Maine Geologic Facts and Localities

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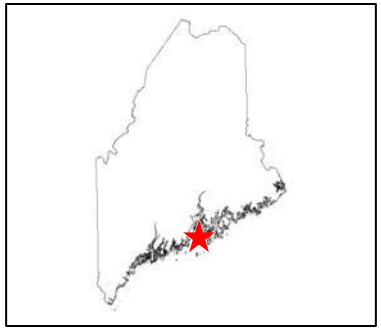
Ancient Volcanic Rocks on Vinalhaven Island, Maine



44° 6‘ 40.19“ N, 68° 53‘ 33.05“ W

Text by
Henry N. Berry, IV
Maine Geological Survey

Introduction

Vinalhaven Island is a large island in Penobscot Bay, 1 hour and 15 minutes by ferry from Rockland. The central and southern parts of Vinalhaven are underlain by a massive body of pink, medium-grained to fine-grained granite. The Vinalhaven granite was quarried in the late 1800's and early 1900's as part of the famous Maine granite industry that provided dimension stone and decorative stonework for large buildings and bridges in Boston, New York, Chicago, and elsewhere. The old quarries are inactive, and Vinalhaven today is a major lobster-fishing town.

Photo by Maine Geological Survey

Bedrock Geology

The geology of the northern part of Vinalhaven, from Middle Mountain to Browns Head, is less famous than the granite but in some ways more interesting. A variety of volcanic rocks give clues to an ancient past when this part of the earth's crust was being formed. Collectively, these rocks have been named the Vinalhaven Rhyolite, after the most common type of volcanic rock there (Figure 1).

Figure 1. Flow-banded rhyolite, a hard, black rock with thin stripes. This photo was taken along North Haven Road north of Middle Mountain, just before the radio tower. This kind of rock extends from the road southward over Middle Mountain. Rhyolite is a volcanic rock that solidifies from a very thick, paste-like lava. As it slowly moves up the volcanic vent, the lava is stretched like taffy to produce the fine streaks and stripes.

Bedrock Geology

Figure 2 shows a volcanic breccia. Notice the angular rock fragments that comprise this rock. Many of the fragments consist of flow-banded rhyolite like the rock shown in Figure 1. Volcanic breccias are formed in explosive volcanic eruptions during which lava and solid rocks of the volcanic vent are blown apart into fragments of different sizes. Some of the rock fragments in Figure 2 are several inches across and are too big too have been thrown very far from the volcanic vent.

Figure 2. Close up view of volcanic breccia.

Bedrock Geology

Figure 3 shows a layered or stratified rock. As in Figure 2, the small fragments consist mainly of rhyolite and other volcanic rock bits. But an important difference is that the rock in Figure 3 has layers in which the fragments have been sorted according to their size. Some layers consist of pebble-sized fragments, while other layers have sand-sized fragments (note lens cap for scale). This sorting indicates that the volcanic debris has been washed down a slope by water and deposited in layers. This type of rock is called a water-laid tuff. These deposits accumulate near active volcanoes, but may have been carried some distance from the volcanic vent.

Photo by Maine Geological Survey

Figure 3. Close up view of a layered or stratified rock.

Bedrock Geology

The rock in Figure 4 also consists of layers of volcanic debris, but one of the layers contains peculiar round balls called accretionary lapilli. Close examination of the outcrop with a magnifying lens reveals that some of these mud balls are internally layered like an onion. It is thought that accretionary lapilli form when an eruption spews a cloud of very finely pulverized dust into the atmosphere. Then, if rain clouds develop, the dust particles become stuck together and grow as they circulate within the cloud, much like a hailstone grows. When the wet mud balls grow big enough, they rain down to the ground, making a layer of mud balls.

Figure 4. Close up view of a layered rock with accretionary lapilli.

Volcanic History

The schematic diagram in Figure 5 shows how the different rocks shown in Figures 1-4 might have formed in a volcanic environment. Flow-banded rhyolite solidifies directly from lava in the volcano. Explosive eruptions produce chunks of rhyolite and other volcanic rocks that land near the vent to form a breccia. As rain or streams wash the debris downslope it is sorted into layered deposits such as tuff. Finely pulverized rock debris may be blown high into the atmosphere only to rain down as accretionary lapilli farther down wind.

