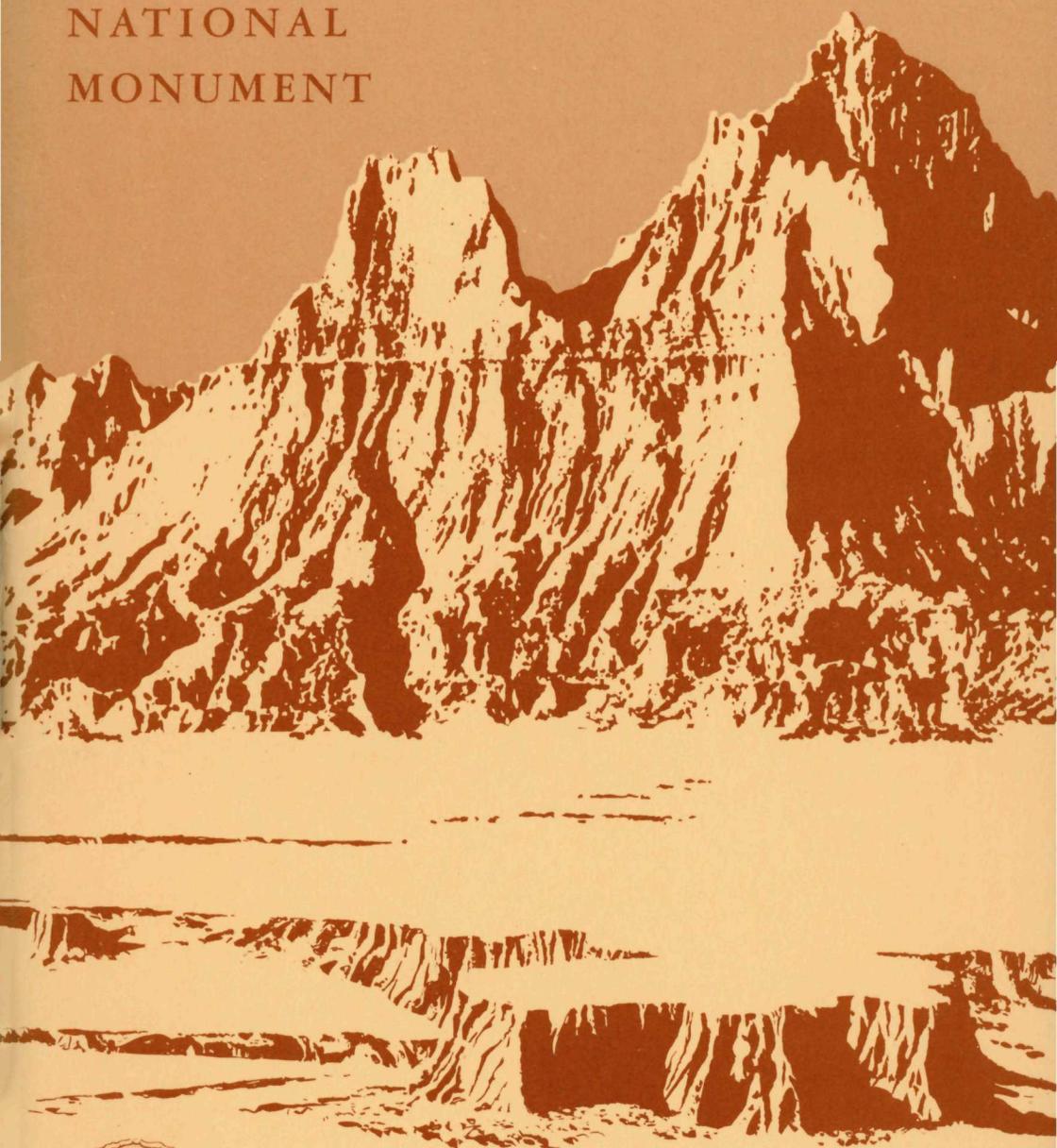


BADLANDS

NATIONAL
MONUMENT



NATURAL HISTORY HANDBOOK



UNITED STATES DEPARTMENT OF THE INTERIOR
Douglas McKay, *Secretary*

NATIONAL PARK SERVICE
Conrad L. Wirth, *Director*

NATURAL HISTORY HANDBOOK NUMBER TWO

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BADLANDS

NATIONAL MONUMENT

South Dakota

*By Carl R. Swartzlow
and Robert F. Upton*



NATURAL HISTORY HANDBOOK SERIES No. 2

WASHINGTON, D. C., 1954

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THE BADLANDS CONTAIN A MYRIAD OF EROSIONAL FORMS.
—*South Dakota State Highway Commission Photograph.*



An Introduction to the Badlands

THE MYRIAD OF COLORFUL SPIRES AND PINNACLES of *Badlands National Monument*, bizarre and unusual in appearance, have much of beauty in their desolation. From many points of advantage they show with clarity the process of wearing away of the land and the cutting of new and complex features in an older surface of more subdued form. The effects of the wearing away, or erosion, of the land on a surface poorly protected by vegetation are also well illustrated.

The highway through the Badlands is a show window through which, you, the visitor, look into the heart of one of the world's most dramatic demonstrations of the great sedimentary land-building process, shown in storybook form in the color-banded formations. These sedimentary deposits, derived from the breakdown and transportation of older rocks, have been and are being cross-sectioned so rapidly by erosion that the story of earlier deposition is being revealed almost with the speed and continuity of a motion picture.

You will not have to hike into the Badlands to appreciate its complex of sharp ridges, steep-walled gullies and canyons, pyramids, knobs, and spires. You may drive along the highway through the monument and stop at parking overlooks to view this landscape of varied forms and colors. It seems to be another world. The scene which unfolds will arouse your curiosity to the point of a question or an exclamation—what is going on here!

The story of what is happening began millions of years ago. This semiarid region was then a broad plain of marshes and of sluggish rivers flowing eastward and depositing on their flood plains layers of silt, sand, and gravel. Lush vegetation covered the land. Animals that

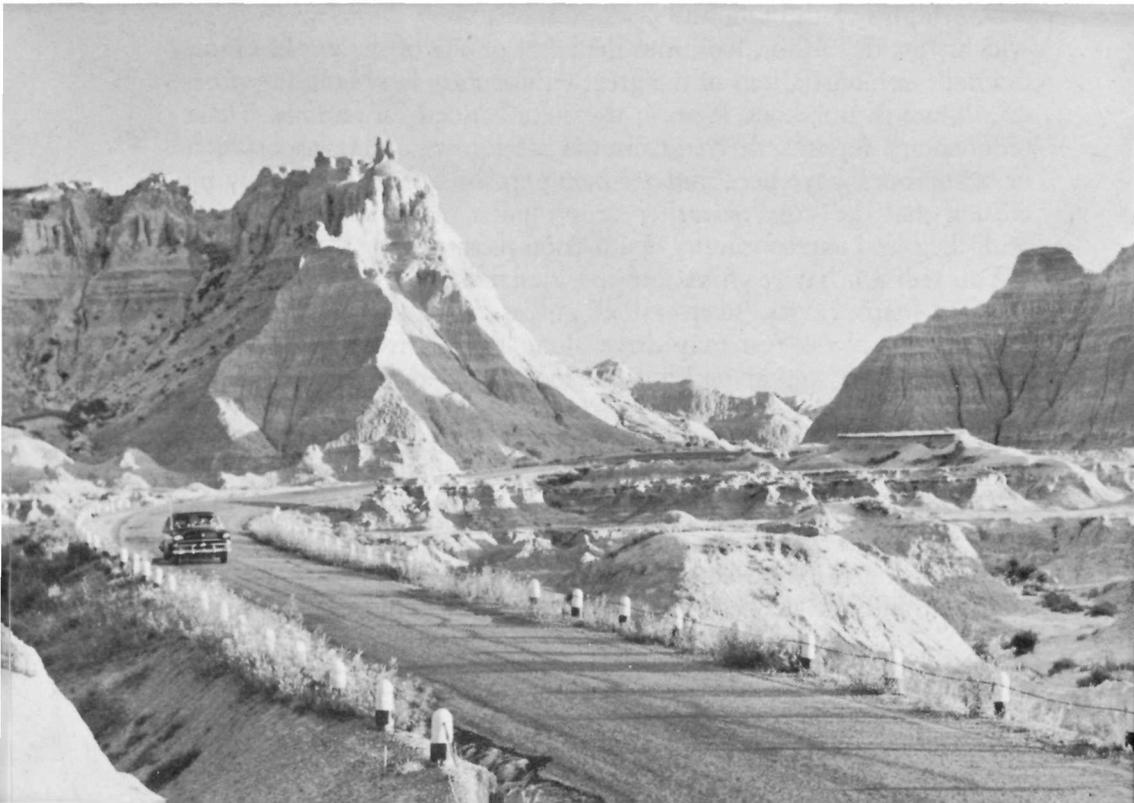
no longer exist were abundant. As they died, their remains were buried in the river sediment or sank into the ooze and decaying vegetation in the marshes. The majestic story of evolution is vividly told by the abundant fossil remains.

Gradually, because the land was rising, the scene changed from the well-watered land of luxuriant vegetation to the semiarid high plains region of today. Rivers no longer deposited their loads of sediments but rather they began to cut into and carry away the layers formerly deposited. It is this rapid cutting-away action that is going on today. As streams cut back into the high plain, the "bad land" is forming. As erosion exposes the layers of rock and the remains of plants and animals, it makes it possible for geologists to help us visualize life and landscapes that were here millions of years ago.

Location of the Badlands

Several areas in the United States have a type of landscape called badlands. The classic example, however, is here in the "Big Badlands of South Dakota." Since the White River flows through much

MODERN ROADS LEAD INTO THE HEART OF THE BADLANDS.
—*South Dakota State Highway Commission Photograph.*



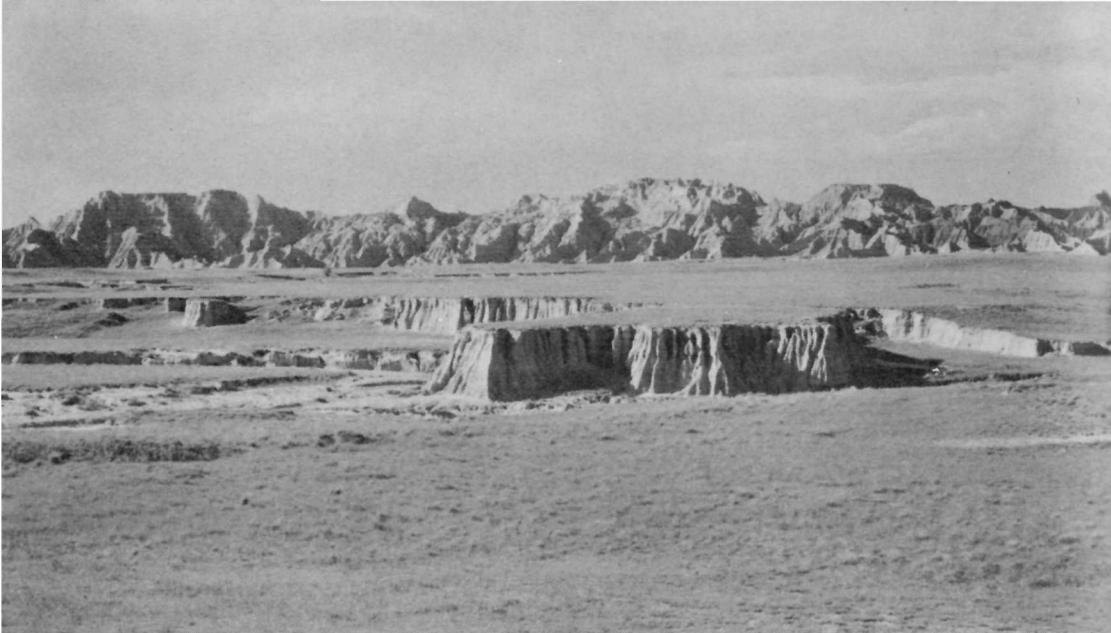
A GREAT THICKNESS OF ROCKS IS NOW EXPOSED IN THE WALL OF THE BADLANDS.
—*South Dakota State Highway Commission Photograph.*

of the area, references are found to the "White River Badlands." Geologists have placed this formation in the Oligocene Epoch (see chart, p. 8). To remove any doubts as to identity, they have applied the title "White River Oligocene Badlands." All of these names refer to the same locality, mostly in southeastern Pennington County and northeastern Shannon County, in South Dakota. Southwestern Jackson County and northwestern Washabaugh County also have colorful examples of this weird landscape (see map, pp. 22-23).

