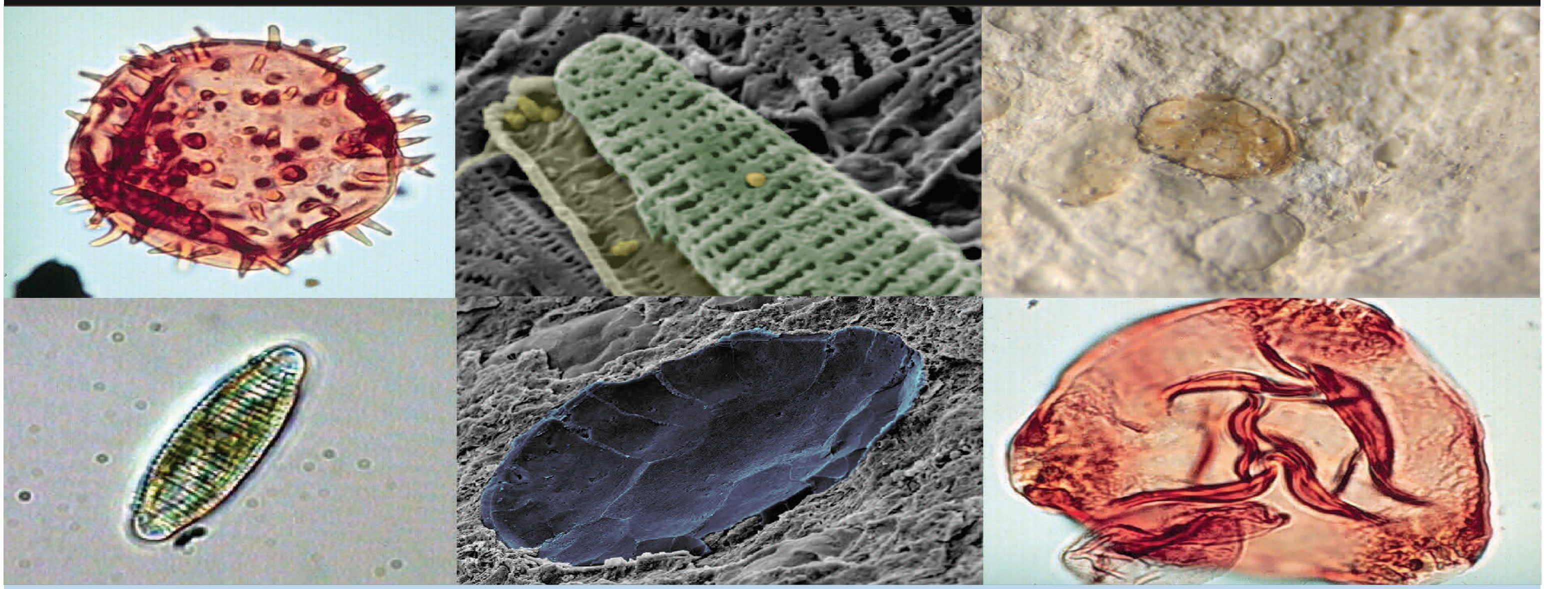
Florissant Fossil Beds
Microscopic World of Florissant

National Park Service
U.S. Department of the Interior

Florissant Fossil Beds
National Monument

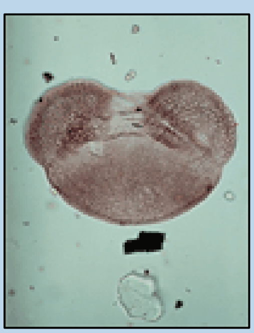


Imagine walking along the shore of ancient Lake Florissant, almost 34 million years ago. What would Florissant look like? During the late Eocene epoch, the world was a much warmer place. You'd see a lush, thriving habitat—water lilies and cattails lying along the beach, willows leaning into the lake, the air thick with hundreds of swarming insects. But unless you had a microscope, you'd inevitably miss the world invisible to the naked eye. Pollen, algae and microscopic invertebrates are preserved in the fossil beds, providing a window into the environment around Lake Florissant.

Fossil Pollen and Spores

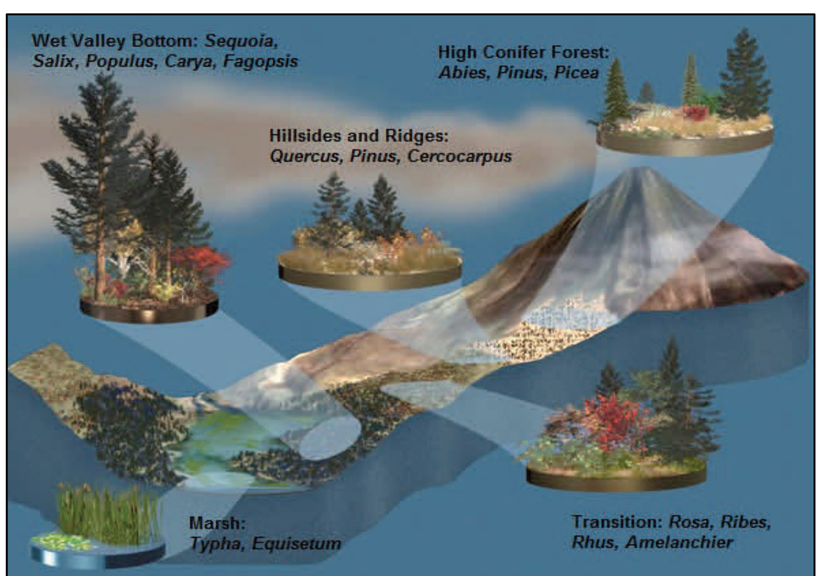
Pollen and spores are regularly released by plants and are carried by the wind or by pollinators. During the late Eocene, pollen from the plants in Florissant ended up either settling on the surface of the lake or washing into the lake by streams. The pollen then settled to the lake bottom, combining with dead diatoms (algae) in the mud that had bloomed from the ash from the nearby Guffey volcano.