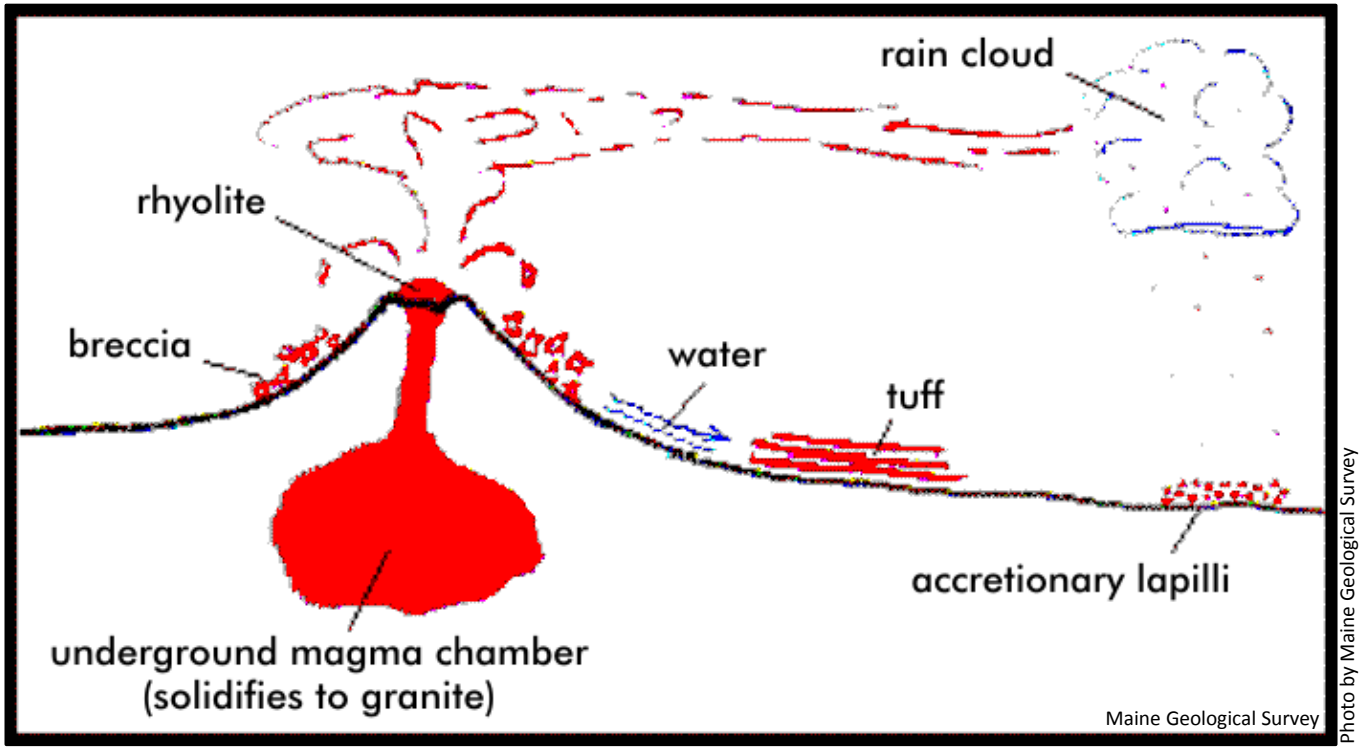


Figure 5. Close up view of a layered rock with accretionary lapilli.

Volcanic History

If such volcanoes really did exist in Maine, they have been long since eroded. All that remain today are clues preserved in the rocks that indicate their volcanic origin.

From the rocks in these photos, we know that this small part of Maine's crust was formed by volcanic activity much like that which occurs today in the Caribbean Antilles or the Aegean Sea of the northern Mediterranean. Unfortunately, the age of the Vinalhaven Rhyolite is difficult to determine, but the best estimate is that it formed in the Silurian Period, more than 420 million years ago.

References and Additional Information

Bedrock Geologic History of Maine