

Virtual Tour of Maine's Bedrock Geology



Introduction

BEDROCK is the solid, intact part of the earth's crust.

Bedrock underlies the entire State of Maine, though it is commonly buried by surface materials of various thickness.

Maine's bedrock is highly complex and fascinating.

The following photographs show:

- Some places where bedrock is exposed at the surface
- Maine examples of the three basic rock types.
- Aspects of bedrock structure



Bedrock Exposures



The Knife Edge of Mount Katahdin is a breathtaking bedrock exposure.



Bedrock Exposures

Solid bedrock can be found at the Katahdin summit, though many surface blocks have been loosened over time by exposure to weather. The person in the bright yellow shirt is sitting on bedrock in its original position, while the blocks to the left of the summit cairn have been displaced slightly.



Bedrock Exposures



Photo by Robert Johnston

North Traveler Mountain has extensive bedrock exposures on its higher parts, with a cover of glacial deposits, soil, and vegetation at lower elevations.



Bedrock Exposures

Photo by Robert Johnston

Maine Geological Survey

Hikers stand on bare bedrock ledges of the East Peak of Tumbledown Mountain, near Mt. Blue State Park. Bedrock can also be seen protruding in several places from the steep, tree-covered slope of the West Peak, to the right.



Bedrock Exposures



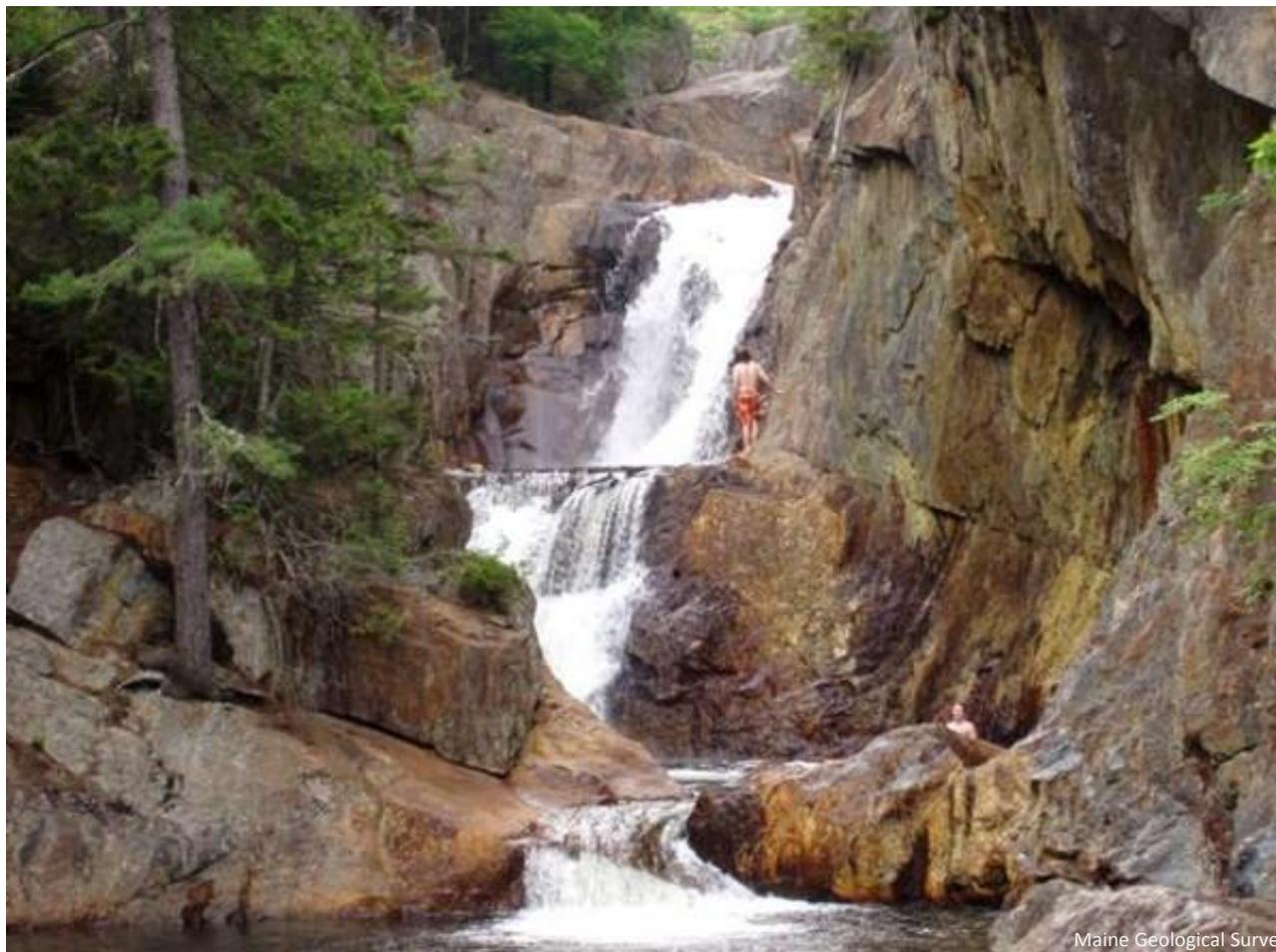
Photo by Henry Berry

Maine Geological Survey

Clean, wave-washed coastal exposures are incomparable for detailed study of bedrock composition and structure. (*Pemaquid Point, Bristol.*)



Bedrock Exposures



Rapids, cascades, and waterfalls occur where streams flow across irregular bedrock surfaces.
(Smalls Falls, Sandy River.)



Bedrock Exposures

The courses of many stream and river valleys in Maine are controlled by the underlying bedrock structure. Here, the stream direction is confined by the steep bedrock wall on the right. (*Pleasant River at Pope Rd., Windham.*)



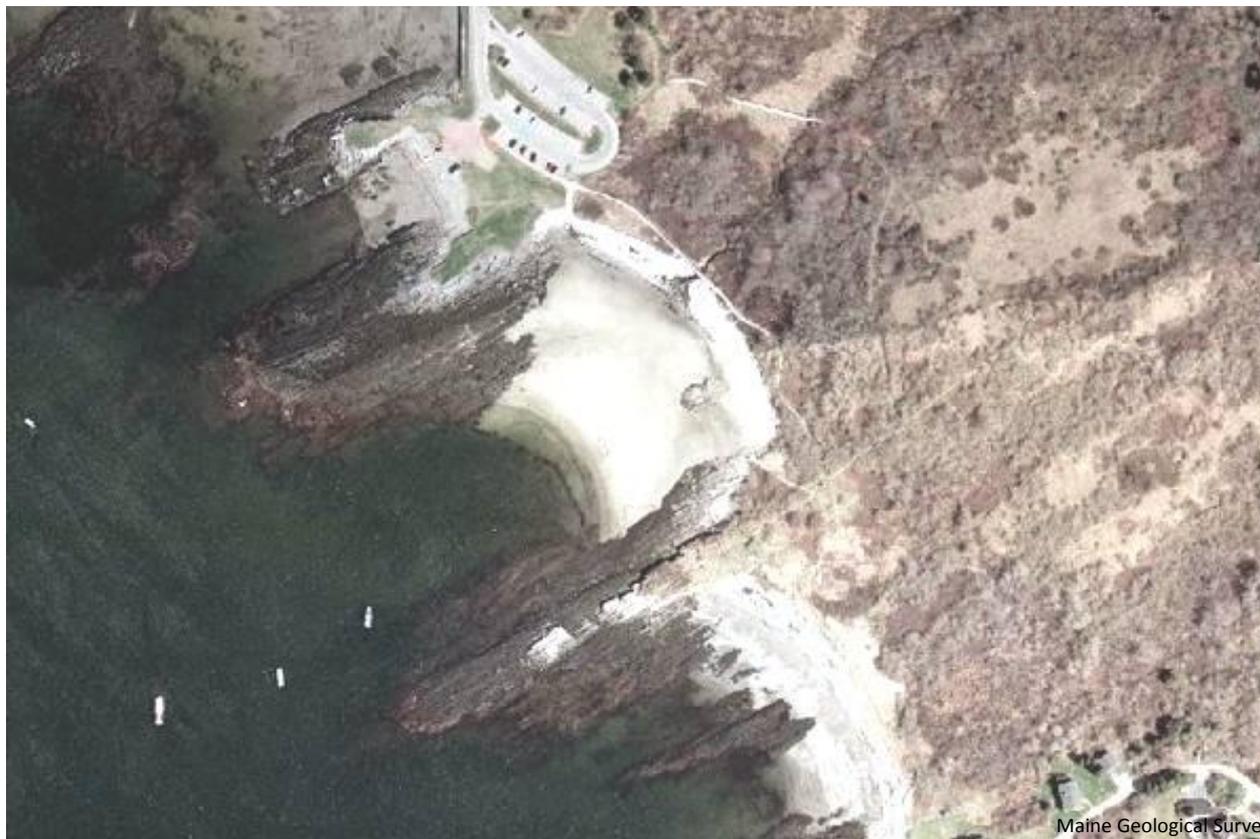
Bedrock Exposures

Photo by Maine Office of Geographic Information Systems, ORTHO_HF

In most of Maine, bedrock is not very far below the ground surface. This aerial photograph shows sand beaches nestled in depressions between bedrock ridges with a northeast trend. Even though the bedrock is exposed to view only where the ocean has washed it clean, the same bedrock ridges continue in the subsurface across the whole area, both out to sea and inland.
(Kettle Cove, Cape Elizabeth.)