A Bit of History and Prehistory

Early French-Canadian trappers, probably in search of beavers, are credited with being the first white men to view the Badlands. They aptly described the region as "Le mauvaises terres a traverser" because it was indeed a "bad land to travel across." The Indians too had a name for it—"Mako Sica" (Mako, meaning land; sica, bad).

Although never heavily utilized as a habitation area by prehistoric Indians, Badlands National Monument contains ancient remains which indicate that the Indians may have roamed over this country,



THE "WHITE RIVER BADLANDS." NOTE THE NEW CYCLE OF BADLANDS FORMING AT THE BASE OF THE BADLANDS WALL.

from time to time, for several thousand years. A lanceolate point, of a type used during the Archaic Period (about 2,000 B. C. to A. D. 500), was found northeast of Dillon Pass a number of years ago.

On the west rim of Sage Creek Basin there is an abundant supply of good water. Since this was presumably the only available source of water within many miles, it attracted groups of hunters or other Indians passing by. Stone chips and refuse at this site indicate that Indians camped here periodically while they refreshed themselves and made arrowpoints, knives, scrapers, and articles necessary to the hunt.

Later Indians, probably prehistoric Mandan and Arickara, brought pottery into the area on their seasonal bison hunts. Possibly a few small groups lived in the Badlands the year around and manufactured their own pottery locally.

A little over a century ago (in 1846 and again in 1847), there appeared the first published accounts of a fossil animal from the Badlands. Dr. Hiram A. Prout, of St. Louis, was the writer. In 1849, Dr. John Evans, under the direction of Dr. David Dale Owen, geologist of the General Land Office, explored and made fossil collections in the Badlands. Owen's report, containing fossil descriptions by Dr. Joseph Leidy, may be considered the beginning of the science of vertebrate paleontology in the United States. Other expeditions soon followed and many universities, museums, and scientific bodies

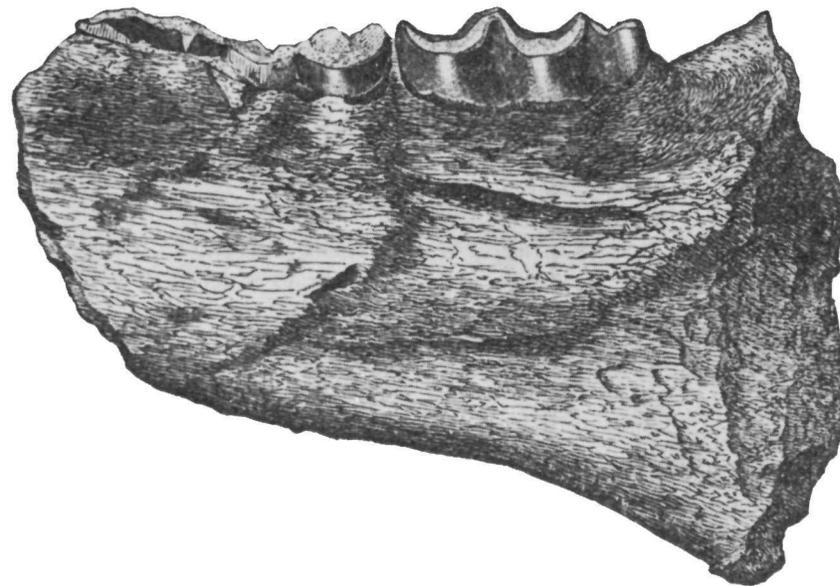
focused their attention on the area to gather a share of the scientific treasures. Perhaps the most active research group today is the science faculty of the South Dakota School of Mines and Technology. They have made numerous discoveries of importance and their writings have enriched scientific literature.

The Badlands do not figure in the colorful episodes or escapades of western history and only a few events of general interest are known. One of these is worthy of passing mention. In 1890 the Indian Chief, Big Foot, was moving his followers to what is now the Pine Ridge Indian Reservation and was pursued by soldiers of the United States Army. The latter expected to corral the Indians on the northerly edge of the Badlands since the military were convinced that there was no way in which the Indians could traverse the rugged country. Chief Big Foot, however, had other ideas. He moved his entire band through a pass and thus escaped the soldiers for a short time, later to meet them in the famous battle of Wounded Knee. Big Foot Pass is named for this enterprising warrior.

Establishment of the Monument

Beginning with the establishment of Yellowstone National Park in 1872, "dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people," the United States has

THE FIRST FOSSIL DESCRIBED FROM THE BADLANDS.





A TYPICAL BADLANDS SCENE, NEAR NORBECK PASS.

evolved a system of national parks, national monuments, and other areas which include the most inspiring of the Nation's scenery as well as many sites distinguished for historic or prehistoric importance or scientific interest.

The National Park Service, a bureau of the United States Department of the Interior, was established by an act of Congress on August 25, 1916, to correlate the administration of the national parks and monuments then under the jurisdiction of the Department. The act directed the Service to "conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

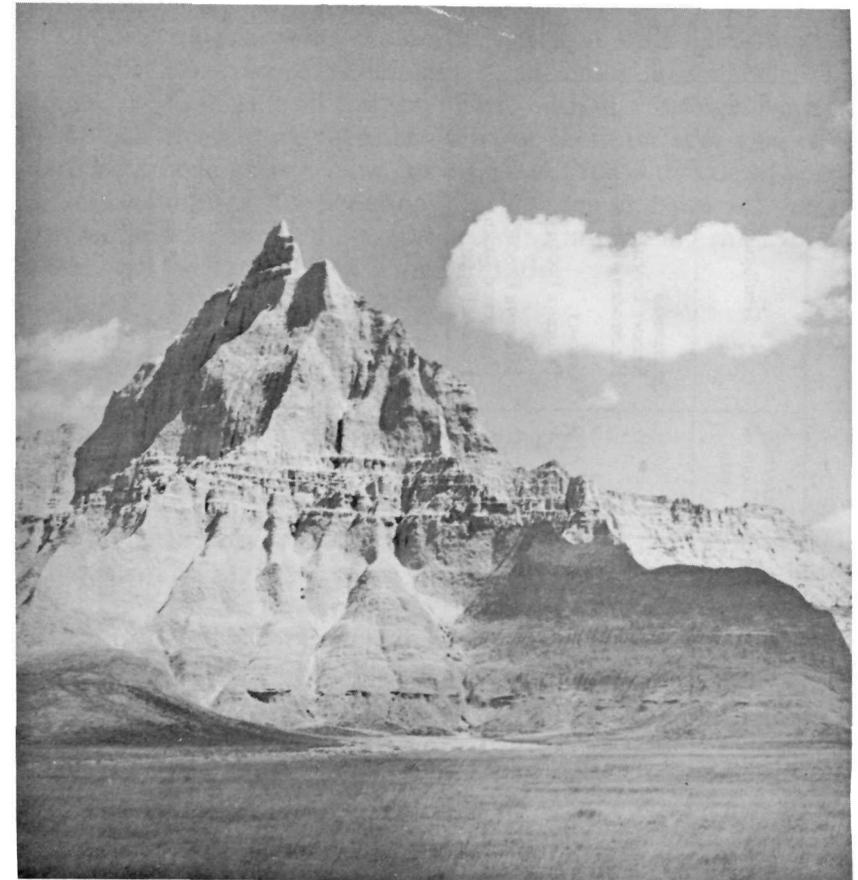
The Act for the Preservation of American Antiquities, which had become a law on June 8, 1906, authorized the President of the United States to set aside as national monuments, by proclamation, lands owned or controlled by the United States containing historic landmarks, historic or prehistoric structures, and other objects of historic or scientific interest. The first national monument established under this authority was Devils Tower, in northeastern Wyoming, on September 24, 1906. Another national monument well known to Black Hills visitors is Jewel Cave, established on February 7, 1908.

With but few exceptions, national monuments are established under the authority of the Antiquities Act without recourse to further legis-

lation. In a sense, Badlands is one of these exceptions, because the Congress, by Public Law No. 1021, 70th Congress (45 Stat. 1553), approved March 4, 1929, authorized the establishment of Badlands National Monument, contingent upon two specific conditions: That acquisition be made of certain lands and that the State of South Dakota build a road from Interior northwesterly through the monument across Big Foot Pass to the Pinnacles and to Sage Creek. These conditions were met and Badlands National Monument was officially proclaimed on January 25, 1939.

The late United States Senator from South Dakota, Peter Norbeck, was the chief proponent for the establishment of Badlands National Monument. It was mainly through his efforts that the area was set aside. The name "Norbeck Pass" was given to a feature in the Badlands to commemorate his work.

THE ROCKS EXPOSED IN THE BADLANDS ARE APPROXIMATELY 40 MILLION YEARS OLD.



GEOLOGICAL TIME CHART

ERA	Duration, millions of years	Geologic period	Duration, millions of years	Cumulative total, millions of years	Remarks
CENOZOIC (Recent Life) Age of Mammals.	58	QUATERNARY:			
		RECENT EPOCH			The atomic age.
		PLEISTOCENE EPOCH	1	1	Continental glaciers of North America. Man appeared.
		TERTIARY:			
		PLIOCENE EPOCH	11	12	Modern animals and plants became abundant.
MESOZOIC (Middle Life) Age of Reptiles.	124	MIOCENE EPOCH	14	26	Devils Tower formed. Rocky Mountains uplifted. Culmination of the dinosaurs.
		OLIGOCENE EPOCH	12	38	
		EOCENE EPOCH	20	58	
		CRETACEOUS	69	127	
		JURASSIC	25	152	
PALEOZOIC (Early Life) Age of Invertebrate Life.	328	TRIASSIC	30	182	{ Great coal beds formed—Jewel Cave and Wind Cave rocks laid down. Fishes and invertebrate animals dominant.
		PERMIAN	21	203	
		PENNSYLVANIAN	} 52	255	
		MISSISSIPPIAN			
		DEVONIAN	58	313	
		SILURIAN	37	350	
		ORDOVICIAN	80	430	
CAMBRIAN	80	510			
PROTEROZOIC PLUS ARCHEOZOIC (First Life Appeared) beginning of the earth.	1, 200 to 1, 600	NOT SUBDIVIDED HERE		1, 710 to 2, 110	Mostly granite. Mount Rushmore figures carved in rocks of this age.

Age of the Badlands Rocks

Although the rocks of the Badlands are young compared to the age of certain formations like the granite in the Black Hills or the rocks enclosing Wind Cave, they are ancient indeed when compared to human history. The geologic period (Tertiary) in which they originated began about 60 million years ago and the Oligocene Epoch of this period began about 38 to 40 million years ago.

