Makoshika State Park

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Montana Geology 2007

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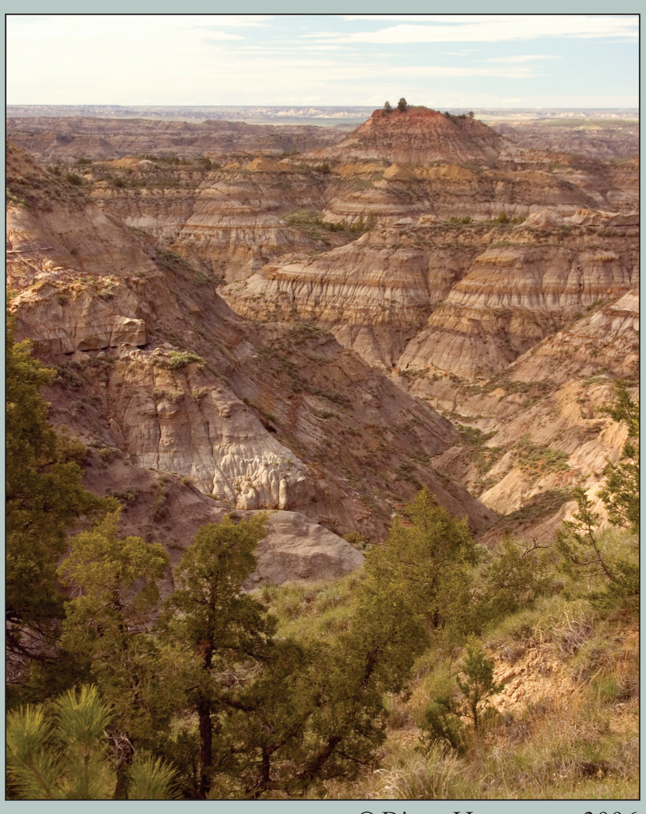

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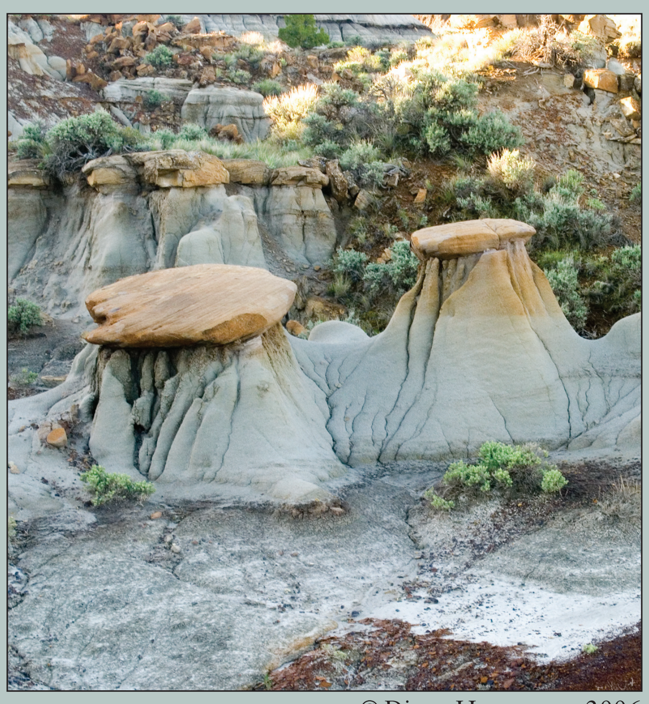

