

Chapter Two – Geology

Overview

Seneca County, bounded on the east and west by Cayuga and Seneca Lakes, straddles two major physiographic provinces, the Ontario Lowland in the north and the Allegheny Plateau in the south. The boundary between the two lies roughly along the line of the Seneca River..

The bedrocks of the county, underlying glacial superficial deposits, are sedimentary rocks nearly 8,000 feet thick, resting on a “basement” of ancient igneous and metamorphic rocks. The younger strata, belonging to the Paleozoic Era of earth history, are inclined gently to the south at about 40 feet per mile, so that the older sedimentaries appear in the north of the county and successively younger formations to the south. This means that the limestone seen along the Seneca River at an elevation of about 450 feet would be found in a well drilled at Ovid at a depth of 150 feet below sea level.

This basement bedrock had been a land surface for several hundred million years. About 600 million years ago the eastern part of what is now North America sank slowly below sea level. Into the shallow sea, various sediments, clay, silt, sand and lime muds were swept in in layers for about 300 million years and became consolidated into solid rock. The strata seen in Seneca County belong to the Silurian and Devonian Periods of the Paleozoic and were deposited between 435 and 345 million years ago.

Late in the Paleozoic Epoch, some 250 million years ago, the region was uplifted with folding to the south. This uplifted area has remained a land surface above sea level ever since. By 70 million years ago, this new land had been eroded down to a nearly even plain.

Another uplift of several thousand feet, beginning some 20 million years ago, initiated another cycle of erosion that developed the Allegheny Plateau and the Ontario Lowland. The Physiography of the Finger Lakes Region even two million years ago was not that of today. Two million years ago there was a well-developed drainage, lacking lakes, swamps, and water falls, and a deep residual soil cover derived from the long weathering of the bedrock.

The latest major change came with the movement over the whole region of the continental glacier—a vast ice-sheet—stripping away the soil cover, eroding the bedrock, excavating deeply the major north-south valleys (Cayuga and Seneca) and dumping a mixture of unconsolidated deposits (till) and later on, lake deposits. Finally, the melting away of the ice revealed the surface as it appears today.

The great weight of the ice had depressed the earth’s crust and removal of the load caused a slow uplift or rebound back to normal that is still in progress, of about 1000 feet in this region during the past few thousand years.

[This information has been largely quoted from John West Wells, *Geology of Seneca County, New York*, Ithaca: Arnold Printing, 2004.]

Different Layers of Bedrock

The so-called Onondaga Limestone, about 90 feet thick in Central New York and just underneath the surface, caps the escarpment separating the Ontario Lowland from the Allegheny Plateau. More specifically, in Seneca County, it underlies the surface from Canoga north westward across Fayette, Seneca Falls, and Waterloo, and where the Seneca River cuts across it onto the weaker rocks below waterfalls were once visible.

The Onondaga is one of the most important limestones in the state for all kinds of lime products—road metal, building stone, chemical lime, etc. Various quarries were opened, including the current Seneca Stone quarry (formerly the Warren Brothers Stone Company) in town of Fayette. The lowest beds of the Onondaga Limestone are crowded with fossils and fossil fragments.

The famous Canoga Springs pours out of fissures in the Onondaga limestone at the rate (in 1947) of over 600 gallons per minute, feeding the Canoga creek. Writing about the situation in 1947, John West Wells says the following:

The water is cold and almost completely devoid of dissolved oxygen, and as the water comes to the surface gas bubbles forth in considerable amounts. The gas was long ago identified as nitrogen, and a few years ago an analysis indicated the proportions were: nitrogen 97.2%, argon 1.03%, carbon dioxide 0.81%, and oxygen 0.96%.

Above the Onondaga Limestone are four formations of gray to almost black shales separated by three thin limey bands: Marcellus, Skaneateles, Ludlowville, and Moscow, in ascending order, grouped together as the Hamilton Group. In Seneca County, the group is about 770 feet thick. This Hamilton Group, along with the Onondaga Limestone in some places, contains many fossils. Some of the best sites in the world for easily collecting trilobites, bivalves, gastropods, and chrinoids are in the Finger Lakes region, including some sites in Seneca County.

Above the Tully Limestone are the sedimentary rocks that are subdivided into three groups-- the Genesee, the Sonyea, and the West River. They have a total thickness of about 1,500 feet, underlying the towns of Ovid, Lodi, and Covert. The most important rock product in southern Seneca County in the latter part of the 19th century was flagstone (siltstone) from the Sherburne. In 1895 there were at least 14 quarries above the lake in the eastern part of Covert. Quarrying had been on a large scale in the 1870s and 1880s, the flagstones being shipped to New York and Philadelphia.

[This information has been taken from John West Wells, *Geology of Seneca County, New York*, Ithaca: Arnold Printing, 2004.]

Natural Gas

Natural gas (methane) springs have been known in Seneca County for over 150 years. The gas is under pressure in the dark and black shales of the Hamilton and Genesee Groups and slowly issues from joints in the bedrock.

