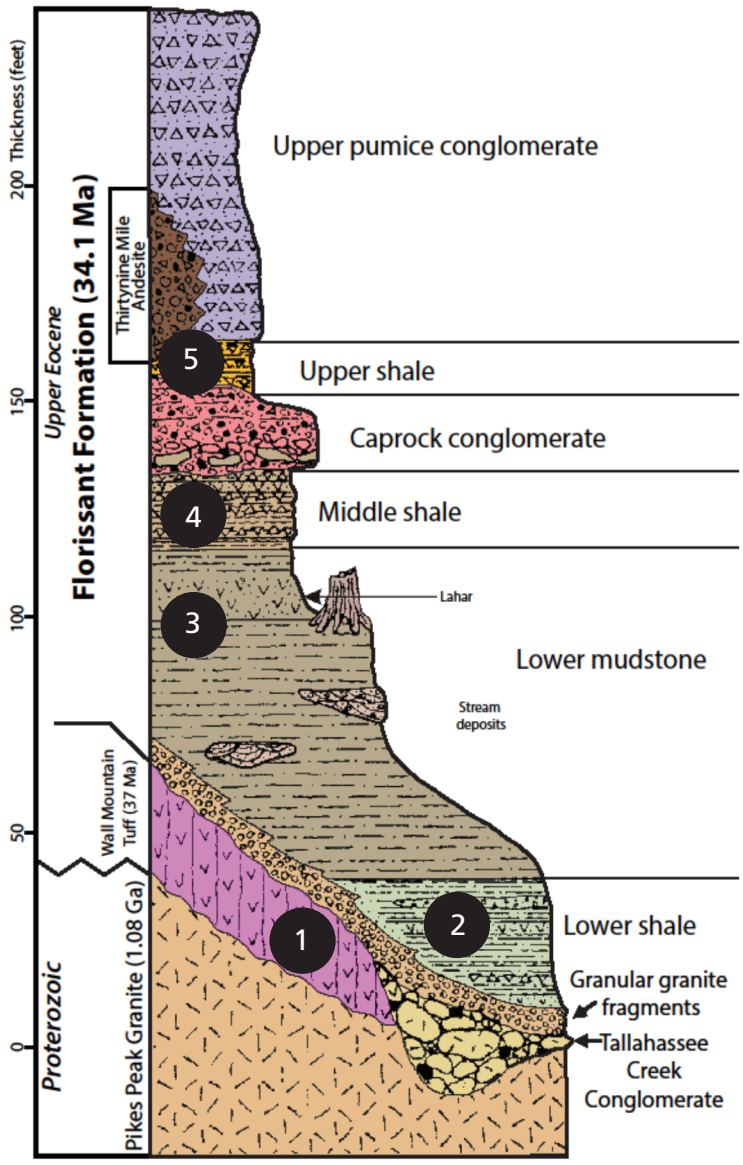
Florissant Fossil Beds
Geologic History of Lake Florissant

National Park Service
U.S. Department of the Interior

Florissant Fossil Beds
National Monument
Colorado

The geologic history of the Florissant Formation includes volcanic eruptions, formations of a lake, and erosion. Geologists can interpret this history by studying the rocks that resulted from these events. A diagram called a stratigraphic column shows the thickness and type of each rock layer present today.



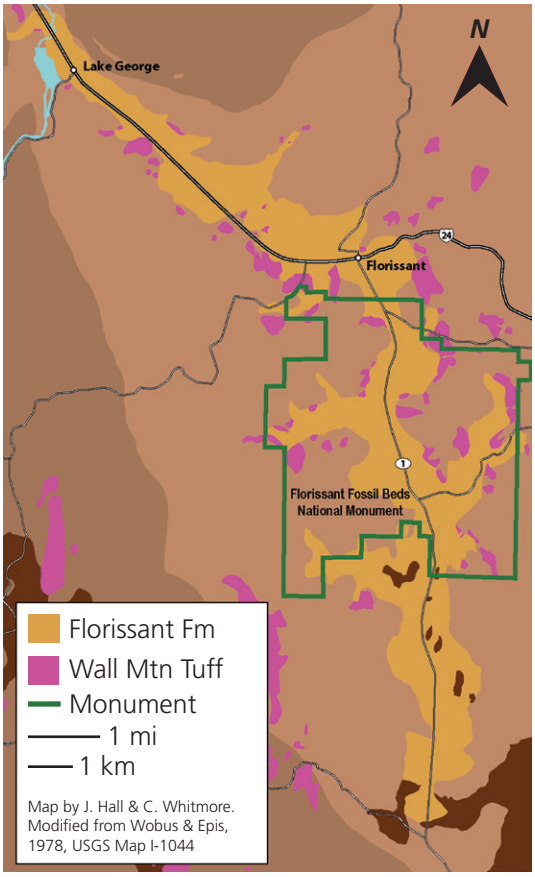
1 Welded Tuff — Volcanic Events

The Florissant area was uplifted when the Rocky Mountains formed, and then it eroded away to a rolling landscape. Streams cut valleys into the surface. By the late Eocene, volcanoes were a dominant force in Colorado. A caldera far to the west of Florissant erupted 36.7 million years ago, at the beginning of the volcanic flare-up of the central Colorado volcanic field. An extremely hot and fast flow of ash and debris blanketed the surrounding area for tens of miles. This flow filled valleys and compacted to form a rock called the Wall Mountain Tuff. In the Florissant region, this welded tuff was then eroded by the stream that flowed through the valley.

