United Nations Educational, Scientific and Cultural Organization

Stonehammer UNESCO Global Geopark

ROCKWOOD PARK
Teacher's Sheet

DRIFTINGAPART

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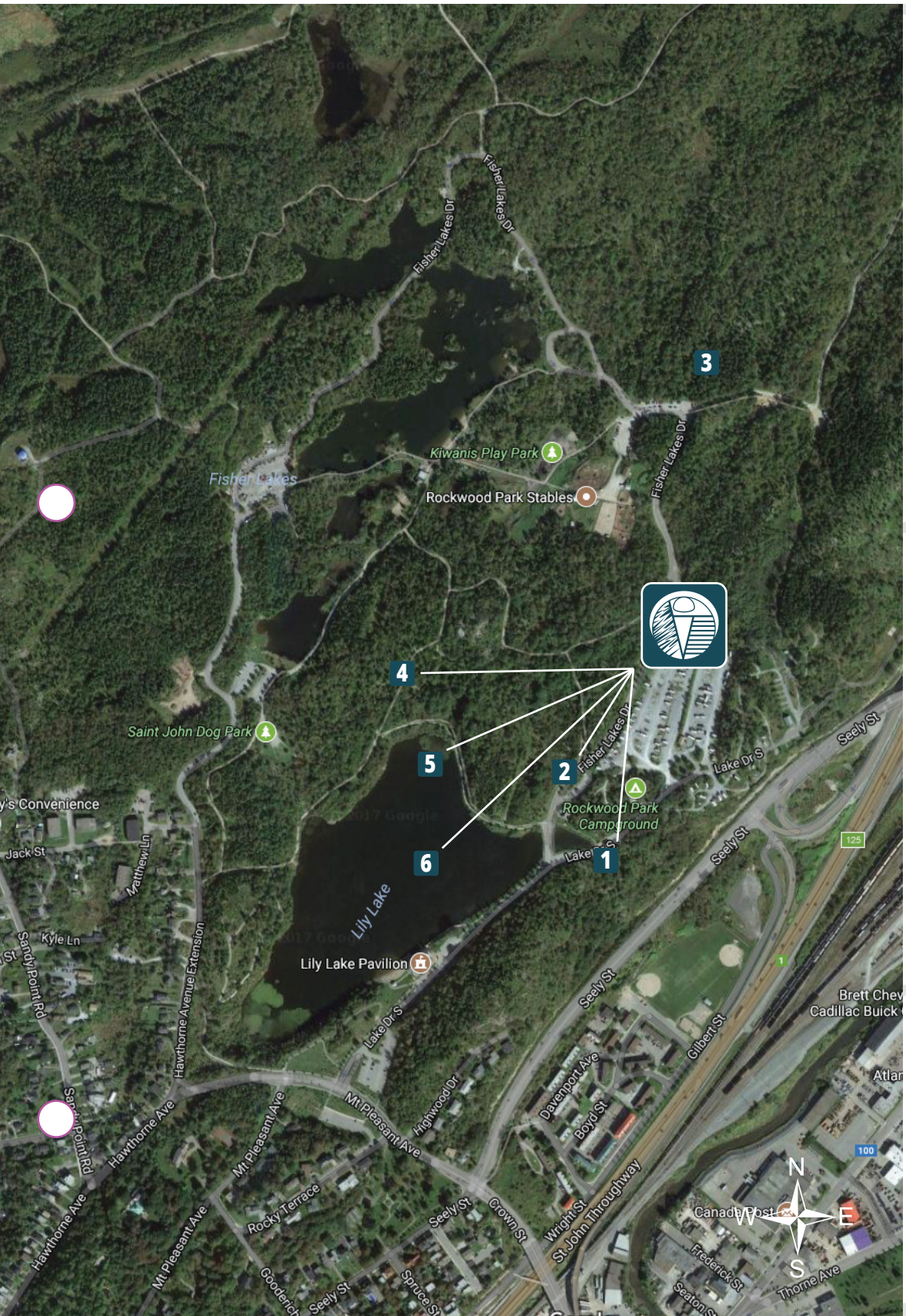


