For more information visit:

wyoparks.state.wy.us/index.php/places-to-go/guernsey

wsgs.wyo.gov/public-info/guide-hartville-uplift

Wyoming State Geological Survey

P.O. Box 1347
Laramie, WY 82073-1347
www.wsgs.wyo.gov
phone: (307) 766-2286
email: wsgs-info@wyo.gov

Geology of Guernsey State Park

INTRODUCTION

Guernsey State Park, home to Guernsey Reservoir, is situated along the North Platte River upstream from the town of Guernsey, Wyoming. The rocks in and around the park preserve more than 2.5 billion years of Earth's history.

Beds of sandstone in the Hartville Formation crop out above Guernsey Reservoir.

GEOLOGIC HISTORY

Guernsey State Park is located within the Hartville Uplift, a large northeast-trending anticline, an arch-shaped fold, that formed during a geologic mountain-building event called the Laramide orogeny. The Laramide orogeny occurred from about 70–35 million years ago, and resulted in the formation of the Black Hills, Hartville Uplift, and much of the Rocky Mountains.

Faulting and folding of rocks in the Hartville Uplift area during this mountain-building event brought much older rock to the earth's surface and increased the elevation of the area. However, deformation in the Hartville Uplift was less intense than in other Laramide structures, resulting in broad, subtle structures that left the sedimentary rocks relatively horizontal.

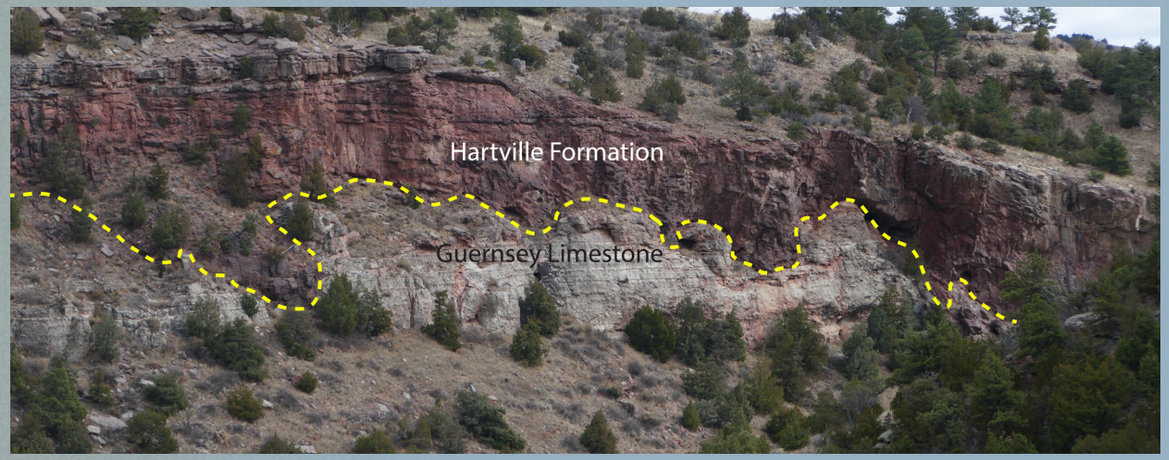
The Castle picnic shelter was built by the Civilian Conservation Corps in the 1930s using sandstone from the Hartville Formation.

Subsequent erosion exposed a wide range of rock types in the Hartville Uplift area. The oldest units are more than 2.5 billion years old, and crop out just southeast of Guernsey State Park. These rocks are metamorphosed carbonate, which are limestones and dolostones that were buried deep underground where they recrystallized due to elevated pressures and temperatures. Despite their metamorphic history, these ancient rocks contain well-preserved stromatolite fossils, layered mounds formed by photosynthetic bacteria that were some of the earliest forms of life.

THE ROCKS OF GUERNSEY

The most prominent rocks within Guernsey State Park are the bluffs of limestone and sandstone that rise above the eastern half of the reservoir and along the North Platte River. These sedimentary rocks are part of the Guernsey Limestone and the Hartville Formation, which are exposed across the Hartville Uplift. The **Guernsey Limestone** contains beds of gray limestone deposited in shallow subtropical seas when the continent was near the equator during the Early Mississippian, about 359–347 million years ago (Ma).

The Late Mississippian–Permian (~331–280 Ma) **Hartville Formation** was deposited on top of the Guernsey Limestone in shallow marine and coastal environments. It consists of gray limestone, tan to maroon sandstones, and multi-colored siltstones. The Hartville Formation was deposited unconformably on top of the Guernsey Limestone, meaning there was a time between deposition of the two units during which either no rocks were deposited or erosion occurred.



The contact between limestone beds of the Guernsey Limestone and sandstones of the Hartville Formation, marked by the dashed yellow line, is highly irregular. Karst features, such as sinkholes and caverns, formed in the Guernsey Limestone before the Hartville Formation was deposited. Sediment from the Hartville Formation then filled in these features. View is to the east from above the Guernsey Dam.

