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Geology of Glendo State Park

INTRODUCTION

Glendo State Park is the home of Glendo Reservoir, located along the North Platte River. The geology exposed around the park—representing more than 300 million years of Earth history—is largely visible because the North Platte River cut a canyon through this region, leaving the landscape seen today. These rock exposures allow a better understanding of the geologic history of the region, telling a story of inland flooding, dinosaurs, mountain building, and volcanism.

GEOLOGIC HISTORY

The oldest rocks exposed in Glendo State Park, along the northwestern edge of the reservoir, are the gray to white limestones and red silty sandstones of the Hartville Formation. These Pennsylvanian- and Permian-age beds were deposited about 300 million years ago in a shallow subtropical ocean that once covered the region. The Hartville Formation also makes up the cliffs above the reservoir at nearby Guernsey State Park.

As this ancient ocean retreated, a broad, flat coastal plain developed. It was in this setting that the middle Permian to Lower Triassic Goose Egg (~250 million years old) and the Triassic Chugwater (~230 million years old) formations were deposited. The Goose Egg Formation contains interbedded rusty-red shales, limestones, and evaporites (mineral deposits left after water evaporates). The Chugwater Formation is made up of red shales, siltstones, and thin evaporite beds. The distinctive red-colored beds found in both formations are the result of oxidation (rusting) of naturally occurring iron in the rock.

During the Jurassic Period, a waterway called the Sundance Sea flooded the arid continental interior, stretching from what is now northwestern Canada to northern Colorado. Its migrating shoreline deposited sands, silts, and muds, which eventually became the sandstones and mudstones of the Sundance Formation (~175 million years old). In Glendo State Park, the Sundance Formation is exposed most commonly as yellow-green silty sandstones.

Yellow sandstone (resistant blocks in foreground) and mudstones (slope in the background) of the Jurassic Sundance Formation.

As the Sundance Sea retreated, the region returned to an arid terrestrial environment populated by dinosaurs. During this time the Morrison Formation (~155 million years old) was deposited, which consists of colorful layers of shales and claystone interbedded with sandstone and limestone. The Morrison Formation occurs across the western United States, and is well known for its abundance of world-class dinosaur fossils, which accumulated and were later preserved in river channels. A wide variety of dinosaurs have been found within this formation, including the plant-eating stegosaurus, long-necked sauropods, and the carnivorous allosaurus, but none have been found in Glendo State Park to date.

Tan sandstone beds of the Cloverly Formation (Kcv) form cliffs that top many hillsides and ridges in the southern portion of the park. Beneath the Cloverly are slope-forming mudstones and thin sandstone beds of the Morrison Formation (Jm). The Twenty 15 trail can be seen cutting across the lower part of the hillside.

Cretaceous rocks exposed in Glendo State Park include the Cloverly Formation, which was deposited in rivers, floodplains, and lakes approximately 140 million years ago. The Cloverly Formation consists primarily of sandstone beds varying from tan to white and gray, with a middle section dominated by gray claystones. In the southern end of the park, tan sandstone beds of the Cloverly form prominent cliffs capping slopes above the reservoir and the North Platte River.

Around 70 million years ago, a geologic mountain-building event called the Laramide orogeny began, continuing until about 35 million years ago. The word “orogeny” comes from the Greek roots oros, meaning “mountain,” and gen, meaning “creation.” During this time, deformation of the earth’s crust formed many of the mountain ranges that make up the Rocky Mountains in western North America. One of the structures formed by the Laramide orogeny is the Hartville Uplift, a large northeast-trending arch-shaped fold, known as an anticline, which is located between the Laramie Mountains and the Black Hills. Glendo State Park is situated along the northwestern edge of the Hartville Uplift.

