

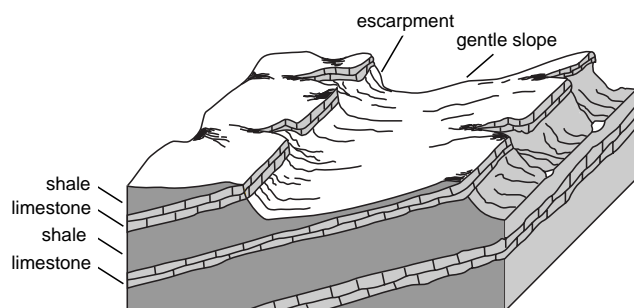
## Osage Cuestas: Rocks and Minerals

The Osage Cuestas region occupies nearly all of eastern Kansas south of the Kansas River and is characterized by a series of east-facing ridges (or escarpments), between which are flat to gently rolling plains. *Cuesta*, Spanish for hill or cliff, is the term geologists use to describe ridges with steep, clifflike faces on one side and gentle slopes on the other.

In the Osage Cuestas, the underlying strata are Pennsylvanian-age limestones and shales that dip gently to the west and northwest. Each *cuesta* consists of a striking east-facing ridge or escarpment and a gently inclined surface that slopes in the direction of the dip of the strata. Each escarpment is capped by the more-resistant limestone, while the gentle slopes are underlain by thick layers of shale. The steep faces of the *cuestas* range in height from approximately 50 feet to 200 feet.

### Common Rocks and Minerals

**Sandstone.**—Like sand, sandstone is made up largely of quartz grains, which are held together by some natural cement such as calcium carbonate, iron oxide, or silica. It is a common sedimentary rock in Kansas. In eastern Kansas, sandstone is often interbedded with shale and limestone. It also occurs as channel deposits, cutting through older deposits of shale and limestone. The Tonganoxie Sandstone Member of the Stranger Formation, which crops out in Franklin, Douglas, and Leavenworth counties, is an example of a channel deposit; it was deposited in a large river valley about 300 million years ago. Today the Tonganoxie is an important aquifer. Another sandstone in this region, the Bandera Quarry Shale Member, is quarried in Bourbon County, near the town of Redfield. This sandstone, part of the Bandera Shale formation, separates easily along natural bedding planes and is used as flagstone for walkways and veneer.



*Cuesta topography developed in gently dipping, alternating hard and soft rock layers.*

**Shale.**—Another common sedimentary rock, shale is composed of hardened, compacted clay or silt that commonly breaks along bedding planes. Its particles are too small to be seen without a microscope. Shales erode easily, and most are soft enough to be cut with a knife. Though usually gray, shale can be black, green, red, or buff. When heated, shale changes to the familiar brick-red color. In eastern Kansas, shale has been used for making bricks. Black, platy shales found in Labette, Crawford, Bourbon, Douglas, Linn, and Neosho counties contain large amounts of organic matter. Called oil shale, this rock can yield oil when distilled; small slivers can be ignited with a match.

**Limestone.**—Limestone is a sedimentary rock composed mostly of calcite (calcium carbonate,  $\text{CaCO}_3$ ), usually deposited in marine environments. It is formed by organic means or 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 and shales in the Osage Cuestas were deposited in shallow seas that lapped onto this area between about 290 and 310 million years ago. The outcrops in this region contain a variety of fossils, evidence of the

abundant life that populated the seas during the Pennsylvanian Period.

The Beil Limestone Member in Osage County, for example,



*Oolitic limestone, Montgomery County.* contains brachiopods, bryozoans, fusulinids, mollusks, and cornucopia-shaped horn coral. Some limestones in this region contain oolites, small spheres of calcium carbonate that formed around some sort of nucleus, such as a grain of sand or shell fragment. Oolitic limestones can be seen in Johnson, Miami, Osage, Linn, Bourbon, and Labette counties, and near the towns of Independence and Cherryvale in Montgomery County.

*Lamproites*.—Almost all rocks at the surface in Kansas are sedimentary in origin, but this region is also known for exposures of igneous rocks in Woodson and Wilson counties. These rocks, which geologists called lamproites,



*Lamproites, Woodson County.*

crop out in sill-like masses about one mile long and several hundred yards wide. Lamproites are dark-colored igneous rocks rich in potassium and magnesium, which formed from the cooling of molten magma. Geologists refer to these rocks as intrusive because they were forced into other rocks below the surface of the earth. These lamproites formed during the Cretaceous Period, about 100 million years ago. They contain irregular spots of hardened or altered shale. When the hot, molten igneous rock came in contact with the Paleozoic shale, pieces of the shale broke off and fell into the liquid mass.

## Places to Visit

*Elk Falls*.—At Elk Falls, near the town of the same name in Elk County, the Elk River drops four to six feet



*Elk Falls.*

over a sandstone ledge. This sandstone, informally known as the Elgin Sandstone for exposures near the town of Elgin in Chautauqua County, is Pennsylvanian in age. The remains of an old mill are located near the waterfall. Downstream from the falls is an iron bridge built in 1893 that is now on the National Register of Historic Places.

*Johnston Geology Museum*.—This museum at Emporia State University contains a wide range of material on Kansas geology, including fossils from different parts of the state, minerals exhibits, and Indian artifacts. The museum is open 8:00 a.m. to 10:00 p.m. Monday-Friday and 8:00 to noon Saturday when the university is in session (316) 341-5330.

*Clinton Spillway*.—A good place to get a look at the limestones and shales of this region is at the spillway near Clinton Lake dam, 3.5 miles west of Lawrence. The spillway provides a dramatic illustration of the cycles of deposition common during the Pennsylvanian Period, about 300 million years ago. The interbedded limestone and shale sequence exposed here, which is part of the Oread Limestone, is common throughout eastern Kansas, and is probably the result of changing sea levels during Pennsylvanian time. The strata exposed on the north face of the spillway include the interval from the Plattsmouth Limestone Member of the Oread Limestone down to the Amazonia Member of the Lawrence Shale.

## Sources

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*This fact sheet was compiled by Kansas Geological Survey staff (April 1999). More information is available on the World Wide Web: <http://www.kgs.ku.edu/Extension/>*