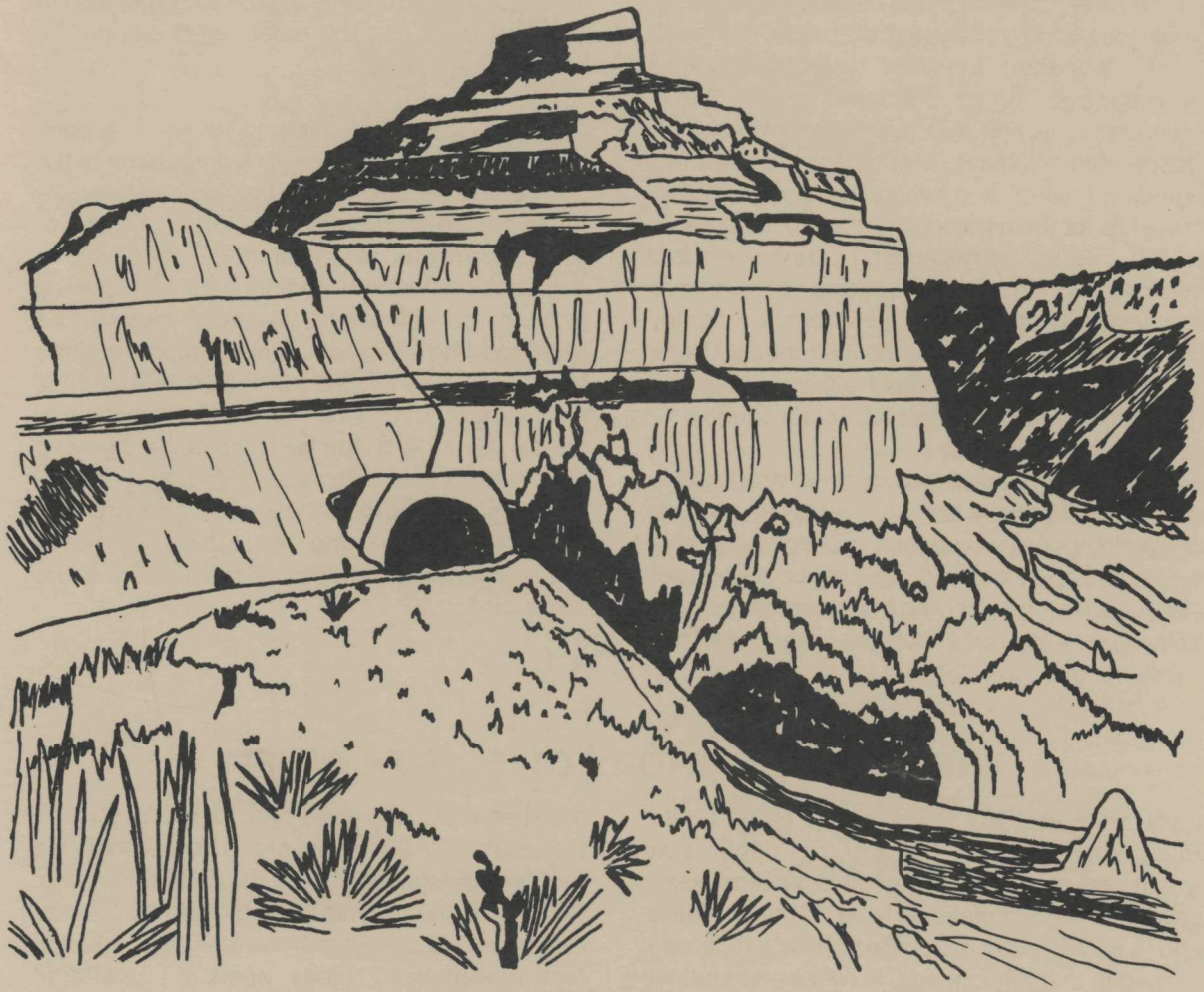
Scotts Bluff

THE ROCKS OF SCOTTS BLUFF



Eagle Rock and Tunnel One

The rocks of Scotts Bluff are very young but also extremely old. Ages of rock here are from 20 to 34 million years old which places them in the Tertiary period of the geologic time scale. In comparison to the estimated age of the earth, about 4.5 to 5 billion years, the rocks here are young. When compared to an average human lifetime, however, the rocks are almost incomprehensibly old.