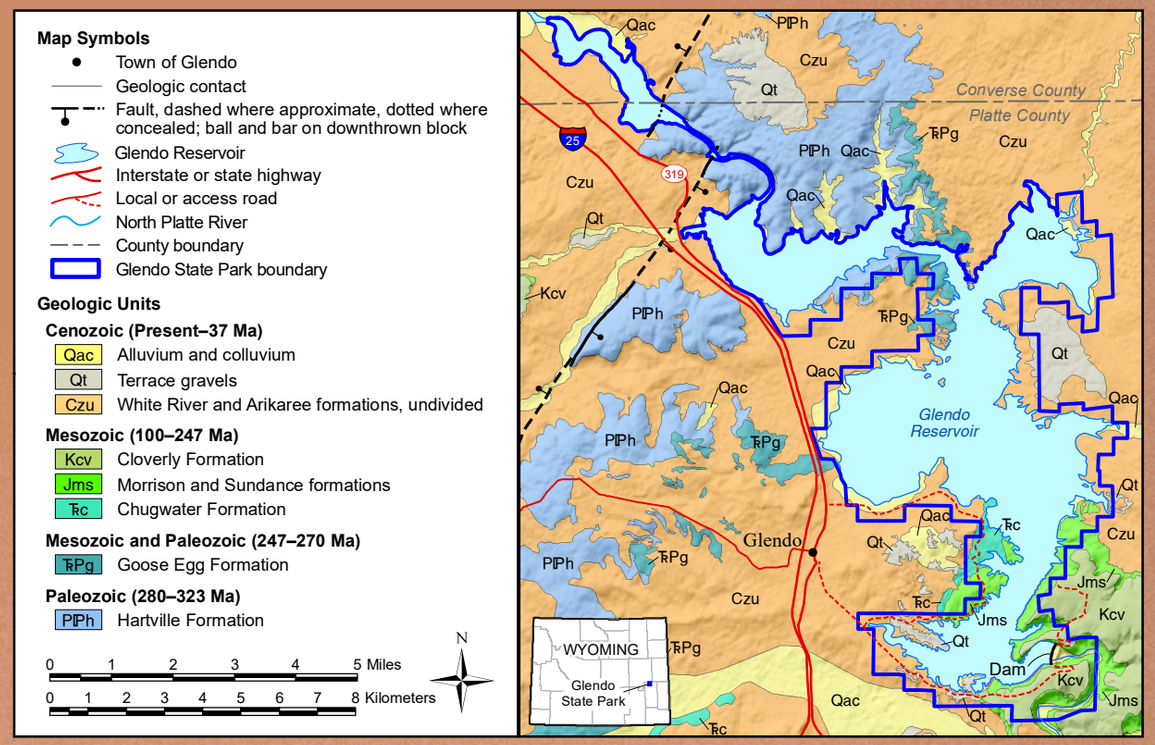
The folding of the Hartville Uplift made it a high point in the region, which resulted in erosion of rocks exposed at the surface and a gap in the rock record, known as an unconformity. In the Glendo area, this unconformity represents more than 60 million years of missing time between the Cloverly Formation, which was deposited before the Laramide orogeny began, and the overlying White River Formation, which was deposited after the orogeny ended.

The Arikaree Formation (~24 million years old) was deposited on top of the White River Formation (~33 million years old). These two formations are geologically similar; both contain interbedded ash-rich claystones, siltstones, and sandstones that represent ancient river, soil, and volcanic ash-fall deposits. The ash within these formations came from explosive volcanic eruptions that occurred across the western United States. Both formations also host well-preserved mammal fossils, including the ancestors of horses, rhinoceroses, and camels.

REGIONAL HYDROGEOLOGY

Glendo Reservoir can hold up to 789,402 acre-feet of water behind an earthfill dam that was constructed in 1958 on the North Platte River. Glendo is the third largest of five reservoirs on the North Platte River in Wyoming. Most of the water originates as surface runoff from parts of the Sierra Madre, Medicine Bow, and Laramie mountains in Wyoming, as well as the mountains circling North Park, Colorado.

The Arikaree, White River, and Hartville formations are important aquifers in eastern Wyoming. The Arikaree and White River formations are part of the High Plains aquifer system, a series of interconnected aquifers spanning eight states from Wyoming to Texas and New Mexico. This system is an important source of agricultural water in these states. Cheyenne, Wheatland, Pine Bluffs, and many other Wyoming communities also use High Plains aquifers as municipal water sources. The town of Glendo gets its municipal water supply from wells in the Hartville Formation, while Glendo State Park sources its water from the White River and Cloverly formations.



Generalized bedrock geologic map of Glendo State Park. Ages of geologic units are in millions of years (Ma).