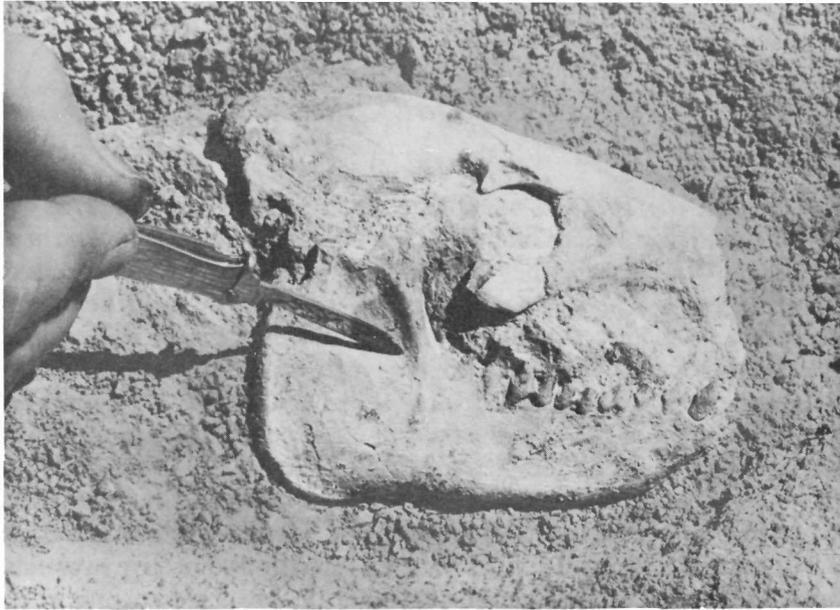
Most laymen are bewildered when confronted with a statement that a certain exposure of rock is 40 million years old. How do we know the age of anything so remote from human experience? The geologist has several ways of determining comparative ages; some are fairly accurate and some admittedly are scientific guesses. The most accurate determinations are made when the rocks contain radioactive minerals. Such minerals, after formation in the earth, break down into other elements at known rates of speed. By carefully controlled chemical and physical techniques the amount of disintegration can be determined and the age of the mineral computed.

The most reliable estimates place the age of the Badlands formations at a little less than 40 million years—an almost incomprehensible figure. Try to visualize it this way: The width of this mark / is $1/64$ of an inch. Let it represent 10,000 years or about the sum total of all recorded human history. Now place 4,000 of these lines side by side to make a solid black line about $62\frac{1}{2}$ inches long and you will have a graphic comparison of the age of recorded history and the approximate age of the layers of rock in the Badlands.

Ancient Climates

So far in our brief account of the formation of the layers of rock, little mention has been made of the climate that existed during Oligocene time, the kinds of plants that grew, and the types of animals that roamed the land or lived in the waters.

There is good evidence that at least during the first part of the Oligocene Epoch, the climate was comparatively warm and moist. A type of crocodile lived at that time; palms were present, as well as other plants and animals which today require a warm, moist environment. Later, these typical warm-weather species vanished from the scene because of changing climatic conditions and those now commonly found in cooler regions appeared in greater numbers.



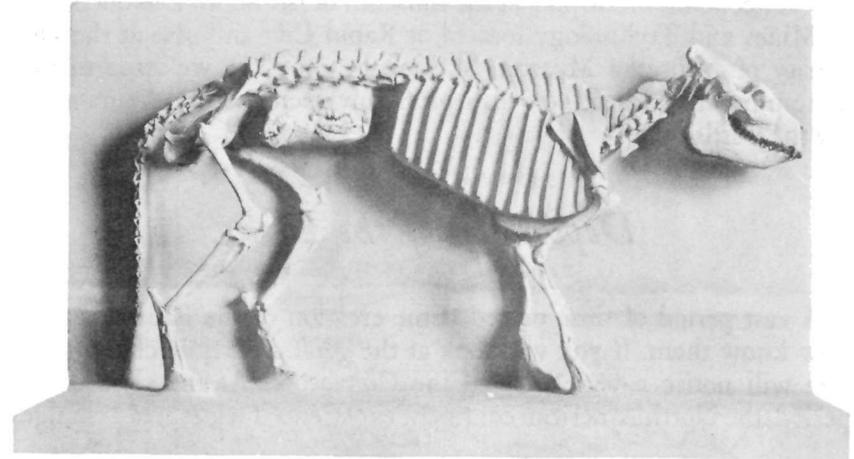
FOSSILS OF ANIMALS ARE FREQUENTLY FOUND IN THE ROCKS OF THE BADLANDS.
—Verne Ordahl Photograph.

Local Life of the Oligocene Epoch

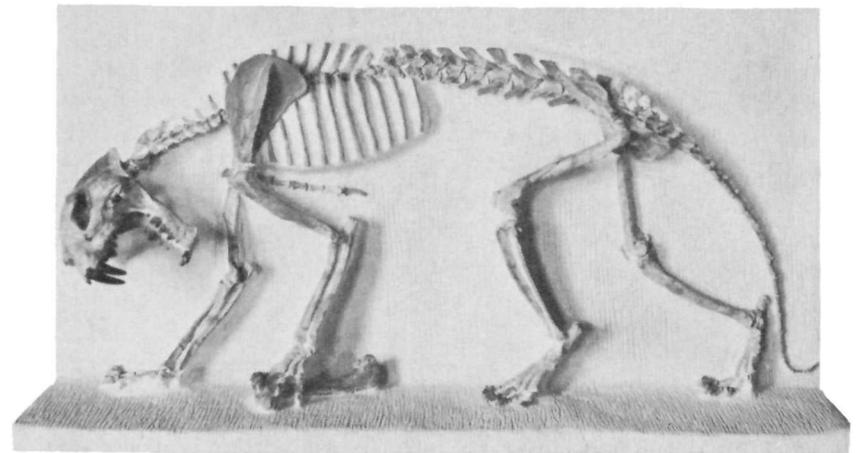
Ancestors to many modern animals lived during Oligocene time. Fossil remains from many, but not all, have been found in Badlands National Monument. Fossils of those not found here have been discovered in Oligocene rocks of neighboring localities. Paleontologists (scientists who study the life of past geologic periods) have identified remains of the horse, camel, rhinoceros, tiger, opossum, pig, and dog. We know that primitive rats, mice, squirrels, marmots, beavers, and rabbits also existed at this stage in the earth's development, but very few belonged to the same species we have today. Lizards also were present, as well as owls, eagles, gulls, and pelicans, but there are only a few fossil records of them. Their bones were too fragile to survive. The horse, which appeared at the dawn of the Tertiary Period, and was about the size of a domestic cat, had evolved into an animal about the size of a sheep. Others such as the oversized titanotheres and brontotheres are no longer existent.

The swampy areas were death traps that claimed the lives of scores of animals. We assume that the larger ones were mired in the muds and sands and could not extricate themselves, and others died of disease, were killed by predators, or succumbed from other natural causes. In any event, the skeletons of many species are entombed in the Badlands rocks.

After the bodies were covered by mud and the fleshy parts decomposed, petrification began. In brief, this process consists of the infiltration of the buried bones by mineral-carrying waters and the deposition of material, usually silica which has great hardness, in the pores and other open spaces of the bones. Thus, instead of the normal skeleton, a hard and resistant structure is formed. These stony skeletons (fossils)



AN ARTICULATED SKELETON OF AN OREODON, A PRIMITIVE CUD-CHEWING ANIMAL, WITH UNBORN TWINS. THIS IS DISPLAYED IN THE MUSEUM OF THE SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY IN RAPID CITY.
—South Dakota School of Mines and Technology Photograph.



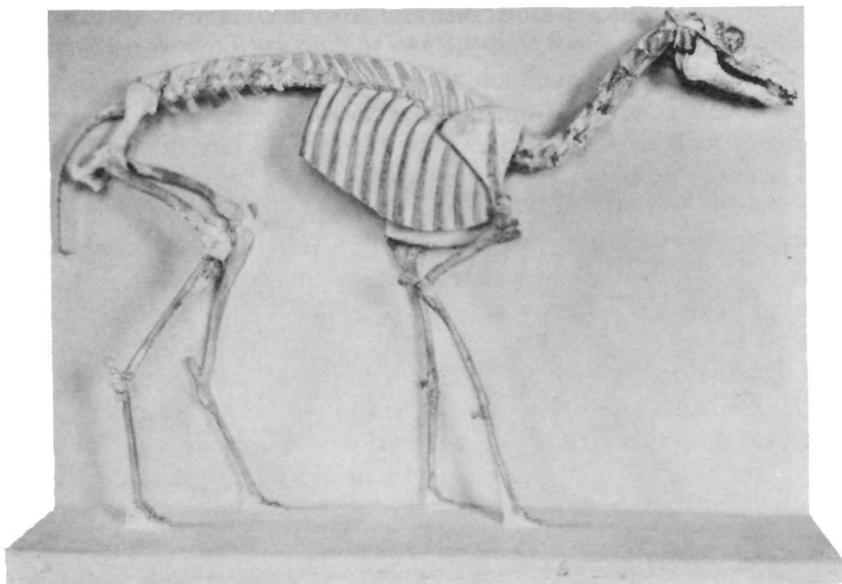
A SABER-TOOTHED TIGER SKELETON FROM AN EXHIBIT IN THE MUSEUM OF THE SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY.
—South Dakota School of Mines and Technology Photograph.

are normally much more durable than the enclosing rocks and, as the softer covering was worn away, the fossils tumbled to the base of cliffs or were left exposed in the rocks.

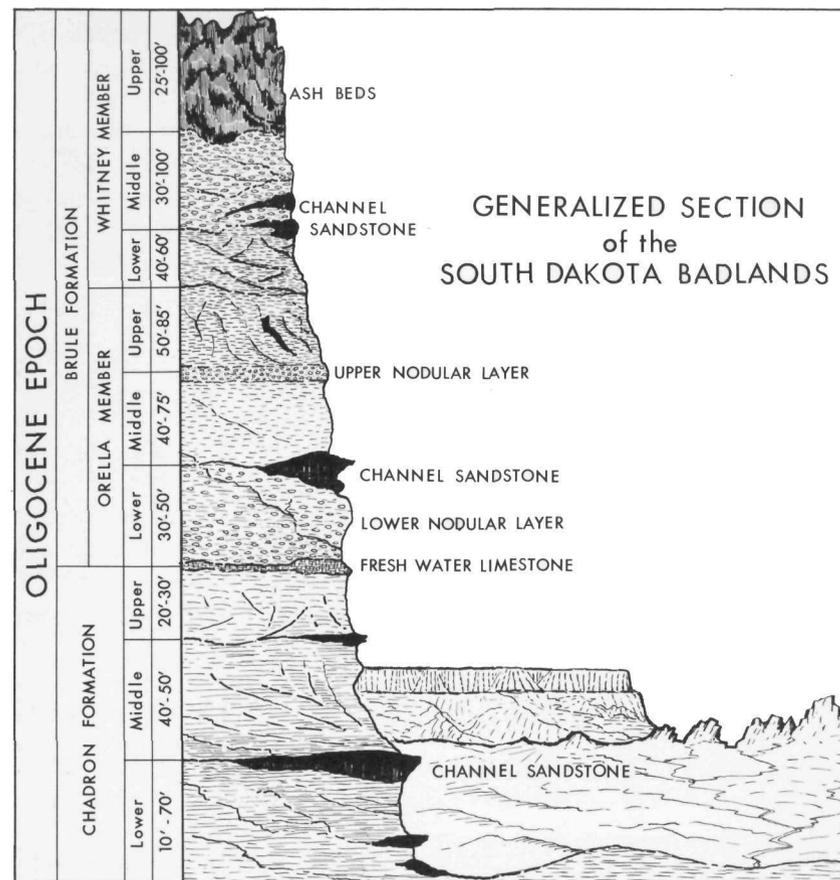
The Badlands are widely known by paleontologists as an important collecting ground and research area. We have already noted that the first published record appeared in 1846. After the first few accounts called attention to the Badlands, a great deal of collecting was done and fossils were sent to most major museums in the country. An excellent collection is on display at the museum of the South Dakota School of Mines and Technology located at Rapid City and also at the University of Nebraska Museum at Lincoln. You are welcome to visit these museums, where you may profitably spend several hours studying the fossils.