Sedimentary Rocks

Photo by Robert Marvinney

Maine Geological Survey

Sedimentary rocks are formed by the accumulation and cementation of mineral grains at the earth's surface. Most sedimentary rocks originally form in the ocean, as thin layers of sand or mud. The rock in this photo shows alternating layers of lighter sandstone and darker mudstone that readily identify it as a sedimentary rock. Sedimentary rocks are common in northern and eastern Maine. *(Below Seboomook Dam, West Branch of the Penobscot River.)*



Sedimentary Rocks

Thin layers of dark shale, and thicker sandstone layers make up this sedimentary rock. The layer through the middle of the photo (with a quarter for scale) contains embedded angular rock fragments that were probably produced in a volcanic eruption.
(Eastport Formation, Quoddy.)



Sedimentary Rocks

Maine Geological Survey

Photo by Henry Berry

These naturally rounded cobblestones were tumbled by water in a fast-moving stream over 300 million years ago. The layers of smooth sandstone above and below accumulated at times of slower current.
(*Perry Formation, Robbinston.*)



Igneous Rocks

Photo by Henry Berry

Igneous rocks form by solidification of molten rock generated at depth in the earth. If the molten rock reaches the surface and explodes in a volcanic eruption, angular fragments of various sizes are produced, and may become welded together as in this volcanic breccia. This particular rock is over 400 million years old. (*Vinalhaven Rhyolite, Vinalhaven*)



Igneous Rocks

Photo by Henry Berry

Maine Geological Survey

When "rivers" of molten lava erupt onto the sea floor, the outer surface of the lava becomes immediately quenched while the inside keeps flowing. The result is a series of lava tubes and blobs (or "pillows") as seen here. These particular rocks are over 500 million years old.
(*Compass Island, Penobscot Bay.*)