PAGES OF STONE

Of the three different kinds of rock identified by geologists, sedimentary (sea bed, river, and sand dune deposits), igneous (volcanoes), and metamorphic (rocks changed by heat and pressure); the first two are found exposed at Scotts Bluff National Monument. Weathering agents of wind and water have contributed materials for the horizontal layering of sediments which upon cementation became the sedimentary rocks. Eruptions of ancient volcanoes to the west have deposited lighter colored ash layers among the sediments. These lenses and beds of volcanic ash make up the igneous rock components at Scotts Bluff.

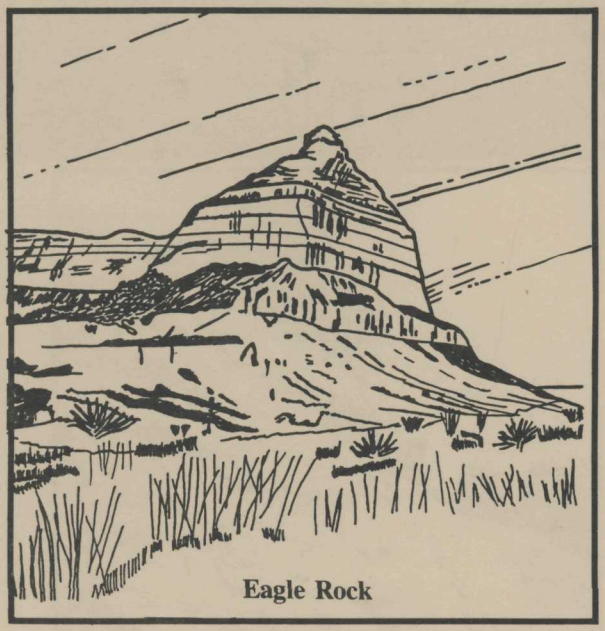
Sediment layers are deposited horizontally. The oldest layer is on the bottom. These simple laws of geology, called original horizontality and superposition of bedding, were first stated about 150 years ago. By applying the two geologic laws to the layers at Scotts Bluff, we can clearly see the original horizontality and by superposition of bedding know that the older layers are on the bottom of the stack.

Comparison of rock layers to pages in a book can conveniently be used for a discussion of the geology of Scotts Bluff. Geologists lump or arrange rock layers by similarities of characteristics, for example, grain sizes, composition, cross bedding and rock colors. Rock layers with similar characteristics can be arranged into members, several members into formations, and several formations into groups. According to our book comparison, individual pages covering a similar topic could become members, one chapter a formation and several chapters a group. In this way geologists are able to discuss rocks using "geologic shorthand" without having to describe characteristics of the rocks in detail.

