Introduction

This geology walk highlights a variety of glacial features found in and around Avalon Park and Preserve. With well-maintained trails, this walk of less than one mile can be completed in about one hour. Avalon is maintained by the Paul Simons Foundation. With the help of Andropogon Associates Ltd., they have transformed the property into a series of woodland gardens and paths celebrating the native flora and fauna of Long Island.

A park map should be used in addition to this self-guided walk. One may be obtained at the kiosk at the Park's main entrance on Harbor Road or at the Shep Jones parking lot (the white rectangle in Fig. 1). Throughout this walk, the names referred to in quotations are from the park's map.

The geology of Stony Brook Harbor includes excellent examples of a wide range of glacial features. Avalon is located less than three miles to the north of the Harbor Hill Moraine, a ridge of sediments, which formed during the last glacial advance, approximately 20,000 years ago. At the time of the last glaciation, much of North America was covered by a continental ice sheet, which traveled as far south as Long Island. This area was once completely buried by flowing glacial ice.

As the glacier receded, small ridges, kettle holes, boulders and a tunnel valley were left behind.

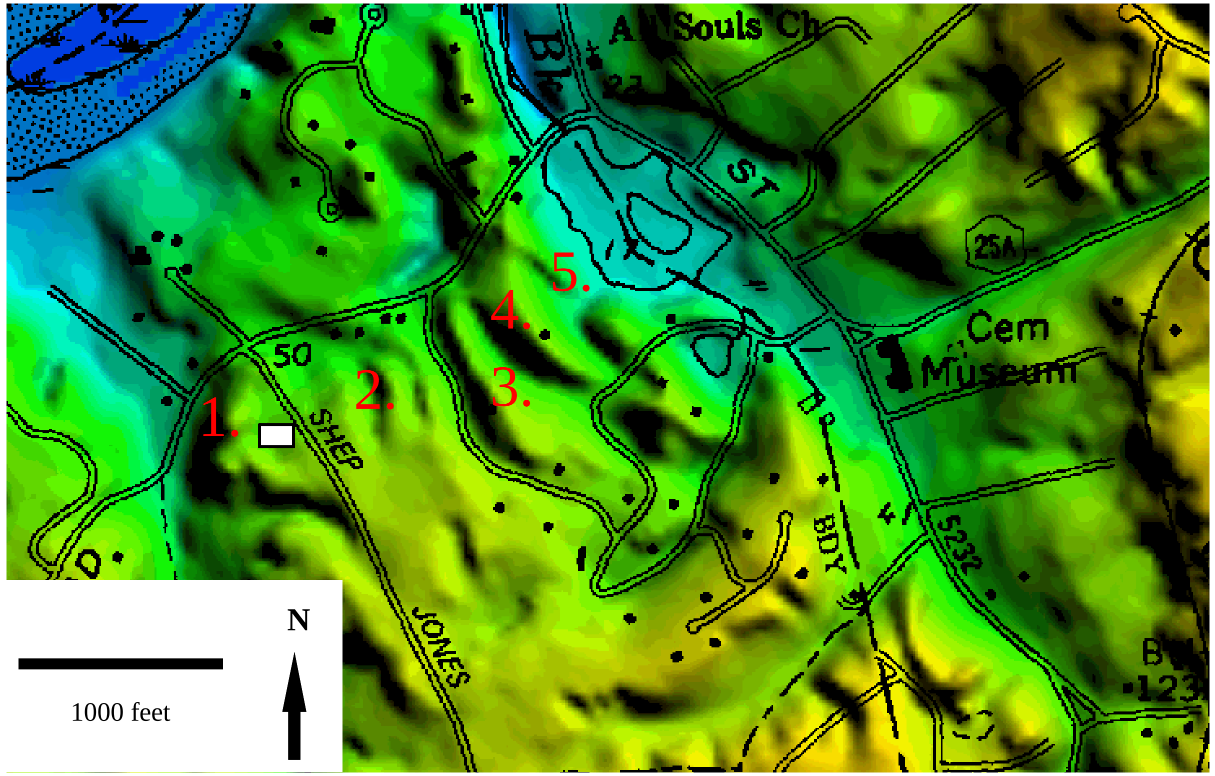


Fig. 1 Digital Elevation Model of Avalon Park and Preserve. Numbers are locations of stops. Blue is the lowest elevation (sea level) and orange is the highest elevation. (about 100 feet in the Park.)

