

A Walk Back in Time

The Ruth Canstein Yablonsky
Self-Guided Geology Trail



Trailside Nature & Science Center

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The Ruth Canstein Yablonsky Self-Guided Geology Trail

This booklet will act as a guide for a short hike to interpret the geological history of the Watchung Reservation. The trail is about one mile long, and all the stops described in this booklet are marked with corresponding numbers on the trail.

“Watchung” is a Lenape word meaning “high hill”. The Watchung Mountains have an elevation of about 600 feet above sea level. As you travel southeast, these high hills are the last rise before the gently rolling lowland that extends from Rt. 22 through appropriately named towns like *Westfield* and *Plainfield* to the Jersey shore.

The Watchung Reservation is located in the central part of a large geologic area called the Newark Basin. The rocks were formed about 200 million years ago, during the late Triassic period. At that time, all of the continents were joined into one landmass called Pangaea. Forces deep within the earth caused this super-continent to gradually pull apart, forming the Atlantic Ocean and the continents we know today.



The Watchung Reservation began as a broad valley in which multiple layers of mud and sand were deposited. Over millions of years, the layers gradually hardened into sedimentary rock. As the crust stretched, cracks formed and lava rose through them and spread onto the surface. The lava cooled and hardened into igneous rock. Three series of lava flows over the course of several million years, were separated from one another by layers of sand and mud now compacted into rock called sandstone and shale. Continued crustal stretching caused the valley to sink further and become tilted to the northwest. As millions of years passed, the rocks were eroded to produce the surface we see today.

The Earth’s climate cooled significantly about one million years ago, causing snow and ice to accumulate and form great ice sheets called continental glaciers. There were four major glacial periods during which the ice moved across portions of North America, including northern New Jersey. Soil and rocks of all sizes were frozen into the glacier and transported south. When the ice melted, these materials settled to the ground to form a blanket of sediments over the surface. The glaciers did not travel much further south than the present day Watchung Reservation.



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Self-Guided Geology Trail

1 Visitor Center

The self-guided hike begins on the lower level of the Nature Center, to provide you with an overview of what you will see on the trail, and a graphic history of the area. Please take time to view the exhibits of basalt minerals and fluorescent minerals (in the Discovery Room) as well.



When you leave the Visitor Center, turn right and walk to the highest edge of the parking lot to the marked outcrop.

2 Basalt Outcrop

In the parking lot, you are standing on the ridge of the First Watchung Mountain, formed by the first, and oldest, lava flow 200 million years ago. Look down the hill, behind the trees, toward

the west to see the second ridge. The low area in between the ridges formed as the softer sandstones and shales eroded more rapidly. The marked outcrop is basalt, which formed the step-like structure as the lava cooled. Basalt is also called trap rock, from the Scandinavian word “treppe” which means stair. The chemical weathering and oxidation of the iron-rich basalt produces its rusty color. Many trap rock quarries are located in the Watchung Mountains. The rock is blasted from the quarry walls and crushed to produce gravel for road stone and asphalt.



Cross the parking lot and continue to the street entrance. Turn right and walk downhill on the paved road, as far as the

lower edge of the parking lot.

3 Erosion at Parking Lot

When rain falls on vegetated areas, much of it is absorbed by the plants and soil. When it falls on an impermeable surface such as this paved parking area, it cannot be absorbed and flows over the surface. The cumulative effect of this surface runoff can be seen at the low corner of the parking area,



where the soil washed away and created a gully, which is now filled with gray gravel. Extensive paving in New Jersey — for parking lots, malls, and business parks — has led to increased runoff, erosion and flooding. The orange basalt fragments you see are highly oxidized due to abundant moisture, giving the fragments, and the soil derived from them, a typically “rusty” color. The gray basalt gravel, recently emplaced, has not yet oxidized.

Continue down the paved road to the Orange Trail entrance.

4 Carriage Road

Follow the Orange Trail past the steps made of logs and rocks installed by volunteers to slow erosion of the trail. The trail was once an old carriage roadway, which led to a mill town called Feltville, now the Deserted Village. As you



proceed down the trail, you will notice the banks on each side are steep. Each time a hiker walks down the trail, a little soil is loosened. When it rains, the loosened soil is washed down hill. At one time, the narrow valley you are walking did not exist. Much of the soil and rock has been transported by erosion, washed away by rainwater flowing down the slope.

Continue down trail.

5 Puddingstone Boulder

This huge purple boulder with white pebbles is an example of a glacial erratic. It was not formed in the Watchung Mountains, but carried by a glacier and dropped here less than one million years ago. It is a conglomerate of white quartz pebbles and purple quartzite in a purple hematite-stained matrix. The rock originated in the Green Pond area of Morris and Sussex counties, over 25 miles to the northwest. It is known as Green Pond Conglomerate or “puddingstone”.



