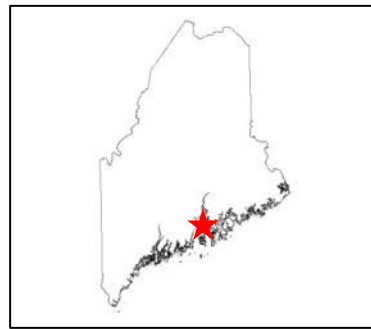


Maine Geologic Facts and Localities

May, 1999

Penobscot Bay 10,000 Years Ago: A submarine canyon was the ancestral Penobscot River valley



44° 11' 11.64" N, 68° 55' 30.08" W

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Introduction

The coast of Maine is ever-changing. Even our primary reference point, sea level, is gradually moving. Though barely perceptible on a human time scale, dramatic changes are happening over geologic time.



Maine Geological Survey

Photo by Maine Geological Survey



The Modern Penobscot Bay

Today, Penobscot Bay is a spectacular and elaborate collection of waterways, coves, and islands. The bay has two main channels: the East and West Passages. These passages connect the Penobscot River to the Gulf of Maine and are divided by several bedrock islands. In the northern part of Penobscot Bay, the island of Islesboro splits the bay in two sections. South and east of Islesboro the bay is divided by North Haven and Vinalhaven Islands. The East Passage is to the east of these two islands and west of Isle au Haut and Deer Isle. The East Passage is shallower than the West Passage.

Southeast of Rockland, through the West Passage, there is a deep canyon on the sea floor. The bathymetry (depth) of the canyon is shown on conventional nautical charts and also on preliminary [bathymetric maps](#) by the National Ocean Service. This canyon is over 500 feet (150 meters) deep at one spot between Owls Head and Vinalhaven Island. The Maine Geological Survey has included the preliminary bathymetry on Geologic Map No. 96-10 of the [Surficial Geology of the Maine Inner Continental Shelf](#), Boothbay Harbor to North Haven, Maine.

As part of the [Penobscot Bay Project](#), Dr. Chris Elvidge and others at the National Oceanic and Atmospheric Administration's [National Geophysical Data Center](#) generated a combined bathymetric and topographic map of the region (using a 3 arc-second grid or 90 m horizontal resolution).



The Modern Penobscot Bay

A portion of this map (Figure 1) shows the canyon at the mouth of the West Passage. There are two arms to the canyon. The deeper and longer canyon extends to the southeast of Owls Head (the peninsula east of Rockland) and south of Vinalhaven Island.

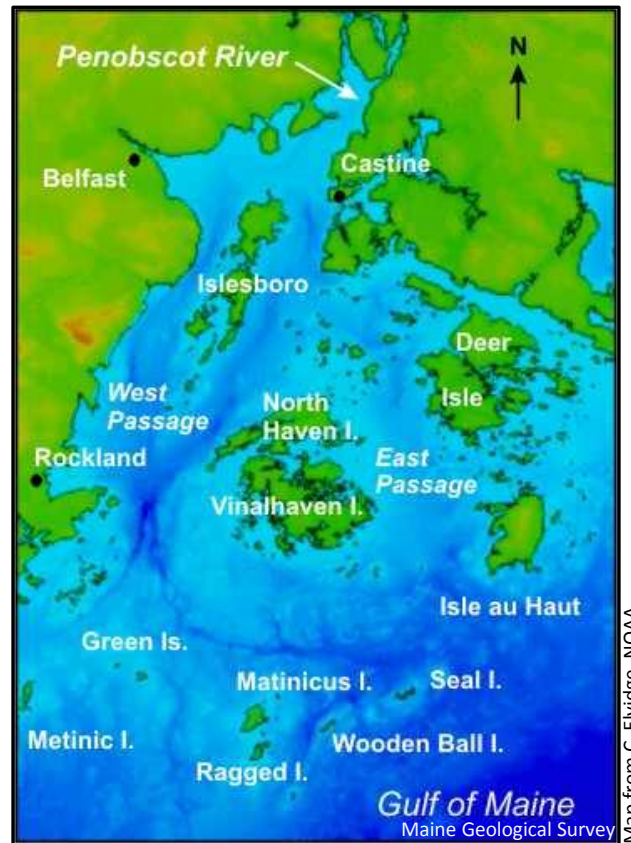


Figure 1. Map of Penobscot Bay.