Walk

We begin our walk at the small parking area, located at the north end of Shep Jones Lane. Enter "Avalon Woods" and stay to the right on the Yellow trail. Notice that the topography is very irregular with many small ridges and valleys. Observe the surface of the trail itself, and the different sizes and shapes of the sediments. As you walk up the hill notice that there is silt, sand, pebbles, cobbles and even some boulders present on the surface. Stop at the top of the hill.

1. Exposed Glacial Till on trail

Glaciers are constantly flowing away from the thickest part of the ice which would have been to the north of here. When a glacier retreats it is not the ice that is flowing in a different direction. Rather it is that the rate of melting is faster than the rate of flow of the ice so the front of the glacier retreats. As the glacier flows it plucks boulders from the bedrock and picks up rocks and sediment at its base. The interface between the glacier and the underlying rocks or sediments is similar to that of a fault in which the material that was incorporated in this zone is abraded and fractured. The abrasion produces rounding of the particles and the fracturing produces smaller particles. The resulting sediment consists of particles of many different sizes and shapes, including boulders, cobbles, pebbles, sand, silt and clay. This unsorted sediment is till.

As the glacier receded it left behind these sediments. Locally the till is generally about 3 feet thick, but can be thicker or thinner. Till formed at the base of a thick glacier is very resistant to erosion. The ridges, valleys and kettle holes in the park are armored by a layer of till that has preserved the topography that we find here. Examine the surface of the trail which is made up of till. Observe that the cobbles and pebbles are mostly rounded and that they include a variety of rock types. Also note the durability of the till exposed on the trails. Why might till be so durable? What caused the cobbles to be rounded?

At the top of the hill, look to the north and northwest and you may be able to see Connecticut, Stony Brook Harbor, and the Long Island Sound (clearest views are in the winter). Locate yourself on Figure 1, you are at stop 1 and are standing at the highest elevation in the park.

Continue along the trail and down the hill, note that till is exposed on this trail and along most of the trails in the park. At the trail intersection turn left, and follow the Blue trail back to the parking area.

Locate yourself on both the map in Fig. 1 and the park map. From the parking area, cross over Shep Jones Lane and walk along the Red and Yellow trails, towards "Mike's Way". Again note the till on the trail.

At the next trail intersection, stay to the left on the Red trail. Then, after descending into and climbing out of a small valley, go up the steps. At the top of the steps, stop and notice the two boulders on the left side of the trail.

2. Glacial Erratics

Glaciers are capable of transporting large boulders, and then depositing them far from their parental bedrock. Such boulders are called glacial erratics. The boulders are often broken, rounded, and polished during transport. While boulders can be transported many hundreds of miles within a glacier, boulders at the base of a glacier usually cannot travel more than 20 miles before they are abraded and broken up forming smaller particles. The closest source for bedrock is within the Long Island Sound Basin about five miles to the north.

Both of these boulders are medium to coarse-grained granite gneiss, with pegmatite veins. Rub the surface of the boulders. Are they smooth or rough? Are they angular or well rounded? The angularity and roughness of the boulders suggests that they did not travel a long distance at the base of a glacier.

Continue walking along the trail, and stop at the next boulder. Note the large quartz and feldspar crystals on surfaces. The quartz crystals are translucent, and the feldspar crystals are pink to white in color. You will also see some shiny muscovite, or mica, in this rock. A closer investigation will reveal small red garnet crystals.

Continue along the trail until you reach the largest boulder. It is very angular and blocky, perhaps it was carried in the glacier above the base. Where was the source area for these boulders? It must be from the north, because that is where the ice was flowing from.

Is this largest boulder similar or different to the other boulders you have seen? All four of the boulders are from the same weathered bedrock, composed mostly of granite gneiss with pegmatite.

Continue along "Mike's Way", and walk down the hill. Cross Rhododendron Lane, and walk thru the gate following the gravel path. Crossover the black top path, and on your right you will find an observation platform with a "bench" next to it. Enjoy the view at Stop 3.