Access: GPS: 45˚17'27" N / 66˚03'14.4" W
Lake Drive into Rockwood Park.
Access: Accessible dawn until dusk, year round

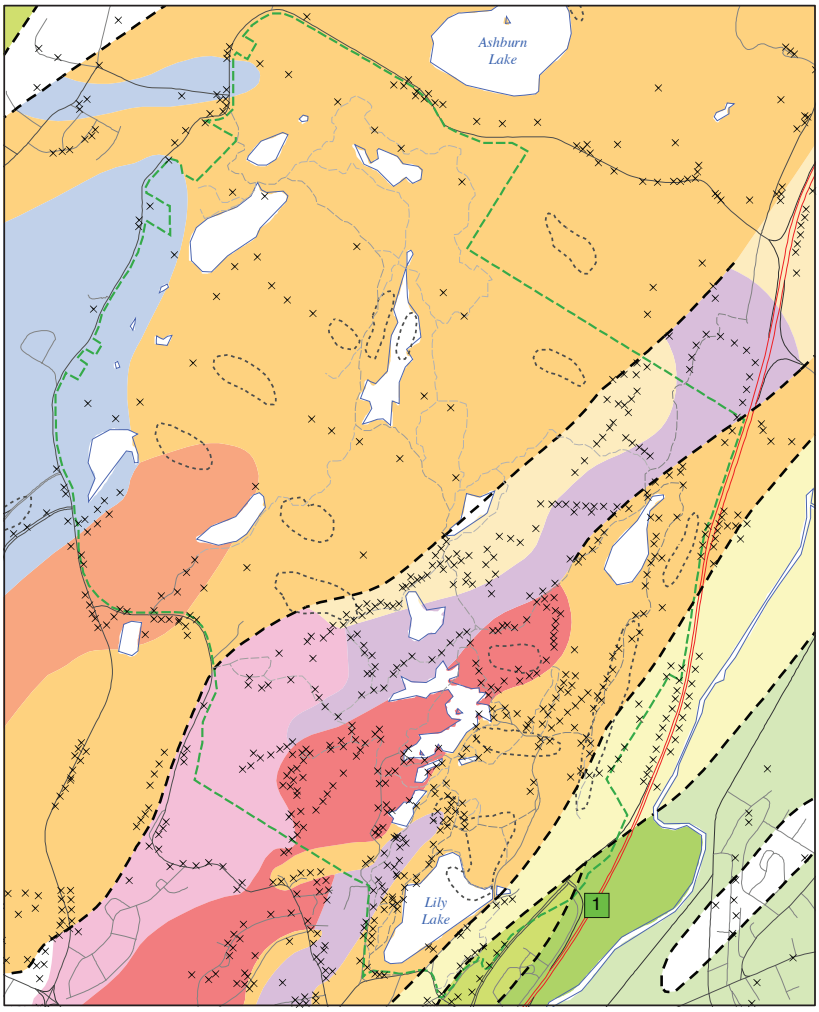
Call ahead to the Interpretation Centre to find out what's going on in the park.

1. Lily Lake Pavilion: 45°17'22.63" N / 66°03'23.44" W,
2. Rockwood Park dacite outcrop at rock climbing wall: 45°17'26.83" N / 66°03'14.09" W
3. Rockwood Park marble outcrop near Fisher Lakes: 45°17'47.00" N / 66°03'20.11" W

Amenities: Walk from ancient 'South America' to ancient 'Africa' across the fault line • Find the volcanic dacite then go look at the granodiorite • Find an igneous, a metamorphic and a sedimentary rock type in the park • Walk the 'Clean Air Trail', swim at the beach, mountain bike or ski • Get active and go rock climbing, hiking, boating, geocaching, rentals available from Inside Out Nature Centre • Relax by the lake and enjoy a geologically themed menu at Lily's.