The Paleogeography of Penobscot Bay

The last ice age had a profound effect on the coast of Maine. At its maximum extent about 20,000 years ago, the ice covered all of New England and most of the Gulf of Maine. Under the weight of the ice the earth's crust sank down into the mantle. Isostatic uplift of the coast occurred as the great ice sheet melted. Upward motion of the land resulted in a relative fall of sea level along Maine's coast. Several studies have suggested that sea level fell as far as about 180 feet (55 m) below its present level between about 11,000 and 10,000 ^{14}C years ago (Barnhardt et al., 1995). Coincidentally, this marks the beginning of the Holocene epoch of geologic time, the current interglacial period of earth history. During the low stand of sea level the coast would have had a very different shoreline shape and coastal geography (paleogeography).

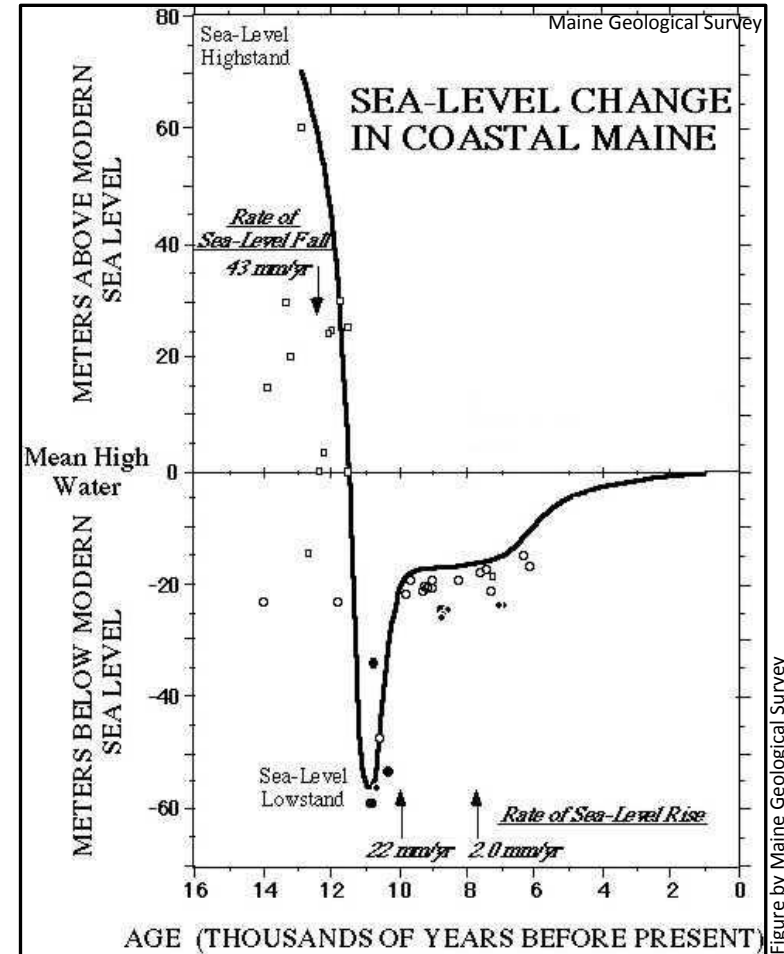


Figure by Maine Geological Survey

Figure 2. Graph of sea level change over time in coastal Maine.



