Trip A-4

OUTDOOR EARTH SCIENCE- A GEOLOGIAL/ECOLOGICAL NATURE TRAIL FOR STUDENTS OF ALL AGES

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ABSTRACT

The field of geosciences addresses a wide range of Earth processes and materials. Individuals of all ages tend to learn about these topics in much the same way, regardless of their grade or level of education. These concepts are best understood when learners can physically see and interact with these processes and materials in their natural environments. We have taken this approach to develop an immersive, geoscience-themed learning experience for visitors to Rice Creek Field Station (RCFS) in Oswego, NY. Participants will hike an approximately 2-mile long 'geology trail' that explores various sites of geological interest, giving them an opportunity to see and interact with the environment both literally and virtually. At each stop, participants will be able to see and feel the varied textures of different types of rock, walk the change in topography left behind by glaciers, watch the movement and flow of water eroding sediment, and see how the land has been shaped by natural and human processes over thousands of years. Maps and placards at each stop will provide information and help guide participants navigate the trail; scannable QR codes linked to websites support a more in-depth understanding of fundamental concepts, and student research taking place at each location. This supports a more complete learning experience and provides greater context of the science for learners of all levels.

RCFS is used primarily by students and faculty of Oswego State University, however, many other local groups and residents regularly make use of the trails and facilities. This presents a valuable opportunity to engage with the public and provide science outreach for adults and students in the area. This project has been developed and maintained by undergraduates who are able to use this as a forum to preserve and communicate their research on local geology to individuals who frequent the park, while educating them about fundamental scientific principles. It also provides K-20 Earth science teachers a destination to share outdoor field experiences with their classes, while reinforcing objectives of state and national science curricula. We provide a simple model for integrating science outreach and education in an outdoor setting that can be easily adapted to many different local settings.

INTRODUCTION

Rice Creek Field Station (RCFS) is a public space dedicated to research and education in the natural sciences to individuals of all ages, which is of particular interest and use to individuals in the Oswego area. Many examples of geological materials and processes that define Central New York are on display at Rice Creek, we will explore some of these during the walk around the property. Glacial and fluvial deposits dominate the surface materials in Central New York (fig. 1). Glacial till is the major surface material, in addition to kame and glacial sands. Lacustrine sands and clays are also minor components of the surface in the area due to the

formation of proglacial lakes and streams. In addition to the abundant materials indicating the influence of glacial activity, there is also striking geomorphological evidence of glacial advance preserved in the topography of the region (fig. 2). Small hills, or drumlins dot the landscape south of Lake Ontario across a large swath of Central New York. RCFS encompasses one of these drumlins, allowing park goers to observe the scale of sediment deposits formed by the movement of ice during the last glacial maximum. RCFS has an extensive trail system that traverses the entire park (fig. 3), allowing visitors to explore various types of geologic materials (rocks, sediment, water) and features (hills, streams, water bodies) formed by natural and human interactions.

While observing these features at RCFS is an effective and educational experience- this area is far from unique, and these features and materials are not quite "world class", however they still provide an ideal environment for learning about basic geologic concepts that often can befuddle students from junior high school through a freshman year in college. Often, there is a great deal of overlap between the content of course work for students aged from 10 to 21, making immersive experiences like this beneficial to a large swath of the population. Further, non-students that are part of the general population who frequent locations such as RCFS can also benefit from outreach programs that employ this hands-on, outdoor, educational approach. It is the goal of this field trip to not simply educate, but encourage educators to develop similar experiences for students of all ages in areas (parks, preserves, campuses) convenient and relevant to your population.