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Photo by Ginette Abdo, MBMG

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Location

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Makoshika State Park

MBMG file photo

History

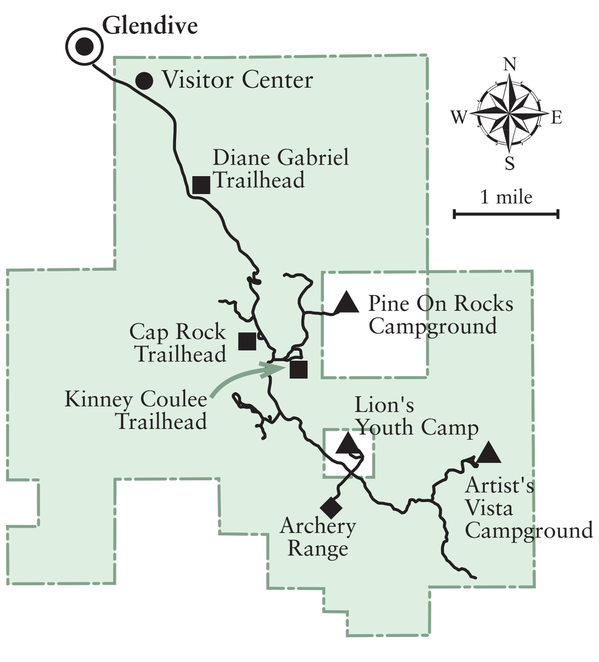
Makoshika State Park, just south of Glendive, Montana, is a harsh, unforgiving landscape—filled with unexpected wonders.

The name Makoshika (Mah-KO-shi-kah) comes from a Lakota-Sioux term for 'land of bad spirits' or 'bad land.' According to archaeological surveys, Native Americans still stopped here despite the forbidding name, likely because of the proximity to the Yellowstone River.

William Clark of the Lewis and Clark Expedition passed the mouth of Cains Coulee, near the entrance to Makoshika, on August 1, 1806. Several other members of Clark's party, whose horses had been stolen by the Crow Indians, floated down the Yellowstone past this area several days later, using skin boats.

As early as 1892 local settlers and homesteaders advocated that Makoshika be designated as a park. This proposal was pushed forward again, without success, in the mid-1920s, and again in 1933, with an official proposal by Governor Frank Cooney. The Federal government built the first road into Makoshika in 1939, but failed to designate National Park status. In the 1940s A.J. and Catherine McCarty—descendants of some of the first homesteaders in the area—donated a tract of land to Dawson County, with the provision that it be preserved. This was the start of the 11,531 acres that make up the park today. The State of Montana officially designated Makoshika as a State Park in 1953. It is still Montana's largest State Park.

Makoshika State Park

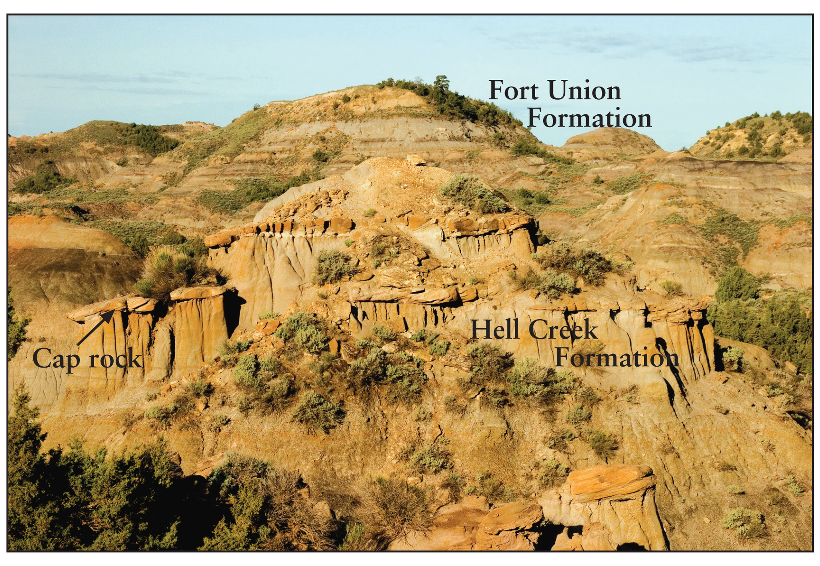


The Park's Visitor Center, which opened in 1995, contains interpretive displays and kiosks, a huge triceratops skull found in the park, and a paleontology laboratory. Paleontology digs are a common activity in the summer.

Makoshika has its share of live wildlife as well, with more than 40 bird species and 150 plant species. It is home to mule deer, coyotes, bobcats, golden eagles, and prairie falcons. One of the most famous birds is the turkey vulture; the second Saturday in June is marked as Buzzard Day, to celebrate the return of the 40-60 native 'buzzards.' But the most dramatic and compelling feature of Makoshika is its scenery.

