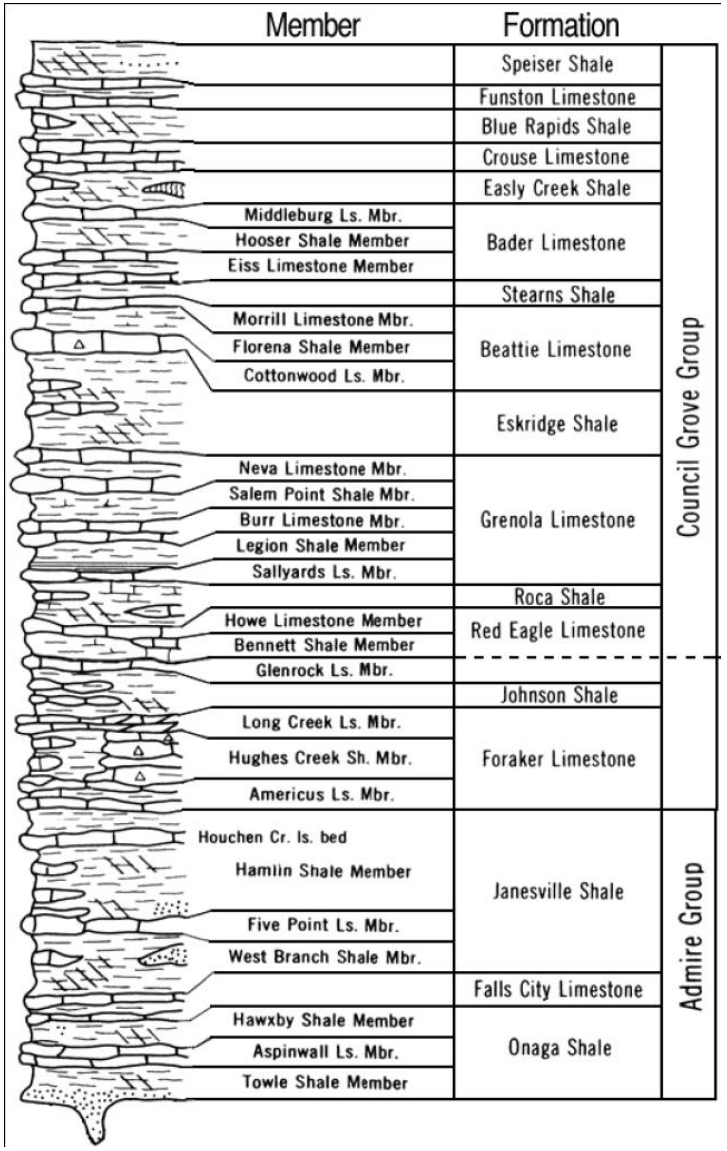
AN OVERVIEW OF THE GEOLOGY OF THE MOUNT MITCHELL HERITAGE PRAIRIE

This guide provides an overview of the geology of the Mount Mitchell Heritage Prairie. To better understand some of the features outlined in this guide we will first cover basic geology of the area.

Mount Mitchell consists of alternating layers of limestone and shale. These limestones and shales were deposited during the Carboniferous and Permian Periods, from approximately 330 to 240 million years ago. During this time Kansas was located closer to the equator, the climate was warmer, and a shallow sea advanced and retreated across eastern Kansas. In general, periods of sea rise, known as transgressions, resulted in deposits of calcium carbonate on the sea floor forming limestone. Periods of sea decline, known as regressions, resulted in shallower seas and at times dry open land forming shale. The cycles of transgressions and regressions, referred to as cyclothems, laid down the limestones and shales in alternating layers in what geologists term “layer-cake stratigraphy”.

To simplify the classification of limestone and shale units, they are organized into Groups, Formations, Members, and Beds. Groups include rocks of similar depositional patterns. The limestones and shales of Mount Mitchell fall within the Council Grove Group. The Groups are subdivided into Formations, which are the basic, distinct, extensively mappable rock units. Formations along the trails of Mount Mitchell include the Beattie Limestone, Eskridge Shale, Grenola Limestone, Roca Shale, and Red Eagle Limestone. Formations can be broken down into smaller rock units called Members, which can be mapped over a small area. Members are named for the geographic locality where they were first recognized and described. Mount Mitchell is comprised of multiple shale and limestone Members. Sometimes the Members are further divided into Beds, the smallest classification representing an individual unit of limestone or shale. The stratigraphic units encountered at Mount Mitchell are represented in the stratigraphic column provided at the right. Note the alternating shale and limestone sequences and the Formations and Members identified.



POINTS OF INTEREST ALONG THE WALKING TRAILS OF THE MOUNT MITCHELL HERITAGE PRAIRIE

(1) The start of the trail and geology walking guide to Mount Mitchell.

