MINERALS are naturally occurring inorganic chemical compounds each with a more or less definite chemical composition and distinctive physical properties. Minerals combine in natural mixtures called ROCKS. FOSSILS are the evidence of past life and are usually found in SEDIMENTARY ROCKS.

Museum exhibits are identified in a general way on the accompanying map.

Section 1:
- **Squeezed pebble.** In the ancient rocks of the Black Hills there are thick deposits of conglomerates (gravel turned to rock). The conglomerates were sometimes squeezed by pressures associated with ancient episodes of mountain building. Precambrian/Proterozoic Estes Conglomerate

- **Slickensides.** During the uplift of the Black Hills many rocks were fractured and faulted. Along the surface of some faults the rocks ground past one another to produce a polished surface such as this. The sample here is a faulted piece of Lakota Sandstone, Cretaceous.

- **Coal.** The accumulation of abundant plant tissues in an oxygen-deficient environment produces coal. The environments vary, as do the plant tissues so the coals show a great deal of variation and interface with a wide variety of hydrocarbon accumulations.

- **Glacier polished rock.** Glaciers behave like giant belt sanders that pick up rock debris and drag it over bedrock until the rock attains a great polish.

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**Section 2:**

- **Septarium or septarian nodules.** These rocks start as an aluminum-rich gel which hardens on the outer surface then dries out and cracks in radiating fractures as well as fractures parallel to the outside of the rock. The fractures then fill with a mineral, commonly calcite, to produce rocks that are sometimes mistaken for **but certainly not** fossil turtles.

- **Gold Nugget models.** These models are one of our most popular exhibits. The models were made about 100 years ago and now are collector’s items in their own right. The actual gold specimens have long since been used for commercial purposes. Of course the big ones come from Australia.

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**Section 3:**

- **Ophiomorpha.** A trace fossil of a burrowing shrimp, *Callianassa* which is a living form common on the East Coast of the United States.

- **Artiodactyl tracks.** Unmistakably the tracks of a two-toed mammal similar to a deer.

- **Plesiosaur gastroliths.** Rocks swallowed by a plesiosaur: the labels tell the story!
Section 4:

- **Ostracoderms.** Jawless fish had a very heavy armor covering the head region during the Paleozoic. *Dartmuthia* and *Tremataspis* are good examples. These fish-like creatures are most closely related to lampreys and hagfishes of our modern oceans.

- **Lungfish.** *Dipterus* is an early air-breathing fish that lived in freshwater ponds and streams on the flanks of an early version of the Appalachian Mountains during the Devonian.

- **Shark teeth.** Many teeth were dropped to the bottom of the ocean because new teeth constantly replace teeth in the mouths of sharks. The fossil record of sharks is very good if we just look at teeth.

- **Mollusk-crushing shark.** *Ptychodus* is a remarkable shark because of this extensive lining of the jaws with rounded nobs of enamel-covered teeth, which are effective crushers when the jaws are brought together.

Section 5:

- **Plesiosaur paddle.** The highly modified limb is from a marine reptile called a short-necked plesiosaur. Compare this paddle with those of the long-necked plesiosaur in the middle. This specimen is Cretaceous in age.

- **Ichthyosaur paddle.** Another limb of a marine reptile was used for steering, in contrast to the propelling function in plesiosaurs. Ichthyosaurs were very active predators of Mesozoic seas and are known from the Jurassic and Cretaceous of the Black Hills.
Section 6:

- **Pterosaur wing.** This is another highly modified limb, but the fluid is air rather than water. This bone is an elongated fourth digit (like our ring finger) that supported a thin but tough membrane for flying. This pterosaur lived during the Late Cretaceous and fell into the ocean that covered the area. Perhaps they lived like modern pelicans, feeding on near-surface fishes.

- **Diving bird skeleton.** *Hesperornis* lived during the time of mosasaurs and plesiosaurs and swam in the ocean. Although a skull is not present with this specimen we do know that the jaws had teeth, which is remarkable but not unexpected for early birds.