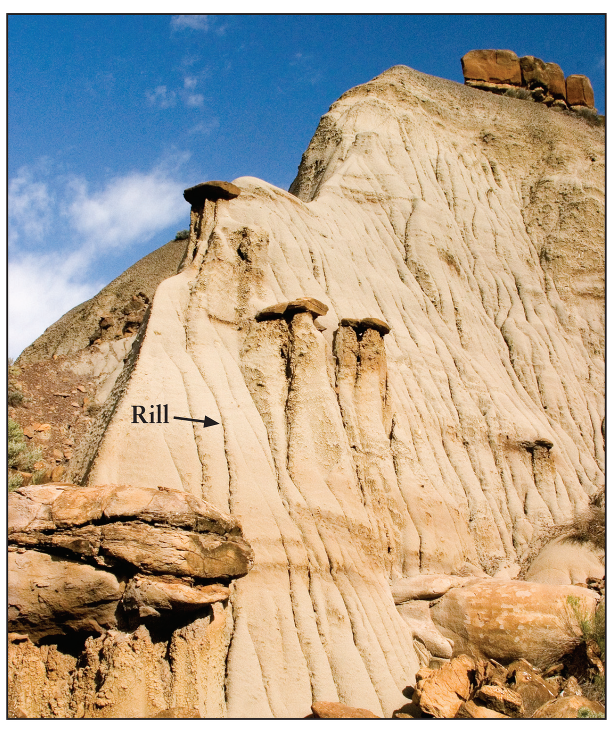
Geology

The deeply gullied topography at Makoshika State Park, called 'badlands,' may be 'bad' because it is difficult to cross, but its spectacular scenery more than compensates. The miles of irregularly shaped hills and canyons are a rugged contrast to the flatlands of the nearby plains. The badlands are striking on a grand scale, but small-scale shapes and patterns also abound in the park, such as the natural sculpture on the front of the calendar.



Cap rocks in the Hell Creek Formation. Relatively well-cemented sandstone lenses form "caps" on softer sedimentary rocks. Photo copyright Diane Hargreaves, 2006.

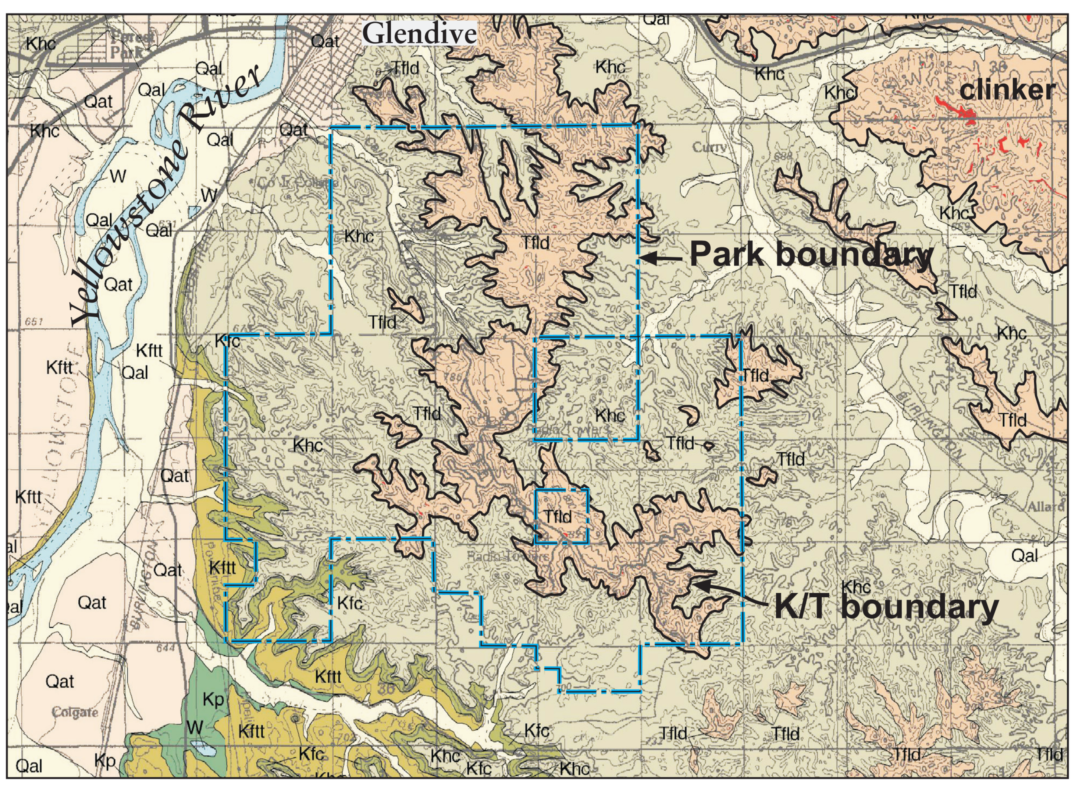
Badlands develop in weakly cemented sedimentary rock, where sparse vegetation and water-resistant clay cause rainwater to run off the slopes. The rain carries sediment gently down the hillslopes or in turbulent flash floods, down gullies that deepen with time. The water drops its load at slope bases, forming broad coalescing fans typical of badland valley floors. Shifting, sediment-laden streams eventually deliver most of the sediment from the valley floors of Makoshika State Park to the Yellowstone River. Wind and water erosion further sculpt the hills into irregular shapes caused by the uneven resistance of the rock.