Deposition of the Rocks

A vast period of time preceded the creation of the Badlands as we now know them. If you will look at the geological time chart (p. 8), you will notice a period called the Cretaceous. At the close of this period, the North American continent experienced widespread changes.



CAMELS ONCE LIVED IN THE BADLANDS REGION. THIS CAMEL SKELETON IS DISPLAYED IN THE MUSEUM OF THE SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY.
—South Dakota School of Mines and Technology Photograph.



IDEALIZED STRATIGRAPHIC SECTION.

These took place especially along the present Rocky Mountain range and to a lesser extent in the vicinity of the Black Hills. Up to this time, the land where these mountains now stand was comparatively flat. In it were shallow lakes, swamps, and wide plains traversed by sluggish streams. It was pretty much as central and eastern South Dakota is today. Then gradually but slowly, forces within the earth caused a buckling of the continent in a general north-south direction across most of the United States—along the present Rockies and also in the Black Hills region.

In the uplifted areas, streams that once were sluggish now flowed more rapidly. Before this they were clear; but now they started to scour their channels. Their tributaries also dumped large quantities of mud, sand, and gravel into the main streams.

These rapidly moving waters carried their burden of sediment out of the mountains to where the country flattened out. Here the carrying



THE LAYERING IN THE EXPOSED ROCKS GIVES EVIDENCE OF THE METHOD OF THEIR DEPOSITION. —*Rise Studio Photograph.*

capacity of the streams was reduced as the currents slowed down. This resulted in the deposition of sand bars, mud flats, and gravel banks along the course of the streams. These choked the channels and caused the water to fan out over wide areas. Depressions were filled with the sands and clays that the streams could no longer carry. This process continued throughout the period when the Rocky Mountains and Black Hills were being pushed upward. It stopped only when the streams had graded their courses to a gently sloping bed. About 2,000 feet of sediments were laid down in this part of the Great Plains before the process ended.

You may obtain a pretty good idea of this process today by observing the course of the White River just to the south of Badlands National Monument. There, sandbars and gravel beds are exposed where they have been excavated to supply material for concrete structures and road surfacing. You will also see places where, during spring floods, many acres have been covered with mud and silt when the White River overflowed its main channel. If you can imagine this process repeated over scores of centuries and several hundred square miles, you will have a pretty fair idea of how a large portion of Badlands sediments were deposited.



THE LIGHT-COLORED ROCK BEDS AT THE TOP ARE REWORKED VOLCANIC ASH. VIEW NEAR SHEEP MOUNTAIN. —*South Dakota State Highway Commission Photograph.*

Toward the close of this period of deposition, a series of prolonged volcanic eruptions took place. The volcanoes were principally in the Big Horn Basin and in the present Absaroka Range of the Rocky Mountain region. Huge quantities of volcanic ash were carried by winds and dropped over western South Dakota. These accumulated to depths of 25 or more feet. In the vicinity of Sheep Mountain some of these ash deposits can be recognized by their white chalky color. Much of the ash was washed away by the streams and redeposited on the flood plains in much the same manner as were the clays. The older ash deposits are a rather dirty gray in color but the younger ash beds are comparatively white. The darker the color the larger the amount of impurities present. These are mostly bits of clay and silt.

The whitish color of the ash beds stands out in rather sharp contrast to the pink, red, tan, brown, bluish gray, and gray of the other Badlands rocks. Generally speaking, the intensity of the red color is

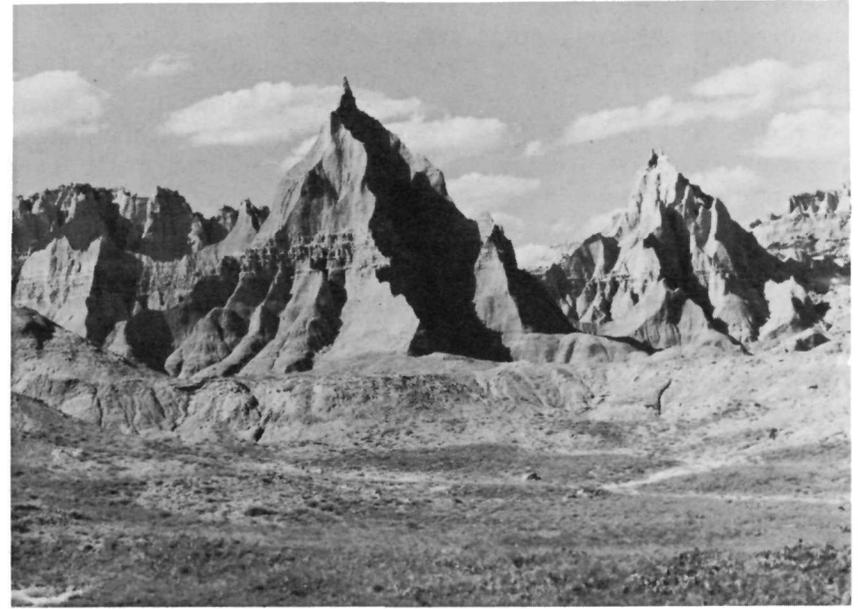
proportional to the amount of red iron oxide present. The various shades of tan and brown are produced by brown iron oxide, the same substance found on rusty iron. Gray colors are most frequently caused by the presence of organic matter. Occasionally, some purplish colors are noticed and these are believed due to the presence of manganese. No matter what the specific cause of each color phase, the brilliant hues of the Badlands spires and pinnacles are one of their most outstanding characteristics.

Formation of the Landscape

The deposition of the Badlands rock scarcely had been completed before the task of erosion of the same area began. At this stage, the broad valleys had been filled with sediments to depths of several thousand feet. We can surmise that the rise of the earth's crust caused the streams to increase their speed slightly and thus to start cutting

TRIBUTARY STREAMS HAVE CUT DEEPLY INTO THE ROCKS.

—*Rise Studio Photograph.*



CLOUDBURST RAINFALL, SCANTY VEGETATION, AND SOFT ROCKS COMBINE TO FORM THE WEIRD EROSIONAL FORMS OF THE BADLANDS.

—*Rise Studio Photograph.*

downward. By this process definite channels were established. Of course, the rivers meandered and, by cutting their valley sides, widened their flood plains to some extent. However, the flowing waters were now following identifiable courses and were not wandering all over the landscape.

We should remember that the Oligocene sediments were mostly clays and shales, with a few thin beds of sandstone and some volcanic ash. These rocks are comparatively soft and easily washed away by rain or stream action. This rapid erosion prevents most plants from getting established; so there are few roots in the soil to bind it and resist erosion. In this locality the White River cut downward quite rapidly and its banks were steep. The small tributary streams also deepened their channels to keep pace with the downward cutting of the White River. Thus, along the stream courses steep-faced gullies were developed. An aerial view would give the impression of a giant tree with the White River forming the trunk and the various tributaries forming the branches and twigs, their canyons having steeply dipping stream beds and very steep walls. This set the stage for the formation of the spires and pinnacles.

Rainfall in this section of South Dakota consists of a certain amount



EROSION CARVES THE BADLANDS AND THEN DESTROYS THEM.

of drizzle, but there are frequent thunderstorms. These are accompanied by short, heavy downpours of rain referred to as cloudbursts. This water rapidly collects in the gullies, and—because they are steep—the water gains speed rapidly. Therefore, the cutting power is greater some distance down the slope. The effect of this action is to further steepen the bed, eventually producing a nearly vertical slope. This is the chief cause of the formation of the walls, spires, buttresses, and pinnacles.

Occasional heavy rains of short duration, with long, dry periods between, are essential factors in the formation of badlands. The soft rocks and loose soil are rapidly sculptured during the brief heavy rains, but they dry quickly and harden between storms to preserve the intricate turreted ridges and sharp gullies. The rapid erosion and fast drying prevent the development of a plant cover which would otherwise retard erosion.

During cold weather a further modifying force is in action. Water, either from rain or melting snow, seeps into cracks and crevices and fills them. As you know, when water freezes it expands about 1/10 of its volume and thus exerts considerable pressure. The repeated freezing and thawing process eventually loosens the rock and it

tumbles to the bottom of the gully, later to be washed away. During the dry summer, winds sweep over the Badlands and fine dust particles are carried to distant places. The amount of material moved at any one time is slight, but the cumulative effect of centuries of wind erosion is astonishing.

In a few localities the visitor will notice sharp spires capped by a rock which is larger than the stem of the spire, looking somewhat like a huge nail with a big flat head, or a long-stemmed mushroom. In such instances the cap, because it is harder than the underlying rock, has not weathered as fast as the rock beneath. Eventually, the cap will tumble to the base of the spire.

Interesting Secondary Features

DIKES, VEINS, GEODES, AND RATTLEROCKS

At some stage after the Badlands rocks had been laid down, the upper exposed part was subjected to drying and, as a result, a series of nearly vertical cracks or fissures developed. Later, percolating ground water leached silica from the surrounding rocks and deposited it in these fissures. The most common mineral thus produced was chalcedony—a hard, brittle, waxy, bluish-colored substance that strongly resists erosion. The soft surface rocks have been worn away and the thin, knifelike ridges (dikes) stand out in sharp relief and can be traced for considerable distances. In some cases, the fissures were filled with sediments of contrasting color such as brown silt or white volcanic ash. If the filling is softer than the enclosing rock, erosion produces a slight trough along the trace of the dike, but this is usually difficult to detect.

In some instances the cracks or fissures branch out into thin strings (veins), but they usually die out within a space of a hundred yards or so. These veins, like the dikes, are commonly filled with chalcedony. However, they are so thin that the mineral breaks off easily and no ridge of any height is left standing.

At certain levels in the Badlands rocks, small, roughly spherical cavities developed, probably as a result of leaching away of materials that dissolve readily in water. Later, percolating ground waters lined these cavities with chalcedony. In many instances, silica crystals (quartz) grew inward from the cavity walls, sometimes completely filling them. These spherical nodules are called geodes. In some parts of the United States they occur in sizes as large as a basketball or even larger. Badlands geodes are quite small—about the size of a lemon. Since the silica is relatively insoluble, the geodes wash out of the soft

clays and tumble to the base of the cliffs and may be found in considerable numbers.

Sometimes the quartz crystals do not completely fill the geodes and, occasionally, a crystal becomes detached and is loose within the cavity. When such a geode is shaken, a harsh rattling sound is heard—hence the name rattlerock.

Future of the Badlands

Every wind that blows and each drop of rain that falls removes some fragment of rock and deposits it in a new location. Each spring freshet, each cloudburst, each stream and its tributaries causes a change in the landscape. In time, the rugged pinnacles will become grass-covered mounds, the fossils will become scattered, unintelligible fragments, and the badlands will have vanished. In time to come, a new earth convulsion may rejuvenate the streams and a new badlands sediment may be deposited in which man could well be the chief fossil. Paleontologists of millenniums hence may ponder over the characteristics of the primates of, say, the 30th century.