(2) Traversing the trail switchbacks as you begin to ascend Mt. Mitchell, blocks of limestone are visible along the trail. The first limestone encountered is the Burr Limestone Member of the Grenola Limestone Formation. Not well exposed at this location, the Burr Limestone is comprised of two individual limestone beds separated by a thin shell.

(3) Above the Burr Limestone is the Neva Limestone Member also within the Grenola Limestone Formation. The Neva is comprised of three to four individual beds of limestone separated by thin shales. This location is the top of the upper limestone bed. These massive blocks of limestone have historically been quarried for use as a building stone.

(4) The top of Mount Mitchell is capped by the Cottonwood Limestone Member of the Beattie Limestone Formation. A characteristic fossil of this limestone are fusulinids. These wheat grain like fossils are actually the calcium carbonate shells remaining from extinct single celled organisms that lived in clear offshore waters. Although not readily visible at this location, another characteristic of the Cottonwood are bands of gray chert within the upper limestone blocks. The Cottonwood limestone, like the Neva, has been quarried for use as a building stone.

(5) Pink to Maroon rocks encountered along the path are Sioux Quartzite, glacial erratic remnants from the late Independence Glaciation also referred to as the Kansan Glaciation. The late Independence Glaciation occurred over 600,000 years ago during the pre-Illinoian ice age of the Pleistocene Epoch. A massive continental ice sheet expanded southward from Canada carrying and pushing earth and rock forward until terminating in the vicinity of the Kansas River Valley. The Sioux Quartzite boulders were transported by the glacier from outcrops in South Dakota, Minnesota, and Iowa. These boulders are the primary remnants from this glacial period as most other rocks and materials have eroded away. It is theorized that as the glacier advanced it crossed the Kansas River Valley in this area damming the Kansas River. This ice dam formed the ancestral Kaw Lake, a gigantic lake likely extending as far west as Salina covering Manhattan, Junction City, Abilene, and Clay Center.

(A) Monument atop Mount Mitchell in commemoration of the Beecher Bible and Rifle Colony and in memory of Captain William Mitchell.

(6) From the top of Mount Mitchell one has a spectacular view of the surrounding Flint Hills and Kansas River Valley. At this location you are approximately 3.5 miles from Wamego, located across the Kansas River Valley to the north. Since the time of the Kansan glaciation, the Kansas River has deepened its valley, cutting into bedrock during times of high flow and subsequently depositing sediment during times of low flow. The result today is a deep bedrock trench of varying depth that contains the Kansas River and its alluvial sediment. The deposits of unconsolidated sediments have been carried by the Kansas River from as far away as Colorado.

(7) A little ways off of the trail at this location is an exposure of the Neva Limestone Member. This exposure is a small old limestone quarry. Here individual beds of the Neva are exposed for closer observation. Local oral history says that stone for the Beecher Church was taken from this site. Be careful as you explore this area.

(8) The trail in this area is relatively flat as you are walking atop the more resistant Neva Limestone forming a bench-like surface around the hillside. Looking up toward the top of Mount Mitchell a steep hillside has formed from the erosion of the less resistant Eskridge Shale Formation. Although the Eskridge Shale is not well exposed in this area, two thin limestone beds within the shale are visible on the hillside.

(B) The 'Dodge' memorial on the side of Mount Mitchell is a glacial erratic.

(9) Crossing the Burr Limestone Member, although not well exposed along the trail at this location.

(10) At this location the trail crosses the Sallyards Limestone Member, the lowest unit of the Grenola Limestone Formation. The Sallyards is a thinner bed of limestone often weathered and covered by topsoil, however at this location blocks of the Sallyards are visible along the trail.

(11) In this area blocks of the Howe Limestone Member of the Red Eagle Limestone Formation appear along the trail. This limestone weathers tan with a skeletal to porous texture. Some white to pink calcite nodules may be observed within the limestone blocks.

(12) The Glenrock Limestone Member of the Red Eagle Limestone Formation is not well exposed at this location but the top of this limestone marks the division between the Carboniferous and Permian Systems.

(13) This road cut exposes the Bennett Shale Member of the Red Eagle Limestone Formation. This gray-green shale contains many fossils, including but not limited to, fusulinids, neospirifer, neochonetes, fenestellids, echinoid plates, calyx spines, and crinoid stalks.

(14) Springs and seeps are visible along the northern edge of the roadway, especially during the days and weeks following rain events. Precipitation falling at Mount Mitchell has percolated into the hill then flowed through the hill as groundwater before reemerging at the surface as springs and seeps. The groundwater often flows through cracks or joints in the limestone atop the shale layers, which often impede the flow of groundwater. As the groundwater emerges on the southeast side of Mount Mitchell one may assume the limestone beds are dipping to the southeast. This southeasterly dip is likely due to the presence of the Nemaha Anticline. The Nemaha Anticline is a buried 'granite ridge' that was uplifted following the Mississippian Period. The Nemaha Anticline is located to the west-northwest trending from approximately Oklahoma City, Oklahoma to Omaha, Nebraska.