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Geology of Buffalo Bill State Park

INTRODUCTION

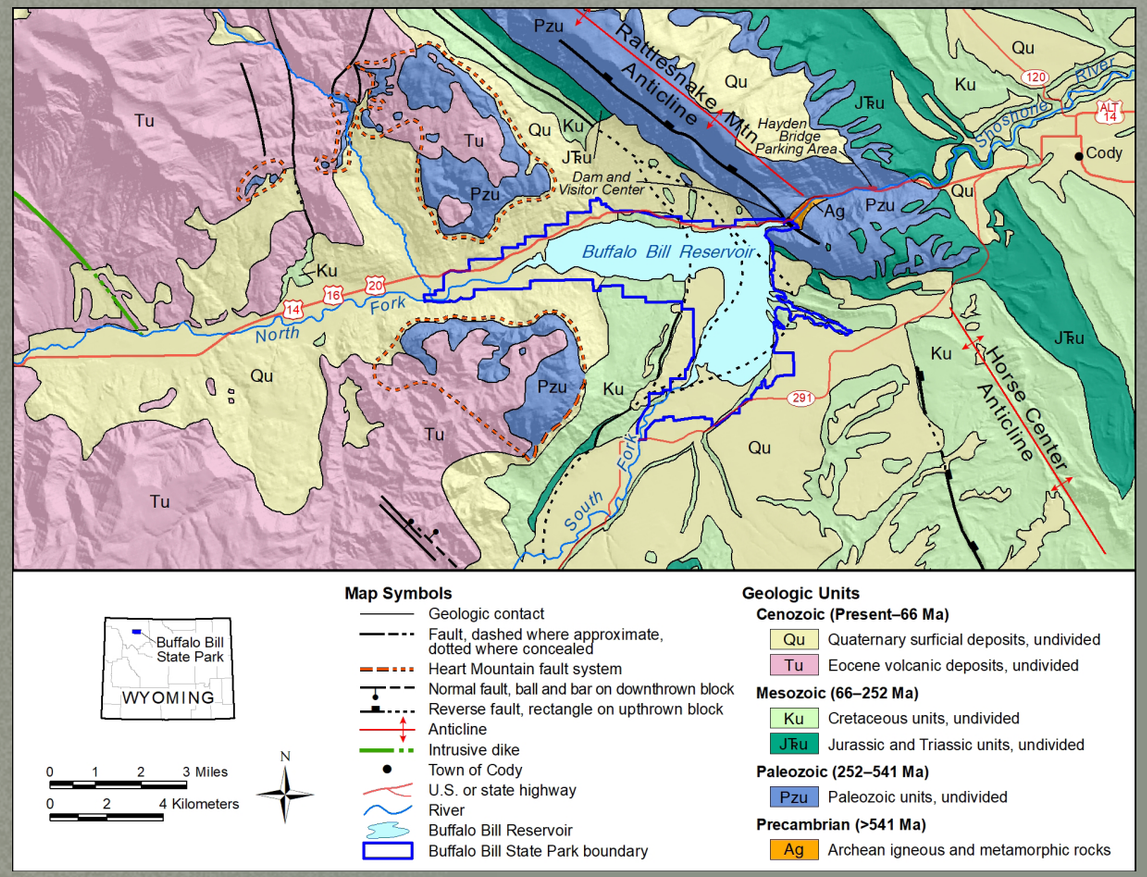
Buffalo Bill State Park is situated just east of the Absaroka Range in a geologically complex area of northwestern Wyoming. The park encompasses billions of years of Earth's history and geologic features such as the Great Unconformity, a dormant volcanic field, and the world's largest known ancient landslide.

GEOLOGIC HISTORY

Below the Buffalo Bill Dam in Shoshone Canyon and along U.S. Highway 14/16/20 between Buffalo Bill State Park and the town of Cody, a tan sandstone overlies pink and black crystalline rock. This contact, known as the Great Unconformity, marks a more than 2-billion-year gap in the geologic record; the underlying crystalline rock is Precambrian in age (2.8–2.5 billion years old), while the overlying sandstone is Cambrian (less than 541 million years old). The Great Unconformity can be observed from the hiking trail beginning at the Hayden Bridge parking area.

The Flathead Sandstone—the first geologic unit above the Great Unconformity—represents the start of hundreds of millions of years of diverse depositional environments. Rivers and streams deposited sediments that would become sandstones, and oceans collected mud and calcium carbonate from marine organisms that later lithified (turned to rock) to become shale and limestone.

Photograph of the Great Unconformity along U.S. Highway 14/16/20. Dashed black line indicates the approximate contact between Precambrian crystalline rocks and the overlying Cambrian Flathead Sandstone. Photograph courtesy of Mark P. Fisher (geowyo.com).



