Maine Geologic Facts and Localities

January, 2017

The Bubbles, Acadia National Park, Maine

44°20'31.1"N, 68°15'17.5"W

Text by
Amber T. H. Whittaker and Thomas E. Whittaker

Introduction

The iconic and distinctive view of the Bubbles on Mount Desert Island is a frequently-photographed attraction in Acadia National Park. A loop trail circumnavigates South Bubble and provides the intrepid hiker the opportunity to examine various natural features that are influenced by the glacial and geologic history of the area.

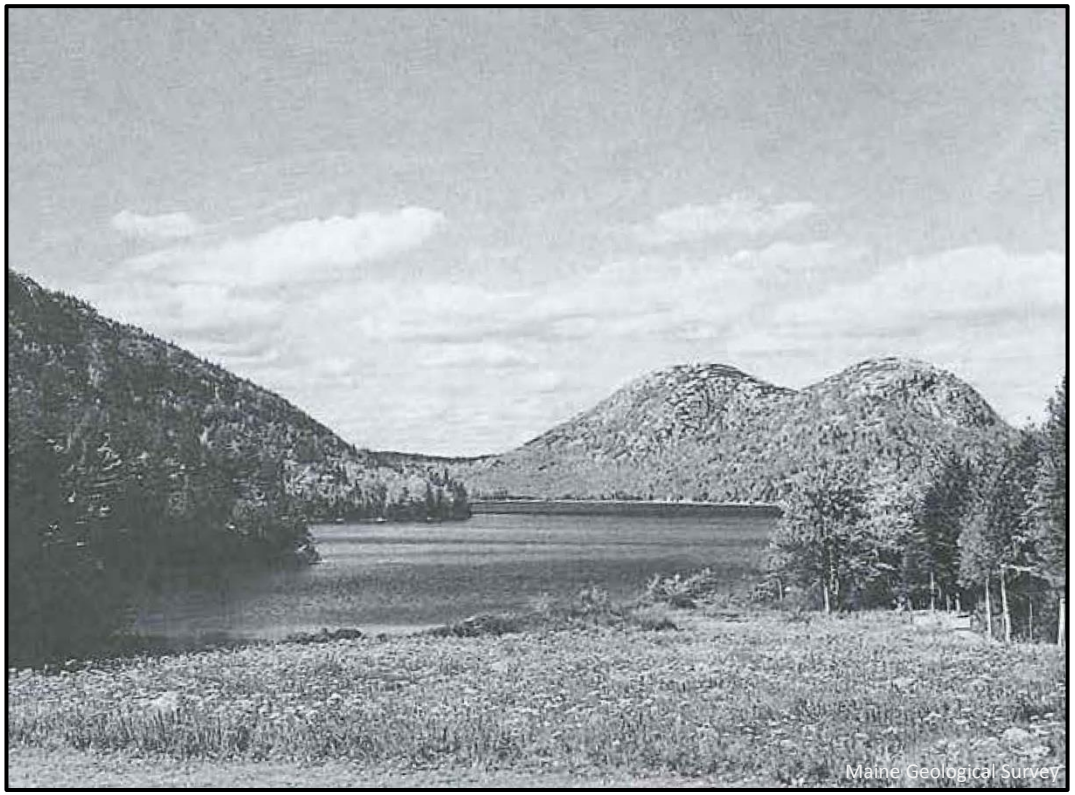
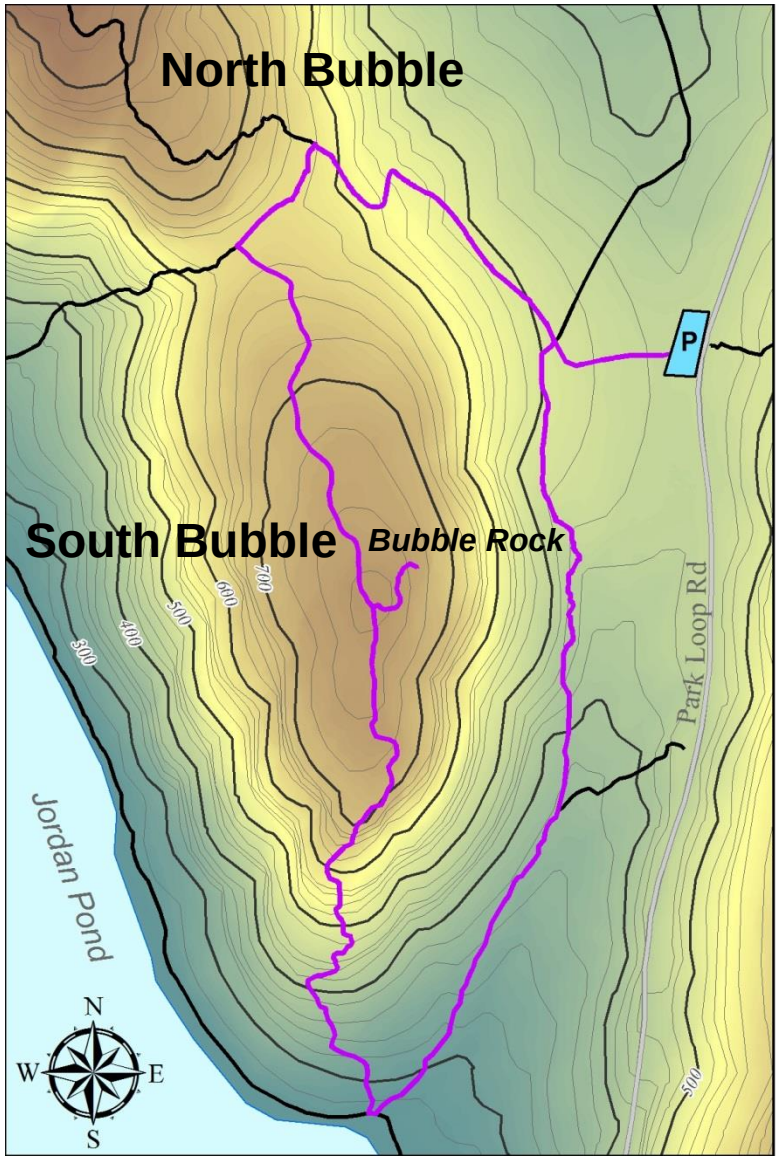


Figure 1. The view of the Bubbles to the north of Jordan Pond (Gilman, 1988).



South Bubble Loop Trail Details

The trailhead is accessed via a small parking area off the Park Loop Road (shown in blue). The lot fills up quickly, so plan to arrive early or to take the park bus. The whole loop is about 1.3 miles long, with a small side trail at the top that goes to Bubble Rock, a boulder perched on the side of the mountain.

Figure 2. Trail map (Maine Geological Survey).

South Bubble Loop trail

Other Acadia National Park trails

Elevation (feet)

High : 850

Low : 270

1 inch = 500 feet

0 500 1,000 Feet

0 0.1 0.2 Miles

South Bubble Loop Trail Profile

Figure 3. Elevation along the South Bubble Loop trail (Maine Geological Survey).

