

Geology and Scenery along the North Shore

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The dramatically beautiful landscape that we enjoy today along the North Shore is a consequence of a geological history that goes back more than a billion years, into Late Precambrian time.

About 1.1 billion ago the center of North America began to split apart as slow upwellings in the Earth's plastic mantle (beneath the crust) began to melt, and huge volumes of molten rock called magma leaked up to the surface along fissures in the crust. The present remains of this world-scale crustal feature, known as the Midcontinent Rift System, extend from southeastern Michigan north through its lower and upper peninsulas, westward through Lake Superior, and south-southwest beneath the Twin Cities and Iowa to northeast Kansas. Most of the magma was erupted as great, pancake-like flows of "flood basalt" of a composition similar to the modern or recent eruptions on Hawaii, Iceland, or the Snake River Plain in Idaho. Hundreds of individual lava flows erupted, building up a sequence of layers up to five miles thick along the North Shore area and even thicker along the axis of the rift, now under Lake Superior.

As the crust was pulled apart, the center of the rift gradually subsided, leaving the rock layers tilted on the flanks towards the rift axis. Erosion during the last billion years has etched out these tilted layers to form the "Sawtooth Mountains" in Cook County. These are a series of long ridges with a relatively gentle southeast slope toward Lake Superior and a steep northwest slope, each one sculpted from a single huge lava flow.

Some basaltic magma never made it to the surface, but squeezed between older layers and solidified at various levels in the crust. When magma cools and crystallizes slowly beneath the surface it tends to produce larger crystals, and the rocks thus formed, called intrusive rocks, are generally more resistant when eventually exposed to erosion at the Earth's surface. A very large complex of intrusions, the Duluth Complex, underlies prominent highlands making up central and southwestern Duluth, such as Bardon Peak and Enger Park hill, as well as extending inland northward almost to Ely and eastward into Cook County.

Smaller intrusions, mainly the dark rock diabase, squeezed in at higher levels within the lava-flow sequence. Some of these make up such prominent hills along the North Shore as Hawk Ridge in Duluth, Silver Cliff, most of the rugged highlands between Beaver Bay and Little Marais, Leveaux and Oberg Mountains and the ski hills at Lutsen. Diabase hills continue in the Hovland area and north to the Jackson Lake area.

In some places these diabase magmas carried up huge blocks of a whitish rock called anorthosite, torn loose from the base of the crust about 25 miles beneath the surface. These anorthosites are very resistant to erosion, and now “hold up” such landmarks as Split Rock Lighthouse, Mt. Trudee and other knobs in Tettegouche State Park, and the greatest of all, Carlton Peak by Tofte.

Some of the magma had more silica and less iron than the basaltic magmas, and when it solidified it formed light-colored rocks in contrast to the dark-colored basalt and diabase. Several large rhyolite flows erupted; one of them forms the bold features of Palisade Head and Shovel Point in Lake County. Big rhyolites have also been eroded to form the deep gorges of the Devil Track, Kadunce, and Brule Rivers in Cook County, and of Split Rock River in Lake County.

For some as yet unknown reason, rifting and volcanism ended fairly abruptly without the continent coming completely apart to form a new ocean basin. The rift continued to sink for a while, however, and streams washed sand, pebbles and mud into the slowly subsiding basin. Several miles of such sediment accumulated in the middle, some of which can be seen today as sandstone on the Bayfield Peninsula and Apostle Islands, Wisconsin. But there was still no Lake Superior.

The last chapter in the saga of the North Shore’s landscape was the Great Ice Age. Several times during the last two million years or so (most recently only about 14,000 years ago) great continental glaciers, up to one or two miles thick, built up and oozed southward from Canada. The great ice streams mainly eroded the underlying rock, which had become deeply weathered over the billion years since the time of rifting. The ice found the sedimentary rocks in the middle of the old Midcontinent Rift System to be relatively easy to erode, and it excavated what was to be the Lake Superior basin well below sea level.

As the glacier melted back about 11,000 years ago, it uncovered this great scooped-out depression, which of course filled with water. Early stages (such as Glacial Lake Duluth) were several hundred feet higher than the present lake because the ice was still blocking the outlet at the east end. Look for rounded beach stones along the trail, high above the current shoreline. By about 5,000 years ago, Lake Superior as we know it today was well established. Since glaciation, the forests have covered the land, the North Shore streams have been eroding their gorges, and waves have been making beaches and eating away at the shore cliffs and bluffs.

As you hike the SHT, keep your eyes open and enjoy the geologic dimension.