- **Badlands bird.** *Procrax brevipes* is a cracid (curassow) bird, related to modern chickens and their allies. The skeleton is complete and is from the Chadron Formation of Late Eocene age.

- **Badlands eggs.** These are mostly duck eggs. The eggs are usually found isolated so the nest is a reconstruction.

- **Dinosaur eggs.** A cast and some shells of *Protoceratops* represent a primitive horned dinosaur from Mongolia. It is Late Cretaceous in age.

Section 7:

- **Soft-shelled turtle** *Trionyx leucopotamicus* is an extinct soft-shelled turtle related to the modern form. This was found in an upper Eocene stream deposit by the R. A. Boyce family.

- **Badlands tortoises.** *Stylemys* and *Geochelone* are common tortoises that lived on the floodplains during the Late Eocene and Early Oligocene of this region.

- **Badlands lizards.** *Peltosaurus* is a true lizard with many small bony plates developed in the skin. The plates are commonly preserved fossils. These lizards are Oligocene in age. *Rhineura* and *Hyporhina* are worm lizards that lived in loose soil and leaf litter during the Oligocene in the Badlands area.

- **Badlands rodents.** *Eumys* and *Ischyromys* are among the more common gnawing mammals of the Badlands.

- **Badlands dog.** *Hesperocyon* is a small dog-like carnivore that is the most commonly encountered predator in the Badlands.

- **Badlands primitive insectivore.** *Lepticitis* is a distinctive insect-eating mammal with two prominent, bony crests on the top of the braincase. This mammal demonstrates many features that paleontologists associate with mammals that lived along side the last dinosaurs.

- **Rabbit skeleton and skulls.** *Palaeolagus* is one of the most common mammals in the Badlands. Most specimens, however, are animals that were eaten by predators, so this exquisite skeleton is remarkable for its completeness.
Section 8:

- **Graduate Student Research.** Sixteen Masters Students and two Ph.D. Students in the Museum of Geology's Paleontology Program are actively collecting fossils from many parts of the United States, particularly the Northern Great Plains.

- **Badlands Mammals.** There have been many specimens found of the same species, allowing us to see a progression from young to old individuals.

Section 9:

- **Faculty Research.** This exhibit features items collected during the research of Museum staff members.

Sections 10 and 11:

- **New Historical Exhibits.** These exhibits are designed to show the visitor the history of our museum, the explorations for fossils to fill it and those who helped build it. There are also historical photos included with other exhibits in the museum.
In the Middle:

- **Styxosaurus.** The long-necked plesiosaur is a beautifully mounted example of one of the marine reptiles that lived in the great Cretaceous seaway that covered this region before the Black Hills were uplifted. This skeleton is not a dinosaur but a marine reptile. Long-necked plesiosaurs have a long history in the Cretaceous of South Dakota.

- **Baby Plesiosaur.** This juvenile Plesiosaur, known as *Mauisaurus*, is from Antarctica. This specimen, found in 2005, is the most complete and articulated specimen known from Antarctica.

- **Mosasaurus.** The second skeleton that dominates the middle of the museum is another beautifully mounted mosasaur, a marine lizard. The advantage that these two large skeletons present is the obvious chance to make comparisons of two very different large swimming reptiles.
- **Tyrannosaurus.** The most famous of all dinosaurs and the largest carnivore to walk the earth. The skull is the first specimen of *Tyrannosaurus rex* to be found in South Dakota. After the great Cretaceous seaway drained from the region, habitats suitable for dinosaurs were present in South Dakota. This specimen is about 67 million years old.

- **Platecarpus.** On the floor is a partial skeleton of a marine lizard (mosasaur) that is exhibited in the position that it was preserved. The skeleton is from the Pierre Shale which also produced the mounted skeletons of the plesiosaur and mosasaur.

- **Mosasaur with stomach contents.** On a stand adjacent to the mounted *Mosasaurus* is a jumble of bones in a cast. These are the stomach contents of a large mosasaur, *Tylosaurus*. They provide positive evidence of a diverse appetite for this creature. The contents include an aquatic bird, *Hesperornis*, another mosasaur, *Clidastes*, and vertebrae of a bony fish. Shark teeth are also scattered among the bones but present a problem because they may have been gastric residues or lost teeth from a scavenging shark.

