

Grand Manan Geology – Back of the Island

Greg McHone, Geologist
North Head, Grand Manan, NB

Grand Manan has a “split personality” regarding its physical geology. The western 2/3 of the island shows thick lava flows of Early Mesozoic ages, which are little changed from when they cooled at the end of the Triassic Period. This Grand Manan Basalt is part of the enormous “flood basalt” that underlies most of the Bay of Fundy, and which erupted 201 million years (m.y.) ago. The basalt is made up of three sections, called members, described below. Beneath the lava is the Sloop Cove Formation, a fine-grained Triassic mudstone that collected in a wide valley or basin with shallow lakes, where the Bay of Fundy is today. The Mesozoic formations rest upon a surface of metamorphic rocks, dated from 618 to 535 million years old. These ancient formations are exposed along the shore between North Head and Red Point, and also in the smaller islands. The two groups are side by side because of two km of vertical movement along a great fault that runs from Red Point northward to Whale Cove, southward between Grand Manan and Wood Island, and far out beneath the sea in both directions. See the geologic map in this summary for locations.

The western shore or “back of the island” has spectacular exposures of the Grand Manan Basalt and Sloop Cove sedimentary rocks. You can see them best from a boat, or with some effort hike to them on the red trails and along the boulder beaches.



The lower part of the Grand Manan Basalt is called the Dark Harbour member. It is one giant lava flow around 110 meters thick in this area, and even more where it made a deep lava lake in the center of the Fundy Basin. As it cooled and contracted, vertical fractures created a columnar structure. Later warps in the upper crust tilt them inward slightly at Southwest Head. Closer to Dark Harbour, the columns tilt outward, causing them to collapse easily and build up piles of broken pieces called talus slopes.

The same basaltic lava flows occur along the western shores of Nova Scotia, where they are called the North Mountain Basalt. We know they also lie beneath the waters of the Bay of Fundy because of seismic surveys done for the oil and gas industry. The volume of lava is at least 6,600 cubic km, making it the largest lava flow on earth.



At Bradford Cove, thinner lava flows each a few meters thick are piled on top of the Dark Harbour member. Here the rocks are tilted into a downward fold called a syncline. The lava layers make up the Seven Days Work member, named after cliffs in which they occur near Whale Cove to the north. There are actually around 14 lava flows not 7, and they are full of gas bubbles in which beautiful minerals have crystallized.

These thinner flows appear to be extruded from the great lava lake beneath them, which is now the Dark Harbour member. Evidence is found near Indian Beach, where a volcanic fissure has produced one of these Seven Days Work lava flows.



In 1862, Moses Bagley discovered a layer of copper-rich ore near Sloop Cove. An exploration mine was opened in 1870, but apparently not enough was found to continue. In the 1970s, several deep drill holes were made to look for copper, again without much result. Some of these cores are on display in the Grand Manan Museum. In this old photo from the museum, horizontal beds of Sloop Cove siltstone can be seen beneath the fir trees.

It appears that the copper is in soft sedimentary rock directly beneath the basalt. It can be a blue-green color, and masses can be close to grey as well. I have only seen thin layers of the ore compounds, but around Whale Cove and Eel Brook people have found small pieces of pure bright copper metal between lava flows of the Seven Days Work member.

Near Dark Harbour, the gray to purplish red Sloop Cove mudstones can again be seen beneath the Grand Manan Basalt.



The last outcrops of the sediment appear on the cliffs south of Money Cove, but north of that cove we only see basalt, so perhaps a fault around there has dropped the northern crust downward a few tens of meters.

There are other faults as well. South of The Gulley on Indian Beach, all three members of the Grand Manan Basalt are exposed next to a fault. The columnar basalt on the right in this photo is Dark Harbour member, on the lower left are the top layers of the Seven Days Work member, which are tilted up to the right as they approach the fault. Rocks are often bent along faults like this one, due to drag or friction as one side moves downward. You can see it at Red Point as well.

Above the thin lava flows is the thick Ashburton Head basalt member, on the upper left in the photo.