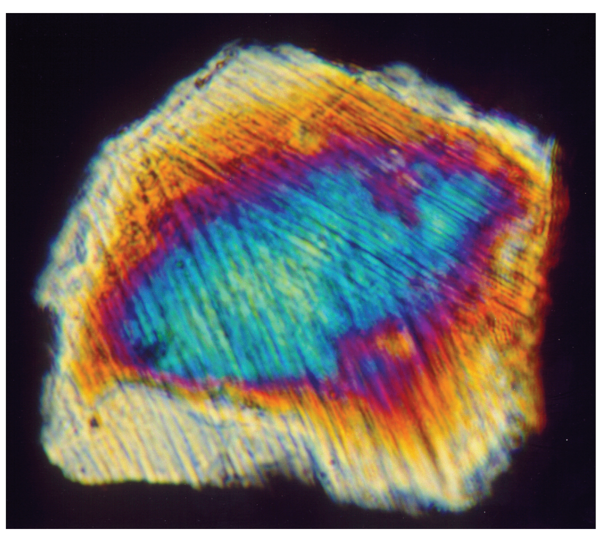
Hell Creek Formation, showing rills eroded by runoff water. Photo copyright Diane Hargreaves, 2006.

Development of the badlands not only produced Makoshika's spectacular scenery, but also exposed layers of sedimentary rock that contain many types of fossils, including fish, salamanders, crocodiles, tortoises, birds, mammals, mollusks, leaves, and petrified wood. The Hell Creek Formation in the park and throughout the region contains dinosaur remains, including those of *Triceratops* and *Tyrannosaurus rex*, but the overlying Fort Union Formation does not. A thin bed of laterally extensive coal marks the contact between the two formations.

In Makoshika State Park the coalbed also approximates the boundary between the Cretaceous and Tertiary periods, the time when the dinosaurs and many species throughout the world became extinct. The geologic symbol for the Cretaceous Period is K, and the symbol for the Tertiary Period is T. Geologists often refer to the change from Cretaceous to Tertiary that occurred about 65.5 million years ago as the K/T boundary.



Many scientists believe that the dinosaur and other extinctions at the time of the K/T boundary were caused by a large extraterrestrial object, probably a meteorite, that crashed into what is now the Yucatan Peninsula of Mexico, engulfing the earth in a massive shroud of dust and debris that blackened the skies, created acid rain, produced widespread fires, and perhaps increased volcanic activity. Organisms that could not tolerate these events became extinct. At many places in the world, including Makoshika State Park, a clay layer at the K/T boundary contains unusually high levels of the element iridium, an indicator of residue from an extraterrestrial object. In addition, the K/T boundary horizon contains shocked quartz. Shocked quartz grains have a distinctive pattern of fractures that could only have come from tremendous shock waves, the kind that a major impact to the earth could produce.