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**Section 12:**
- **Geologic Time Scale.** Geologists and paleontologists tell time by several methods including radioactive decay (giving an absolute date) and by the sequence of fossils (giving a relative date). Geologic history is subdivided into Eons, Eras, Periods, Epochs, and Ages on the basis of absolute dates, relative dates, and stratigraphic relationships. This exhibit summarizes the geologic time scale and the ages of various sediments in the Badlands of South Dakota.

**Badlands Dioramas:**
- These are accurate reconstructions of details at the three major fossil horizons in the Badlands of South Dakota as they exist today.

**Section 13:**
- **The upper horizon,** representing 28-32 million years ago, contains the horned *Protoceras* and *Leptauchenia*, along with turtles and more artiodactyl tracks.
Section 14:
- **The middle horizon**, representing 32-34 million years ago, contains many animals found in the Badlands including camels, horses, turtles, oreodonts (sheep-like mammals) including a pregnant one, the “Big Pig” *Archaeotherium*, primitive saber-tooth cats, and the “false deer” *Leptomeryx*.

Section 15:
- **The lower horizon**, representing 34-36 million years ago, contains a large Brontothere, which is not found in the rocky layers of the upper part of the White River Badlands. An alligator is also present and is chiefly of interest because its presence in the rocks of the Badlands clearly points to more temperate conditions in the past.
Section 16:
- **Badlands skulls and jaws.** A sampling of the diversity of skulls and jaws from common to rare forms from the White River Badlands. Rhinoceros, horse, giant pigs, camel, and cat-like animals are present in this case. Most notable is *Nimravus* with a puncture in its head and healed bone around the puncture. The mural above tells the story in a graphic way.

![Badlands skulls and jaws](image)

Section 17:
- **Gomphotherium.** A partial skeleton of this early form of elephant-like creature. Note particularly the straight tusks, the elongate symphysis of the lower jaw.

Section 18:
- **Brontothere Skull.** One of the largest Brontothere skulls known in North America. The sculptures were created by 20th century artist Charles R. Knight who is famous for his reconstructive drawings of Ancient Life.

![Brontothere Skull](image)

Section 19:
- **Agate Bone Bed.** This slab of fossil Rhinoceros bones, originally 2 feet thick, was collected in 1924 from near Agate, Nebraska, where a National Monument now preserves the site.

![Agate Bone Bed](image)
Section 20:

- **Mammoth skull.** This impressive skull and jaws testsifies to the dedication of the Museum of Geology staff in the late 1940’s. The skull was uncovered by a bulldozer during the construction of a stock pond. Many pieces were found. Reconstruction revealed a very large mammoth, *Mammuthus imperator*. At this point it is appropriate to compare *Gomphotherium* and *Mammuthus*.

- **Bison Skull.** Perhaps the mammal most identified with the Black Hills today is the American bison, *Bos bison* (formerly *Bison bison*). Bison are relative newcomers to North America with the first appearance within the last 300,000 years. The most imposing of all the bison is *Bison latifrons* with horn cores (actual horns would be much larger than the bony horn cores) that make a Texas longhorn look small. This specimen is from gravels deposited during the ice age in western South Dakota, reminding us that glacial ice did not extend much beyond the current path of the Missouri River.

Venta

Section 21:

- **Edmontosaurus.** A common dinosaur, the duck-billed form is from the Latest Cretaceous of South Dakota.

Section 22:

- **Xiphactinus.** A large predatory bony fish of the Cretaceous seas from South Dakota.

- **Triceratops.** The official South Dakota State Fossil specimen, from the latest Cretaceous deposits of South Dakota.

Section 23:

- **Dunkelosteus.** A placoderm or armored jawed fish of the Devonian from Cleveland, Ohio.
Section 24:
- **Antarctica Fossils.** These fossils are similar to those from South Dakota indicating that Antarctica had an environment similar to that of the Black Hills Region.

