

Smoky Hills: Rocks and Minerals

The region known as the Smoky Hills occupies the north-central part of the state. It is delineated by outcrops of Cretaceous-age rocks and takes its name from the early morning haze that often gathers in the valleys.

During the Cretaceous Period (that interval of geologic time from about 144 to 66 million years ago), Kansas was once again under water. Unlike the relatively shallow seas of the Pennsylvanian and Permian, the seas that advanced and retreated during the Cretaceous were deeper and more widespread. Three principal rock outcrops characterize the Smoky Hills—the sandstones of the Dakota Formation, the limestones of the Greenhorn Limestone Formation, and the thick chinks of the Niobrara Chalk.

The Dakota Formation sandstones crop out in a wide belt from Rice and McPherson counties, in the south, to Washington County, in the north. They are the remains of beach sands and sediments dumped by rivers draining into the early Cretaceous seas. The hills and buttes in this part of the Smoky Hills, such as Coronado Heights in Saline County, are capped by this sandstone and rise sharply above the surrounding plains.

The next outcrop belt to the west is the Greenhorn Limestone, which is made up of thin (usually less than 6 inches) chalky limestones beds alternating with thicker beds of grayish shale. The Greenhorn Limestone was deposited in a relatively shallow part of the Cretaceous sea. Near the top of the Greenhorn is a limestone bed called Fencepost limestone. Because timber was scarce in this part of the state, limestone was used extensively by early settlers for buildings and fenceposts.

The third and westernmost range of hills in the Smoky Hills developed on the thick chinks of the Niobrara Chalk. These chalk beds, which were deposited in the deeper part of the Cretaceous ocean, are exposed in bluffs of the Solomon, Saline, and Smoky Hill rivers and in an irregular belt from Smith and Jewell counties to Finney and Logan counties. The Niobrara chalk is known for the pinnacles, spires, and odd-shaped masses formed by chalk remnants, such as Castle Rock and Monument Rocks in Gove County. It is also known for fossils of swimming reptiles such as plesiosaurs and mosasaurs that lived in the ocean while dinosaurs roamed the land.

Common Rocks and Minerals

Sandstone.—Sandstone is a sedimentary rock, made up largely of quartz grains held together by some natural cement (calcium carbonate, iron oxide, or silica). In the Smoky Hills, some of the sandstones in the Dakota Formation are cemented by dark-brown iron oxide and are so resistant to erosion they cap steep hills. Other sand-



Outcrop of the Dakota Formation at Wilson Lake, Russell County.

stones—such as the giant concretions at Rock City in Ottawa County and Mushroom Rock State Park in Ellsworth County are cemented by calcium carbonate.

Concretions.—Concretions are formed when minerals in water are deposited about a nucleus (such as a leaf or shell or other particle), creating a rounded mass whose composition or cement is usually different from the surrounding rock. This can occur at the time of deposition, shortly thereafter, or after the sediment has hardened.

Generally, concretions are harder than the rocks around them; therefore, over time, they can weather out of the surrounding rocks. Concretions in Kansas are formed from any of a number of minerals, including calcite, limonite, barite, pyrite, or silica. They vary widely in shape and size. The smallest are oolites, which can be smaller than the head of a pin. At the other end of the spectrum are the huge spherical concretions at Rock City in Ottawa County and Mushroom Rock State Park in Ellsworth County, the largest of which have diameters of 27 feet.

Limestone.—A sedimentary rock common in Kansas, limestone is composed mostly of calcite (calcium carbonate, CaCO_3). It is formed (largely in marine environments) by organic means—that is, from the remains of animals or plants—or by chemical deposition. Many animals and plants (such as oysters, corals, some sponges, sea urchins, plankton, and algae) take calcium carbonate out of the water and secrete it to form shells or skeletons. As these organisms die, they drop to the bottom of the ocean, lake, or river. Over time, the organic parts decay and the calcium carbonate accumulates to form limestone. Chemically deposited limestones are formed when calcium carbonate dissolved in water falls out of solution and settles to the bottom of the ocean, lake, or river.

The limestones that crop out in the Smoky Hills were deposited during the Cretaceous Period. A popular limestone for building, the Fencepost limestone, occurs near the top of the Greenhorn Limestone. This relatively thin limestone, up to one foot thick, is marked by a distinctive rust-colored band in the middle. In addition to widespread use as a building stone, Fencepost limestone is the source of the stone fenceposts that have made this part of the Smoky Hills known as post-rock country.

Another variety of limestone, chalk dominates the landscape in the western part of the Smoky Hills. Chalk is a soft, porous, very fine grained kind of limestone that crumbles easily. In its pure form, it is white, but it may be colored by iron oxide or other impurities. Chalk forms from the seafloor accumulation of tiny marine organisms that lived near the surface. As the tiny shells piled up, a soft limy ooze formed, perfect for engulfing and preserving the remains of other animals—such as fish, sharks, turtles, clams, pterodactyls, mosasaurs, and plesiosaurs—that fell to the bottom of the sea.

Places to Visit

Rock City.—At Rock City, two hundred sandstone concretions are distributed in an area about the size of two football fields. Rock City is located 3.6 miles south of the town of Minneapolis in Ottawa County, off Kansas Highway 106. A small admission fee is charged from May to August. For more information, contact the Chamber of Commerce, 213 West Second, Minneapolis, KS 67467 (785) 392-3068.

Mushroom Rock State Park.—Another place to see sandstone concretions from the Dakota Formation is Mushroom Rock State Park, one mile south of Carneiro in Ellsworth County.

Balanced on pedestals of softer rock, the spheres are the result of differential erosion of the Dakota Formation sandstone.

Kanopolis State Park.—This park is a good place to get a feel for the rugged beauty of the Dakota Sandstone country.

Gypsum crystals (selenite) weather from the shale slopes around the lake. The gypsum is a secondary product derived from the weathering of iron sulfide (mainly marcasite) in the shale. For more information, contact Kanopolis State Park, 200 Horsethief Rd., Marquette, KS 67464 (785) 546-2565.

Sternberg Museum.—The newly remodeled Sternberg Natural History Museum in Hays opened in March 1999. Adjacent to Interstate 70 on the northeast edge of Hays, this is a great place to learn more about what life was like



Sandstone concretion at Mushroom Rock State Park.

at the edge of the Cretaceous sea that covered western Kansas, roughly 80 million years ago. For more information, visit the Museum's web site at www.fhsu.edu/sternberg/.

Monument Rocks and Castle Rock.—These chalk monoliths in western Gove County were carved by wind and water in the thick chalk of the Smoky Hill Chalk Member of the Niobrara Chalk. Harder layers within the chalk protect the underlying rock from erosion, creating the distinctive buttes or “monuments.” To get to Castle



Chalk monuments at Castle Rock in Gove County, showing Cobra Rock before it toppled in 1998.

Rock, take the Quinter exit off Interstate-70 and head south for 14 miles on Castle Rock Road. To get to Monument Rocks, head south on U.S. Highway 83 from the intersection with U.S. 40 at Oakley. After 20 miles, head east on Jayhawk Road for 4 miles, then south for 2 miles, east for 1 mile, and south for one-half mile. Although both sites are open to the public, visitors should bear in mind that they are located on private property.

Sources

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