The late Oligocene–early Miocene **Arikaree Formation** (~28–19 Ma) overlies the Hartville Formation. It is a white fluvial (meaning it was deposited by rivers) sandstone rich in volcanic ash that forms the sparsely vegetated badlands along the western side of the reservoir near Sandy Cove. At the nearby Guernsey Ruts and Register Cliff historic sites, the names and wagon wheel ruts are carved into soft Arikaree Formation sandstone.

Pleistocene **fluvial conglomerates** (~2.6–1.8 Ma), deposited by the Ancestral North Platte River, are exposed sporadically along valleys and above the reservoir. These thick deposits, up to 150 ft, contain boulders, cobbles, and pebbles of a wide range of rock types, the majority of which came from the Laramie Mountains and other nearby ranges.

Overlying these formations are deposits of **windblown loess**, beds of silt, clay, and very fine sand that were carried by the wind. This loess was deposited during the Quaternary (between 2.6 Ma and modern times). Within Guernsey State Park, the loess forms broad slopes around the reservoir.

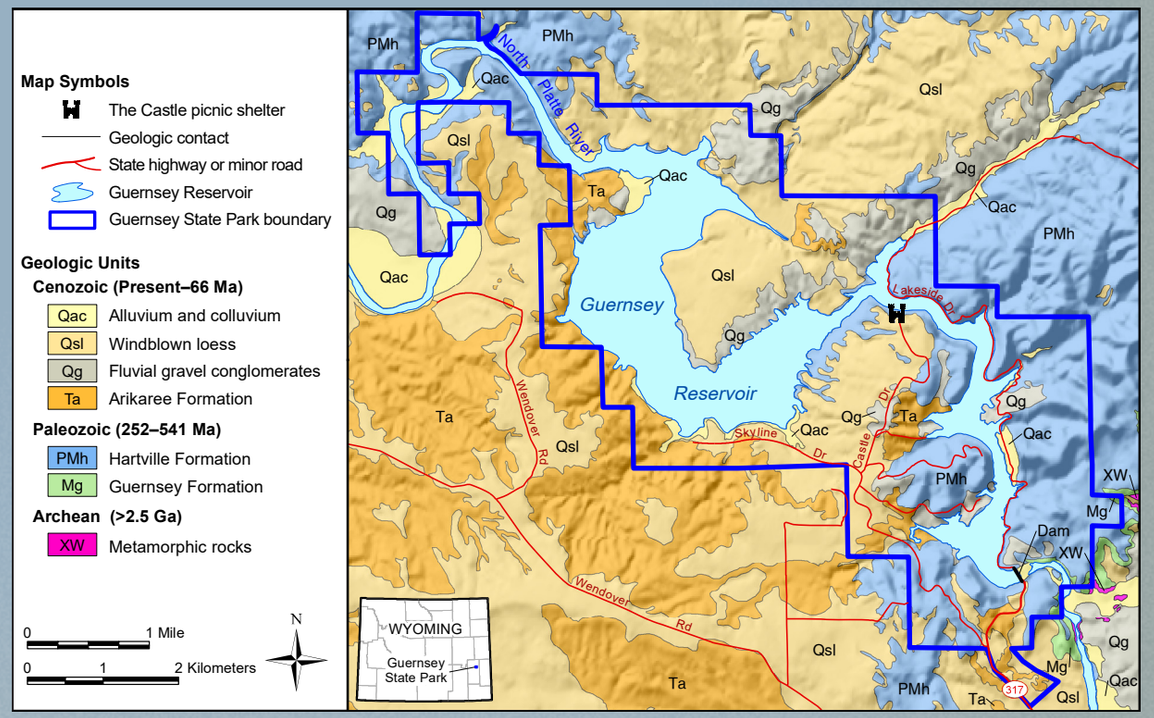
MINING HISTORY

Some of the rocks exposed in the Hartville Uplift have undergone mineralization that made them rich in iron and copper. Native Americans mined hematite, a soft iron-rich mineral often referred to as “red ochre,” and chert, a hard silica-rich rock, for a variety of uses. Evidence of mining activity in the Hartville Uplift area dates back to approximately 13,000–11,500 years ago, making this one of the oldest mining sites in North America.

Commercial mining in the area began in 1880 with the production of copper, which lasted until 1887. Iron mining began in 1898 and continued until 1980.

HYDROGEOLOGY

The Arikaree and Hartville formations are regional aquifers used primarily for agricultural and domestic purposes. Water flows between Guernsey Reservoir and the Arikaree and Hartville aquifers to form an integrated surface water and groundwater system. Reservoir water infiltrates the rock through porous voids between individual mineral grains and through fractures and faults in the rocks. In turn, these aquifers seep groundwater back into the reservoir during the annual summer “silt run” when stored water is released from the reservoir, rapidly decreasing water levels.



Generalized bedrock geologic map of Guernsey State Park. Ages of rock are in millions of years (Ma) or billions of years (Ga).