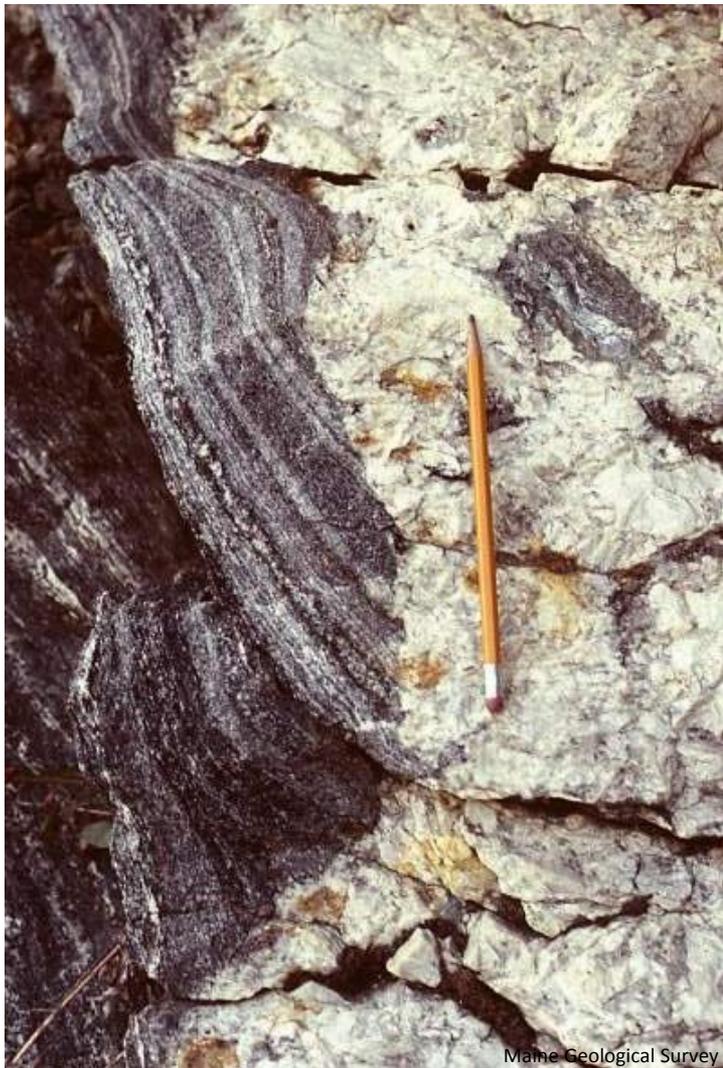
Igneous Rocks

Photo by Henry Berry

Maine Geological Survey

Another class of igneous rocks forms when molten rock solidifies before reaching the surface. These are **intrusive** igneous rocks, as distinguished from the **extrusive**, or volcanic igneous rocks. Intrusive igneous rocks, such as the granite shown here, commonly occur in large, massive, uniform bodies up to several miles across. The fact that we find granite at the earth's surface today requires that a significant thickness of overlying rock has been removed by erosion since the granite formed. (*Spectacle Island, Vinalhaven.*)



Igneous Rocks

Intrusive igneous rocks are younger than the rocks around them, as can be seen in this photograph. When it was still molten, the white, igneous rock cut across the layers in the older, dark gray rock. A fragment of the dark gray rock (to the right of the pencil point) was broken off in the process, and engulfed by the igneous fluid. This particular igneous rock with very large mineral grains is called pegmatite. (*Interstate 295, Richmond.*)

Photo by Henry Berry

Maine Geological Survey



Igneous Rocks

Photo by Henry Berry

Maine Geological Survey

This black rock formed from molten rock that flowed upward through a fracture in pink granite, then solidified in place. The resultant long, thin, vertical sheet of intrusive igneous rock is called a **dike**. A significant thickness of overlying rock must have been removed by erosion. (*Schoodic Point, Acadia National Park.*)



Metamorphic Rocks

Photo by Henry Berry

Maine Geological Survey

Metamorphic rocks have been transformed by heat and pressure beneath the earth's surface, but not to the point of melting. Under these conditions, rocks can bend and flow like putty, as illustrated by the interesting pattern of curved and contorted layers in this marble. (*Lime Island, Penobscot Bay.*)



Metamorphic Rocks

Photo by Henry Berry

Maine Geological Survey

Another characteristic of metamorphic rocks is the growth of new minerals, such as the light-colored andalusite crystals in this dark gray rock. Laboratory experiments have shown that this mineral requires high temperatures to form. (*Mount Megunticook, Camden Hills.*)



Metamorphic Rocks

At sufficiently high temperatures metamorphic rocks begin to melt, producing mixed rocks called **migmatites**. The white patches in this rock are blobs of melt that have solidified, making those patches igneous. But most of the rock, the dark gray part, did not melt and is metamorphic. Such mixed rock, or migmatite, is common in southern and western Maine. (*Douglas Mountain, Saddleback Hills, Sebago.*)



Bedrock Structure

Metamorphic rocks in Maine commonly have a folded internal structure, in which layers are continuously curved without being broken. This can make it difficult to predict the location of bedrock units as they wind their way across the landscape, without referring to a detailed geologic map. (*Rockport Harbor.*)



Bedrock Structure

Photo by Henry Berry

Maine Geological Survey

A common feature of metamorphic rocks is a series of fine, closely-spaced planes called **cleavage**. Cleavage is a secondary fabric which cuts through and distorts the original sedimentary layers. In this photograph, the cleavage is nearly vertical, and the light and dark sedimentary layers are inclined to the left. Cleavage can be the dominant plane of weakness in a rock, along which the rock will break and along which ground water will travel. (*Islesboro, Penobscot Bay.*)



Igneous Rocks

A fault is a broken plane through rock along which the rock has moved. In this example, the upper part of the white layer, near the pen, has moved to the right about six inches with respect to the lower part of the same layer. The thin fault surface would be difficult to detect in uniform gray rock. Faults form when rocks are subjected to geologic pressure under relatively low temperatures so the rocks break rather than bend.

(Owls Head.)

Photo by Henry Berry

Maine Geological Survey



Bedrock Structure

Photo by Henry Berry

Maine Geological Survey

Massive, uniform rocks commonly are broken by long, straight fractures called **joints**. This particular outcrop shows three sets of joint planes, one horizontal set and two vertical sets at approximately right angles to each other. Intersecting joint systems like this are the primary pathway for ground-water movement through crystalline bedrock in Maine. (*Lucerne Granite, Route 1, Orland.*)