Continue down the slope until you are standing on a bumpy gray rock surface in the middle of the trail.

6 Surface of Lava Flow

You are standing on the top of one of the lava flows that make up the First Watchung Mountain. This is the top surface of a series of basalt columns formed when the lava contracted as it cooled and hardened.

Continue down the hill.



7 Glacial Erratics

These boulders are glacial erratics, too. The term “glacial erratic” refers to any rock that was frozen into glacial ice and carried with it on

its southward journey.

Continue down the slope a short distance.

8 Hillside Spring

This muddy spot is where the water from a hillside spring emerges at the surface and flows down the trail.

There is a great supply of water stored below the surface of the Watchung Reservation. Native Americans used these springs, and today our local water company has wells that tap this water supply for our homes.



Continue down the hill, which becomes the Blue Trail. Do not follow the Orange trail. Just ahead look at the stream to your left.

9 Stream

Streams do not flow in straight lines, but form and follow gentle curves called meanders. Water flows faster on the

outside bend of the meander, eroding the stream bank there more quickly. The faster water moves, the more sediment it can carry, transporting particles of all sizes downstream.

Continue on the Blue Trail. Look at the hill to the right.



10 Red Sandstone & Red Shale

These are sedimentary rocks. The shale is composed of thinly-layered lithified mud that breaks easily into sheets. The sparkly surfaces are caused by bits of



mica deposited with the mud. Intermixed with the shale are blockier layers of red sandstones. The muds and sands were deposited by streams along the edges of shallow

lakes where seasonal drying occurred, and their red color is due to the chemical reaction of atmospheric oxygen with the iron in the rock. These rocks, in layers called beds, are tipped slightly to the northwest. Most of the rocks in the Newark Basin dip in this direction at an angle of about 15 degrees. This tilt is due to the movement of the Earth’s crust as the continental plates drifted apart during Jurassic time, forming the Atlantic Ocean.

Continue down the hill and turn right on the bridle trail (an unmarked, wider trail). Do not stay on the Blue Trail.

Gray Shale

(As you walk up the trail, notice many of the smaller trees with the lower portion of their trunks curved in a downhill direction. This is evidence of a form of erosion called “soil creep.” Under the influence of gravity, the soil on steep hillsides moves slowly downhill. As the trees grow, they constantly adjust their growth direction to remain upright.)

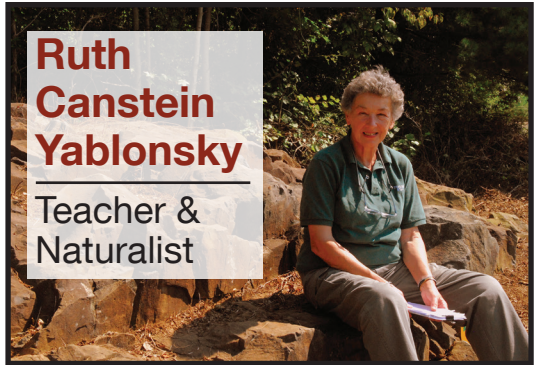
11 At this stop, the thin papery pieces of shale are gray. This color indicates that these sediments were continuously covered with water, probably in a deeper part of a lake or swamp. The red and gray shales are part of a larger unit called the Feltville Formation. This formation is approximately 600 feet thick and overlies the basalt of the Orange Mountain Formation that forms the First Watchung Mountain. The Feltville Formation is, in turn, covered by another flow of lava known as the Preakness Basalt. This forms the Second Watchung Mountain, which rises on the other side of the swampy area.



This concludes the geology hike. You may turn around and walk back up the Orange Trail to the parking lot or you may continue up the bridle path, and bear right, which will take you to The Loop picnic area.

Ruth Canstein Yablonsky

Teacher & Naturalist



For over three decades Ruth has been teaching children about the natural world, both at the science center and in visits to elementary schools. She is a teacher's teacher, always encouraging children.

In recognition of her achievements, Yablonsky was awarded the Alliance for New Jersey Environmental Education's Patricia R. Kane Lifetime Achievement Award in 2010 for excellence for environmental education.

Yablonsky grew up in The Bronx, went to Hunter College and then to the University of Michigan, where she earned her Master's Degree in geology. In 1985, Yablonsky came to Trailside.