Equipment: magnifier, mineral information, camera; clear containers with vinegar and water, pieces of Crayola chalkboard chalk (or another brand that contains calcium carbonate)

Geological Age: Precambrian (about 1,000 Ma to 548 Ma) Cambrian (538 Ma) and Devonian



Rockwood Park
Bedrock Geology

Bedrock Geology

Formation (GNB Abbreviation) Age, Rock Type

- Ashburn Formation (ZASmb) Precambrian, Marble
- Brookville Gneiss (ZBKgn) Precambrian
- Fairville Granite (ZCFAfi) Precambriann Intrusive
- Kennebecasis Form. (CKcc) Devonian, Sedimentary
- King Square Formation (CKQ) Cambrian, Sedimentary
- King Square Formation (CKQc) Cambrian, Sedimentary
- Mayflower Lk. Tonalite (ZCMAii) Precambrian, Intrusive
- McBrien Lake Formation (ZMBiv) Precambrian, Volcanic
- Deformed/Undivided (ZCii) (Pre)Cambrian, Intrusive
- Rockwood Pk. Granodiorite (CRPii) Cambrian, Intrusive
- Saint John Grp. (COSJc) Cambrian, Sedimentary
- Park Boundary
- Outcrop Point
- Outcrop Area
- Faults
- Water

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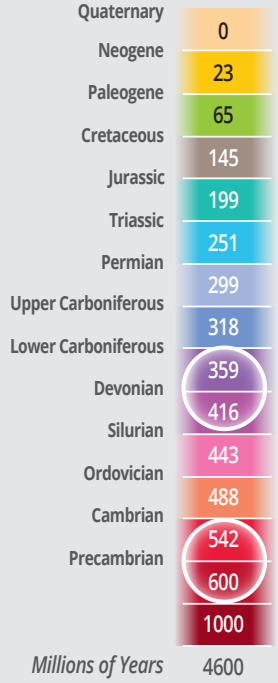
Author: Andrew Pollock
Date: July 2011
Scale: 1 : 22,000

Coordinate System:
NAD83 New Brunswick Stereographic Double Projection

Data Sources:
Roads - Government of Canada, Natural Resources Canada, Earth Sciences Sector; Bedrock Geology - New Brunswick Department of Natural Resources, Minerals; Rockwood Park Boundaries/Trails - Digitized from City of Saint John maps.

N

0 0.25 0.5 1 Miles
0 0.25 0.5 1 1.5 2 km



Classes can easily walk from the Duck Pond and Rock Climbing Face (location 1) or Lily Lake Trail (location 6) up the road past the Interpretation Centre to the Arboretum Trail (location 2), along it, then turn left at the end to walk further along the road for a short distance to the start of the Clean Air Trail (location 3) and then the Visit Canada Visitez Confederation Trail (location 4) is a short walking distance further, where classes can finish at the group picnic area (location 5) to complete task F and walk back through the playground to be picked up at the upper parking lot between the playground and the Stables.

1. Rock Climbing Face and Duck Pond Task B

Rockwood Park is a great spot to examine igneous rock and learn about processes that form rock. The Rockwood Park Granodiorite is found in outcrops along the Trans Canada Trail, produced during the plate tectonic processes that created the Iapetus Ocean. Here at location 1, the rock climbing face opposite the duck pond near the entrance to the campground is dacite. You may see people rock climbing there. The rocks are very fine grained since the molten lava cooled very quickly. The dacite has lots of fractures and joints making it 'easy' for rock-climbers to find handholds and footholds.

Dacite and granodiorite are an intrusive and extrusive pair, with the same chemical makeup but different grain size. Dacite is from lava, cooled quickly just below the surface (near-extrusive,

small grains). Granodiorite was magma that did not come as close to the surface, cooling slowly underground (intrusive, large grains). The dacite here has been dated and was found to have an age of 554 million years old. The great amount of igneous rock in Rockwood Park speaks to the earth processes in Stonehammer at the margin of the tectonic plates as they moved, collided, and ripped apart into terranes.