The trail along the north side of South Bubble is rated as moderate. The elevation gain from the trailhead to the summit along the northern slope is approximately 300 feet over about half a mile.

The trail along the steep southern face of South Bubble is rated as difficult, and requires navigating some tight spaces and sheer rock faces. The elevation gain is approximately 480 feet over about one third of a mile.

On the Trail

At the trailhead and as the trail traverses the lower slopes of The Bubbles it is immediately noticeable that the trees of the canopy and sub-canopy are almost exclusively saplings or young trees, most being American Beech (*Fagus grandifolia*). Furthermore, there is relatively little vegetation in the understory.

This area occurs at the edge of the burn area of the Bar Harbor fire of 1947.

Photo from University of Connecticut, 2017.

Figure 4A Above: Example of the alternate pattern of toothed, large leaves (grandifolia) of American Beech.

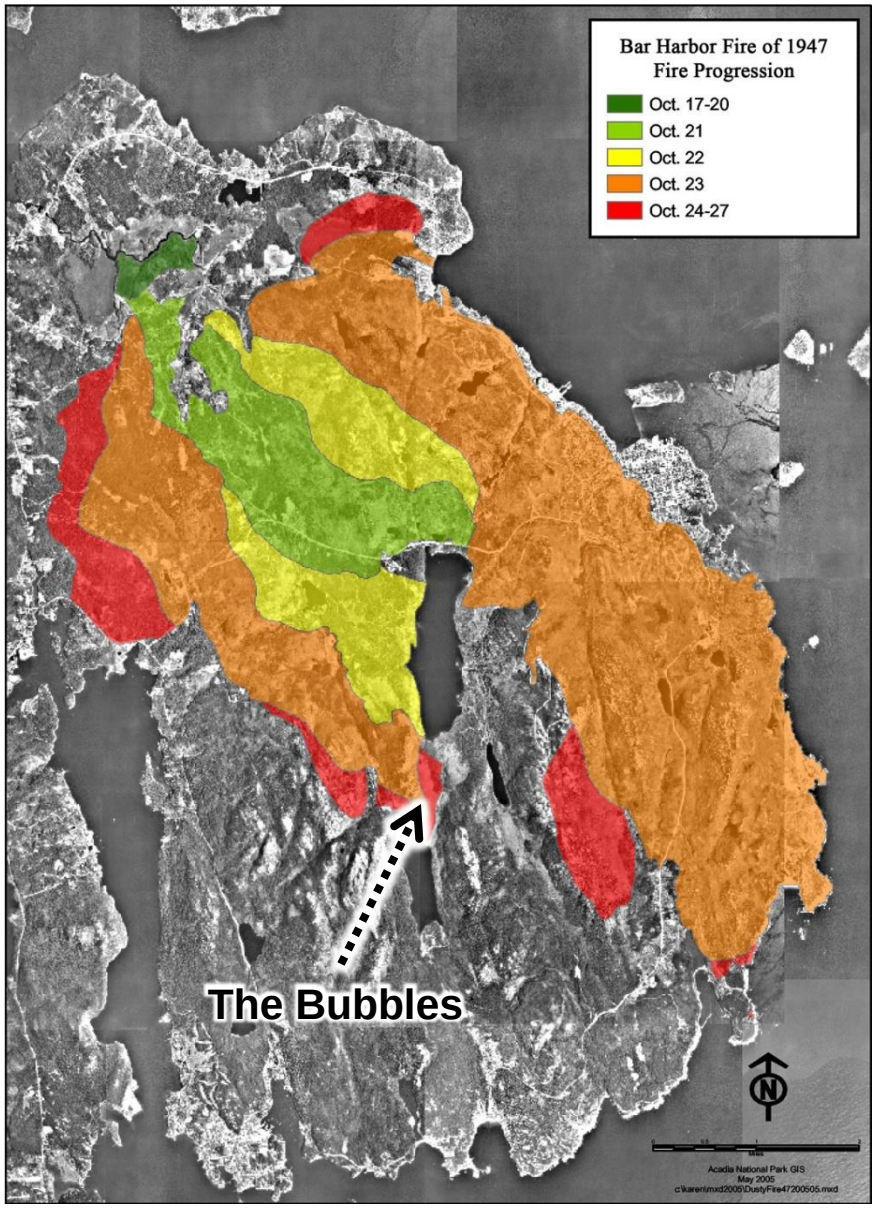


Figure 4B Right: Orthophoto with overlay of fire progression during the Bar Harbor Fire of 1947 (Wildland Fire Leadership Development Program).

On the Trail

Between Jordan Pond and the parking lot there is significant diversity in broad leaf tree species. As well as beech, expect to find white ash and red oak. Careful observers will also be able to find individuals from five different maple species (sugar, red, mountain, striped, and Norway). Conifers are more abundant on the steep trail from Jordan Pond to the summit of South Bubble. Expect to find species of pine, spruce, cedar, fir, and hemlock.