When these fossils are excavated, the rock might not show signs of containing fossils at all. This might explain why early naturalists to the area rarely documented the presence of such microfossils. In order to see the identifying characteristics, a micropaleontologist needs to isolate the individual pollen grains and spores by dissolving the rock in acid. The extracted pollen grains are then stained with dye and mounted on slides to view under a microscope. Pictured to the left is a fossilized pollen grain found at Florissant from a fir tree.



Longest dimension: 0.128 mm

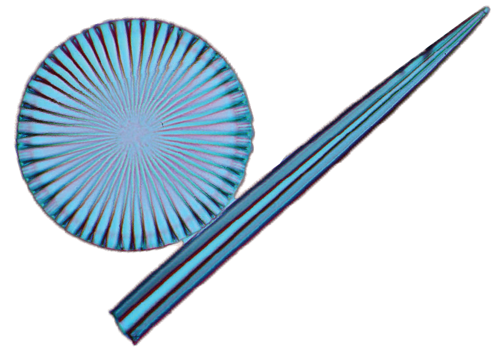
Pollen can be identified by size, shape, and the number and location of pores and furrows. Florissant's collection has been identified to contain over 130 different species of pollen and spores. Moreover, 25 of the plant genera at Florissant are known only by their pollen. These microfossils have been critical to defining the plant communities surrounding the lake and the climate necessary to support these plant species as seen in the figure below.

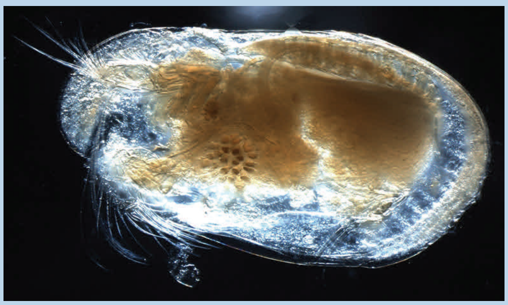


Fossil Diatoms

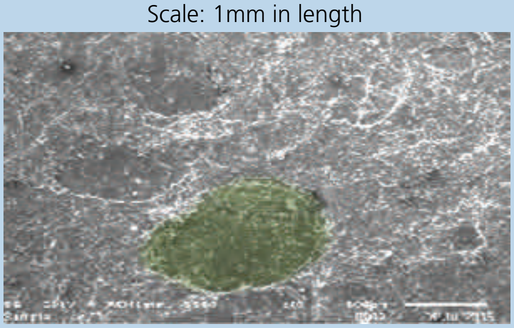
Diatoms are a type of unicellular algae that flourished in Lake Florissant that have cell walls made of silica. The exterior is typically covered in pores and unique ornamentation and can be used to identify different genera of diatoms. Like pollen, diatoms are carefully extracted from the rock matrix and then mounted on slides. A scanning electron microscope (SEM) is used to be able to view the sub-millimeter level of detail on the diatoms. The photo to right displays an SEM image of two exceptionally preserved of Florissant's diatoms.

Diatoms were critical to the preservation of the fossils at Florissant due to the mucus they produce when stressed. The silicon-rich volcanic ash from the nearby volcanoes would be deposited into the lake that acted as a fertilizer, causing algal blooms to form large mats on the surface of the lake. When the silicon was exhausted, the diatoms would become stressed and exude mucus that would eventually settle to the bottom of the lake. The mucus slowed the decay of dead organisms in the lake so they could fossilize.





Scale: 1mm in length



Scale: 1.11 mm in length

Fossil Ostracods

Ostracods are a type of small crustacean, almost like a shrimp enclosed in a shell, which resided in Lake Florissant. The top left photo depicts a modern ostracod within its shell. They likely lived in the lake's shallow areas, feeding on detrital remains that settled to the bottom. As they fed on detritus, they absorbed dissolved calcium and other elements from the lake water to augment to their shells. These ostracods were then fossilized, embedded in the resulting shale in their original assemblages.

Like diatoms, ostracods are typically observed using SEM. The bottom left photo shows an ostracod shell that was extracted from the Florissant shale viewed under an SEM. Once identified, ostracods can reveal clues about their original habitat in Lake Florissant. Various elements in the shell record water quality during the ostracod's life, like the water current, depth and salinity. Furthermore, their presence across the fossil record can be related to temperature. Ostracods can even be used to estimate the temperature at the time they were buried. Knowing this, scientists can approximate the changes in the paleoclimate, and help us better understand modern climate change.

Fossil Charophytes

The most recent fossil finds at Florissant include freshwater algae called charophytes. These macro algae are considered the progenitors of land plants since they have a complex lifecycle similar to mosses. When their spores are fertilized, they surround the spores with a lime covering so that upon release, it will be protected from elements. The capsule, also called gyrogonite, keeps the spores dormant until favorable conditions to grow arise. Rarely, the gyrogonites get buried and become fossilized instead.

Like ostracods, gyrogonites have unique features on the exterior that is indicative of a certain genus. Charophytes can be seen with the naked eye but a microscope is needed to view the intricate details on specimens. Such as the spiral patterns along the exterior as seen in the photos to the right.

Charophyte fossils can detect paleoenvironment conditions like water quality and salinity. These algae continue to exist today shallow ponds with high water clarity. Because of this, lake Florissant may have been shallow lake with low turbulence for some of its existence.