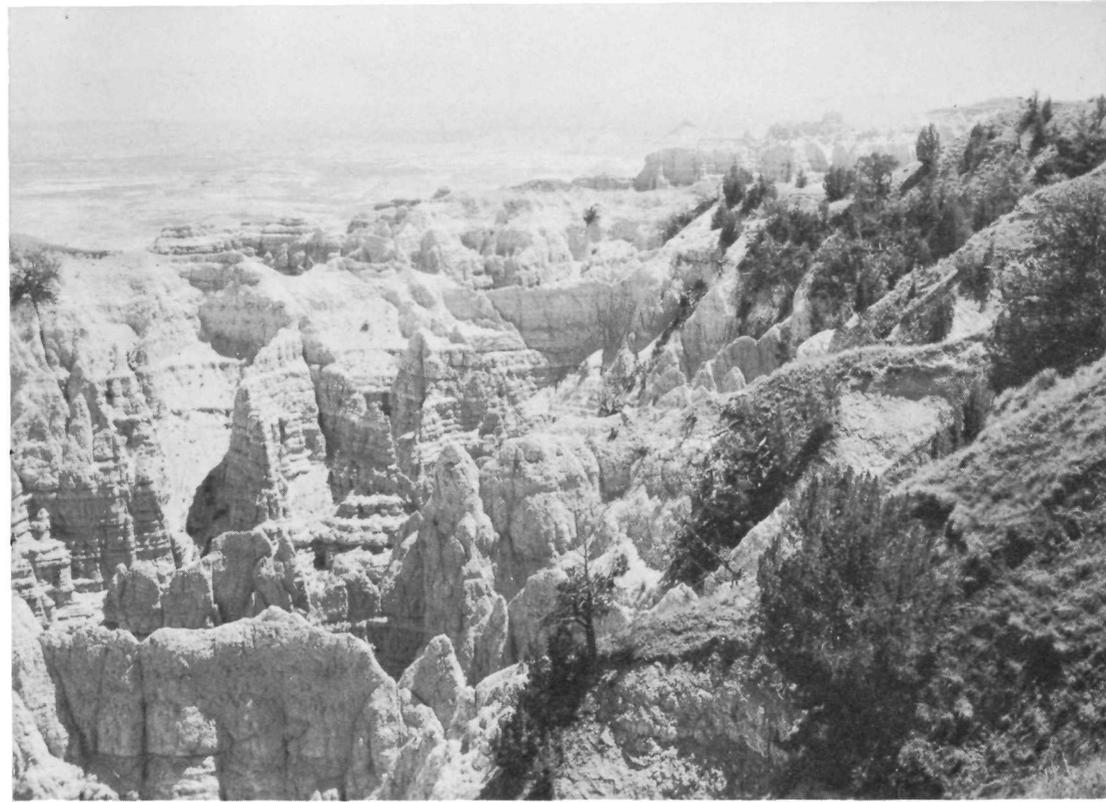
*There rolls the deep where grew the tree,
Oh earth, what changes thou hast seen,
There where the long street roars
Hath seen the stillness of a central sea.*

*The hills are shadows and they flow
From form to form and nothing stands,
They melt like mists, the solid lands,
Like clouds, they shape themselves and go.*

—TENNYSON.

Plants of the Monument

It is estimated that 60 percent of the monument is nearly barren Badlands. The remainder, however, contains the various types of grasses that are found just above the broken wall of the Badlands, on isolated buttes extending out from the wall, and on the plain below the wall. In addition, colorful wildflowers dot the land in the early summer. Broad-leaved trees occur sparsely along the stream courses. Small groves of juniper grow in the vicinity of Sheep Mountain and in many of the passes and, with their verdant green, relieve the barren appearance of the deeply eroded canyons and pinnacles.

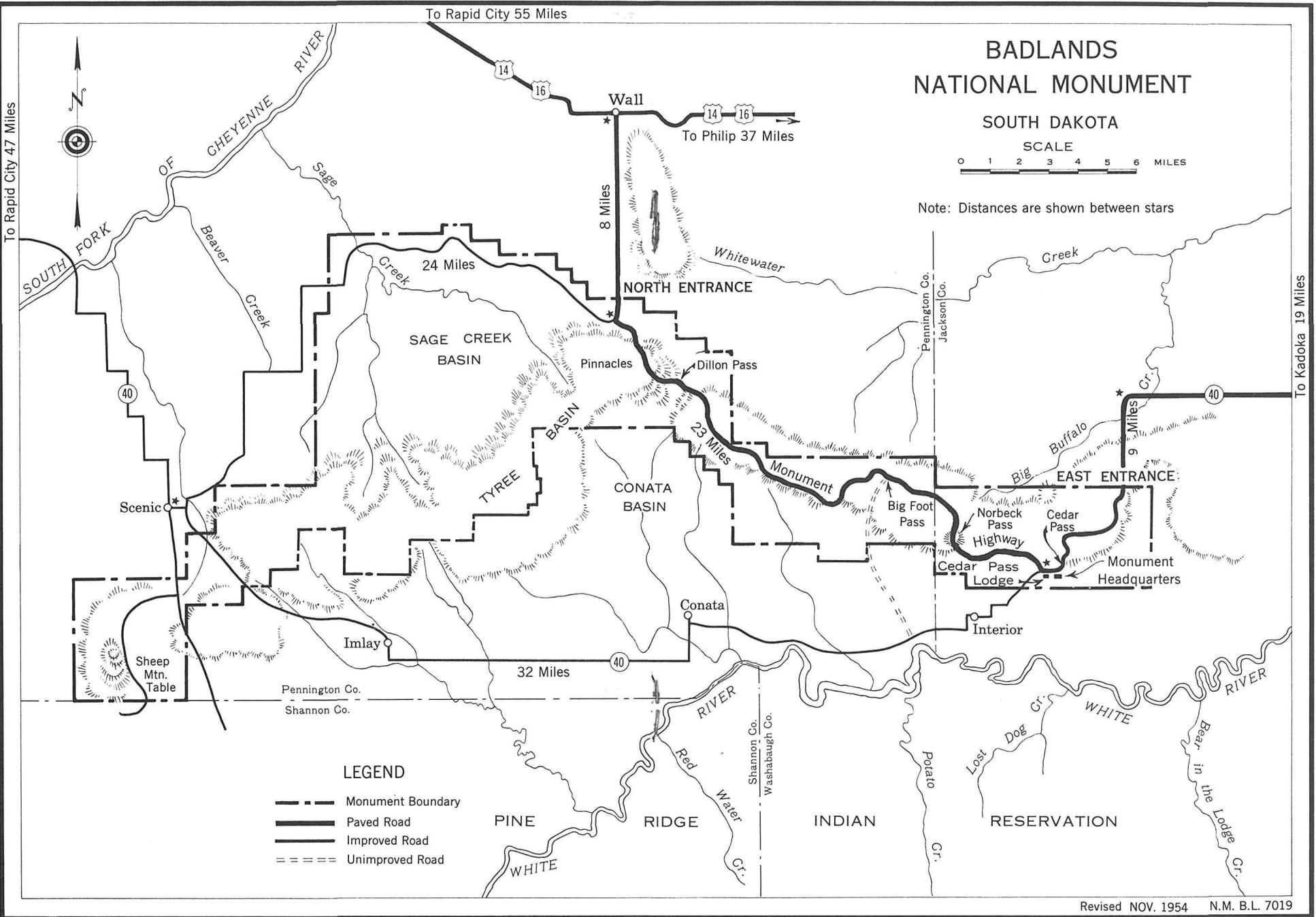


JUNIPERS HAVE BECOME ESTABLISHED ON THE BETTER STABILIZED SLOPES.

TREES

The juniper has a unique advantage over many other evergreens for it appears to thrive in all parts of the country and under the most contrasting of weather conditions. It withstands the cold of the north and flourishes in the extreme heat of the south. Most of the members of this large family prefer open, sunny locations and light, clay soils. Misnamed, it is commonly called "cedar." It is one of the best-known evergreens, for with its wide range of shapes it lends itself to ornamental landscape work.

ROCKY MOUNTAIN JUNIPER (*Juniperus scopulorum*).—Having an exceedingly wide range, this juniper occurs from Montana to Arizona. In Badlands National Monument and vicinity its height does not exceed 20 to 25 feet. Often it is no higher than a man's head. The foliage has both sharp-pointed, prickly needles and smooth, scalelike ones; sometimes both appear on the same tree. The fruit, in the form of a small, blue berry, remains on the tree and is a source of food for birds, coyotes, and some other animals during both summer and winter. The foliage and wood have a pungent odor.



PLAINS COTTONWOOD (*Populus sargentii*).—This is a rapidly growing tree that matures quickly. It much resembles the eastern cottonwood with which it was long confused. Often reaching a diameter of 2' or 3 feet, it has a large spreading top that gives shade to both man and animal. In early times it was planted by the settler as a shade tree. The leaves are large and oval-shaped, with the typical waxy, green gloss of the cottonwood. It grows singly or in small groves in the valleys and along the stream beds. For the beavers that live in the permanent streams of the monument region, cottonwood is the first choice for food and building material.

AMERICAN ELM (*Ulmus americana*).—The beautiful, vasselike form of the elm is a common sight lining the streets of our American cities. Along the streams of the Badlands, where sufficient moisture is available, it grows singly or in small groups.

BOXELDER (*Acer negundo*).—A fast-growing tree, the boxelder was planted extensively as a shade tree by the early pioneer. Though not particularly attractive, its foliage is dense and provides shelter within a few years. It is sometimes called "ash-leaved maple," for it belongs in the maple "family," although the leaves are not as deeply lobed as the hard and soft maples of the east. It grows along the stream courses and the bottoms of canyons.

COMMON CHOKECHERRY (*Prunus virginiana*).—This wild cherry grows in dense thickets in draws and in bottoms of canyons. It bears a bright red berry that turns shiny black when ripe. The fruit, which was used by the pioneer housewife, is still the source of delicious jelly and jam. It is a favored food of birds, coyotes, foxes, and some rodents.

SILVER BUFFALOBERRY (*Shepherdia argentea*).—This dense, bushy shrub is found growing along the sides of stream beds and nestles in the depressions on the slopes of protected ridges. The long narrow leaves are silver-gray on both surfaces and grow on branches and twigs that bear long, sharp thorns. The red, currant-sized fruit is borne in clusters and is extremely sour. From them a wonderful, tart jelly is made—a favorite of both the pioneer and the more modern housewife. It provides an important food for birds.

FLOWERS

When spring arrives and the sun climbs higher in the sky, this land of deeply cut canyons and strangely formed spires and capped knobs becomes a garden of warmth and freshness.

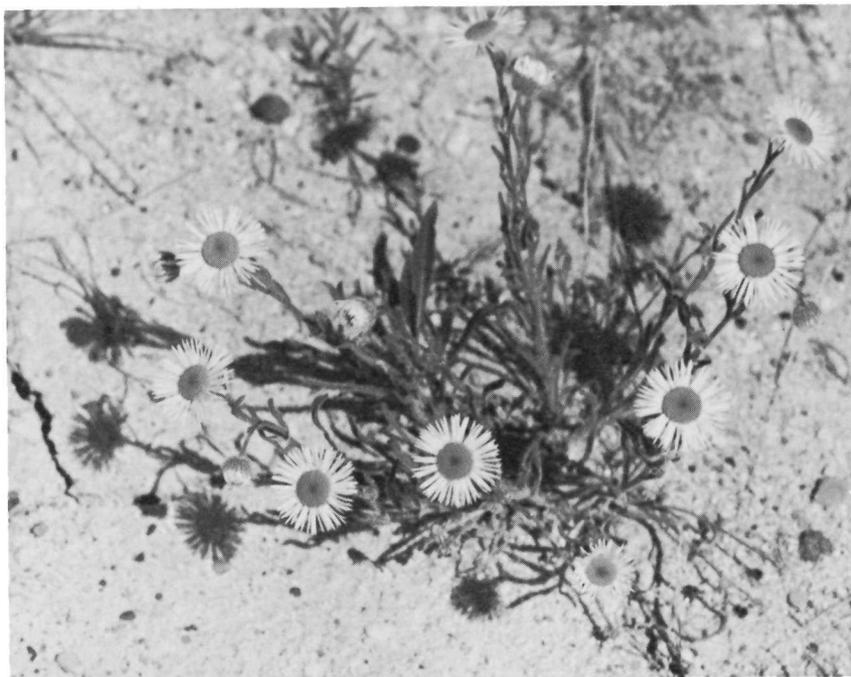
Early in April the AMERICAN PASQUEFLOWER (*Pulsatilla ludoviciana*),



TUFTED EVENING-PRIMROSE.