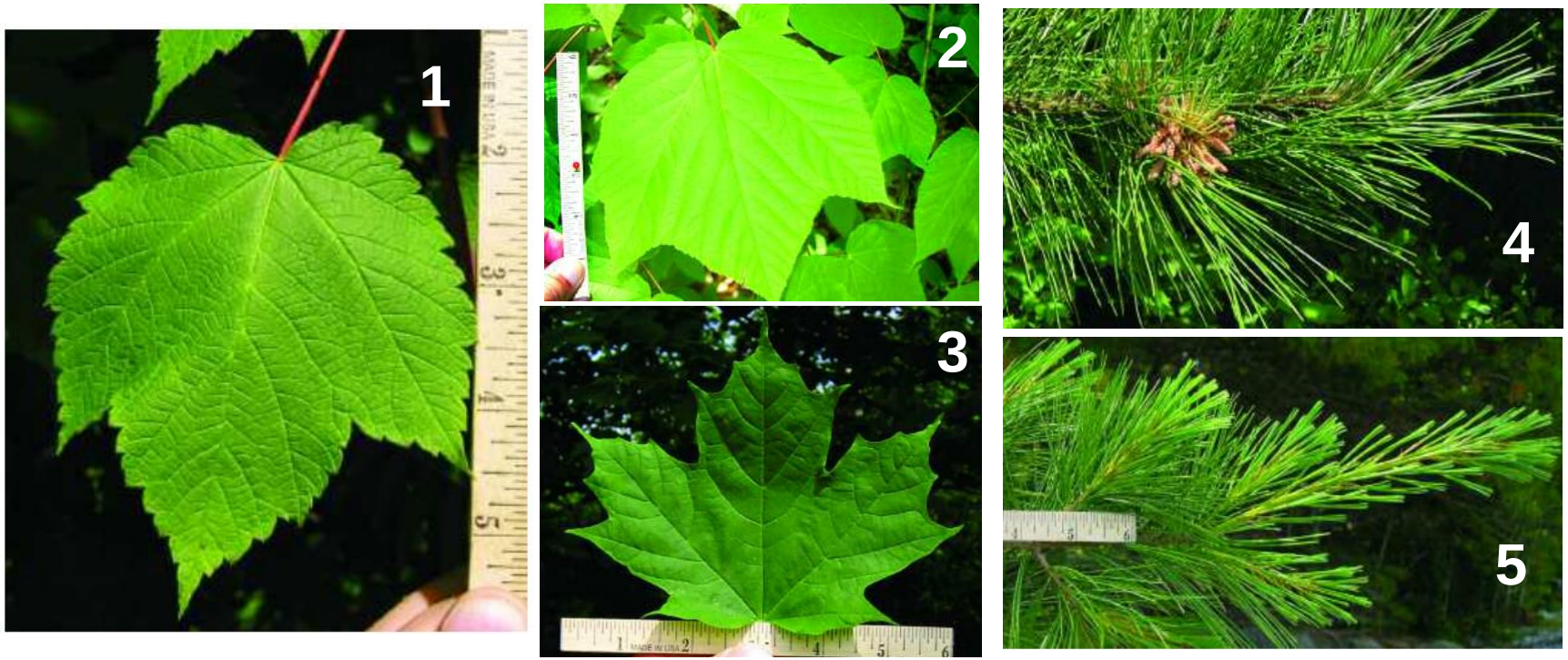


Figure 5. Example leaves of three maple species and two pine species found on the trail: (1) Mountain Maple (*Acer spicatum*), (2) Striped Maple (*Acer pensylvanicum*), Sugar Maple (*Acer saccharum*), (4) Red Pine (*Pinus resinosa*) distinguished by long needles in clusters of two, and (5) Eastern White Pine (*Pinus strobus*) with needles in clusters of 5. All photographs on this page are from the Centennial Edition of the Forest Trees of Maine (view online here).

Glacial History

Mount Desert Island and the rest of Maine was covered by a large glacier, called the Laurentide Ice Sheet, during the most recent glacial period which lasted from 85,000 to about 11,000 years ago. The ice sheet reached its maximum position (around Long Island, New York, on the east coast) by about 25,000 years ago, and began to retreat north by 18,000 years ago. Many features on the Bubbles are the result of the movement of the glacier over the landscape.

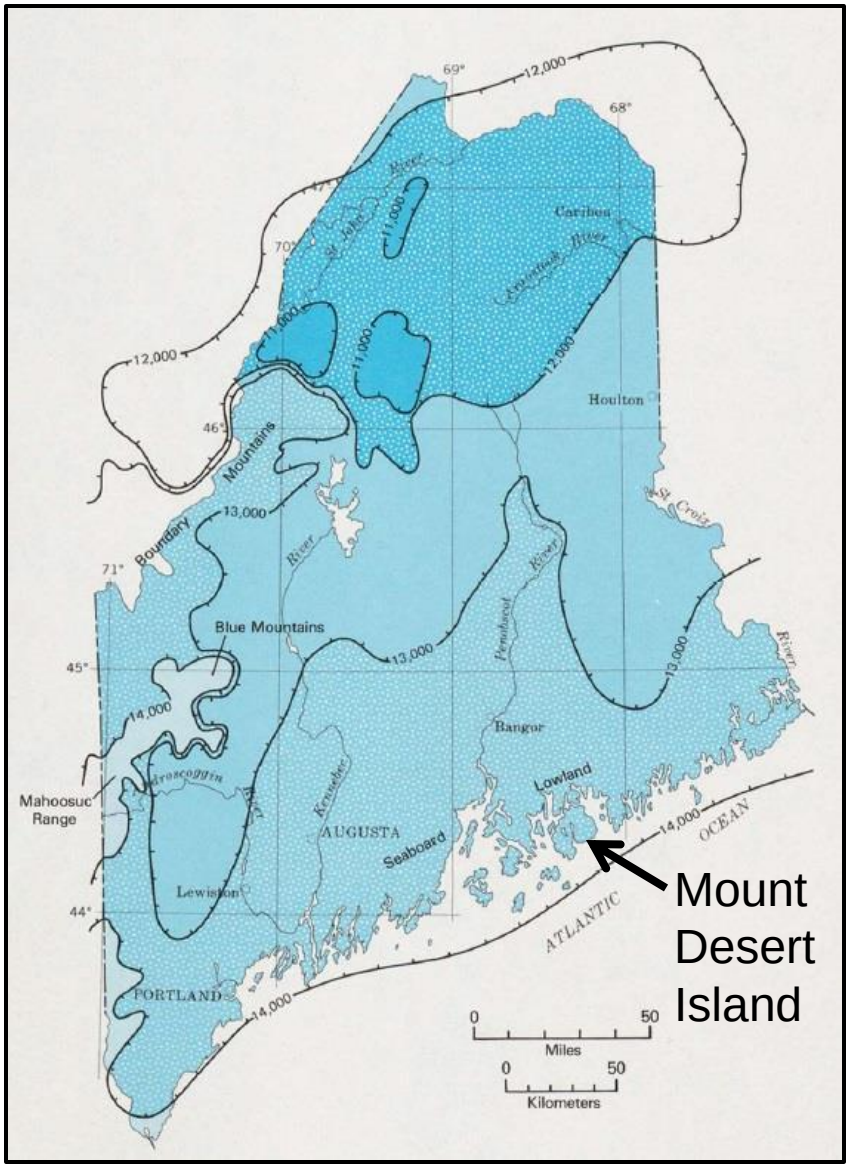


Figure 6. Progress of deglaciation in Maine (Thompson and Borns, 1985).

Glacial Geomorphology

The shape of the Bubbles and many other mountains on Mount Desert Island is an example of a streamlined glacial landform called a roche moutonée, which is a common type of stoss and lee feature. Stoss and lee features display the effects of both glacial abrasion and plucking: abrasion creating a smooth, gentle slope on the stoss (up-ice) side, and plucking creating a rough, steep slope on the lee (down-ice) side.

