For more information visit:

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Geology of

Bear River State Park

INTRODUCTION

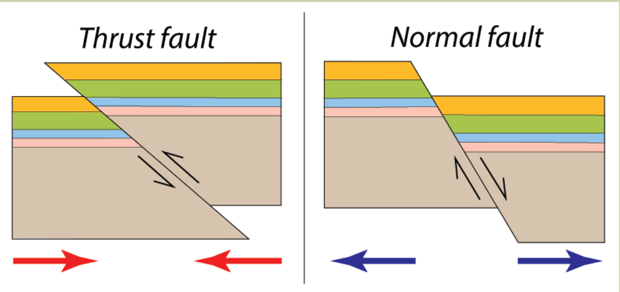
Bear River State Park, in southwestern Wyoming, is part of a landscape shaped by ancient mountain-building processes and multiple episodes of faulting. More recently, erosion by the dynamic Bear River formed the topography you see today. Views from the park frame a portrait of the major events that formed the present-day Rocky Mountains.

GEOLOGIC HISTORY

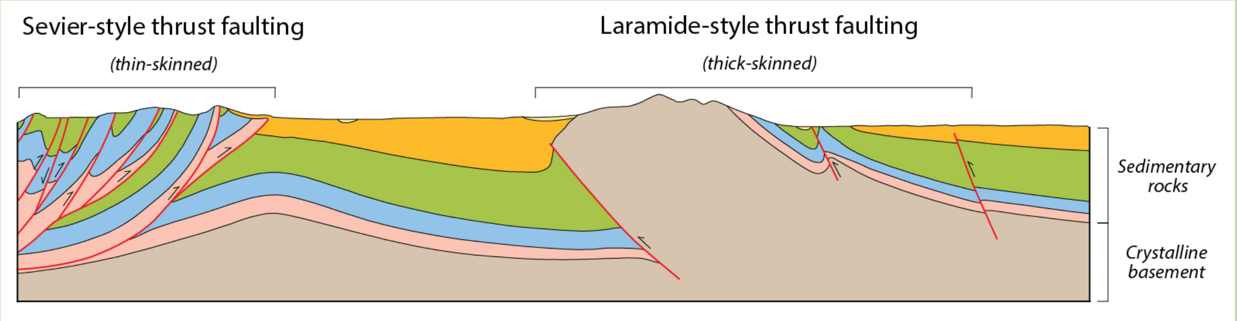
Bear River State Park sits at the southern end of what geologists call the Wyoming Overthrust Belt, a 180-mile-long and 50-mile-wide corridor of mountains and narrow basins formed by tilted and faulted sedimentary rock. The Overthrust Belt is on the western edge of the Rocky Mountains, a chain of many different mountain ranges that form the backbone of the North American continent.

Two major mountain-building episodes, called orogenies, uplifted the Rocky Mountains through numerous large thrust faults (ruptures in the earth's crust caused by compression). The first of these orogenies, the Sevier orogeny, began about 120 million years ago with "thin-skinned" deformation that involved faulting and folding only in the relatively shallow sedimentary rocks overlying crystalline basement rocks. The Overthrust Belt directly surrounding the park was part of the Sevier orogeny. "Thick-skinned" faulting, involving deeper basement rocks, is characteristic of the Laramide orogeny, the second mountain-building episode that began about 70 million years ago. The Laramide orogeny uplifted the nearby Uinta and Wind River mountains.

During the Sevier orogeny, older sedimentary rocks within the Overthrust Belt were thrust up and over younger rocks to the east. Faulting generally advanced eastward with time, beginning in eastern Idaho and northern Utah and extending about 20 miles east of Bear River State Park. The Medicine Butte thrust fault, which lies just outside the state park, is one such fault that displaced Jurassic and Cretaceous rocks above the younger Evanston Formation.



Cross section comparison of two fault types. Thrust faults form due to compression (red arrows) while normal faults are the result of tension (blue arrows).