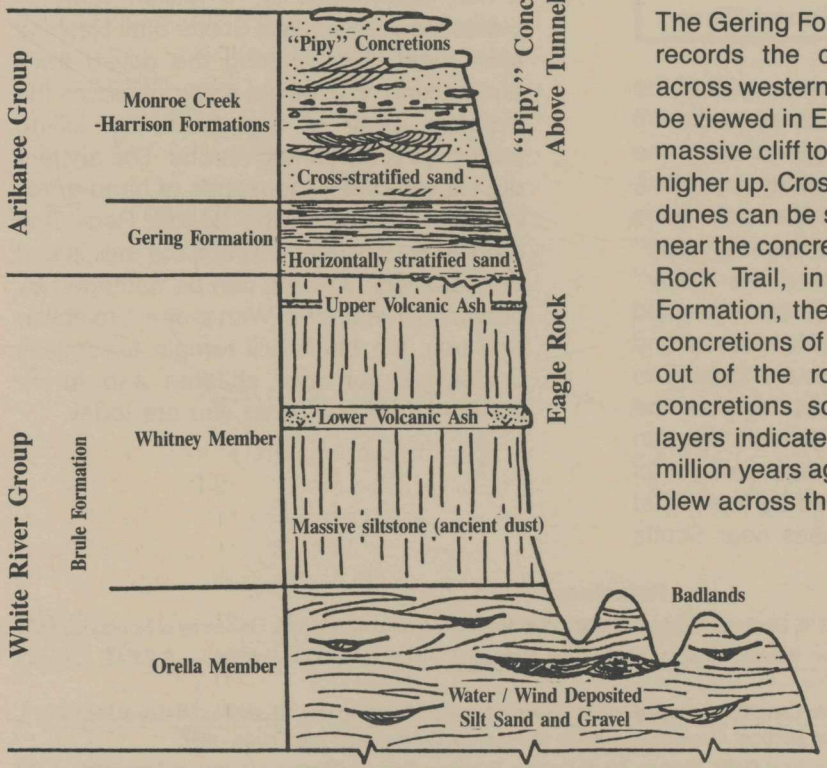
THE GEOLOGIC STORY OF SCOTTS BLUFF

If you were to drill a well near the North Platte River, upon reaching the 250 foot depth, you would find evidence that ancient shallow seas covered the great plains at least 70 million years ago. A sedimentary rock called shale, which was formed in that ancient sea, is now buried below the promontories of Scotts Bluff. Geologists give this layer the formation name Pierre Shale. The sea receded as the great plains began to uplift at the same time as the Rocky Mountains. Meandering rivers and eastward blowing winds then began to carry weathered sand and silt from the uplifted Rocky Mountains. The materials left by these rivers comprises the Orella Member, Brule Formation, White River Group which forms the area of Scotts Bluff known as the badlands (see generalized cross section). Scattered among these layers, fossils have been found which have helped in dating the rocks. Fossil collecting ended when the monument was established in 1919 and is still prohibited by federal regulations.

Next in the geologic story of Scotts Bluff, huge volcanic eruptions occurred in what is now south central and western Colorado beginning about 33 million years ago. These eruptions were similar in character to the violent eruption of Mt. Saint Helens in Washington state in 1980. Westward blowing wind currents carried the exploded volcanic ash to western Nebraska. The evidence for these eruptions is the Whitney Member, Brule Formation, White River Group. The Whitney Member contains two ash layers lower and upper. The lower ash probably records pulses of closely spaced eruptions about 32 million years ago. The upper ash records one enormous eruption about 31 million years ago. Both of these ash layers are visible about half way up Eagle Rock.



Eagle Rock



Generalized Cross Section of Scotts Bluff

The Gering Formation of the Arikaree Group records the development of sand dunes across western Nebraska. This formation can be viewed in Eagle Rock at the change from massive cliff to the more layered appearance higher up. Cross sections of Gering Formation dunes can be seen on the Saddle Rock Trail near the concrete steps. Higher up the Saddle Rock Trail, in the Monroe-Creek Harrison Formation, the so called potato and "pipy" concretions of hard calcium carbonate stick out of the rock layers. The dunes and concretions scattered together among the layers indicate changes in climate about 20 million years ago. During dry times the dunes blew across the plains. When more rain and snow fell, concretions formed. Geologists believe that slowly flowing underground water may have caused the development of the "pipy" concretions.

National Monument
National Park Service
U.S. Department of the Interior

"Pipy" Concretions Above Tunnel Three

About 5 million years ago renewed uplift of the plains and decreasing amounts of sediment allowed rivers and winds to begin to erode the very sediments that they had formerly deposited. The uplift of the plains caused the rock layers to break including the layers containing "pipy" concretions. Those areas where the "pipy" concretions remained essentially intact protected the underlying layers from erosive forces and they became the higher ridges we see today. The Tertiary plains were at least as high as the highest part of present day Scotts Bluff. You can get an idea about the enormous amount of material which has been eroded by looking at the sizes of the valleys or passes near Scotts Bluff.

THE BOOK OF SCOTTS BLUFF

Ancient seas, streams, sand dunes and volcanic eruptions have all worked to produce the layers making up Scotts Bluff. At one time, water and wind were the forces which deposited the fine silt and ash which formed the plains 5 million years ago. Today, the same forces are working to tear down the bluffs. Perhaps in another 2 million years there will be no bluffs at all. The North Platte River and the wind will be left to begin, perhaps, another cycle of deposition.

It has taken close to 70 million years to create the landscape at Scotts Bluff National Monument. Crosscutting the paved trails and walking off of paved paths increases the wearing away of the bluffs by killing protective grasses and shrubs. The ancient dust is very soft. Thousands of hand-prints in the tunnel along the Saddle Rock Trail graphically illustrate how soft the rock is and the ease with which it can be damaged by human mistreatment. With proper protection and use, the bluffs will remain essentially unchanged for your children and future generations to enjoy as you are today.

References

Pabian, Roger K., and Swinehart, James B. II, *Geologic History Of Scotts Bluff National Monument.* Lincoln: University of Nebraska, 1979.

Swinehart, James B. II, et. al., Cenozoic Paleogeography of Western Nebraska, *Rocky Mountain Section — S.E.P.M.*, Lincoln: University of Nebraska, 1985.

Swinehart, James B. II, Loope, David B., Late Cenozoic geology along the summit to museum hiking trail, Scotts Bluff National Monument, western Nebraska, North Central Section: Geological Society of America Centennial Field Guide, 1987.

Trimble, Donald E., *The Geologic Story of the Great Plains.* Medora, North Dakota: Theodore Roosevelt Nature and History Association, 1990.