Maine Geologic Facts and Localities
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Pine Hill Serpentinitized Peridotite, Little Deer Isle, Maine

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Introduction

Maine’s scenic mid-coast islands offer the visitor many opportunities to investigate the bedrock foundations of our natural landscape. One such locality is Pine Hill, a small knob rising about 100 feet above its surroundings on Little Deer Isle, now maintained by the Island Heritage Trust. Pine Hill boasts some of the most unique rocks found anywhere in the state, the chemistry of which supports some of the rarest plant species.
Geologic Setting

Little Deer Isle is in eastern Penobscot Bay, a region of bold granite shorelines, contorted metamorphic rocks, and ancient volcanic eruptions. On this map, the areas shown in various brown, red, and orange colors are layered metamorphic rocks, which began as sediment in an ancient ocean anywhere from 700 million to 420 million years ago. The unit shown in light green in much of eastern Penobscot Bay represents a mix of volcanic rocks of various types which erupted on the ocean floor about 500 million years ago. All these units are intruded by younger granites (370 to 420 million years old), shown in blue.

Figure 1. The Penobscot Bay Area of the Bedrock Geologic Map of Maine, 1985.
USGS geologist David Stewart spent much of his career mapping the bedrock geology of the greater Penobscot Bay area. Figure 2 shows a small section of his 1998 report and map summarizing his work. On this map, the Cambrian Castine Volcanics (Cc) are shown in blue and the Cambrian Ellsworth Schist (Ce) is shown in brown. The unusual rocks of Pine Hill are shown as a maroon oval in the center of Little Deer Island. Similar and potentially related rocks on Deer Isle are shown in green. Stewart identified the rock at Pine Hill as peridotite – an unusual rock that has a much lower content of silica (one of the most important components of rocks in the crust) than other igneous rocks. It also has a much higher iron and magnesium content and less calcium than other rocks, imparting a very dark color to the rock, a fact that will be quite evident when you visit the site.

![Figure 2. A portion of the Stewart map showing Little Deer Isle](image-url)
Pine Hill Serpentinitized Peridotite, Little Deer Isle

Directions
From US Route 1 in Orland take Route 15 to Blue Hill. In Blue Hill turn right onto Route 15/172/176. Follow Route 15 across Eggemoggin Reach onto Little Deer Isle and turn left in 0.4 miles onto Lobster Pool Lane. In 0.2 miles turn onto Blastow Cove Rd. The Pine Hill Preserve will be on the right in 0.2 miles.

Figure 3. Location map of the Pine Hill Preserve.
Pine Hill Quarry

Just a few hundred yards along the well-maintained trail from the parking area, Pine Hill rises sharply, its south-facing slope having been quarried away, the material used to fortify the causeway between Little Deer Isle and Deer Isle. There is no need to clamber at the base of the cliff where there is a danger of falling rocks – there are plenty of fallen boulders that offer everything worth seeing.

Figure 4. Photo of Pine Hill from the south.
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Maine Geological Survey

Pine Hill Quarry

Peridotite is an igneous rock that originally crystallized from liquid magma, and is composed mostly of the iron-magnesium silicate mineral olivine. But here due to metamorphic processes (temperature and pressure) and the introduction of water, most of the original olivine has been converted to dark green serpentine. The aligned plates of serpentine impart the waxy sheen to these rock samples.

Earth's mantle is thought to be composed mainly of peridotite. The mystery for geologists is how this mantle rock came to be exposed at the surface. One possibility is that it was brought up as magma from great depth. Or the peridotite at Pine Hill may be a slice of oceanic crust thrust up on the edge of the continent through a collision of the great tectonic plates that constitute the crust. More work is needed to determine which of these processes produced the rock at Pine Hill.

Figure 5. Photos of peridotite boulders at Pine Hill.
Novaculite

Some of the blocks are cut by white veins. These may be veins of novaculite – very fine-grained, dense quartz-rich rock that may have formed from hot mineralized fluids flowing through fractures. Due to its fine-grained and hard characteristics, novaculite makes an excellent whetstone. Novaculite was first reported on Little Deer Isle in 1837 by Charles Thomas Jackson, Maine’s first State Geologist, who described it as “equal in quality with that brought from the Mediterranean, known under the name of Turkey oilstone.”

Figure 6. Photo of novaculite vein.
Rare Plants

Soils produced from the serpentinized peridotite at Pine Hill lack many nutrients required by most plants, particularly calcium, and contain high levels of toxic metals, such as chromium, nickel, and cobalt. Plants adapted for these conditions are rare. More than 70 lichen species occur here, several of which occur at no other localities in Maine. Pine Hill also supports many unusual flowering plants, mosses, and ferns. Please be mindful of these rare plants when exploring this site.

Figure 7. Protected rare plants area at Pine Hill.
References and Additional Information


Pope, N., Harris, T.B., and Rajakaruna, N., 2010, *Vascular plants of adjacent serpentine and granite outcrops on the Deer Isles, Maine, USA*: Rhodora: 105-141. DOI: 10.3119/09-02.1