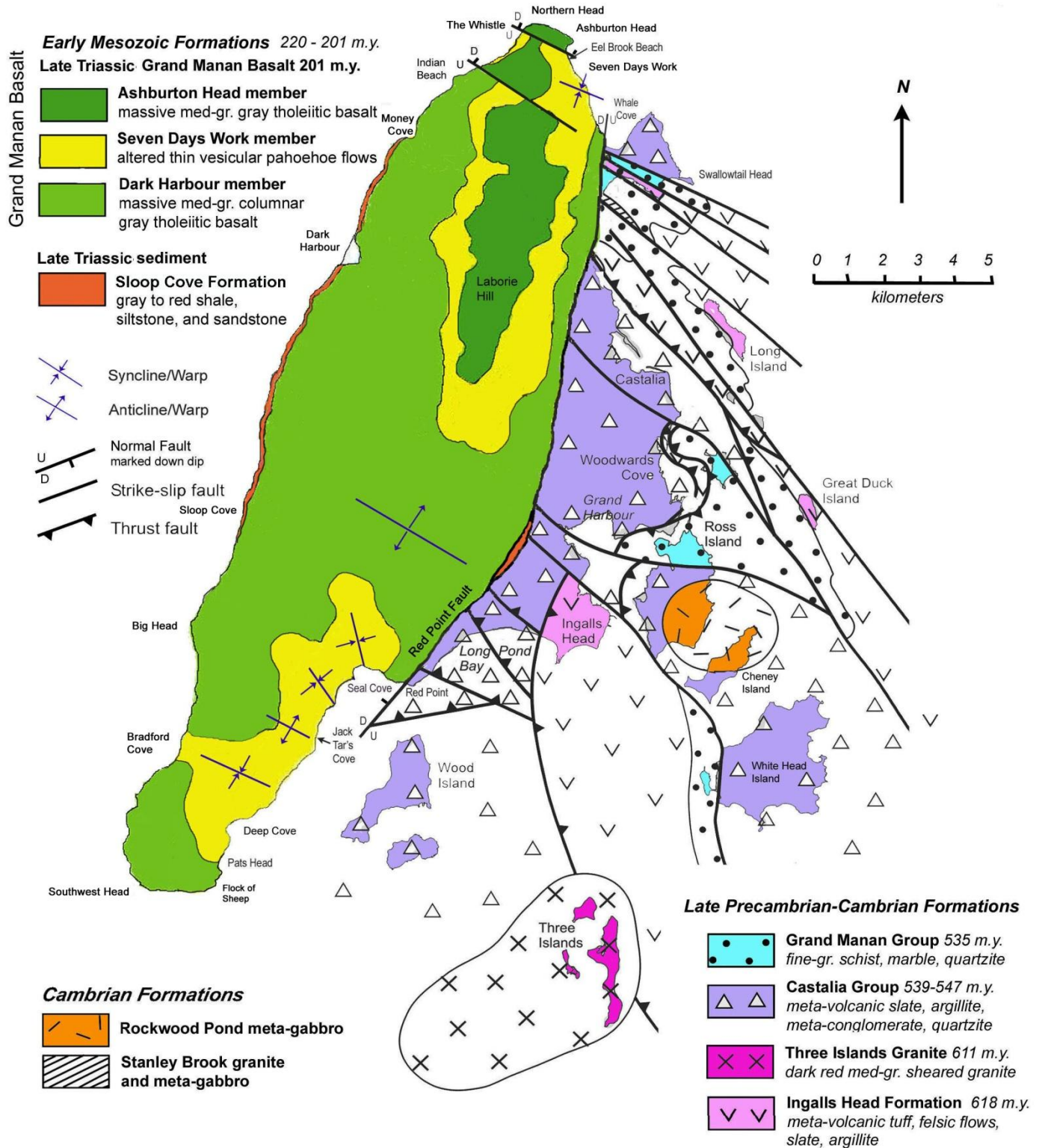


Ashburton Head is named after the Lord Ashburton, a ship that crashed into it on a dark winter night in 1857 with the loss of 21 out of 28 crew men. This basalt flowed onto the top of the Seven Days Work member, and it is well exposed here, thus its member name. It is at least 70 meters thick, and in places appears somewhat columnar like the Dark Harbour member. Mainly it looks deformed and broken, perhaps by faults or by irregular cooling.

The beach in this photo is at Eel Brook. Here interesting minerals and rocks attract collectors.

GEOLOGICAL MAP OF GRAND MANAN

compiled by J. Gregory McHone, 2008
 adapted from maps by Leslie Fyffe, Richard Grant, and George Pajari



Copyright 2009 J. G. McHone