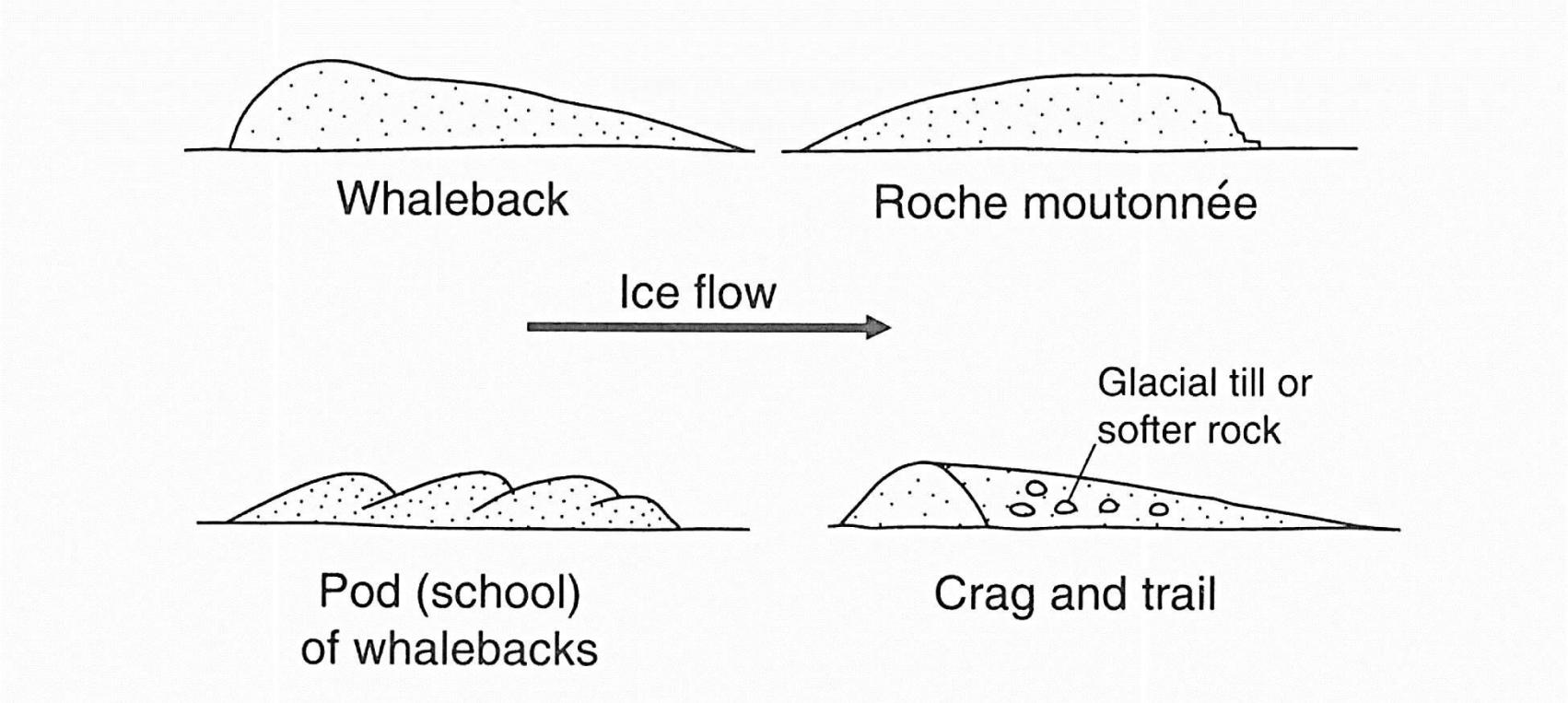


Figure 7. Different types of streamlined erosional features created by glaciers (Bennett and Glasser, 1996).

Glacial Geomorphology

The glacier flowed over Mount Desert Island heading roughly from the north to the south. It rode up the north side of the Bubbles, grinding down the granite bedrock and creating a gentle slope, and removing rock by plucking it from the south side of the mountain, creating a steep cliff.

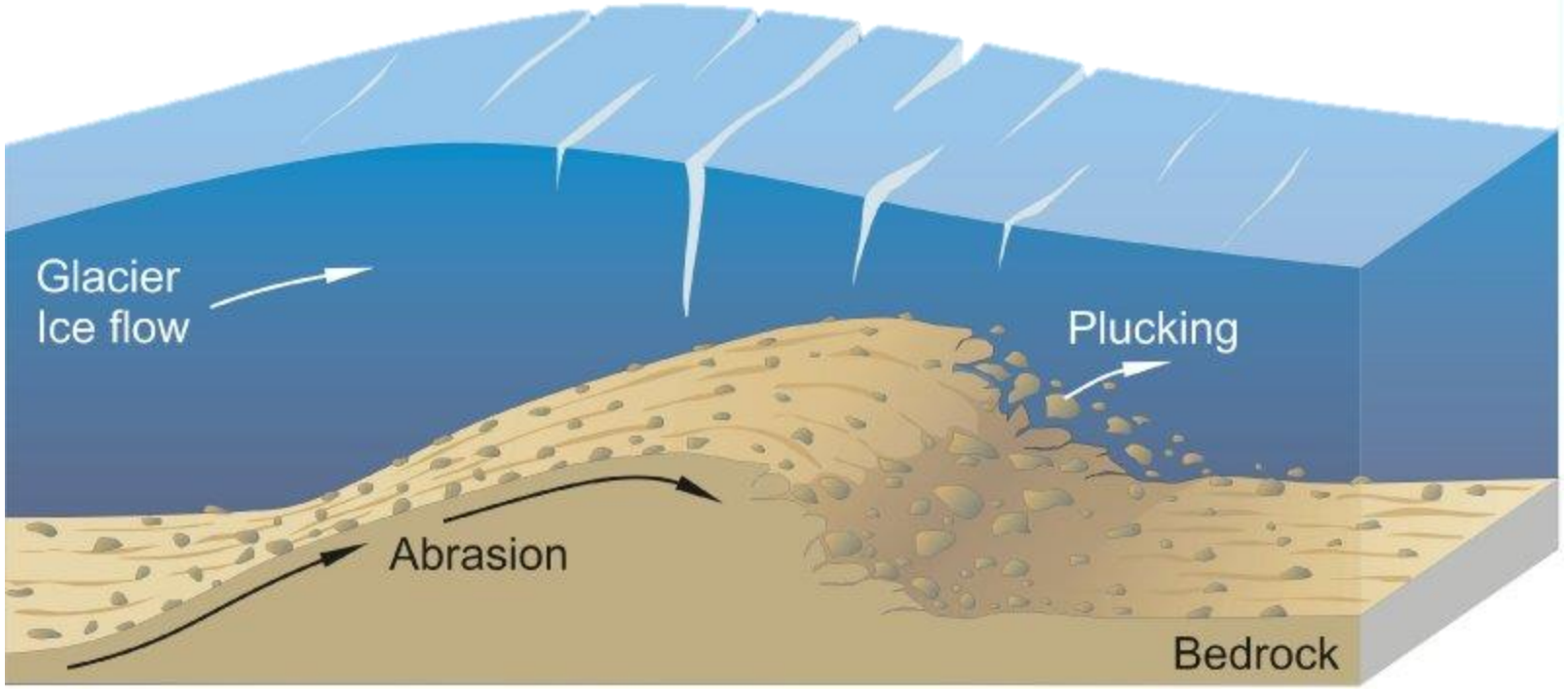


Figure 8. Stylized diagram of a glacier creating a roche moutonée (image from http://www.geo41.com/glacial-environments/).

Glacial Geomorphology

Plucking takes advantage of existing fractures, or joints, in the bedrock. Glacial meltwater can flow into joints and freeze, and the moving ice will carry the block of rock with it.