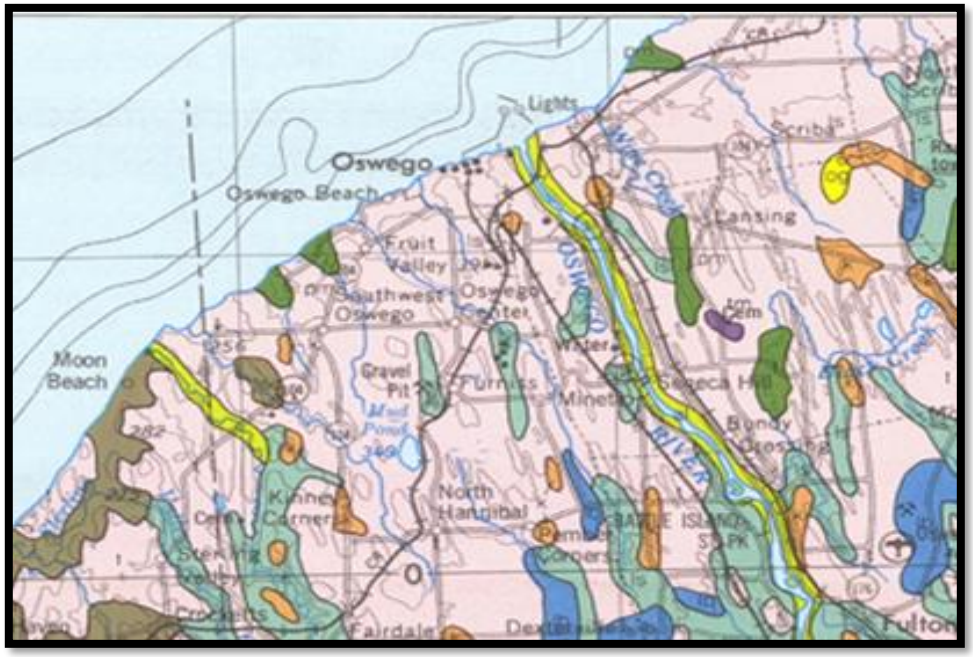

Figure 1. *Geologic surface map (NYS) showing the types of sedimentary deposits found in the region surrounding RCFS. Most abundant is glacial till (pink) and lacustrine sands and silts (teal/brown). After Muller et al. (1985).*

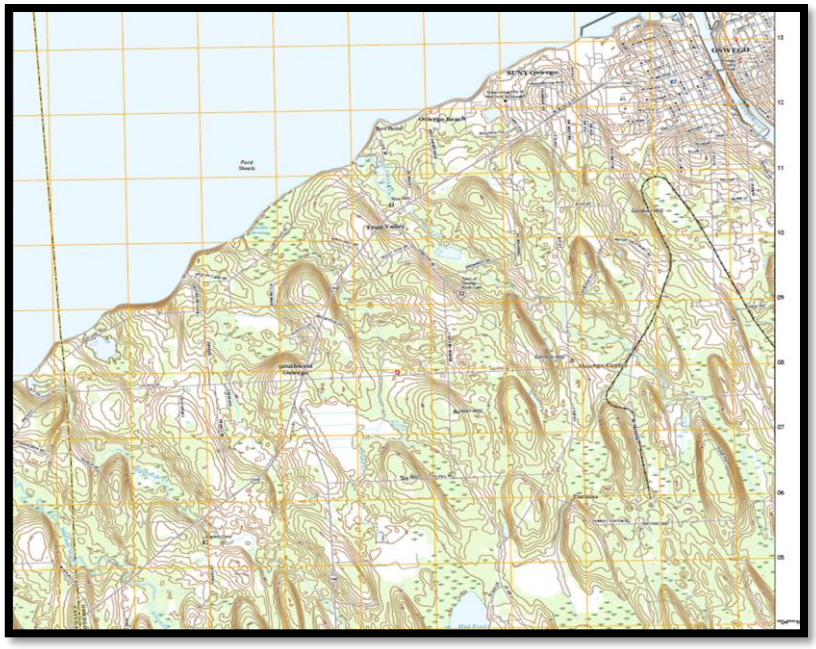

Figure 2. *Topographic map of the area, showing abundant drumlins. Oswego West, USGS (1997)*