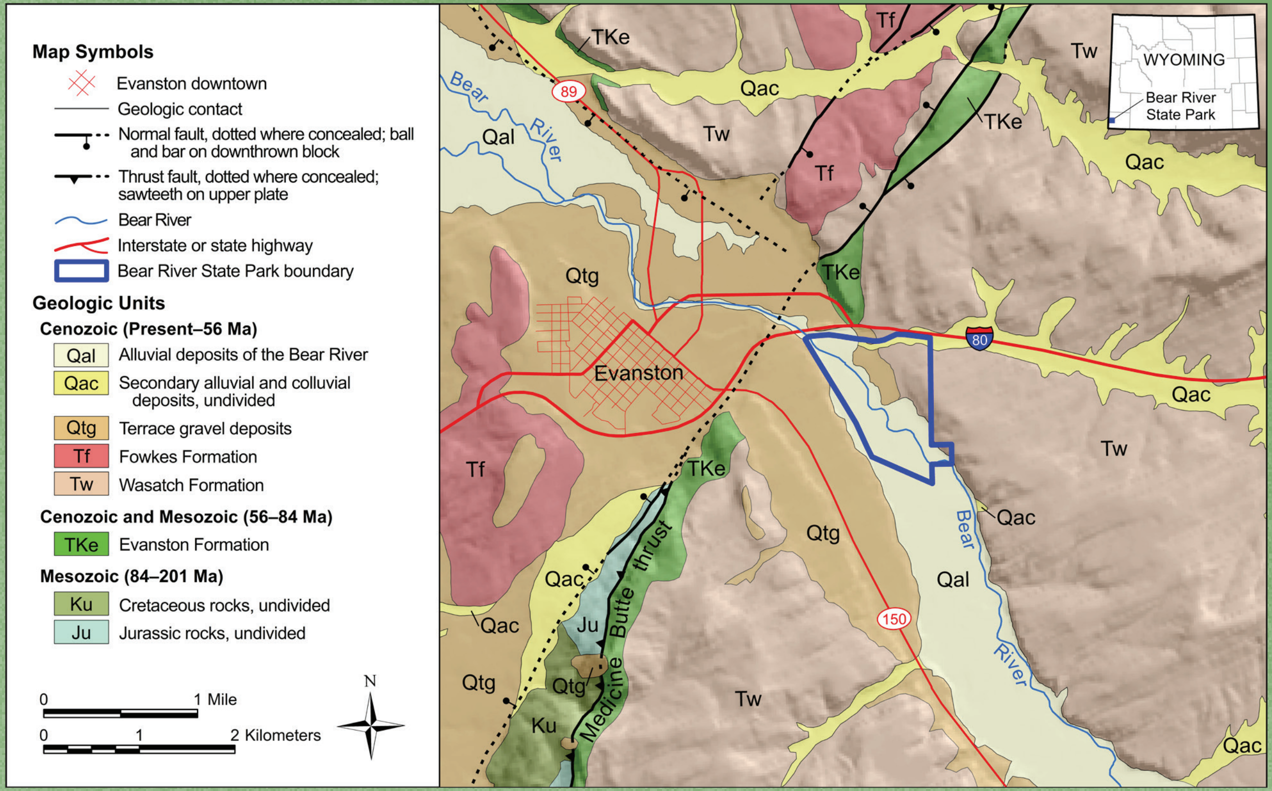


Cross section comparison of "thin-skinned" (Sevier) and "thick-skinned" (Laramide) thrust faulting. Mountain ranges uplifted by both styles of thrust faulting are visible from Bear River State Park.

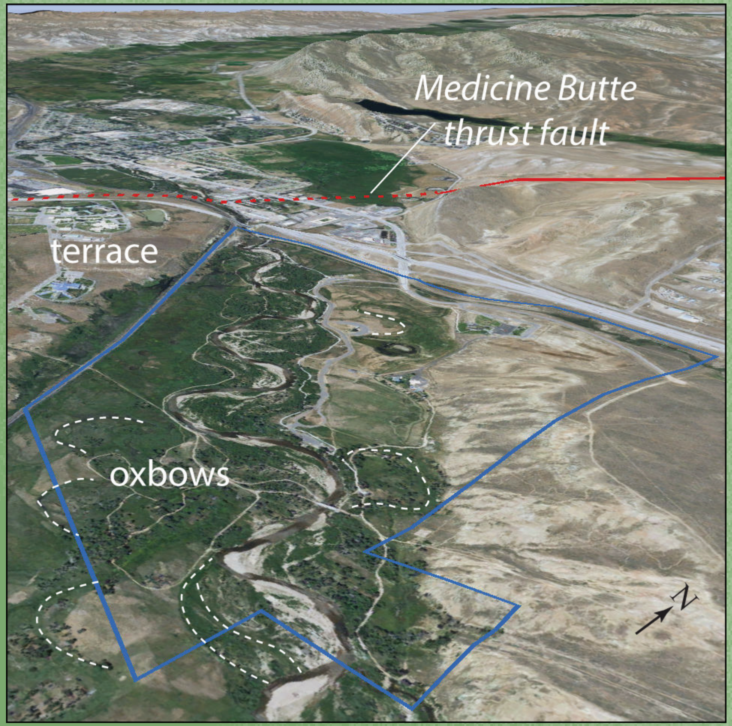
Faulting along the Medicine Butte thrust formed a mountain range to the west and a basin to the east. Sediment eroded from this mountain range was deposited in what geologists today call Fossil Basin.

