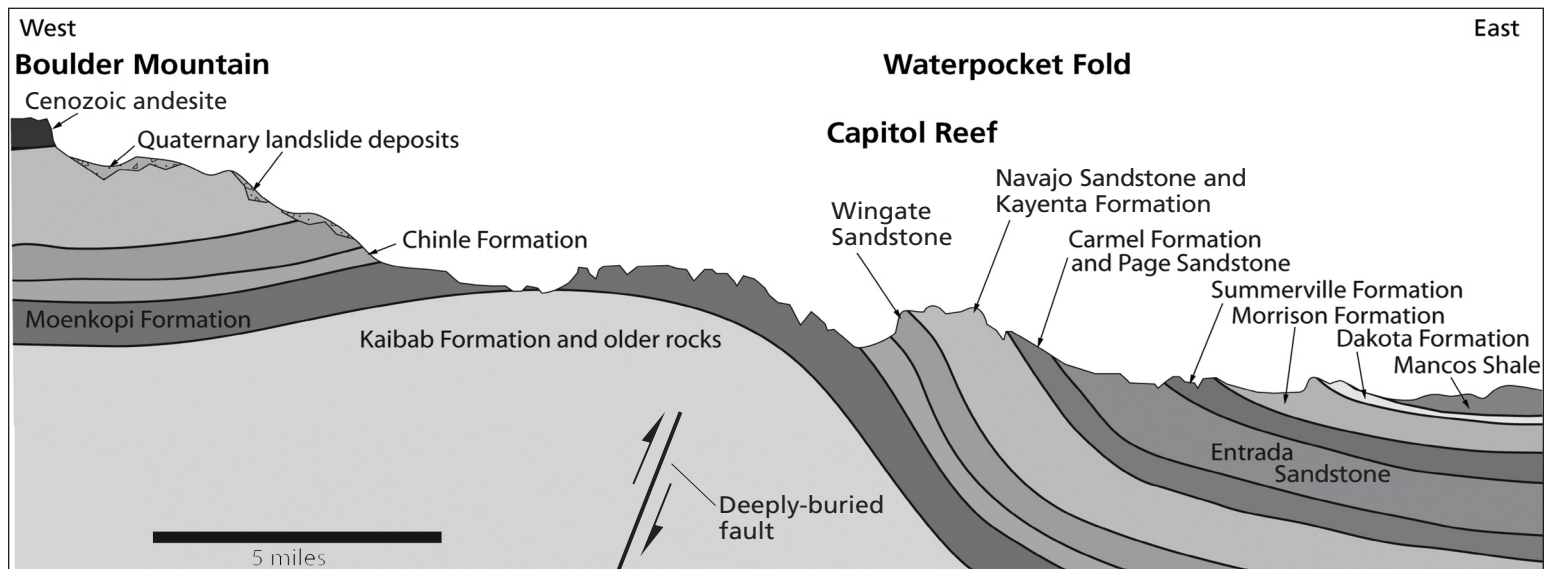
## Erosion


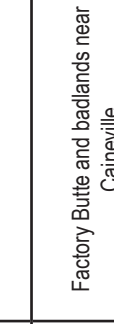



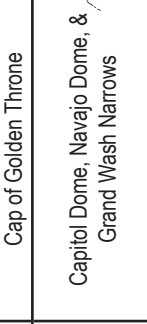


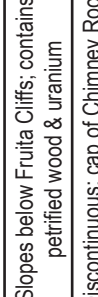



Capitol Reef’s spectacular scenery reflects not only the underlying structure of the Waterpocket Fold, but also the differing degrees of resistance to weathering and erosion seen in each rock layer.

Water is the dominant erosional force in Capitol Reef, with wind playing only a minor

role. Flash floods are the most dramatic display of erosion in action. Floodwaters propel debris, sediment, cobbles, and boulders, increasing water’s carving power.

Deposition and uplift in Capitol Reef have created a unique window into Earth’s history, revealed through the power of erosion.



Thickness	Rock Type	Paleo-environment	Location / Remarks	Landforms	Age	Capitol Reef Stratigraphy Column
1200-1450 feet (combined)	Shale interlayered with sandstone	Floodplains, coastal areas, and marine	West side of Henry Mtns., east of Strike Valley		65 MYA	Tarantula Mesa Sandstone Masuk Formation Muley Canyon Sandstone
2000-3000 feet	Mostly dark gray shale interlayered with sandstone	Shallow sea that bisected North America	Factory Butte and badlands near Caineville		Cretaceous	Mancos Shale
0-50 feet	Tan sandstone, oyster shell fossils	Coastal	Oyster Shell Reef; locally absent			Dakota Sandstone
0-100 feet	Conglomerate and mudstone layers	Rivers and Floodplains	North and east of the Hatnet Road river ford		144 MYA	Cedar Mountain Formation
180-700 feet	White crossbedded sandstone (Salt Wash) & candy-striped mudstone (Brushy Basin)	Vast river systems; bentonite clays from altered volcanic ash	Bentonite Hills; along Notom-Bullfrog Road north of Burr Trail			Morrison Formation Brushy Basin Member Salt Wash Member
150-300 feet	Thinly-bedded, reddish siltstone; thick, wavy gypsum on top	Tidal flats	Cliffs at east park entrance			Summerville Formation
0-80 feet	Grayish-green sandstone & siltstone	Marine	Caps cathedrals of Cathedral Valley			Curtis Formation
450-750 feet	Earthy, red, very fine-grained sandstone & gypsum	Transition between tidal flats and dune fields	Cathedrals of Cathedral Valley		Jurassic	Entrada Sandstone
300-100 feet	Interlayered red sandstone, siltstone, & gypsum	Shallow marine, tidal flats, & sabkhas (sandy salt flats)	Forms red V-shaped chevrons on east side of Waterpocket Fold			Carmel Formation
50-100 feet	Tan sandstone	Sand dunes	Cap of Golden Throne			Page Sandstone
800-1100 feet	White crossbedded sandstone	Vast region of sand dunes	Capitol Dome, Navajo Dome, & Grand Wash Narrows			Navajo Sandstone
350 feet	Interlayered white sandstone & red siltstone	West-flowing rivers	Top, ledgy portion of Fruita Cliffs; Hickman Bridge		206 MYA	Kayenta Formation
350 feet	Sandstone, often stained dark red	Sand dunes	Fruita Cliffs & Circle Cliffs			Wingate Sandstone
350-550 feet	Interlayered sandstone, siltstone, & bentonitic mudstone	Forested basin with rivers, swamps, & lakes	Slopes below Fruita Cliffs; contains petrified wood & uranium		Triassic	Chinle Formation
0-90 feet	White sandstone	River channels	Discontinuous; cap of Chimney Rock			Shinarump Member
500-1000 feet	Mostly dark red siltstone & mudstone; minor yellowish limestone	Gently sloping coastal plain, fluctuating sea level	Miners Mountain, Egyptian Temple, & base of Chimney Rock		248 MYA	Moenkopi Formation
70-100 feet	Gray dolomitic limestone	Marine	Fremont River Gorge			Kaibab Limestone
400+ feet	White crossbedded sandstone	Beach & dune sands	Fremont River Gorge & Goosenecks of Sulphur Creek		290 MYA	White Rim Sandstone

MYA = Million Years Ago

Additional information on the geology of Capitol Reef National Park is available on our website ([www.nps.gov/care](http://www.nps.gov/care)) which also links to the Capitol Reef Natural History Association, a non-profit cooperating association that sells publications on Capitol Reef's natural and cultural history.