3. Kettle Holes

As the glacier was melting, a massive block of ice was buried or surrounded by glacial sediments. When the block of ice finally melted, a hole or depression was left. These depressions are called kettle holes. You are now looking at a kettle hole full of Rhododendron bushes.

If the bottom of a kettle hole intersects the water table, it becomes a kettle lake (See Fig. 2. The water table is the surface where the underlying sediments are saturated with water.) Lake Ronkonkoma is a kettle lake. Why are some kettle holes larger than the ones here at Avalon? Why is there no water in this kettle? We are standing at an elevation of about 100 feet above sea level. The bottom of the kettle is 60 feet about sea level and the water table here is about 15 feet above sea level. So the bottom of the kettle is way above the water table.

Would you expect all kettle holes to be the same size or shape? As you can imagine, kettle holes come in a wide range of sizes and shapes depending on the size and shape of the block of ice. Once the ice melted, where did the water go? The water either infiltrated into the ground or evaporated into the air.

Notice the houses on each side of this kettle hole. How much does the elevation change from the house to the bottom of the valley? Elevation changes almost 60 feet. Can you estimate how large the block of ice that formed this depression was? It was almost the size of a football field in area and many 10's of feet thick.

Notice the boulders surrounding the platform. Are they the same type as the other coarse grained boulders you have seen? No, these are darker in color and have smaller grain sizes.

Again, locate yourself on both maps, and continue walking along the gravel trail (bear to the right). Turn right at the paved path and walk about 175 feet and stop at the gravel path.

4. Hummocky Terrain

The small ridges and kettle depressions in the park are part of a hummocky terrain. (Also, called a hummocky moraine.) This terrain typically forms near the front of the glacier. As the ice melts it leaves ridges of sediment and blocks of ice that form kettle holes. This terrain is considered ideal for golf courses because the ancient St. Andrews Golf Course in Scotland which is on a hummocky terrain is the standard for golf courses.

Stay to the right on the gravel path and continue walking towards "Mill Pond". Do you see any other depressions that look like kettle holes along the way? "Boulder Pond" on your right is also a kettle hole. Why is there water in this kettle if it is well above the water table? Do some investigating and you will note that water is being provided to this kettle hole.

As the trail descends down "Pepperbush Path" it becomes very steep. Proceed down the trail to "Mill Pond". Sit at the "Eastern Pavillion", a platform with benches on your right.

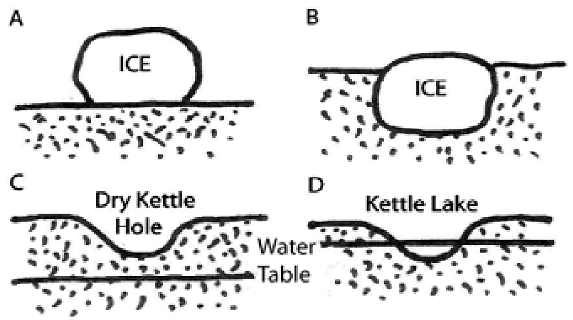


Fig. 2 A block of ice left (A) on the surface will not form a kettle hole. The block must be buried or surrounded by glacial sediment (B) to form a kettle hole. After the block of ice melts it leaves a depression, a kettle hole. If the bottom of the kettle hole is above the water table the kettle hole will be dry most of the time (C). The water table at this location is below the bottom of the kettle. Thus there is no standing water in this kettle. If the bottom of the kettle hole intersects the water table the kettle hole will contain a lake or pond (D).

5. Sub-Glacial Tunnel Valley

Look back towards the trail, and across the small pond to the west, notice how steep the valley wall is. Look across the Mill Pond to the east and you will see houses built on another valley wall. The Mill Pond is at the bottom of this valley.

This large valley is a tunnel valley created by stream erosion beneath the glacial ice (See Fig. 3 and Fig. 4). Which direction do you think the water was flowing in this sub-glacial tunnel valley? In fact the water was flowing uphill, or from the harbor towards the south.

How do we know that this is a tunnel valley? There are many lines of evidence. One of the most crucial is that the walls of this valley are armored with till that prevents the underlying sands and gravels from eroding (See Fig. 5). If the valley formed after the glacier had receded, the till formed at the bottom of the glacier would have also been removed by erosion. The till that armors the valley walls preserved the walls and also provides evidence for how the valley formed.