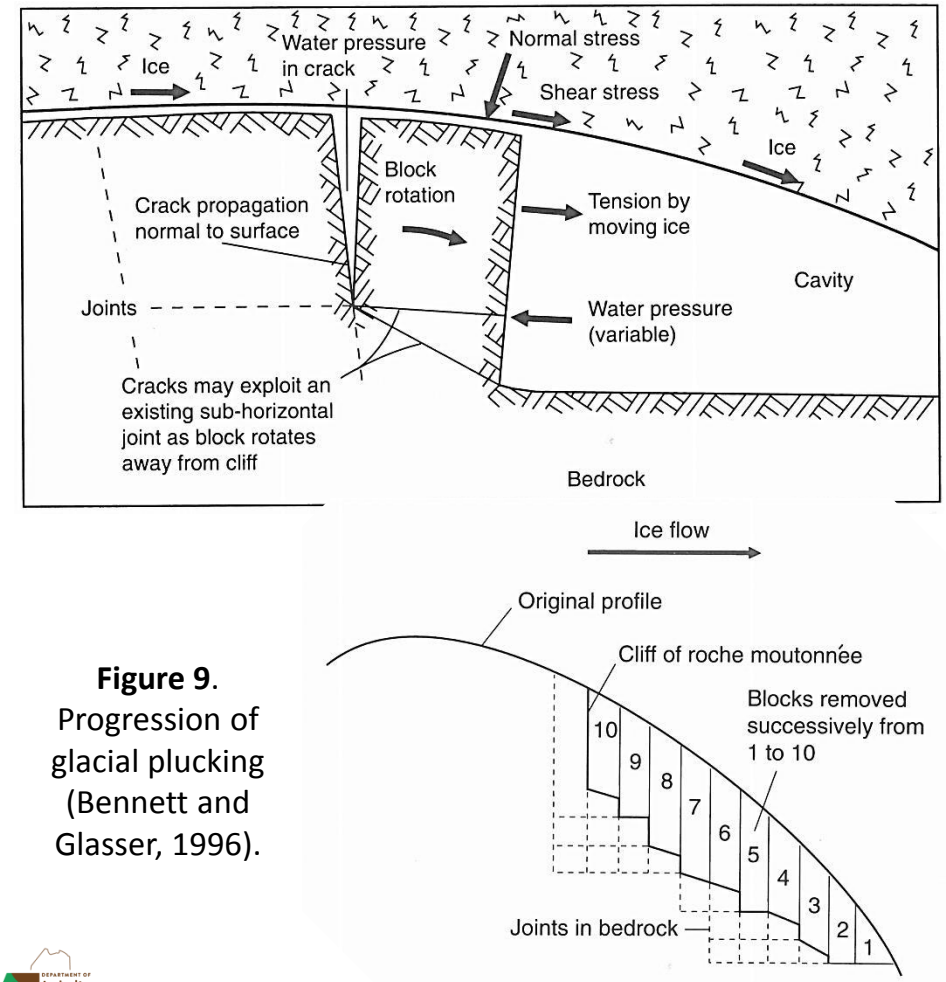


Figure 9. Progression of glacial plucking (Bennett and Glasser, 1996).

Photo by A.T.H. Whittaker .

Figure 10. Author T. Whittaker with weathered joints in the granite on South Bubble.

Glacial Geomorphology

It is not necessary to hike the steep face of the Bubbles to see the effects of plucking. There is a short excursion off the gentle portion of the South Bubble Loop Trail that provides a view of the steep and jagged cliffs on the south face of the North Bubble.

Photo by A.T.H. Whittaker .

Figure 11. View of the steep, plucked south face of North Bubble (looking north from South Bubble Trail).

Bedrock Striations, Till, and Erratics

Along the trail it is possible to observe several other features of formerly glaciated landscapes. Bedrock exposures on the trail have been polished by the movement of ice with entrained sediment, which acts like sandpaper on the rock. Larger pieces of gravel in the ice create faint scratches, called striations, in the rock. These striations can be measured to determine the direction of glacier movement. Orientations of bedrock striations are roughly north-south (Lowell, 1989). Can you see them in the photo below?

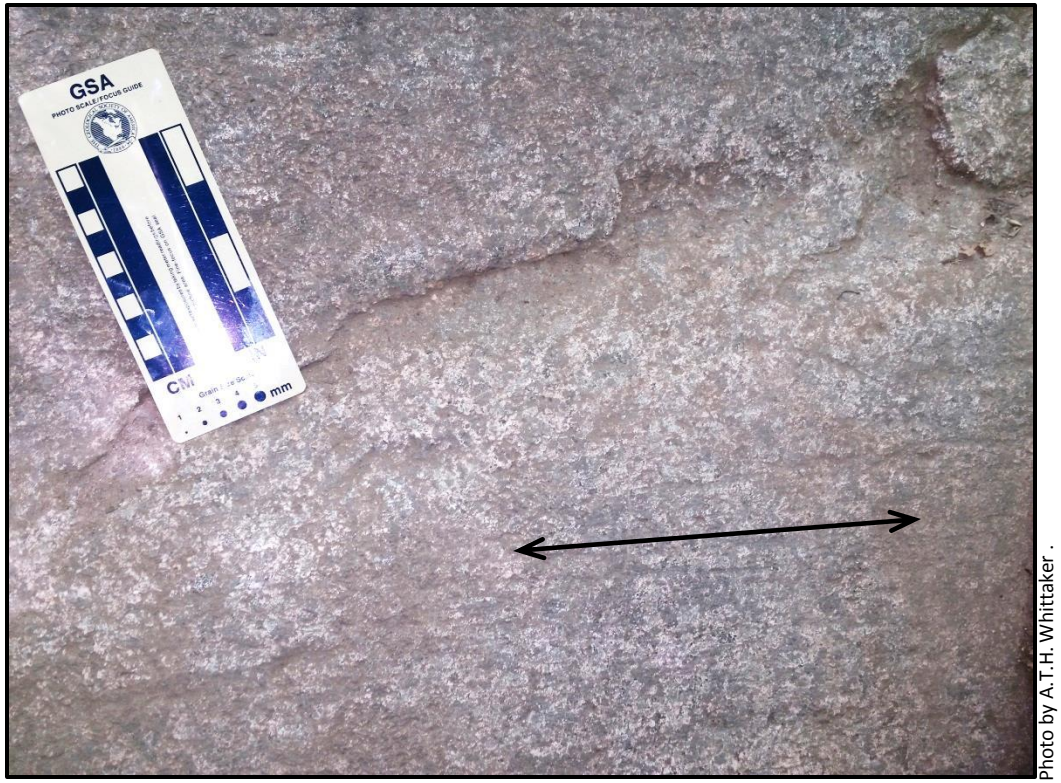


Photo by A.T.H. Whittaker .

Figure 12. Glacial striations on the bedrock on South Bubble.