Most of the mountain-derived sediment was carried by rivers into Fossil Basin and the surrounding region, leaving behind the Wasatch Formation, deposited between about 56 and 40 million years ago during the Eocene Epoch. The environment of southwest Wyoming during the Eocene was a semi-tropical savanna that supported an abundance of life. The Wasatch Formation in Fossil Basin consists primarily of red, yellow, brown, and gray mudstone and sandstone along with minor layers of conglomerate, marlstone (a clay-rich freshwater limestone), and volcanic ash. The color variation in the Wasatch Formation is due to weathering of different minerals found in volcanic ash, as well as oxidation (rusting) of iron in sandstones and mudstones. Sandstone and conglomerate layers record deposition in river channels, whereas mudstone layers record floodplain settings. The Wasatch Formation is exposed in the yellow-gray hillslopes on the east side of the Bear River in the park.

About 53 to 49 million years ago, an inland lake, known as Fossil Lake, occupied the center of Fossil Basin northeast of the state park. Silt and clay that settled in the calm waters of Fossil Lake were preserved as the Green River Formation. The Green River Formation is famous for containing fish and other vertebrate fossils, which can be seen at Fossil Butte National Monument and surrounding areas near Kemmerer, Wyoming.



Simplified geologic map of Bear River State Park and its surroundings. Geologic unit ages are in millions of years (Ma).



Oblique aerial view to the northwest looking downstream along the Bear River. The river's floodplain is marked by the extent of green vegetation. White dashed lines highlight oxbows and abandoned meanders, the red line shows the trace of the Medicine Butte thrust fault (dotted where concealed beneath river deposits), and the blue line outlines the state park boundary.

After deposition of the Wasatch and Green River formations, beginning in late-Eocene time, the Overthrust Belt and much of western North America were subjected to tensional forces that began to slowly stretch the crust in an east–west direction. In places, including along the Medicine Butte fault, older thrust faults became reactivated as normal faults (faults that form in response to tension rather than compression). The Fowkes Formation, exposed near the town of Evanston, represents sediment deposited in valleys downdropped by normal faults. Normal faulting largely shaped the modern landscape and present course of the Bear River.

HYDROGEOLOGY

The Bear River originates in the Uinta Mountains, which are the high peaks visible to the south of the park. It flows northward through the park and crosses the Wyoming/Utah border twice on its way into Idaho. The river then turns back to the south and finally drains into the Great Salt Lake. Because the Great Salt Lake has no outlet, water passing through the park never reaches an ocean. The Bear River travels 350 miles on its winding route, yet ends a mere 75 linear miles from its source.

Within the park, the Bear River has a relatively low flow for most of the year as it is fed by regional precipitation and groundwater from the surrounding bedrock and gravel. However, the river's discharge swells by roughly 40 times in late spring due to snowmelt in the Uinta Mountains. A portion of the high flows are stored for irrigation in local reservoirs upstream and downstream from the park (not shown in map extent).

The Bear River has a meandering channel pattern. As the river progressively erodes its banks on the outside of bends and deposits sediment on the inside, the channel migrates, or meanders, back and forth across the floodplain, leaving behind numerous oxbow lakes and abandoned side channels. An oxbow lake forms when a meander develops into a pronounced loop and the river cuts through the narrow neck of the loop, stranding the former channel as a small lake that may only recharge when the river is in flood.

Above the modern floodplain are terraces, flat landforms composed of gravel deposited by the Bear River tens of thousands of years ago and subsequently left behind as the river has cut down into the valley bottom. The town of Evanston is built on one of these river terraces.