The Paleogeography of Penobscot Bay

To illustrate the extreme difference in appearance of Penobscot Bay at the beginning of the Holocene, the bathymetric data were used to trace a generalized shoreline at a time when sea level was 165 ft (50 m) lower than it is today (Figure 3).

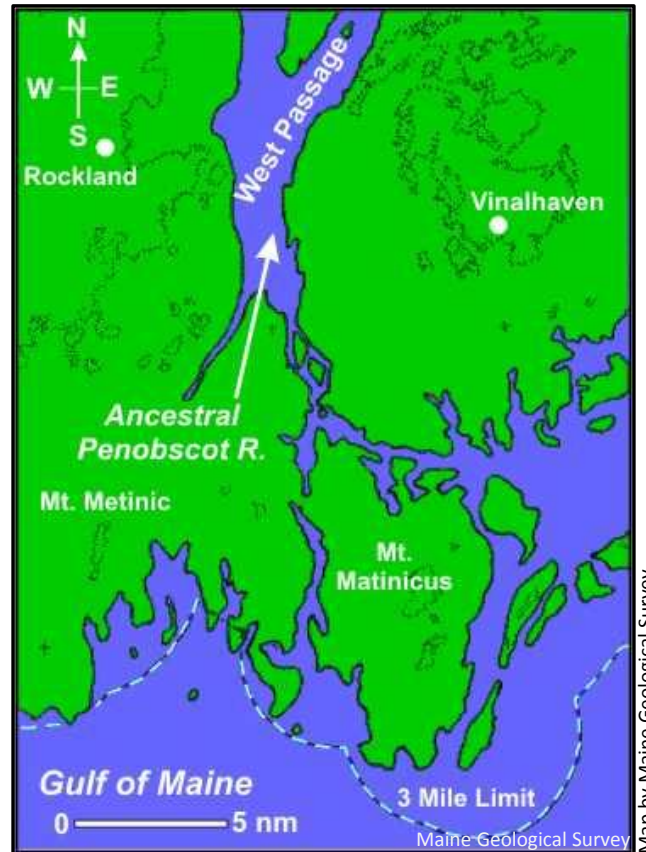


Figure 3. Generalized shoreline with sea level 165 feet lower than present.



The Paleogeography of Penobscot Bay

This reconstruction of the former coastline shows the importance of the deep canyon in the West Passage. This canyon served as the channel of the Penobscot River in the early Holocene. In fact, the river consisted of a large bay east of Rockland and then a narrow gorge-like channel that curved east to enter the ocean at a location about seven nautical miles (nm; 1 nm is 1.15 statute miles or 1.85 km) south of the modern-day town of Vinalhaven.

In the early Holocene, Matinicus Island was part of the mainland. Back then, the "island" would have been a mountain top, "Mt. Matinicus." Other peaks would include Mt. Ragged, Mt. Metinic, and the Large and Little Green "Peaks." Vinalhaven and North Haven Islands would have been joined and part of a mainland peninsula extending south all the way from Castine and Cape Rosier. About 10 nautical miles upstream of the ancestral Penobscot River mouth there was a large, protected bay just east of Rockland. This bay was probably estuarine and mixed by tidal currents, much like the modern Great Bay near Portsmouth, New Hampshire. The bay was about 10 nautical miles long from north to south and some 3 to 4 nautical miles wide. The present Rockland Harbor waterfront was about 2.5 nautical miles inland from the bay.

This paleogeographic reconstruction of the early Holocene Penobscot Bay is just an example to illustrate how very different the coast of Maine was 10,000 years ago, during the Paleoindian period. As the Gulf of Maine continues to rise, the sea will transgress over the mainland and slowly, but surely, continue to change the shape of the Maine coast in years to come.



Additional Links

More on the [history of changing sea level](#)

[Sea-Level Trends Today](#)

An overview of the [Penobscot Bay Marine Resource Collaborative](#)

[Nautical Charts](#)

[Metric Bathymetric Maps](#) from the National Ocean Service

[NOAA/National Geophysical Data Center](#)



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