Bedrock Striations, Till, and Erratics

The ground along the trail is scattered with small boulders of varying shapes and sizes set on a soil made of fine clay and sand. This is till, the debris that was caught in the base of a glacier and deposited on the ground directly from the ice when it melted. Boulders in till are often described as faceted, with rounded edges and flattened sides from grinding against the underlying bedrock while entrained in the ice.

Photo by A.T.H. Whittaker .

Figure 13. Scattered boulders in a till deposit on South Bubble.

Bedrock Striations, Till, and Erratics

Bubble Rock, a large boulder balanced on the shoulder of the South Bubble, is an example of a glacial erratic. It, too, has a faceted shape with rounded edges similar to the smaller boulders strewn along the trail.

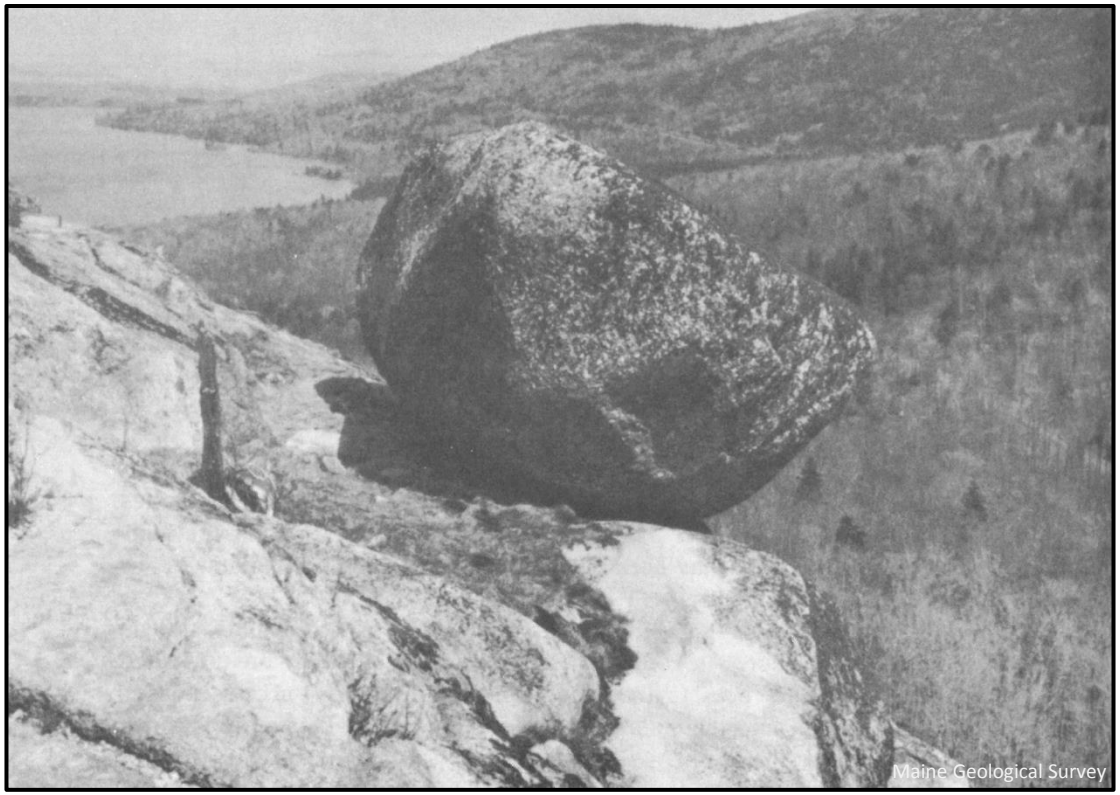


Photo from Chapman, 1970.

Figure 14. Bubble Rock on South Bubble (Chapman, 1970).

Bubble Rock

The Bubble Rock is composed of a gray granite– it is obviously not composed of the pink Cadillac Mountain Granite. This fact, combined with its faceted shape and precarious position, reinforces the interpretation that Bubble Rock is a glacial erratic, carried from somewhere north of the island and deposited when the glacier retreated. Some researchers have suggested that the boulder is made of Lucerne Granite. The image on the left is Bubble Rock; the image on the right is a sample of Lucerne Granite. What do you think?

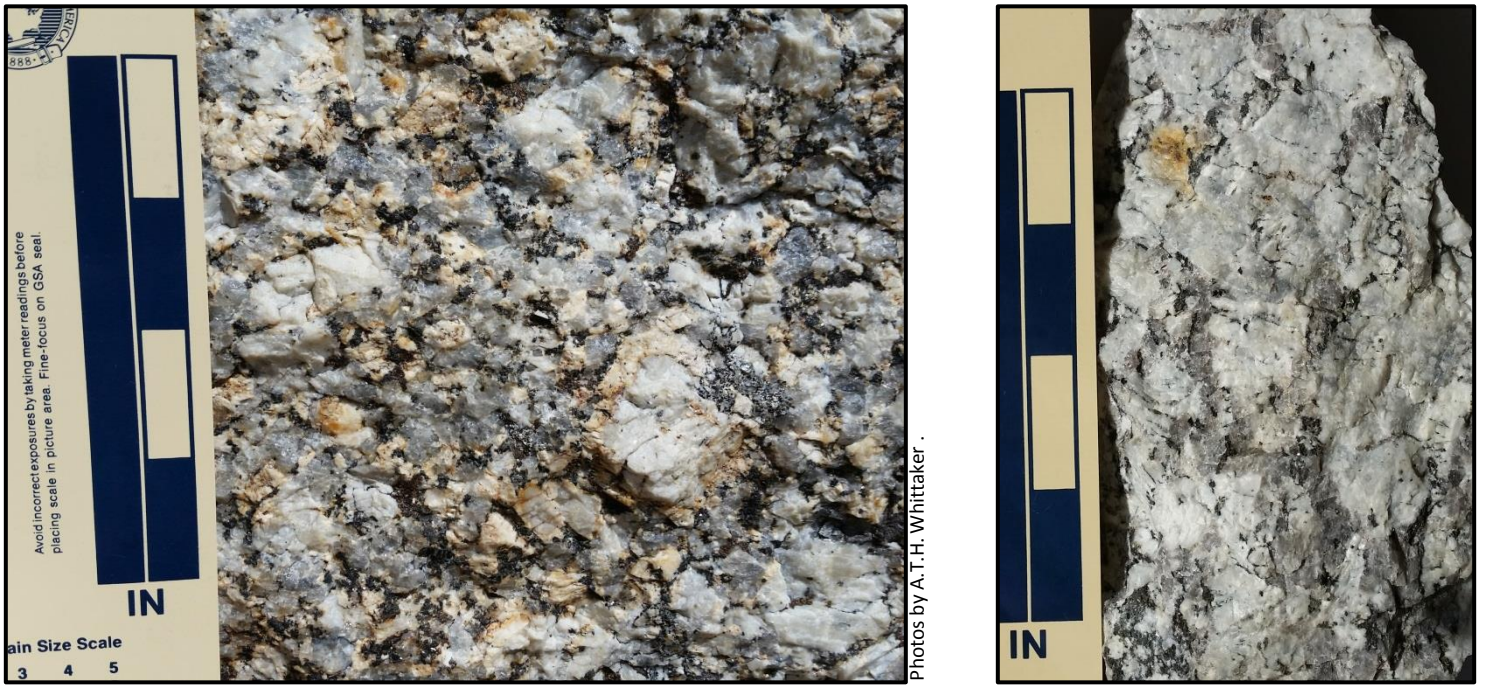


Figure 15. Close up of Bubble Rock (left) and a sample of Lucerne Granite (right).