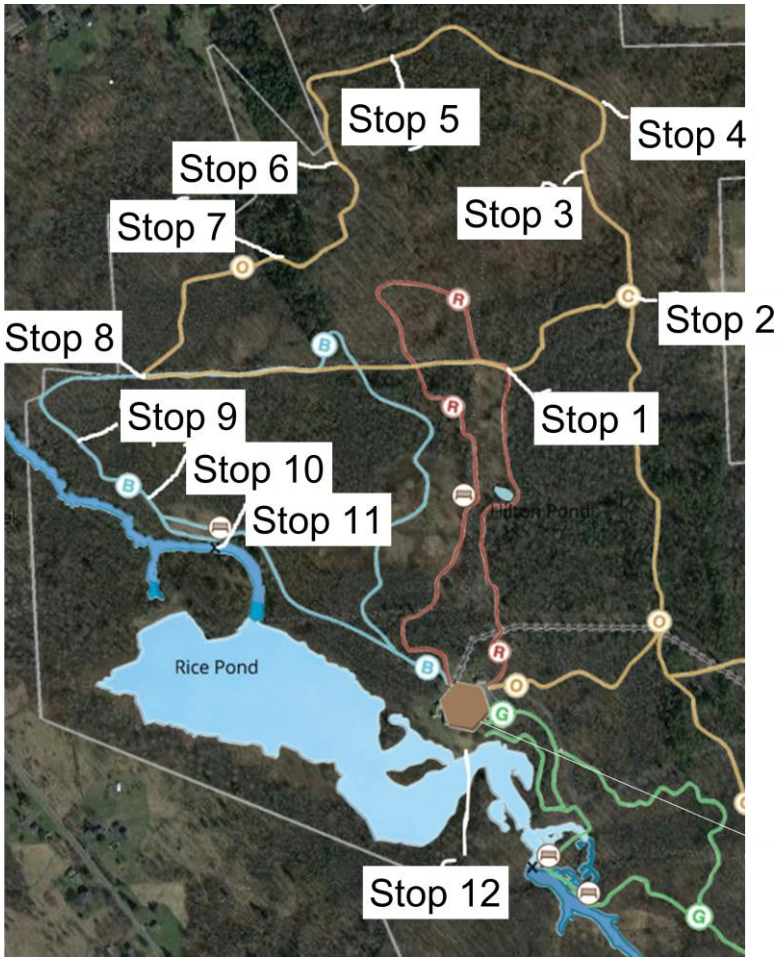

Figure 3. *Trail map of Rice Creek Field Station with nature trail stops noted. Used from DiFrancesco (2022).*

GEOLOGIC NATURE TRAIL AROUND RICE CREEK FIELD STATION

The following is an approximately 1.75 mile moderately strenuous walk around the RCFS in Oswego, NY. Parking is free, but there are limited spaces. Overflow parking is available along the roadside. Bathroom facilities are also available in the Field Station building.

WALKING LOG

The group will meet at the pavilion outside of the Rice Creek Field Station main building (adjacent to the traffic circle). This is within sight of the trailhead for the Red Trail- where we will begin our walk.

STOP 1: Bottom of the drumlin

Proceeding north along the red trail, away from the pavilion the group will walk approximately a quarter mile until reaching the intersection with the orange trail. At this point, we will bear to the right and walk up the orange trail. Here, we can notice the trail steepen- this is the edge of the drumlin. When you look up the trail you can see that you are looking up the slope of it (Figure 4).

Figure 4. *Standing at the bottom of the drumlin, the trail takes a noticeable climb up the slope of the hill.*

STOP 2: Meta/igneous erratic

Here just off the trail, there is an erratic made of granite. We will take the opportunity to discuss the fact that an erratic is a rock or boulder that differs from the surrounding rock and is believed to have been brought from a distance by glacial action. We will discuss the differences between the sedimentary rock that makes up the bedrock of most of Central NY (fig. 5), and contrast that with the magma that formed this rock. It is notable that this is different from the regular glacial sediment, as these erratics are by definition quite large and stick out, as this one does. In addition, we can discuss the composition- the minerals in it are, potassium feldspar (pink), quartz (white/clear), and biotite mica and hornblende (black).

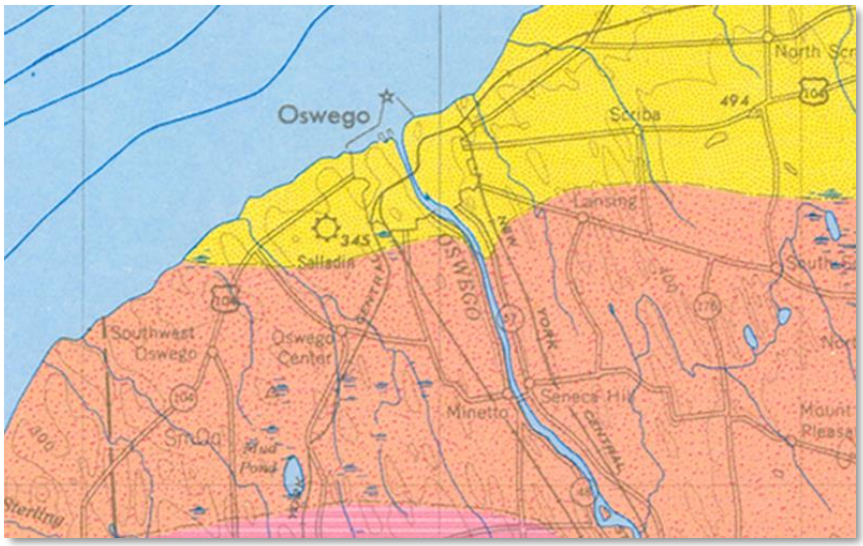

Figure 5. *Geologic bedrock map of the area surrounding RCFS. Note the abundance of sandstone, siltstone and shale- all sedimentary rocks. Rickard et al. (1970)*

STOP 3: Granitic erratic

This erratic is a granite, which is an igneous rock. The minerals in it are potassium feldspar (pink), quartz (white/clear), and biotite mica (black). Note the difference in color and texture from the previous stop. It is clear that these erratics are from different sources, in addition to being distinct from the sedimentary rock forming the bedrock in this area.