Wells drilled for natural gas were first sunk in and around Seneca Falls in 1887 to a depth of 1500 feet into the Medina Sandstone, a known gas reservoir rock. Altogether, by 1895 twelve wells were drilled with six of them producers. Other well drillings in other places in the county—Junius, Waterloo, Seneca Falls and Ovid—were unsuccessful and the Geneva gas field and its setp-off wells in Seneca County were abandoned as commercial producers. Drilling for natural gas in Central New York increased significantly in the 1980's and 1990's, and annual production in Seneca County has been more than 500,000 million cubic feet since the late 1980's. According to data provided by New York State, in 2004 more than 160 wells are producing at least some natural gas in the county.

[source: John West Wells, *Geology of Seneca County, New York*, Ithaca: Arnold Printing, 2004.]

Igneous Rocks

A wide variety of ancient igneous rocks—granite, syenite, gabbro, anorthosite, etc.—occur as erratic boulders and cobbles in the glacial deposits in Seneca County, far from their homes to the north in Ontario, Canada.

There is also evidence in the south wall of the Seneca Stone quarry west of Canoga of a volcanic ash deposit several inches thick from volcanic eruptions spreading over the inland sea at that time.

[source: John West Wells, *Geology of Seneca County, New York*, Ithaca: Arnold Printing, 2004.]

Meteorites

Two falls of meteorites are recorded for this area. One, a small stony meteorite (or aerolite) fell through the roof of Judge Watkins' mill in Waterloo into a bin of wheat in 1826 or 1827. It passed through several hands and its present whereabouts are unknown. The other, a 9 pound siderite, was found in 1852 in digging a ditch on a farm near the east end of the Free Bridge over the Seneca river in Cayuga County. A piece of it is in Yale University.

[quoted from: John West Wells, *Geology of Seneca County, New York*, Ithaca: Arnold Printing, 2004.]

Pleistocene Glaciation – The Ice Age

The Pleistocene Epoch began about two millions years and ended about 25,000 years ago.

About one million years ago, a giant ice sheet came from the present-day Hudson's Bay part of Canada, moving over the northern part of the United States to as far south as New York City and eastern Pennsylvania. This ice mass was at least 6,000 feet thick as it moved over the Finger Lakes Region. The original topography was greatly modified because the bottom of the ice picked up rock fragments of all sizes from Ontario, causing much erosion even of bedrock.

About 25,000 years ago began the melting of this vast south-moving ice sheet. The melting ice sheet left huge quantities of boulders, cobbles, gravel, sand silt and clay—what became known as “glacial till” or “ground moraine.” The larger cobbles and boulders, rounded

and smoothed from churning and scraping in the ice are called “erratics.” Some of these erratics are as much as 25 tons in weight, demonstrating the vast transporting power of the moving ice sheet. Also, in the lowlands of northern Seneca and southern Wayne counties are the “drumlins”—long, narrow, north-south aligned hills of glacial till up to 1000 feet high, steeper on the north ends than on the south.

In the Finger Lakes region, most major river valleys ran north and south with tributaries flowing from the east and west. The glaciers gouged deep troughs in these valleys, greatly steepening the slopes on either side. These “over-steepened” valley walls (as they are called by geologists) can be seen throughout the region. The present Finger Lakes were formed in these troughs after the retreat of the latest glacier, about 10,000 years ago. The lakes lie in very deep basins eroded in the bedrock, and are dammed up at their northern ends by glacial debris. The streams that poured over the newly-steepened slopes as the latest glaciers retreated, rapidly cut into the soft shales of the hillsides, forming the present-day gorges. Where layers of resistant rock such as sandstone and limestone were encountered, the waterfalls and cascades resulted. The most famous of these is the Taughannock Falls about nine miles north of Ithaca. At 215 feet, it is the highest waterfall east of the Rocky Mountains.

(source: “Glaciers Created Finger Lakes,” *Finger Lakes Times*, May 21, 1982)

Gravel and sand in large amounts are found mainly in the glacial deposits in northern Seneca County. A number of pits have been worked from time to time for use by the highways departments and for providing fill and sand for concrete in commercial and residential construction projects.

At the time of the melting, retreating glaciation, the climate of the Finger Lakes area was comparable to that part of Alaska today where plants and animals of the cold temperate and subarctic zones now live up to the fronts of glaciers. It is believed that about 10,000 years ago we had animals and plants moving in from the south into the Finger Lakes Region as the glaciation retreated. In 1891, mastodon bones were uncovered in an excavation for an ice pond on the Halsey-Nevius (later the Farr) farm on the north edge of the village of Lodi. One of the teeth weighed more than 5 pounds. The bones are on display in the Museum of Natural History in New York City. There was also uncovered in 1910 in the southern part of Wayne County, in excavations at Lock 26 east of Clyde, the remains of a mammoth. One of its teeth is in the New York State Museum at Albany.

[except as noted for the one paragraph, the source for this section: John West Wells, *Geology of Seneca County, New York*, Ithaca: Arnold Printing, 2004.]