View From the Summit of South Bubble

Looking south from the summit of South Bubble, over the lee side, the hiker is afforded a view across Jordan Pond. The pond is impounded by a combination of a glacial moraine and a small dam.

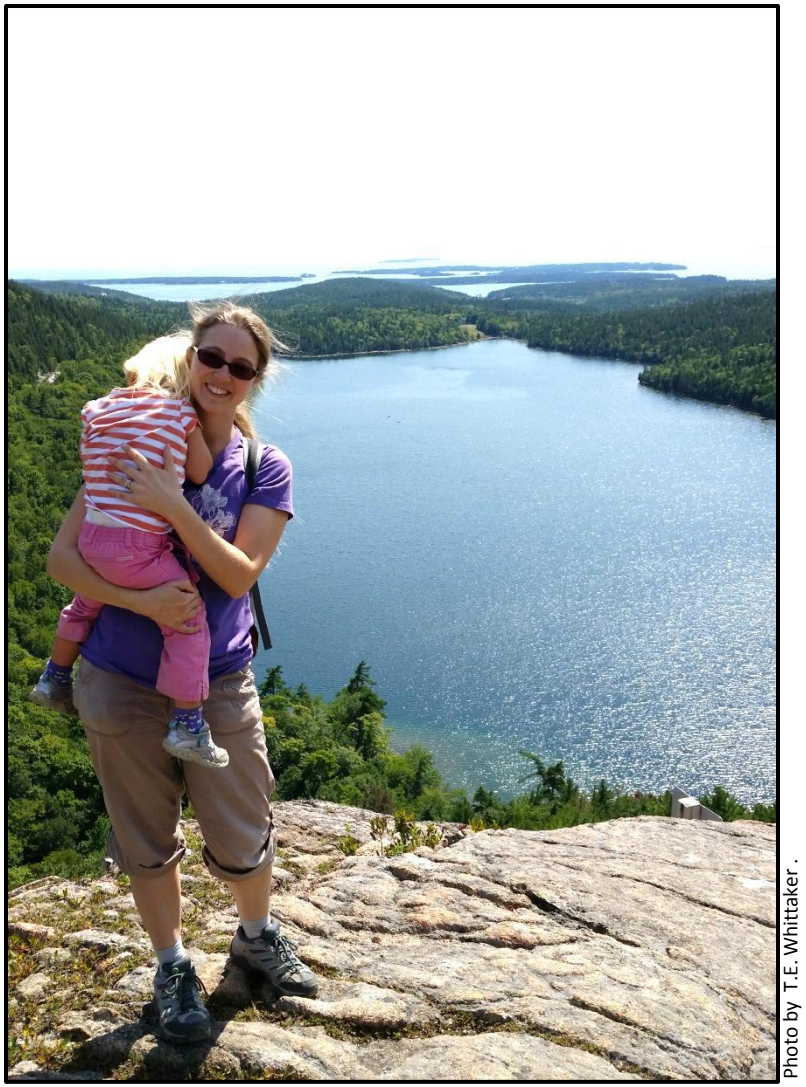


Photo by T.E. Whittaker .

Figure 16. Author A. Whittaker and the view of Jordan Pond (looking south from South Bubble Trail).

Cadillac Mountain Intrusive Complex

The Bubbles are made of the Cadillac Mountain Granite, part of the Cadillac Mountain intrusive complex that dominates Mount Desert Island. The granite has been dated to 419 ± 2 million years by U-Pb analysis of a zircon, a mineral present as small grains in the granite (Seaman and others, 1995).