Rockwood Park includes the same terrane contact seen at the Reversing Falls Rapids with the fault line running approximately under the roadway at the park entrance. Here geologists can also see some of the igneous rocks that were part of the plate tectonics story. The Caledonia Terrane includes the McBrien Lake Formation Dacite (554Ma), a volcanic rock possibly erupted in an "island arc" setting, a string of volcanic islands formed above a subducting ocean plate. The resulting mountain range, the Appalachians, once stood as tall as the Rockies or Himalayas do today. They were created during the closing of the Iapetus Ocean. Our rolling hills are the roots of these ancient mountains, the peaks now lost to erosion.

Caledonia Terrane rocks, visible as sedimentary rock at Reversing Falls Rapids, here include a 554 million year old volcanic rock. This lava, or near surface intrusive, called dacite, is exposed near the campground entrance. This volcanic rock possibly erupted in an 'island arc' setting, a string of volcanic islands formed above a subducting ocean plate.

The rocks next to Lily Lake are Ashburn Formation marble, part of the Brookville Terrane. They may be as much as a billion years old. In places, this formation contains cabbage-like stromatolite fossils, the oldest evidence of life (cyanobacteria) in Stonehammer and in the whole Drifting Apart area.

A graphite mine in operated here in the mid-1800s, just in front of the Interpretation Centre.

2. Arboretum Task A, D

Walking into the start of the Arboretum Trail, the rocks placed on the ground next to the road signage include Dacite and Granodiorite. Walking further in to find the paved area on the Arboretum Trail is location 2. Large samples of each prominent rock type in the park (gneiss, limestone/marble, volcanic dacite, conglomerate, and granodiorite) with interpretive signage are found here.

Take note of the conglomerate rock in the group. This was formed in riverbeds at the time when all the sites in the Drifting Apart area were together as one landmass, at the centre of Pangea. Conglomerate rock can be seen on the Lily Lake Trail (location 6). The water must have been moving fast to have carried such large rock fragments. This is the only true sedimentary rock in the group: the sample of limestone from the Ashburn Foundation is a sedimentary rock that underwent metamorphosis to become marble. The limestone/marble is the rock that forms the park's Karst landscape, especially visible on the Clean Air Trail (location 3) and less changed from the original limestone on the exposed rock face near the group picnic area (location 4). Rockwood Park is also one of the only places to see a "mystery" metamorphic rock called the Brookville Gneiss. It outcrops along the Zoo Trail near the overhead powerlines. The gneiss forms a narrow belt, 37 km long and less than 1 km wide extending from Green Head, east to the Hammond River near Hampton. This remains a puzzling rock in Stonehammer Geopark. With ages ranging from 1640 Ma to about 605 Ma, it is believed to be Precambrian, but it has been hard to understand how it relates to the other rock units. The heat and pressure during metamorphosis caused the minerals to band together making "stripes" in this rock. Gneiss is also found in the quarried rock that surrounds the Duck Pond (location 1). Finally, we have the two examples of intrusive and near-extrusive igneous rock, dacite and granodiorite, which were discussed at location 1. They are seen as outcroppings at the rock climbing face (dacite, location 1)) and along the trans-Canada trail. Students are directed to look for the natural granodiorite outcropping opposite the Newfoundland installation on the Visit Canada Visitez Confederation trail (location 4).

3. Karst Topography, Clean Air Trail, Task C, E

Clean Air Trail: closest parking is at the playground/stables; cross the road to the trail. There is a relief map of Canada on the ground and Canadian Lung Association signage at trail head. Observe Karst landscape features along the trail. The destination of the trail (paved area where it loops back) is a cave. Beware of spreading White Nose syndrome to bat population: students should not go inside caves, but they can look in.

The Precambrian marble forms interesting erosion features in the park. These rocks are easily weathered by acidic water. The marble forms what is called 'karst' topography, a landscape with caves, disappearing streams and 'limestone pavement'.

