Evidence #1: Trilobites were small animals that lived at the bottom of the ocean. They fed on organic matter in sediment on the ocean floor. Because trilobite fossils are so abundant and well preserved in the limestone and shale rock of Ohio, they were officially named the state fossil.

Figure 1. Trilobite fossils found in Ohio. Credit: Wright Seneres based on Fossilera (2018).

Limestone is a sedimentary rock that is formed at the bottom of the ocean. Shells and skeletons of ocean organisms are deposited on the ocean floor and become compacted over millions of years, creating limestone from the pressure of the ocean water.

Trilobites are sea creatures that lived more than 250 million years ago. As trilobites died, their hard body parts were deposited on the ocean floor. Large (15 inch) trilobite fossils have been found in limestone and shale rock in southern Ohio, which is more than 500 miles from the ocean. The figure above shows the location of Ohio.

Evidence #2: Leaf fossils from Wyoming found in a deep rock layer show a climate that is cooler than that of the fossils found above it.

At Bighorn Basin, Wyoming, leaf fossils found in deep rocks show an average climate of 61°F. Leaf fossils found in shallower rock layers that formed 10,000 years later show an average climate of 71°F. This change in climate is estimated using a technique called leaf margin analysis.

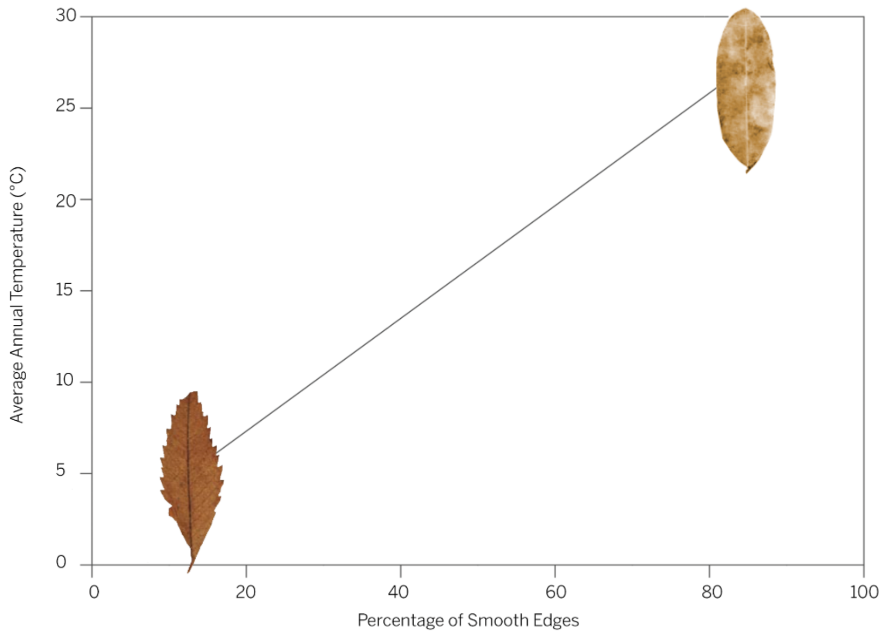

Figure 1. Leaf margin analysis at Bighorn Basin, Wyoming. Credit: Wright Seneres based on Smithsonian (2009).

Scientists study the shape of leaves to learn about environments. Leaf margin analysis uses the ratio of smooth to toothed fossil leaf edges to determine average temperatures of a region. The edges or "margins" of leaves may be toothed or smooth. The figure above shows that more toothed-edged leaves are associated with the cooler temperature. Toothed-edged leaves are able to begin photosynthesis early in the spring, making them better adapted to cooler climates. However, toothed edges result in a loss of water vapor, which is a disadvantage in a warm climate.

Therefore, there is usually a higher ratio of smooth to toothed-edged leaves in warmer climates. In this way the ratio of fossilized smooth to toothed edges of leaves in a region can act as a fossil thermometer and tell us about past climates.

Evidence #3: The Svalbard forest in Arctic Norway is filled with fossils of tropical trees, called Lycopsid. These trees lived hundreds of millions of years ago.

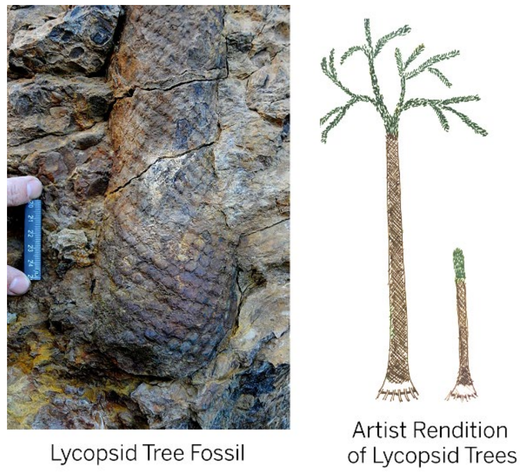

Figure 1. Tropical Lycopsid trees in the Svalbard forest in Arctic Norway. Credit: Wright Seneres based on Weisberger (2015).