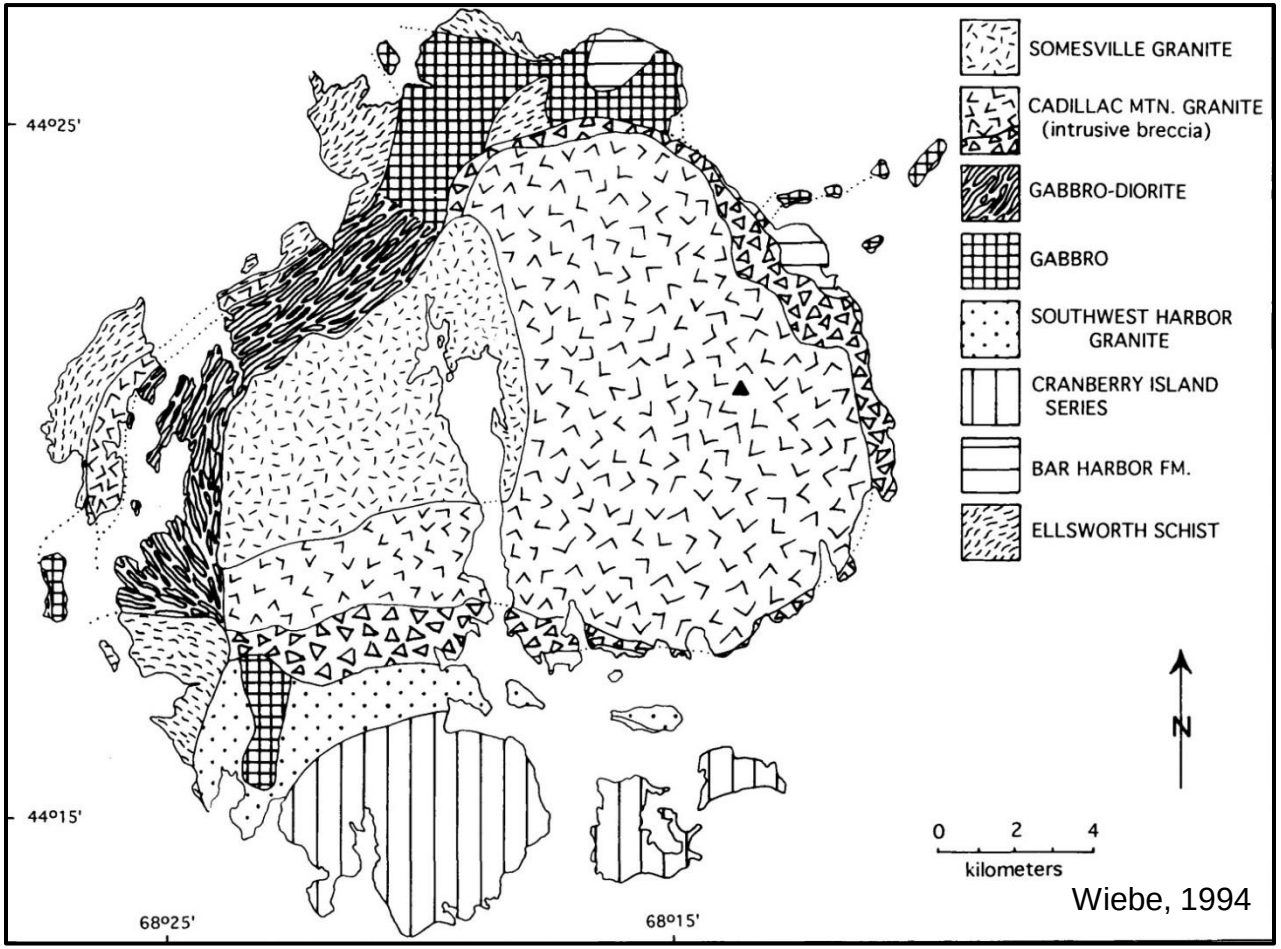
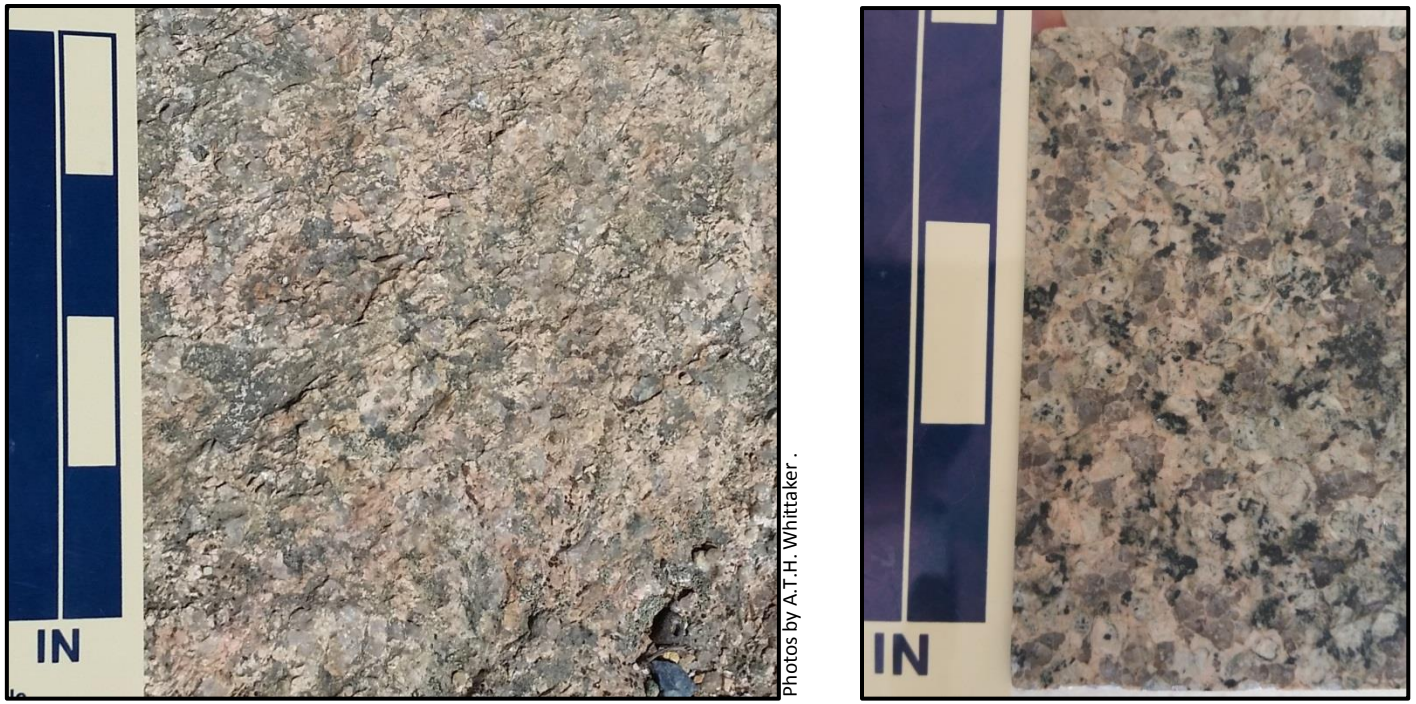


Figure 17. Bedrock map of Mount Desert Island (Wiebe, 1994).

Cadillac Mountain Granite

The Cadillac Mountain Granite is described as a homogeneous, massive, medium- to coarse-grained granite that contains pink or greenish-gray minerals called feldspar, clear and smoky minerals called quartz, and small black minerals called hornblende.



Photos by A.T.H. Whittaker .

Figure 18. Close up of Cadillac Mountain Granite on the South Bubble (left) and a cut and polished sample of the same granite (right).

Volcanic Dikes

The Bubbles are crisscrossed by linear features of darker igneous rocks known as dikes. They can be seen along the trail, and indeed, the trail often follows the dike as an easier route through the smooth granite. The black rock is diabase which contains feldspar, pyroxene, and/or hornblende.

Photo by A.T.H. Whittaker .

Figure 19. Dark-colored dike on the South Bubble Loop Trail.

Website sources:
Bar Harbor Fire: https://www.fireleadership.gov/toolbox/staffride/downloads/lsr7/lsr7_ortho_map.jpg
Forest Trees of Maine: http://maine.gov/dacf/mfs/publications/handbooks_guides/forest_trees/index.html

References:

Bennett, M.R., and Glasser, N.F., 1996, Glacial Geology: ice sheets and landforms: John Wiley & Sons Ltd, 364 p.

Chapman, Carleton A., 1970, The geology of Acadia National Park: Chatham Press, Old Greenwich, Connecticut, 128 p., illustrations (includes geologic sketch map).

Lowell, Thomas V., 1989, Late Wisconsin Glacial Geology of the Eastern Portion of Mount Desert Island, Maine Geological Survey Studies in Maine Geology, v. 6, p. 103-118

Seaman, S. J., Wobus, R. A., Wiebe, R. A., Lubick, N., and Bowring, S. A., 1995, Volcanic expression of bimodal magmatism; the Cranberry Island-Cadillac Mountain complex, coastal Maine: The Journal of Geology, 1995, volume 103, No. 3 (May, 1995), p. 301-311.

Thompson, Woodrow B., and Borns, Harold W., Jr. (editors), 1985, Surficial geologic map of Maine: Maine Geological Survey, 42" x 52" color map, scale 1:500,000.

University of Connecticut, College of Agriculture, Health and Natural Resources, Plant Database, Accessed January 5, 2017. http://www.hort.uconn.edu/plants/detail.php?pid=175

Wiebe, Robert A., 1994, Silicic magma chambers as traps for basaltic magmas; the Cadillac Mountain intrusive complex, Mount Desert Island, Maine: Journal of Geology, v. 102, no. 4, p. 423-437.