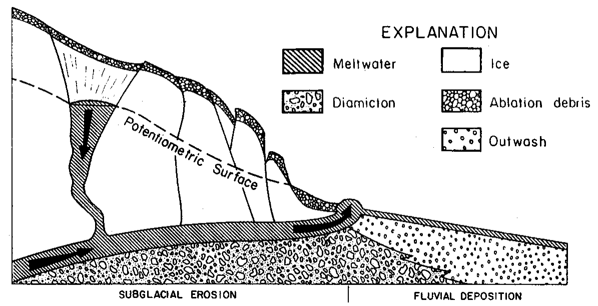


Fig. 3 This figure shows haw the water pressure within a glacier can be high enough so that the water at the base of a glacier can flow up hill eroding the underlying sediment and depositing the sediment in front of the glacier

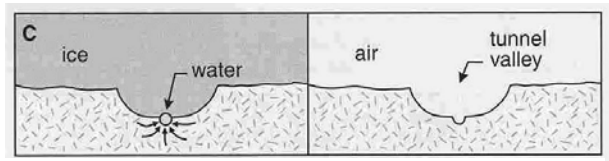


Fig. 4 This illustration shows one way that a tunnel valley may form. Note that the water filled tunnel under the ice is much smaller than the valley.

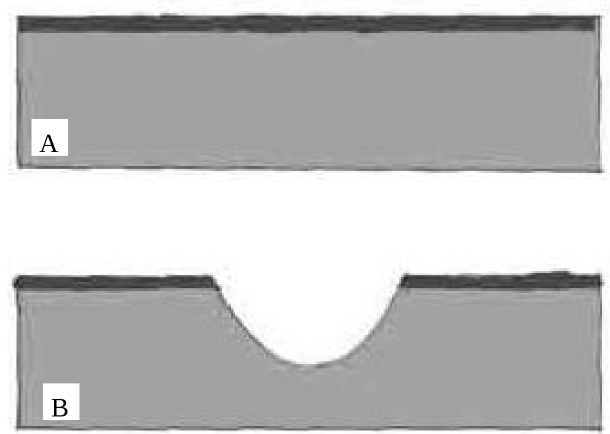
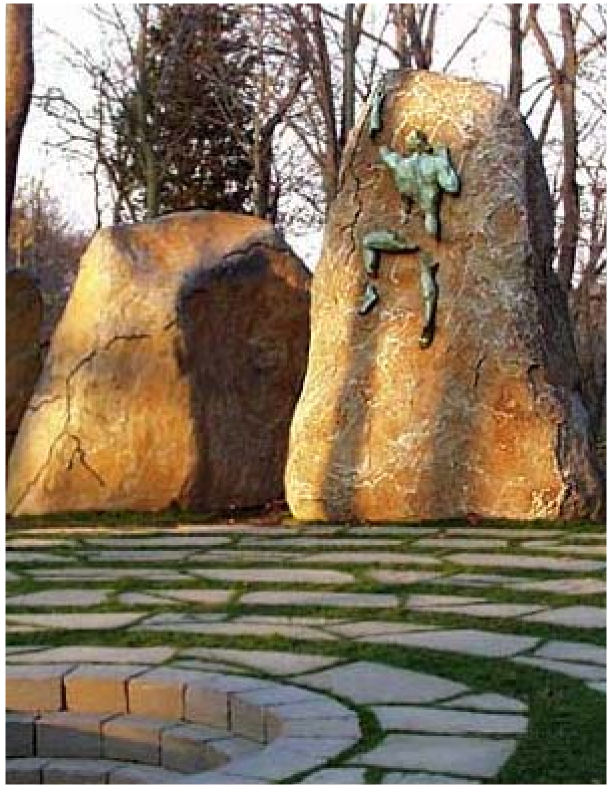


Fig. 5 This illustration shows that if the valley formed by streams after the glacier had receded, the till left at the surface in A (the dark layer at the top of both illustrations) would be eroded and would not armor the valley walls as shown in B. Yet the valley walls here are armored with till



Geology of Avalon Park Preserve

Written By:
David Altizio

Modified by Gilbert N. Hanson
Department of Geosciences

STONY BROOK
STATE UNIVERSITY OF NEW YORK