WILD PEA.





FLEABANE.

WALLFLOWER.



locally known as the CROCUS, the State flower of South Dakota, appears, and the hillsides, that yesterday were bare, now are covered with a blue blanket. Clumps of TUFTED EVENING-PRIMROSE (*Oenothera caespitosa*) begin to show on the bald, clay hills, opening in the evening in their white radiance and wilting the next day with the rising sun. The gray clumps of BIG SAGEBRUSH (*Artemisia tridentata*), that last fall were hard and dry, take on a greener luster.

May brings the MARIPOSA-LILY (*Calochortus nuttallii*) with its white bloom. The FENDLER WILDROSE (*Rosa fendleri*) is evident by the fragrance of its pink blossoms. The yellow of the PRAIRIE THEMOPSIS, better known as the WILD PEA (*Thermopsis rhombifolia*), and the blue clumps of LOCO (*Astragalus sp.*) begin to show in the draws and ravines. The daisy-eyed FERNLEAF FLEABANE (*Erigeron compositus*) dots the roadside and the sides of the hills, and canyons display the waxy, white flowers of the species of yucca known as SMALL SOAPWEED (*Yucca glauca*).

In June, the yellow ERYSIMUM, more frequently called WALLFLOWER (*Erysimum sp.*), appear by the roadside. Then come the PENSTEMONS (*Penstemon sp.*) in shades of blue and white. The bushy SNOW-ON-THE-MOUNTAIN (*Euphorbia marginata*) begins to flower. If Nature has been kind and spring showers have brought moisture, July will see the blue CANADA VIOLET (*Viola canadensis*), orange splashes of color of the SCARLET GLOBEMALLOW (*Sphaeralcea coccinea*), and the nodding heads of the UPRIGHT PRAIRIE-CONEFLOWER (*Ratibida columnaris*). The introduced WHITE SWEET CLOVER (*Melilotus alba*) lines the highway through the passes. The white heads of the WESTERN YARROW (*Achillea lanulosa*) dot the prairie. The PRICKLYPEAR (*Opuntia sp.*), the most abundant form of cactus in the Badlands, has budded and begins its yellow and pink floral display that covers the land as far as the eye can see.

By August and September, most of the flowers have bloomed and faded. The coneflower and yarrow still persist, with an occasional scarlet globemallow remaining. The length of the season is dependent upon the rainfall; with occasional summer showers, the flowers continue their display, but if it is dry they soon wither and disappear.

GRASSES

The grasses, although not as colorful as the wildflowers, are a more important part of the ground cover. From them come the food of the larger animals; within their protection many of the birds build their nests; because of them the topsoil is formed and grows in fertility; their covering mat retards erosion; and from their green mantle man derives great pleasure. The grasses of these plains have supported



GRASSY PLAIN AT THE FOOT OF THE BADLANDS WALL.

untold generations of grazing animals in almost myriad numbers, from the camels and horses of the geologic past to the bison and pronghorns of the last century.

The various grassland types have developed because of differences in the environment, chiefly soil conditions, in which they grow. There are many such types referred to by the character and depth of soil. Here in the Badlands are found representatives of 9 types of range sites, of which 4 have special significance.

On the higher land, especially along the approach to the Badlands, is a good cover of upland vegetation. It contains principally BLUE GRAMA (*Bouteloua gracilis*) and NEEDLE-AND-THREAD (*Stipa comata*). At lower elevations, however, the same type of site appears with these grasses subordinated by WESTERN, OR BLUESTEM, WHEATGRASS (*Agropyron smithi*) and BUFFALO-GRASS (*Buchloe dactyloides*). The clay and thin-clay sites have a similar covering with western wheatgrass, blue grama, and buffalo-grass predominating. The fourth significant range type found in the area is the shallow site. As the name implies, the basal cover is somewhat patchy. Fairly dense stands of blue grama and buffalo-grass alternate with western wheatgrass. SIDEOATS GRAMA (*Bouteloua curtipendula*) is also present as a major constituent.

The grasslands, or prairies, were once the most extensive plant type areas of the North American continent. Cultivation, grazing, fire, urbanization, and other factors have so removed or modified these vast

areas of grassland that little now remains in essentially its natural condition. The importance of preserving grassland types in Badlands National Monument lies in the opportunity provided present and future visitors to see samples of this cover which is so rapidly disappearing from the American scene. Protection of grasslands in the monument permits study and comparison with other areas that have been greatly modified. The results can be of value in working out methods of better management, for many rangelands are badly damaged through overuse and their yield reduced as much as half their normal potential.

Animals

The animal life of the Badlands and vicinity, as of any region, is molded by the vegetation, the type of soil, and the climate. Most of the animals of the Badlands are adapted for living in open grassland and for survival with comparatively little water. Many of them are rather pale in coloration. Thus, they blend with the soil and the dry grass and so escape detection by their enemies.

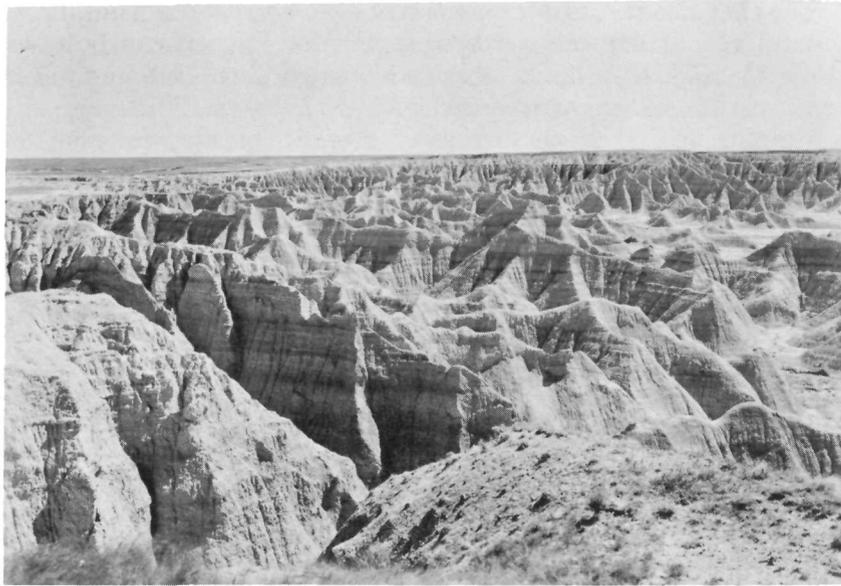
BIRDS

Birds live under conditions most favorable to their particular needs. The grassland, the occasional groups of small shrubs and juniper, and even the bare canyon walls provide the food and the environments that certain birds require. Some are transients and are here for only a few days in the spring and fall. Others nest here and return to warmer climes in the winter. A few remain—dwellers of the Badlands—the year round. It will not be the purpose to list here all the birds, but mention will be made of some of the more common and interesting ones.

Members of the finch family are seedeaters and have strong bills for crushing their food. Their preference is the prairie and the margins of the groves that are close to their food supply.

The EASTERN GOLDFINCH, frequently called the “wild canary,” is a charming little yellow songster with black cap, wings, and tail. Often they flit along the roadside, feeding on the seeds of sunflowers and weeds.

The sparrows, which belong to the finch family, are modest-colored birds and are often difficult to distinguish. One of the common summer residents is the WESTERN VESPER SPARROW. You will find the white outer tail feathers, that flash conspicuously in flight, a good identifying mark. Its song will come to you in the evening from a lone bush or tree.



SOME BIRDS PREFER THIS BROKEN COUNTRY OF THE BADLANDS.

The WESTERN LARK SPARROW likes the open country and the grassy hillsides. The striped crown, chestnut ear-patches, and white breast with a single dark central spot are the best identifying markings. It is a summer resident with a beautiful song.

The song of the WESTERN CHIPPING SPARROW is a single, prolonged, vibrating trill. A resident of the meadows, the little "chippy" with the bright rufous-red cap is equally at home in the sparsely wooded sections.

The juncos are sparrow-sized with uniform gray coloration on the back, lighter or contrasting underparts, and white outer tail feathers that flash conspicuously when they fly. They, like the sparrows, are seedeaters and occur both in the open prairie and in the sparsely wooded areas.

The SLATE-COLORED JUNCO and the WHITE-WINGED JUNCO are found in the Badlands. Common in winter, they are often seen in mixed flocks or with sparrows. The slate-colored junco is distinguished by the slaty-gray back, white bill, and white underparts. The white-winged junco resembles the other in color but is slightly larger and has two, prominent, white wing bars.

The LARK BUNTING is distinctly a bird of the prairie and nests on the ground near clumps of weeds or sagebrush. The male, a beautiful singer, is black with large, white, wing patches. It is often mistaken for a small blackbird or confused with the bobolink. The song, with a warbling and gurgling, with several distinct phrases, begins as the bird rises in flight and continues until it alights.

Swallows are sparrow-sized with long, slim wings. They capture and eat insects in flight. Both the NORTHERN CLIFF SWALLOW and the VIOLET-GREEN SWALLOW can be seen in the Badlands. The rusty-buff rump distinguishes the cliff swallow; perceived overhead it appears square-tailed, with a dark throat patch. The violet-green swallow is glossed with green and purple, with clear white below and white patches that almost meet over the base of the tail. Social birds, the two species are often seen together in flocks.

The wrens are small, energetic, brown-backed birds with slender bills, and tails which are often cocked over the back. An inhabitant of canyons and rocky slopes, the CANYON WREN is readily identified by the reddish-brown back and the conspicuous white throat and breast. The song is a gushing cadence of clear, curved notes that come tripping down the scale. It nests in rocky crevices.

The WHITE-BREASTED NUTHATCH is a common winter resident, but frequently remains all summer to nest. The white breast, blue-gray back, black cap, and the unusual habit of creeping upside down on tree trunks and cliff walls assure ready identification.

Another curious winter boarder is the BLACK-CAPPED CHICKADEE that is a permanent dweller of the Badlands and often is seen in junipers. It is the only small bird with the combination black cap, black bib, and white cheeks. Its most common note is the clearly enunciated "chick-a-dee-dee-dee."

Few people think of the EASTERN ROBIN as a thrush, but actually it is the most highly developed of that family. To most of us it is just "the robin"—a good neighbor, a dependable friend—the first bird to arrive with its cheering spring song, often before the snow has disappeared. One of the most familiar of all birds, it is easily recognized by its gray back and brick-red breast.

The MOUNTAIN BLUEBIRD lacks the chestnut breast of its eastern cousin and is azure blue above with a white belly. As though to accentuate its beauty, it has a delightful habit of poising like a hummingbird on wing while watching for insects in the grass.