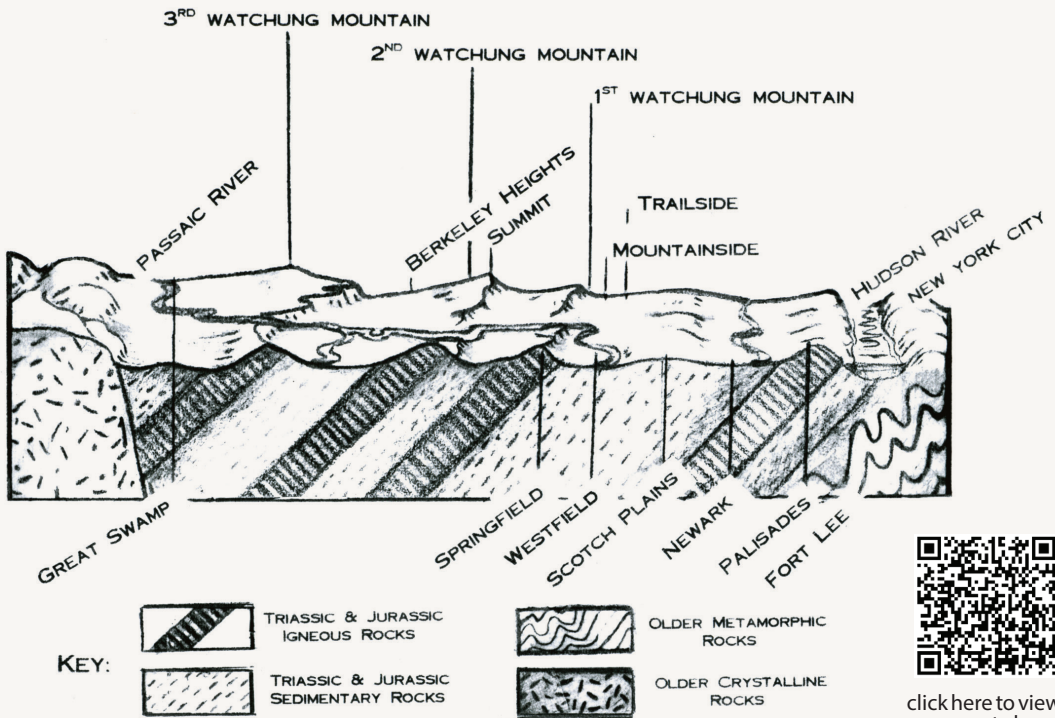
Naming the trail after her is the perfect honor, for as she said in an interview two years ago:

“My passion is geology. If you have an understanding of the basics of geology, anywhere in the world you go you have an understanding of why things are the way they are.”

Glossary

| | | | |
|------------------------|---|---------------------|--|
| basalt | a fine-grained, dark-colored igneous rock. | Mesozoic | a span of geologic time from approximately 225 million years ago to 71 million years ago, and divided into smaller units called Triassic, Jurassic and Cretaceous. |
| bedrock | solid rock found in the same area as it was formed. | oxidation | a chemical reaction combining with oxygen. |
| beds | layers of sedimentary rock. | Pangaea | supercontinent that broke apart in early Mesozoic time, forming separate continents and the Atlantic Ocean. |
| conglomerate | sedimentary rock made of rounded pebbles cemented together by a mineral substance (matrix) . | puddingstone | a type of conglomerate. |
| erosion | processes (running water, ice and wind) which loosen and transport rock on the earth's surface. | quarry | an open cliff face where rocks are removed to be used for building -stone, paving, etc. |
| glacial erratic | a rock fragment different from the rock on which it lies, having been transported by a glacier. | quartzite | a metamorphosed form of sandstone. |
| glacier | a thick mass of ice, formed by compacted snow, with motion in a definite direction. | sandstone | sedimentary rock composed of sand-sized minerals or rock grains. |
| hematite | a red-colored iron ore. | sedimentary | rocks formed from fragments of other rocks, compressed or cemented together. |
| igneous | rock formed by the cooling of molten material. | shale | sedimentary rock composed of mud that is a mix of clay materials and other fine textured mineral fragments. |
| impermeable | having a structure that does not permit water to move through it. | soil creep | slow movement of rock fragments down a gentle slope. |
| Jurassic | the second of three geologic periods in the Mesozoic era (180 - 135 million years ago). | spring | a small pond or stream of water flowing naturally from the earth. |
| lava | molten igneous rock that flows out and cools on the surface of the Earth. | Trap rock | Scandinavian for "stairs," construction term for basalt. |
| lithify | to form rock by cementing or compressing sediments. | Triassic | earliest of three Geologic periods in Mesozoic era (225 - 180 million years ago). |
| matrix | mineral material by which rock fragments are cemented. | | |
| metamorphic | rocks that have in some way been changed by temperature and pressure. | | |

The cross section below shows the rocks of the Watchung Reservation and surrounding area, revealing the relative positions of the lava flows that erupted in this region and the sedimentary rock layers between them.



NOTES _____

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