Generalized bedrock geologic map of the region surrounding Buffalo Bill State Park. Ages of rocks are in millions of years (Ma).

The geologic event that shaped much of the terrain seen in and around the park occurred between 70–35 million years ago. This significant mountain-building episode, known as the Laramide orogeny, exerted compressional forces on all the older formations, forming large faults and arch-shaped folds called anticlines. Steeply tilted sedimentary rocks are on the flanks of these anticlines, while Precambrian basement rocks are commonly exposed at the center of the folds. Rattlesnake Mountain, visible from the Buffalo Bill Dam and Visitor Center, is an example of one such anticline.

Near the end of the Laramide orogeny, a period of extensive volcanic activity occurred in the now-dormant Absaroka volcanic field. The volcanoes deposited large amounts of igneous and volcanic-derived sedimentary rocks, forming the Absaroka Range, west of the park. Intrusive dikes formed in the subsurface when magma moved through fractures in these rocks and cooled below ground; erosion has since exposed many of these dikes. An example of an intrusive dike is exposed as a long prominent ridge west of the park.

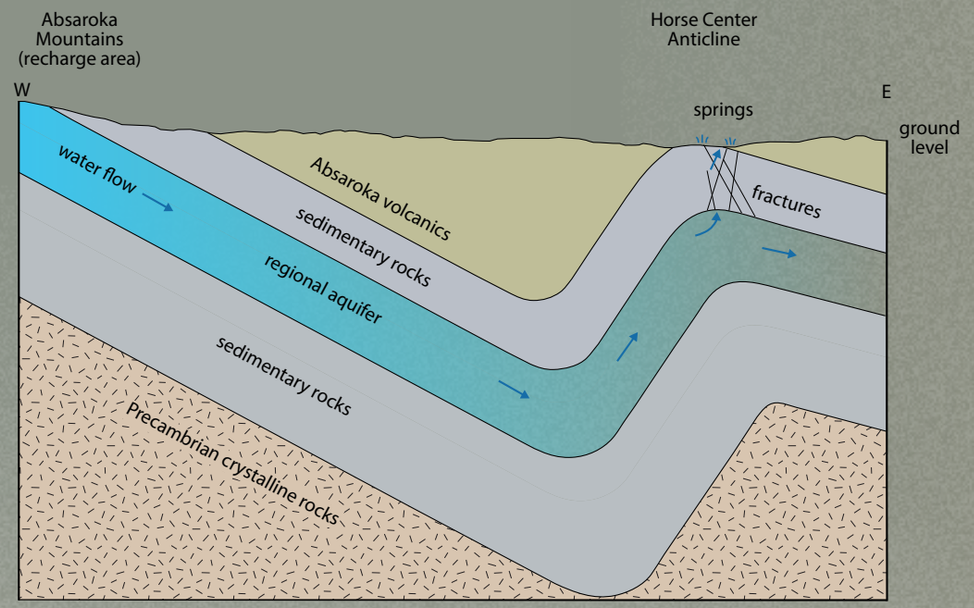
At the same time that volcanism was forming the Absaroka Range, extensive landslide activity—including the geologically famous Heart Mountain detachment—was taking place. The Heart Mountain detachment, the largest landslide ever found on Earth's surface, slid between 50 and 49 million years ago. Rocks within the detachment moved a minimum of 45 km (28 mi) from their source. Geoscientists estimate that when the landslide came to rest, the resulting deposit covered an area ranging from 3,400–5,000 km^2 (1,300–1,900 mi^2). Deciphering how this massive landslide occurred and transported such a large volume of rock over a great distance is a source of debate and controversy among geologists.

HYDROGEOLOGY

The North and the South forks of the Shoshone River feed Buffalo Bill Reservoir. These two rivers flow east from the Absaroka Range and provide nearly all of the water in Buffalo Bill Reservoir.

This part of northwestern Wyoming also contains the Cody hydrothermal system. The system begins along the eastern flank of the Absaroka Range where snowmelt and rainfall enter regional aquifers, flowing down-gradient through fractures and faults toward Cody. As groundwater travels through the subsurface, it reaches depths at which the natural geothermal gradient heats it to temperatures of more than 43°C (110°F).

After the heated groundwater flows under the park, it rises toward the surface through fractures in the southeastern flanks of the Rattlesnake Mountain and Horse Center anticlines. As the water moves upward, it cools slightly and discharges from springs along the Shoshone River at about 32°C (90°F). De Maris, Shoshone, and Needle hot springs, east of the Buffalo Bill Dam, are identifiable by conspicuous white travertine (a type of limestone) and yellow sulfur deposits along the river. A fourth hot spring, called Colter's "boiling tar" spring, is beneath Buffalo Bill Reservoir.



Generalized hydrologic model of the Cody hydrothermal system.