The flight of the WESTERN NIGHTHAWK is erratic, punctuated by frequent repetitions of a short, nasal, and utterly unmusical call that usually comes at the termination of fluttering dashes upward. The most unusual flight performance is the astonishing aerial dive that is executed by almost closing its wings and plunging downward. Suddenly the descent is checked, accompanied with a weird booming sound as the diver sweeps gracefully upward to renew its flight. It feeds on flying insects that it gathers into its large mouth. Just before sunset, especially in the fall migration period, nighthawks may be seen in large numbers swooping and diving over the Badlands and adjacent plains.

SAY'S PHOEBE is a summer resident about the size of a bluebird. It, like others of the flycatcher family, feeds on flying insects, darting out upon its prey from a perch, usually a limb of a tree, an old stump, or an overhanging cliff. The pale rusty breast contrasted to the brownish back and black tail identify it. The phoebe prefers the open prairie country, although, not uncommonly, it builds its home near the habitation of man. Its plaintive call is usually accompanied by a nervous flirt of the tail.

The PRAIRIE HORNED LARK is one of the first birds to nest in the spring, often when the snowbanks are still visible. This brown, prairie bird is distinctly marked with a black mustache, black breast patch, and a black, horseshoe crown terminating in two, erect, black horns. It walks and does not hop. Preferring the open prairie and fields, it lives principally upon weed seeds. During the winter, flocks of horned larks often feed on the shoulders of the highway.

The AMERICAN MAGPIE is the only large black and white land bird with a long sweeping tail. In flight, the iridescent tail streams out behind, and large white patches flash in the wing. The magpie is a year-round resident of the Badlands and vicinity.

The WESTERN MEADOWLARK, a prairie dweller, arrives early in March and lingers in the fall until a severe storm drives it southward. Although somewhat smaller than the eastern meadowlark, the general coloration of the yellow breast and the black crescent at the throat are similar. It feeds chiefly on insects and weed seeds and builds its nest on the ground. The song of the meadowlark can be heard a considerable distance and fairly fills the prairie with its melody.

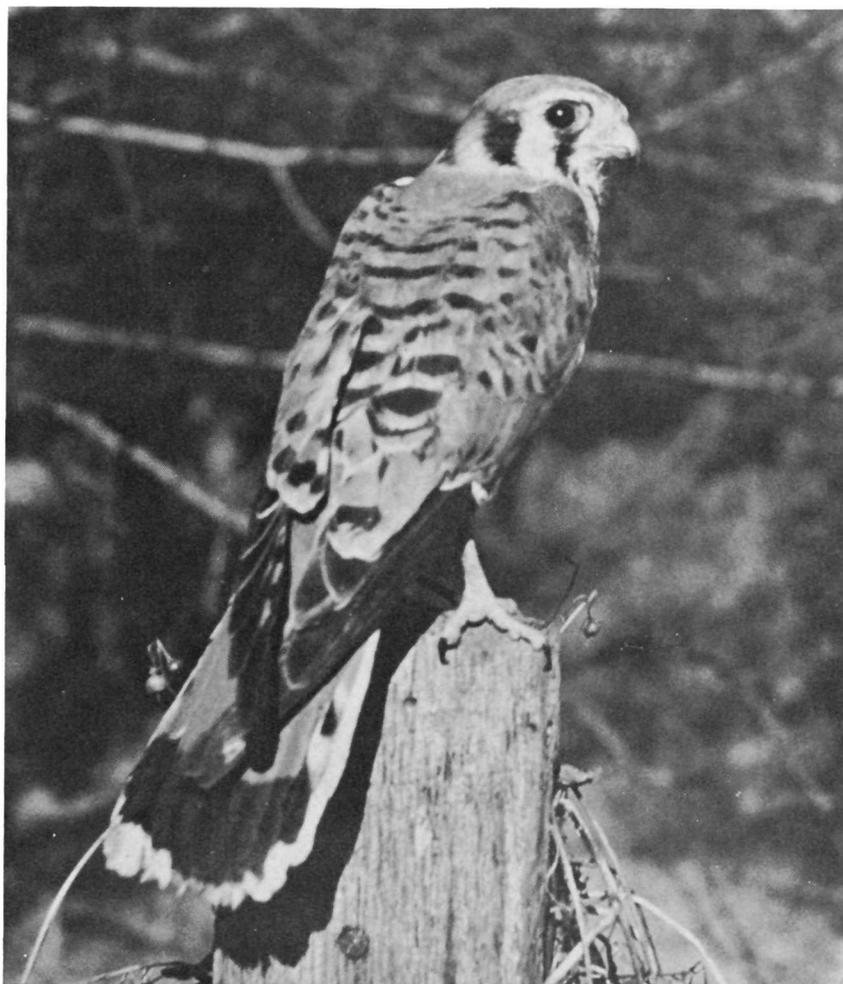
The TURKEY VULTURE is a large blackish, eagle-sized bird, usually seen soaring on motionless wings in wide circles high over the cliffs of the Badlands. Birds of this family feed chiefly upon decaying flesh, seldom attacking living animals. The nest is built on shelves under

overhanging cliffs. The bird's ability to sail or soar for hours with few wing movements is a ready identification.

A familiar hawk and one of man's best friends is the MARSH HAWK. In ordinary flight the bird glides low over the ground, with the white rump patch, the badge of the species, plainly visible. The nest is built on the ground, hidden in tall grass or brushy thickets. Mice and gophers comprise the bulk of its food, with only a small portion coming

A WESTERN MEADOWLARK HIDING IN THE GRASS.—J. S. Dixon Photograph.





THE SPARROW HAWK.—*Rex Garry Schmidt Photograph.*

from small birds and farm poultry. Everyone should become familiar with it and aid in its protection. You may see it as you drive along the highways through the Badlands.

Not much larger than the robin, the EASTERN SPARROW HAWK is the most common of the falcons. It is the only common small hawk that habitually hovers in one spot and the only one with the rufous-red tail. The chestnut back is clearly marked with several black bars and the tail has one wide black bar. The upper parts are bluish slate and the underportions are creamy white with black spots. Its food is chiefly mice, grasshoppers, beetles, and occasionally small birds. Of all the falcons, this is the most beneficial.



A CLOSEUP OF A WESTERN BURROWING OWL.

—*Fish and Wildlife Service Photograph.*

The little WESTERN BURROWING OWL is found in the Badlands. The upper parts are dull grayish brown slightly spotted with white, while the belly is light, barred with brown. The legs appear long for the size of the bird and are feathered only in front. It prefers to build its nest in abandoned holes, or burrows, often taking possession of deserted prairie-dog burrows. The food of this small owl consists mostly of small rodents, snakes, lizards, grasshoppers, and beetles. It does not live in common with the prairie dog and rattlesnake as many persons suppose.

MAMMALS

Early explorers and settlers tell of bison and antelope in great numbers ranging the grasslands above and below the great wall of the Badlands. Audubon bighorn, mule and whitetail deer, and occasional bands of elk and antelope fed on the grass-covered tablelands and



BISON ONCE ROAMED THE GRASSLAND IN VAST NUMBERS.

along the stream courses. Small wonder that this was a favored hunting ground for the early Indians.

Westward settlement sounded the death knell for many of the wild animals of the plains. With the coming of the hide hunters in the late 1800's, the bison, or buffalo as they are more commonly known, almost disappeared from the scene. The antelope were reduced to only a few scattered bands. The Audubon bighorn that early was found on Sheep Mountain is now extinct, destroyed by the hunter's rifle. Only a few deer and antelope remain. Conforming to the objectives of the National Park Service, all animals that now live within the monument's boundaries are protected. Elk and bison may still be seen in Wind Cave National Park and Custer State Park in the nearby Black Hills.

Deer, one of the important game animals of western South Dakota, are commonly found in the Black Hills and are occasionally seen in some parts of the Badlands. Both the WESTERN WHITETAIL DEER, a relative of the common deer of the East, and the MULE, OR BLACKTAIL, DEER live in this section of the State. The former is found here in restricted numbers. The large white tail that is waved like a warning "flag" when the animal is alarmed is the famous trademark.

The mule deer is widely distributed throughout the West, and in the Black Hills region is more common than the whitetail deer. The large mulelike ears and the black-tipped tail are distinguishing characteristics.

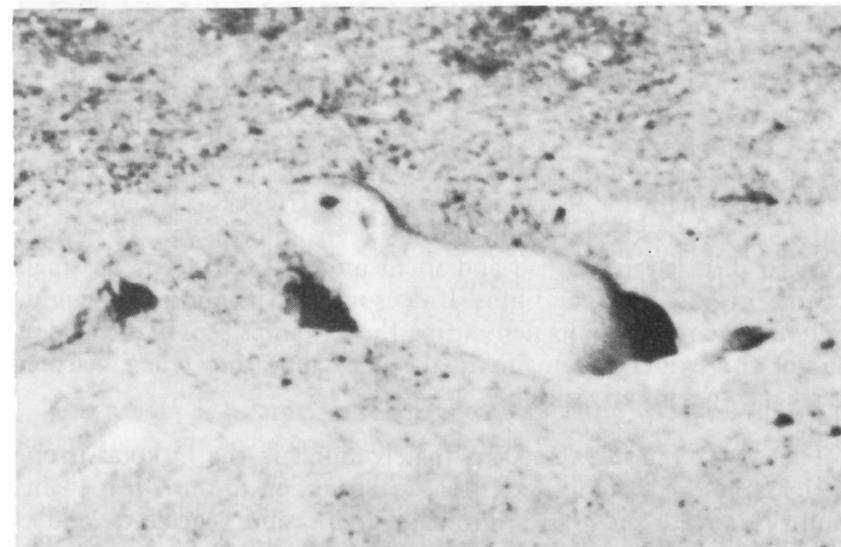


THE PRONGHORN ANTELOPE.—E. P. Haddon Photograph.

A few small bands of the PRONGHORN ANTELOPE are still found near the Badlands, although they are seldom seen by the visitor. In some open prairie sections of the West the antelope remains one of the important game animals. The name comes from the conspicuous fork, or prong, on each horn. An animal of the open prairie, the pronghorn, having keen eyesight and fleetness of foot, is able



A COYOTE.



A PRAIRIE DOG AT HIS DEN ENTRANCE.

to detect and make good its escape from its natural enemies. The large, white rump patch serves much the same purpose as the waving white flag of the whitetail deer, for when alarmed, the antelope flashes its warning signal to others of the band.

The COYOTE is one animal of the great plains that has persisted and continues to live and raise its young in spite of modern civilization. Whereas its larger cousin, the gray wolf, has been almost completely wiped out in most sections of the West, the coyote has successfully adapted itself to the changing environment created by man. In spite of organized attempts to exterminate it, the coyote has continued in some numbers and has even extended its range in certain places.

Small animals, such as rabbits, ground squirrels, mice, and chipmunks, form a substantial part of the coyote's diet. It is a common dweller of the Badlands and often may be heard at night singing its weird lament.

The PRAIRIE DOG actually is not a dog, but is a fat, sociable ground squirrel about the size of a full-grown cottontail rabbit. Because of the characteristic sharp bark, it has acquired the name "dog." During the early history of this country, "dog towns" were widely scattered over the western plains. Gradually, the prairie dogs were destroyed, until today they are seldom found in their old range. In areas administered by the National Park Service they are protected with the other native wild animals.

During the summer, the prairie dog feeds on the green vegetation surrounding its home. During its semihibernation in winter, when snow covers the ground, it lives on its accumulated fat, emerging from its den only on the warmest days to lie in the sun.

The burrow extends downward 10 to 15 feet at approximate right angles to the surface, with several short branches radiating from it. The entrance is protected from flooding by a mound of earth that is kept in constant repair by the occupants. This dike also serves as an observation post for the sentries that are constantly on guard throughout the town. When danger approaches, those nearest set up a chatter that in turn is picked up by the neighbors. Thus the warning echoes across the colony. As the danger nears, they disappear down their holes with a flip of their stubby tails and a parting "yip" of alarm.