The Svalbard forest in Arctic Norway is filled with fossils of tropical trees known as Lycopsid. Figure 1 shows the fossils and what the trees may have looked like. These trees appeared 380 million years ago and were mostly known as “club mosses.” In Svalbard, Lycopsid these tropical trees grew to a height of nearly 13 feet (4 meters) in dense, crowded forests.

Figures 2 and 3 below are two climate graphs. Figure 2 is for the current climate of the Svalbard Forest, and another for a region that has a tropical climate today. The one for the Svalbard Forest shows that Arctic Norway has short, cool summers, but long and extremely cold winters, which is very different from the climate graph of a tropical ecosystem (Figure 3).

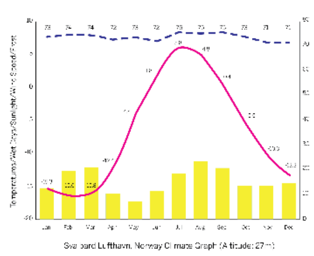

Figure 2. Climate graph for the Svalbard Forest in the tundra biome. Credit: Wright Seneres

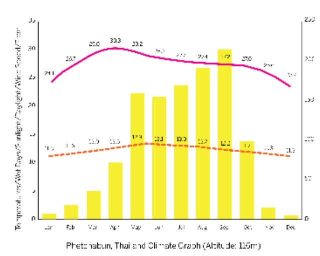

Figure 3. Climate graph for Thailand, which is in a tropical biome. Credit: Wright Seneres

Evidence #4: Many large geographic areas, like the Blue Ridge and Piedmont regions in Georgia, are made up of metamorphic and igneous rock. Fossils are not usually found in these types of rock.

About 20% of Earth's surface is either igneous or metamorphic rock. Igneous rock does not contain fossils, and metamorphic rock *usually* does not. About 80% of Earth's surface is sedimentary rock, which can contain fossils.

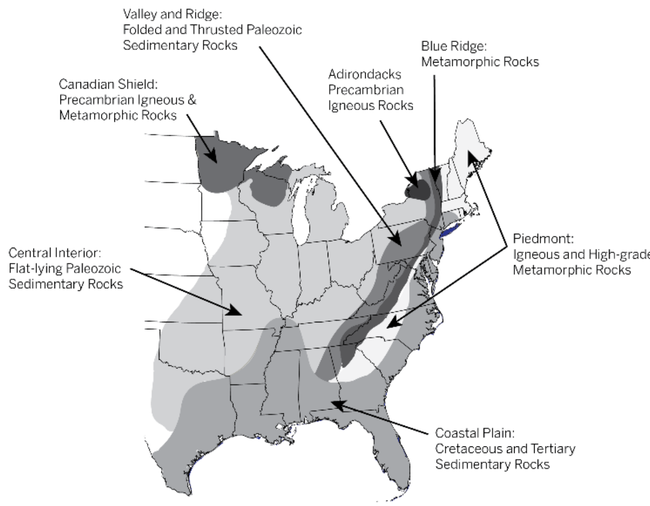

Figure 1. Metamorphic rocks along the East coast and Midwest. Credit: Wright Seneres .

Figure 1 shows mountain belts containing uplifted metamorphic and igneous rock that are found in locations such as the Blue Ridge and Piedmont regions of Northern Georgia. Figure 2 shows there are no fossils in these areas that could provide evidence of Earth's past.

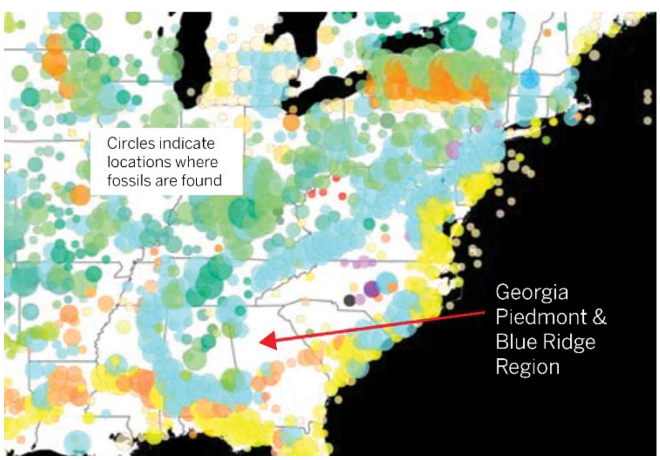

Figure 2. Location of Georgia Piedmont and Blue Ridge Region. Credit: Wright Seneres.

e (2015).