![Antarctica Map](image1)

Section 25:
- **Metoposaurus.** A Triassic amphibian which was an active aquatic predator, from New Mexico.

Section 26:
- **Cenozoic and Mesozoic Invertebrates.** Fossils displayed include bivalves, ammonites, baculites, and snails.

![Fossil Images](image2)

Section 27:
- **Preservation of fossils.** The discovery of a fossil normally elicits a number of questions. One question that immediately comes to mind is "How did it become a fossil?" In this case are several examples of the various results of the fossilization process.
- **Early Paleozoic Invertebrate** fossils from the Cambrian, Ordovician, and Silurian include: Trilobites, Brachiopods, Nautiloids, Gastropods, Corals, Bryozoans, Sponges, and Algae.
- **Late Paleozoic Invertebrate** fossils from the Devonian, Mississippian, Pennsylvanian, and Permian include: Trilobites, Nautiloids, Gastropods, Bivalves, Corals, and Bryozoans.
Section 28:
- **Big Pig Dig.** The Pig Dig is an ongoing dig in Badlands National Park that is open for the public to view. These are some of the animals found there.

Section 29:
- **Coal swamp plants.** The oldest land plant remains date back to the Silurian, abundant and widespread remaines are known from the Pennsylvanian coal deposits. Extinct seed ferns and horsetail-like plant fossils are very common. Horsetails are common along the streams of the Black Hills.
- **Petrified wood.** One of the most famous areas for petrified wood is the Painted Desert of Arizona, where numerous large tree trunks were preserved in streams and flood-plains. The fossilization process carried with it iron and manganese to enrich the color of these woods as they became silicified. Most of the trees are relatives of the modern Norfolk Island Pine, a common plant used for interior decorating. These beautifully preserved woods are from the Chinle Formation of the Late Triassic.
- **Cycadeoids.** These extraordinary fossils are the silicified trunks of plants that had large palm-like fronds with thin, tough leaves. The cycads also produce large cones and are most similar to modern cycads. These cycadeoids are from the river deposits of the Lakota Formation and are Early Cretaceous in age. The details of internal structure are beautifully developed when the fossils are sectioned and polished.
- **Fuson Shale Flora.** One of the pleasant surprises in the Early Cretaceous rocks of the Black Hills is the presence of plant fossils that are more typically Mesozoic. The plants are dominated by the remains of conifers rather than by the newly emerging flowering plants. Compare these with the plants of the Late Cretaceous and the differences are immediately apparent.
- **Hell Creek Flora.** Flowering plants demonstrate substantial diversity by the end of the Mesozoic. Life on land made a very distinctive change, important to insects that feed and pollinate flowers, to all herbivores, and to the sum of biological productivity on land.
- **Florissant Flora.** This flora is a diverse assemblage of plants from Florissant, Colorado, the nearest site that is approximately the same age as the South Dakota Badlands. The flora has many familiar forms, with modern representatives.

**MINERALS.** This is a systematic arrangement of 1000 specimens of over 400 minerals species, arranged according to chemical composition.

- **South Dakota Room.** South Dakota minerals are arranged here according to the environments they have been found in including pegmatites, vein and replacement minerals, sedimentary deposits, cave formations, and metamorphic minerals.
A suite of minerals from the Homestake Gold Mine, and the state gem (Fairburn Agate), and the state mineral (rose quartz) complete this exhibit.

- **Fluorescent minerals.** Mineral fluorescence is caused by the absorption and transformation of invisible ultraviolet energy to visible light.
- **Meteorites.** Meteorites from all over the world are displayed here. Many are from South Dakota, including the McMurchie Meteorite which punctured a tin roof in 1956.

- **Sand Calcite.** The sand calcite crystals are unique and only found in two places in the world: South Dakota and France. This specimen comes from a National Natural Landmark, so the site is now protected from poachers.

- **Gold.** Many gold specimens come from the Black Hills, including dust, nuggets, and inclusions in quartz.