Example of a shocked quartz grain (0.13 mm) from diamicton at 820.6 foot depth in the NASA Langely Corehole, drilled in the Chesapeake Bay impact structure, Hampton, Virginia. Two well-developed sets of shock lamellae can be seen in the quartz grain. From Dr. Glen A. Izett, with permission.

Some scientists believe that the decline of dinosaurs and the flourishing of mammals and flowering plants were already underway at the time of the impact. Their view is that the impact may have hastened the changes, but was not the main cause. The excellent rock exposures and fossil preservation in the badlands at Makoshika State Park provide an exceptional opportunity for paleontologists to determine whether changes across the K/T boundary, such as extinctions and flourishing of certain species, happened gradually or abruptly. One study in the park has shown that fossil fern spores and fossil pollen are more abundant immediately above the boundary, suggesting a relatively sudden change. Other studies are underway.

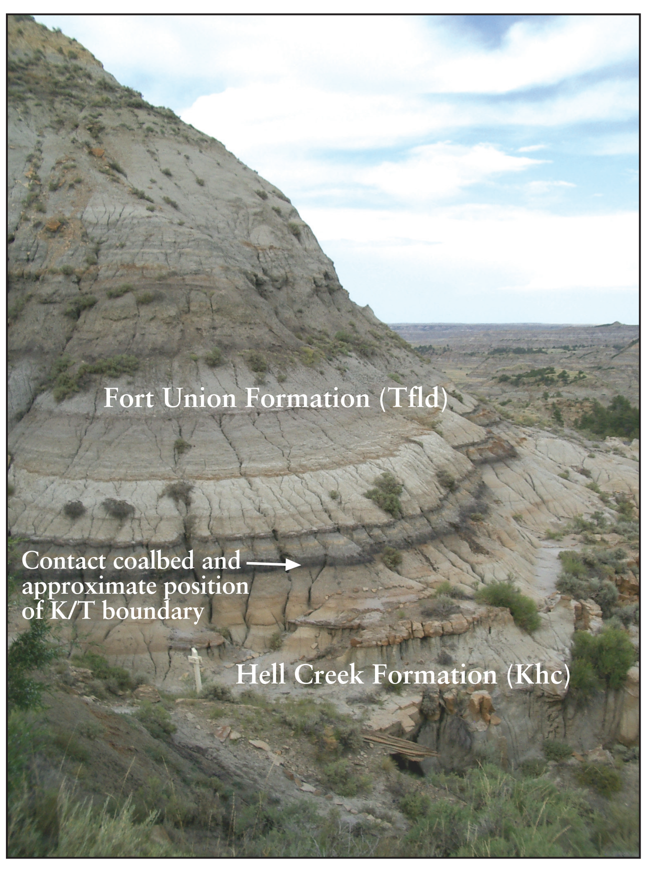


Photo by Sheila Roberts, The University of Montana-Western.

Woodland rivers that flowed toward a nearby sea to the east deposited the sediment that in time became the rocks of Makoshika State Park. Fossil plants and fossil soils indicate that the environment when Cretaceous dinosaurs roamed the area was seasonally dry and subtropical, whereas the environment during the early Tertiary, following their extinction, was humid with abundant swamps. Numerous coalbeds in the Fort Union Formation are evidence of the abundant vegetation in the swamps. Red clinker, rock baked by burning coal, caps some hills and is evidence of ancient fires in the area. A fire may have initiated formation of the badlands by denuding the landscape of vegetation. The sudden increase in runoff water may have promoted erosion of gullies and the self-perpetuating process of badland development at Makoshika State Park.

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Montana Bureau of Mines and Geology

Montana Tech of The University of Montana

Scope and Organization

The Montana Bureau of Mines and Geology (MBMG) was established in 1919 as a public service agency and research entity for the State of Montana, *to conduct and publish investigations of Montana geology, including mineral and fuel resources, geologic mapping, and ground-water quality and quantity.* In accordance with the enabling act, MBMG conducts research and provides information but has no regulatory functions.

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