STOP 4: Large intermediate meta-igneous erratic

Here we have another erratic. This one is significantly bigger than the other two and is what's known as a diorite gneiss. The sodium plagioclase (white), and hornblende and biotite (black). The minerals in this rock are substantially darker than the other granitic rocks we've observed. This demonstrates the variability in composition of many of the erratics that are deposited in RCFS. We can also note the variable texture of this rock (pegmatite veins), suggesting interaction with fluids (Figure 6).

Figure 6. *Student examining the large glacial erratic at stop 5.*

STOP 5: Top of the drumlin

This stop is the top of the drumlin. At this point this surface was directly in contact with the glacier. At that point you would be standing under nearly 2 miles of ice. After the glacier ablated, the melt water flooded the area, creating glacial Lake Iroquois. This lake eroded and flattened the tops of many of the drumlins closest to Lake Ontario today.

STOP 6: Seasonal stream

Walking down the side of the drumlin, we see evidence of groundwater infiltration as well as surface runoff. Seasonal streams such as these running along and beside the trail help to gradually erode and wear down the surface. This is a visual representation of a large scale process operating at a very small scale. Also observable is particle sorting- small particles of clay are carried further than larger particles of silt, and sand. The effect is more dramatic directly after heavy rainfall, but it is useful to illustrate these processes.

STOP 7: Bog

A bog is a type of wetland that is too soft to support a heavy body. Walking off the trial, you will sink a little bit. A bog is also known for the accumulation of peat. Peat is a deposit of dead plant material, and another major constituent of the local surface geology (fig. 2 – peat and muck). It can be discussed that this peat gets buried and lithified (compressed into a rock) it forms coal.

STOP 8: Rock Wall

Proceeding down the orange trail to the intersection with the blue trail, we come across one of many rock walls that are constructed throughout RCFS (fig. 7). Notice, the majority of the rock forming the wall is flat, squared off sandstone/siltstone- this is the Oswego formation, and makes up the majority of rock in the area.

In contrast, there are occasional rounded stones that are made of granite, gneiss, or some other igneous/metamorphic rock. These rocks are very different from the sandstone, and they each have very different formational histories.

Figure 7. *Rock wall along the blue trail. Note the abundance of flat sedimentary rocks, with only a few igneous/metamorphic rock that has been more rounded.*

STOP 9: Bridge over stream and vernal pool

This section of the blue trail is damp, requiring a bridge likely because the surface is quite close to the water table. This area is also home to a vernal pool (or ephemeral pool) that forms during the rainy season. These are temporary bodies of surface water that provide sanctuary to different species of plants, insects, and animals. It should be understood that these pools form as a consequence of the local geology and environmental conditions which can vary throughout the year.

STOP 10: Meandering stream

Another stream draining off the drumlin, and flowing along the flat lowland along the base of the hill. This stream clearly shows a meander- it is a single channel, but we can observe that it winds back and forth, following the route of least resistance (fig. 8). Closer examination of the stream channel, we can see sorting of sediment, grading from coarser to finer moving closer to the shoreline. Point bars can be identified as well, forming as a consequence of the stream flow.

Figure 8. *Small stream running through RCFS showing a characteristic meander as it flows onto more level terrain.*

STOP 11: Rice Creek

Here we follow the blue trail down to the deep, wide channel of Rice Creek for which the field station is named. Walking upstream, we see the flowing water has eroded much of the loose, finer, sediment from its channel, exposing more of the cobble to boulder-sized till. These rocks are continually being mechanically and physically weathered by the movement of the creek. This water flowing out of Rice Creek will eventually enter into Lake Ontario as a minor tributary. Walking along the creek, it may be possible to visit the artificial dam that forms Rice Pond.

STOP 12: Rice Pond

Rice Pond is artificially formed by the dam at the northern edge of the pond. Rice Pond conforms to the local topography and geology of the area as Rice Creek has flooded the lowest points of the valley. Proceeding further south, the pond transitions into another large swamp/bog. Note that the flow has slowed considerably, but not stopped. This allows for deposition of sediment that has been transported from further

upstream. Walking along the shoreline of the pond will lead back to the traffic circle and the start of the walk.

Figure 9. *Rice pond, partially frozen over during the winter of 2021. Here we see the center of the pond is not frozen, suggesting there is still some gradual flow through the channel.*

End of trip.

ACKNOWLEDGMENTS

The geology walking tour of Rice Creek has been developed and revised over several years by many undergraduate researchers and teaching assistants for use with various lab classes as well as youth, school, and community groups with the goal of educating the public about the natural history of their community. I am grateful for the input and participation of all of these individuals. I am also grateful to Rice Creek and Rice Creek Associates for their continued support of this venture and other associated research.

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