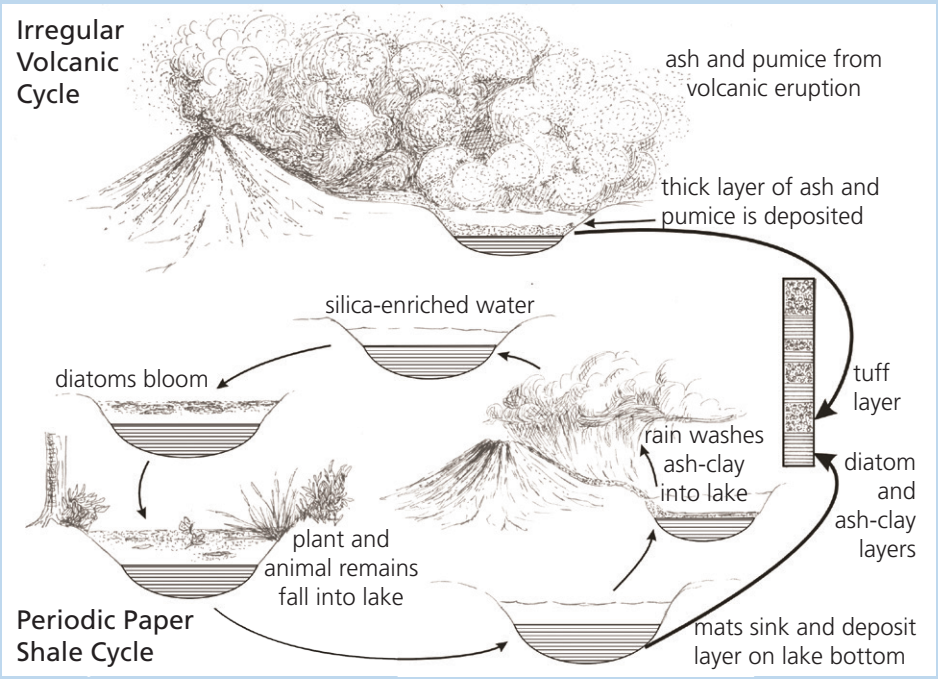
2 Lower Shale — The First Lake Florissant

About 18 miles (30 km) southwest of the Florissant region are the remains of the Guffey volcanic center. This stratovolcano belonged to the Thirtynine Mile volcanic area and was similar in structure to modern Cascade mountains like Mt. St. Helens and Mt. Rainier. Eruptions sent flows of lava and debris into the Florissant paleovalley 34 million years ago. One volcanic debris flow, also known as a lahar, intersected the stream of the ancient Florissant valley. The stream backed up behind a dam of volcanic rock and debris, forming Lake Florissant. Paper-thin layers of ash, clay, and algae built up on the bottom and eventually compacted into shale rich in fossils.

This stratigraphic column shows the thickness of each rock layer in the Florissant Formation. Geologists interpret the diagram from bottom to top, because younger rock layers form on top of older ones. Shales were deposited when Florissant had a lake. Petrified stumps were preserved in a lahar flow. The caprock conglomerate formed after a large lahar entered the lake and mixed with sediment. The top rock unit contains pumice, which is evidence of a volcanic eruption that filled the lake with ash.



A geologic map of the Florissant Formation shows the approximate outline of ancient Lake Florissant. About one-third of the formation lies within the boundaries of Florissant Fossil Beds National Monument.



The ancient Guffey volcanic center near Florissant erupted sporadically 34—36 million years ago. Large eruptions covered the Florissant Valley with ash and pumice, which cooled to form layers of volcanic rock called tuff.

Ash settled on Lake Florissant and enriched the water with silica. The silica influx led to blooms of single-celled algae called diatoms, which use silica to grow glassy "shells" (frustules). The diatoms produced slimy mats, which coated plants and insects as they settled to the lake bottom. Ash on hillsides weathered into clays that washed into the lake on top of the diatom layers. The alternate layers of siliceous clay and diatom mats turned into paper-thin layers of shale, and trapped organic remains turned into fossils.

3 Mudstone — The Interim Between Lakes

The lake began to fill with volcanic sediment washed down from the surrounding slopes. At the same time, the stream was breaching the dam. The area once again became a stream valley, rich in plant and animal life. The stream deposits of this time contain fossils of mammals such as brontotheres (an animal that looked like a rhinocerous) and *Mesohippus* (a small horse). The lower mudstone unit contains the stream deposits and fossils from this time.

Another large eruption from the Guffey volcanic center triggered more lahars, one of which buried the stumps of the trees that grew there, forming a rock layer above the stream deposits. A later lahar dammed the stream once again.

4 Middle Shale — The Second Lake Florissant

Lake Florissant formed again after the stream valley flooded behind another lahar, as mentioned above. Once more, layers of ash, clay, and diatom mats accumulated as ash from new eruptions of the Guffey volcanic center entered the lake. The layers contain many fossil leaves and insects and make up the rock unit called the middle shale.

5 Conglomerates — The End of Lake Florissant

The second period of paper shale deposition was interrupted when a large lahar flowed into Lake Florissant, stirring up the sediment. The event is preserved as the caprock conglomerate. The lahar did not fill the lake, however, and periodic volcanic eruptions led to new layers of shale (the upper shale unit).

The rock record indicates that Lake Florissant disappeared after a huge eruption that covered the landscape with pumice. A cloud of erupted material fell into the lake and is preserved as the pumice conglomerate, the youngest and uppermost rock unit in the Florissant Formation. Any evidence of further eruptions has been erased by erosion.

What remains today?

The Guffey volcanic center has been eroded over the last 34 million years, and the Florissant valley has partially filled with sediments from Pikes Peak Granite and Florissant Formation rocks. Only remnants of the volcanic center remain. Outcrops of Wall Mountain Tuff occur throughout the monument (see map above); the Geologic Trail passes one exposed section. The map of the Florissant Formation also shows approximately where the edges of Lake Florissant were in the late Eocene.

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