Much of Rockwood Park is underlain by a karst landscape formed in Precambrian marble of the Green Head Group. Karst topography is created when soluble bedrock is

dissolved by mildly acidic water. Soluble bedrock is usually carbonate rock such as limestone, dolomite or marble. Marble is a metamorphic rock, meaning the original sedimentary limestone has been altered by heat and pressure. Acidic water (rainwater and groundwater) dissolves the bedrock along cracks or bedding planes. Over long periods of time the cracks enlarge and the size of the openings in the rock increases. As the acidic water drains through the cracks into the bedrock, the landscape develops sinkholes, underground streams and caves.

There are a few 'large' caves in Rockwood Park including Howe's Cave and Harbell's Cave. A man named Oliver reportedly discovered Howe's Cave, also known as Oliver's Cave, in the 1860s. Two members of the Natural History Society of New Brunswick, Robert Matthew and I. Allen Jack soon after, explored it. George Matthew wrote a description of the cave in 1904 for the Bulletin of the Natural History Society of New Brunswick. The landscape and karst features that include Howe's Cave are a unique feature in the geology of Saint John.

Along with the underground caves, other karst features are seen at Rockwood Park. These features include flutes, runnels, sinkholes, vertical shafts, disappearing and reappearing springs, limestone pavements and spring fed lakes, like Lily Lake.

4. Visit Canada Visitez Confederation Trail - Task B

In the year 2000, Visit Canada Visitez developed a trail to commemorate Canadian Confederation. Each Province and Territory sent a two tonne rock to be used as a monument. Each stone monument was cut, polished and decorated with the provincial or territory crest, the year of entry into confederation, and an image to represent the region. New Brunswick's monument was decorated with an image of the Hopewell Rocks, an iconic image of eroding 'flowerpot' structures from Lower Carboniferous age rocks along the Bay of Fundy coast. A piece of each rock was also used to create a 'maple leaf' monument. Across from "Newfoundland," as well as in several other places, students can find granodiorite natural outcroppings. Rockwood Park Granodiorite was produced during the plate tectonic processes that created the Iapetus Ocean 538 million years ago. It is an intrusive igneous rock. It is part of a suite of igneous rocks in Rockwood Park that also includes Dacite, its near-extrusive cousin, and tonalite.

5. Group picnic area: sedimentary bedding face - Task F

Located between the playground and the supervised swimming area at Fisher Lakes/ AFrame (washrooms and canteen), the rock face across from the group picnic tables is part of the same limestone/marble formation that we explore in the Karst landscape of the Clean Air Trail (location 3). The sedimentary properties of this rock are quite clear here as students can read layers of sedimentary bedding.

6. Lily Lake (task D)

Lily Lake was carved out by glacial runoff. Around the trail, look for glacial erratics, which are rocks of a different type than the bedrock that were moved by glacial processes. Also look for glacial striation on the rocks that emerge from the ground (especially visible on certain sections of marble at the far side of Lily Lake) these deep gouges were made by the rocks embedded in the glacier as it moved and scraped the bedrock below. There is also a large boulder of Conglomerate rock where students may do task D (may also be competed on the arboretum trail.)

Teaching tips for the Student Tasks:

Use the field guide the Students create in task A to identify rocks in each location visited. Gneiss will mostly be only found in the cut rocks used in landscaping but if you add on the Zoo Trail you can see some naturally occurring there. You may use this field guide to shape a self-directed hike in the park by students to look for examples of each type. If so, you might want to have student take photos as well as their field notes and sketches.

Task C *You may compare the chemical weathering of the limestone (now metamorphosed into low-grade marble) of the Karst landscape with the physical weathering of the sandstone along the Bay of Fundy Shoreline that created the caves at St. Martin's and the flowerpot rocks on the Fundy Trail. You can also have students research other Karst landscapes found around the world.*

Task E *Students should visualize how the "baking and squeezing" that turns sedimentary limestone into metamorphic marble would distort or destroy the fossil record it might contain.*

Task F *Students are sketching the bedding of sedimentary rock in this task. You can add on Task D from the Fundy Trail worksheets, making a homemade clinometer to measure the strike of the bedding as a geologist would do to record the information on a geological map.*