Geology of Boysen State Park

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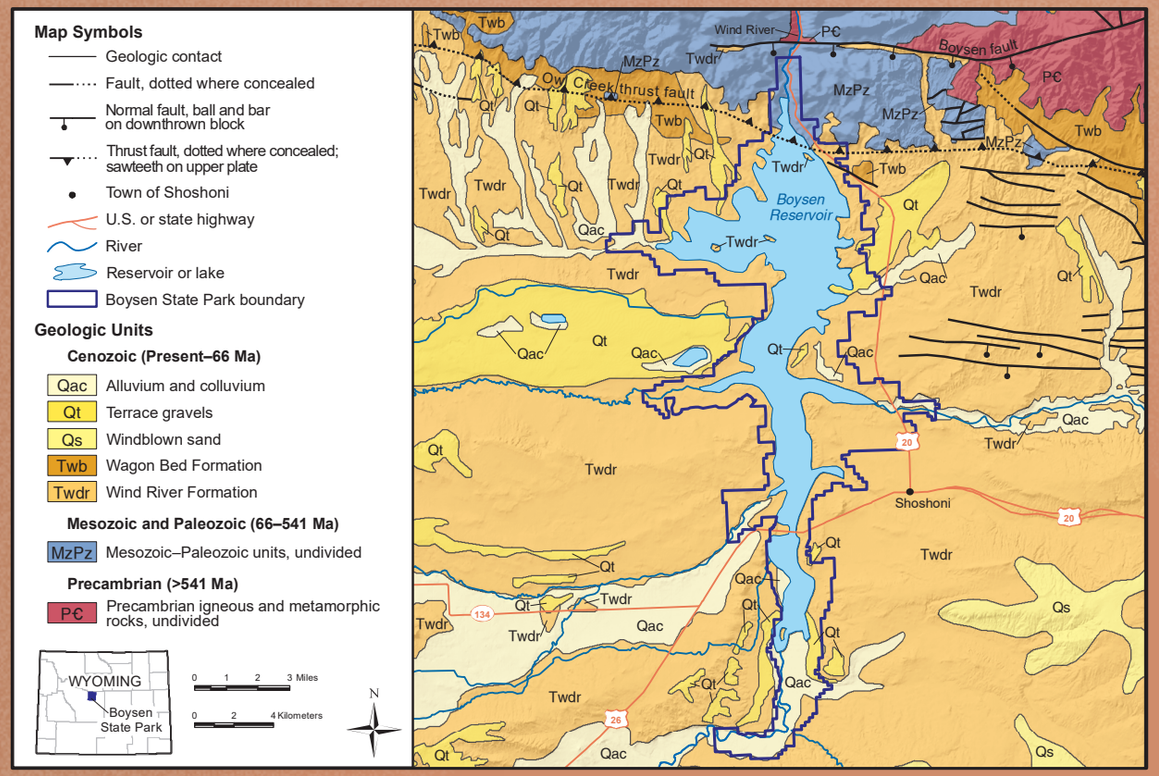
INTRODUCTION

Boysen State Park is situated on the southern flank of the Owl Creek Mountains in central Wyoming. The park encompasses Boysen Reservoir and is the gateway to the spectacular geology of Wind River Canyon. Geologic units in and around the park range from 2.9-billion-year-old rocks to modern flood plain deposits.

GEOLOGIC HISTORY

The park is at the northern edge of the Wind River Basin, a broad depression that formed in response to the Laramide orogeny. The Laramide orogeny was a mountain-building event that occurred between 70 million and 35 million years ago. During this event, Precambrian crystalline igneous and metamorphic rocks and overlying sedimentary strata were uplifted and displaced southward along the Owl Creek thrust fault, shaping the Owl Creek Mountains. Through time, the uplifted rocks eroded and were transported by rivers into the Wind River Basin, forming the Eocene Wind River Formation (53–51 million years old). The multicolored to light-brown claystones, siltstones, and interbedded sandstones of the Wind River Formation are exposed in the hills around the park and as islands within Boysen Reservoir. The overlying green and gray claystones, sandstones, and conglomerates of the Eocene Wagon Bed Formation (approximately 51–49 million years old) were deposited predominantly in ancient lakes within the basin.

Exposure of the Eocene Wind River Formation in Boysen State Park.



Geologic map of Boysen State Park and the surrounding area. Ages of rocks are in millions of years (Ma).

Also during the Laramide orogeny, a series of normal faults formed north of the Owl Creek thrust fault, the most prominent being the Boysen fault. Unlike thrust faults, normal faults form when the earth's crust experiences tensional, or pulling apart, forces. In this case, normal faults developed as rocks transported to the surface by the Owl Creek thrust fault deformed and folded downward. Dark-colored Precambrian rocks are exposed along the Boysen fault near the entrance to the southernmost tunnel on U.S. Highway 20 in Wind River Canyon.

Displacement along the Boysen fault and erosion by the Wind River exposed what is known to geologists as the Great Unconformity. In Wind River Canyon, the Great Unconformity represents more than a 2-billion-year gap in the geologic record; this feature is common in the western United States and can be observed in a few other Wyoming state parks. The Great Unconformity is visible at the southern end of Wind River Canyon, where the Precambrian igneous and metamorphic rocks (formed and metamorphosed between 2.9 billion and 2.7 billion years ago) are overlain by the Cambrian Flathead Sandstone (550 million years old; shown on map as part of Mesozoic–Paleozoic units, undivided), which was deposited in an ancient sea and in shallow rivers.

The two most prominent cliff-forming units in the upper Wind River Canyon are the marine shelf deposits of the Ordovician Bighorn Dolomite (450–446 million years old) and the shallow marine shelf deposits of the Mississippian Madison Limestone (357–345 million years old).

View to the northwest of Precambrian rocks exposed along the trace of the Boysen fault at the southernmost tunnel in Wind River Canyon.

HYDROGEOLOGY

Boysen Dam, a 220-foot-tall earth-fill dam, holds back the water of the Wind River that forms Boysen Reservoir. The present-day dam was constructed between 1946 and 1951 at the head of Wind River Canyon, slightly upriver from the original dam built by Asmus Boysen in 1908.

The reservoir is designed to hold 802,000 acre-feet (1 acre foot=326,000 gallons) of water. Most of the water stored in the reservoir originates as snowpack at higher elevations in surrounding mountains. In fact, one of the reservoir's critical functions is to regulate snowmelt flows from these mountain ranges during high snowpack years to prevent flooding in downstream communities such as Thermopolis, Worland, and Greybull. Additionally, the reservoir is a source of municipal water for Thermopolis and provides irrigation water storage for regional agricultural lands. Hydroelectric power generated at the dam is connected to transmission lines that distribute electricity across the area.

The water stored in Boysen Reservoir and aquifers in the surrounding area form an integrated surface water and groundwater system. Reservoir water infiltrates into the aquifers through fractures in aquifer rocks and through porous voids between individual mineral grains. However, when water levels are low in the reservoir, some groundwater stored in the aquifers flows back into Boysen Reservoir as springs. Groundwater also discharges from springs located along the base of the Owl Creek Mountains to feed small creeks that flow directly into Boysen Reservoir. Springflows are highest for a few weeks after snowmelt and then decrease. By mid-summer, flows from these springs may be reduced to a trickle or dry up completely.