The WESTERN PORCUPINE, one of this country's largest rodents, is a common resident of the pine forest and is often found in the prairie country along the edge of the Badlands on the north.

During the summer, it prefers the tender shoots of small shrubs and the green herbs, and in the winter it lives on the underbark of trees. It is an expert climber. Normally, "Porky's" quills lie flat and are well hidden by the long yellowish-white guard hairs that cover the head and back. The hollow, white quills are black-tipped and are 1 to 2½ inches long. Contrary to the mythical story, the porcupine does not throw its quills. Peace-loving by nature, it goes its solitary way, but when danger threatens, it is immediately on guard. It is unfortunate for the animal

that comes too near, for with a slap of the broad tail, the quills, that are minutely barbed on the ends, become deeply imbedded in the flesh of the victim. They are very painful and extremely difficult to remove.

The RACCOON, common throughout much of the United States, is found occasionally in the stands of timber that fringe the dry creek beds and lie in the pockets of the breaks of the great north wall. Possessing a varied diet, it relishes fish and small mollusks and feeds on small rodents, insects, fruits, and nuts. It does most of its hunting at night, preferring to roll up in its nest during the day and sleep. In the coldest part of the winter it remains in the den, appearing when warmer weather comes in early spring.

The WHITE-TAILED JACKRABBIT that is found in the Dakotas is one of the largest of several species that are common to the Great Plains country. It feeds on grasses, growing grains, and vegetables, and is especially fond of clover and alfalfa.

A full-grown jackrabbit may weigh from 6 to 10 pounds. The fur, which is buffy gray in summer, is nearly white in winter, save for the

PRAIRIE DOG DEN THAT HAS BEEN DUG OUT BY A BADGER.



black tips of the long ears. It is unusually fleet of foot, traveling with long leaps of from 10 to 20 feet, and when alarmed may reach a speed of 30 miles per hour or more.

The COTTONTAIL is found all over the United States and forms an important small game item for the hunter's bag. It is a small cousin of the jackrabbit and weighs from 2 to 3 pounds. The fur, which is dark brown mixed with gray, does not change color with the coming of winter. It does not have the speed of the larger rabbit and depends on the cover of fence rows, wooded thickets, and brush patches for protection. It feeds on grass and loves the clover and alfalfa patches.

The BADGER is a large powerful member of the weasel family and ranges through the central and western part of the United States. The fur is silvery, grizzled gray and black, and the head is marked with bold white and black patches and stripes. The heavily developed fore legs are armed with long claws that are adapted primarily to digging, for it lives on ground squirrels, mice, prairie dogs, and other small burrowing animals that it digs from the earth. It frequents the prairie-dog towns of the Badlands. Its wide and compact body is about 2 feet long, with short muscular legs. It is a tough and fierce fighter.

The NORTHERN PLAINS SKUNK is the local form of the LARGE STRIPED SKUNK which is found in many parts of the United States. Recognized by the black and white markings on back and tail, it frequently announces its presence by a strong, rather offensive odor. Its food consists largely of small rodents, snakes, and beetles, and it has a particular fondness for grasshoppers.

Its chief defense is a musky secretion that has a most penetrating and offensive odor. This secretion is stored in two glands located at the base of the tail and is ejected in a fine spray by muscular contraction. Unaggressive, it attends strictly to its own business; but if interfered with, or suddenly alarmed, woe to the man or beast in range of its artillery.

The GROUND SQUIRRELS, frequently called "gophers," prefer the open country. Like the chipmunks, their food is composed of seeds and grasses with occasional crickets, grasshoppers, and similar insects for variety. Growing grain is a favorite food; the ripened kernels are stored in underground chambers to be used in the early spring after the long winter's hibernation.

The BADLANDS CHIPMUNK, often, popularly described as a small edition of the tree squirrel, is not to be confused with the ground squirrels. This bright, alert little creature makes its home in burrows under rocks

and tree roots. August, September, and October are busy months, for it is then that the chipmunk gathers seeds and stores them in its underground granaries. With the arrival of snow, it takes to its snug quarters for a long winter sleep. The species found in the Badlands is the smallest of the chipmunks. It is very pale in color and blends in with the light-gray background.

REPTILES

The PRAIRIE RATTLESNAKE is the only common poisonous snake in the Badlands. It is not numerous, but may be encountered by persons while walking through the grass or when wandering from the main roads. The rattling hiss, a pronounced characteristic of the reptile, is caused by the vibration of the "rattles" that are attached to the end of the tail. Grayish green in color, the back is marked by a row of circular brown splotches. The average length is about 3 feet, and the head is triangular in shape—a characteristic common to many poisonous reptiles. When alarmed, it rattles vigorously and, if approached too closely, strikes by throwing its body forward from a coiled position. The bite is poisonous and may be fatal if not promptly treated.

It is wise to avoid poisonous snakes by remaining alert; but if, in spite of precautions, you or a companion should be bitten, the following first-aid treatment is recommended.

Keep the patient quiet and as calm as possible.

Obtain medical help as soon as possible. Rather than require the patient to walk or otherwise exercise, bring medical aid to him.

If there will be delay in getting medical assistance, apply a tourniquet a short distance above the bite (between it and the heart). The tourniquet should be loosened for a few seconds every 20 minutes and never applied too tightly.

There is a persistent myth that rattlesnakes, owls, and prairie dogs live together in harmony. The rattlesnake commonly adopts a deserted prairie-dog burrow, but it is not true that the three live together.

The largest reptile common to the Badlands is the BULL SNAKE reaching an average length of 5 to 6 feet. Sometimes it is called the "yellow gopher snake" because of its orange-yellow color. It also has a row of large, square, reddish-brown, or black, splotches along the back. This harmless reptile is decidedly beneficial in that its principal diet is small animals and rodents such as mice and gophers.

The BLUE RACER is a color variety of the black snake and is abundant west of the Mississippi River. It is bluish green, or olive, in color with a pale yellow belly. The average length is from 3 to 4 feet. As the name implies, the racers are extremely swift in their movements.

The RED-BARRED GARTER SNAKE is common on the Great Plains. It is marked with a central stripe down the back, with fused black spots on each side. The bars are brick red—hence the name. The head is a pale-olive color. The snake feeds on earthworms and often eats toads and frogs. It is harmless to man.

The HOG-NOSED SNAKE, commonly known as the puff adder, often lives in dry, sandy places. When frightened, it "puffs up" or enlarges its body and hisses. This harmless reptile may attain a length of from 2 to 3 feet. It derives its name from the up-turned nose, by which it is easily identified. The snake feeds mostly on toads and frogs.

It is expert in feigning death when danger approaches. It is a rather frightening reptile, since it mimics the cobra by expanding its body, hissing, and making a show of its fangs, which do not inject poison. When all the bluffing fails, it rolls over and plays dead.

Present Climate

The climate of the Badlands area is characterized as typically continental and arid. The summers are short and hot, and the winters long and cold. Annual precipitation averages 17 inches, most of which falls during the spring and early summer. The time of precipitation varies, and long periods of drought may be expected. Temperatures vary from a low of -30° , or colder, in January or February to over 100° in July and August. Those extremes seldom last more than 1 or 2 days. Winter precipitation is mostly snow, but, because of gusty winds, large areas are blown free of snow and sizeable drifts accumulate in road cuts and protected gullies. The transition from winter to summer is usually rapid so the period of spring lasts but a few weeks.

Summers are characterized by hot and frequently windy days which may see dust storms develop in the exposed Badlands formations or from the neighboring cultivated fields. Nights are comparatively cool. From time to time rather violent, but short, hailstorms occur, and these speed up erosion. The infrequent summer rains run off rapidly and within a few minutes the gullies may contain raging torrents that disappear shortly after the rain stops.



A WINTER SCENE IN BADLANDS NATIONAL MONUMENT.

How and When to Enjoy the Monument

The monument is open all year, and any time is a good time to visit it. However, for those who want to study the floral displays, late May and June are suggested. Most of the colorful flowers will be gone by mid-July, and by August the prairie grasses will have become sere and brown.

If you have a choice as to time of day, early morning and late evening are ideal. At these times the rising or setting sun casts shadows that give the scene a beauty not evident at midday. For a special thrill, try to view the landscape under the light of a full moon. The spires and pinnacles are set off by jet-black shadows that give a sharp two-dimensional effect, as if the skyline were cut from cardboard.

As you drive over the highway you will find numerous parking areas located at or near places where outstanding panoramas are evident. Park your car, set the brakes, and enjoy the scenery. Please do not

park on the roadway and thus obstruct or endanger through traffic. A WORD OF CAUTION—please do not throw cigarettes or burning material of any kind from your car or into the grass. Devastating prairie fires may result. Place your film cartons, candy wrappers, or lunch refuse in containers found in the parking areas. It is a mark of a good citizen to take pride in your national parks and monuments and to respect the rights of others. *Be a good citizen.*

How to Reach the Monument

BY AIR

The nearest transcontinental airfield is at Rapid City, S. Dak.

BY RAIL

The Chicago and North Western Railway serves Wall and Rapid City.

FINE VIEWS OF THE BADLANDS ARE PROVIDED FROM VARIOUS ROADSIDE PARKING AREAS.—*South Dakota State Highway Commission Photograph.*



BY BUS

Transcontinental buses discharge passengers at Kadoka, Wall, and Rapid City. Black Hills and Western Tours of Rapid City offer a daily round-trip tour June 1 to September 30 from Rapid City to the Badlands as far as Cedar Pass Lodge.

BY AUTOMOBILE

West-bound motorists will find U. S. 14 and 16 provide the nearest approach to the monument. For north-south travelers, U. S. 83 intersects these highways about 90 miles east of the Badlands and U. S. 85A intersects them about 75 miles to the west. A surfaced road (alternate 16) leaves Wall, S. Dak., on combined U. S. 14 and 16, passes through the Badlands, and joins U. S. 16 about 19 miles east of the monument. Consult road maps for other routings.

Accommodations

Within the monument, at Cedar Pass Lodge, cabins, meal service, gasoline, oil, and souvenirs are available. This lodge, which is open during the summer travel season, is a private enterprise, on private land, not subject to Government supervision. Rapid City, Wall, Kadoka, and other nearby cities and villages have facilities to meet the normal requirements of motorists.

Other Areas of the National Park System Having Badlands Topography

THEODORE ROOSEVELT NATIONAL MEMORIAL PARK, in the southwestern part of North Dakota, has some colorful examples of a more mature stage of badlands development. There are few spires and pinnacles, and the hills are more rounded, but numerous buttes and mesas are in evidence. The Little Missouri River bears the same relationship to this area as the White River does to the South Dakota Badlands. The rocks of the park are older and were probably exposed to erosion longer, which may account for the "older" appearance of the topography.

The Painted Desert of northern Arizona, a spectacular portion of which is located within PETRIFIED FOREST NATIONAL MONUMENT, is a colorful and well known badlands area. It is composed of altered volcanic ash, and its rocks are considerably older than those of Badlands National Monument. The landscape, however, has been formed in the same manner—the result of soft rocks, scanty vegetation, and cloudburst rainfall.

Although seldom considered as "badlands" topography, BRYCE CANYON NATIONAL PARK, in southern Utah, has a vast array of brilliantly tinted spires and pinnacles which resemble in both color and form the principal features in Badlands National Monument. In reality, Bryce Canyon is a huge horseshoe-shaped amphitheater with precipitous walls which are receding in much the same manner as the wall in Badlands National Monument.

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