

Maine Geologic Facts and Localities
October, 2000

***A General Introduction to the Presumpscot Formation
Maine's "Blue Clay"***



Text by
Thomas K. Weddle
Maine Geological Survey



Introduction

During the end of the last Ice Age, when the great ice sheet was melting, its margin had reached the present coast of Maine about 16,000 years ago. The mass of ice had caused the earth's crust to bend downward, and as the ice margin retreated, the ocean flooded the downwarped areas when they became ice free. Into this glacial-marine environment, glacial streams deposited great quantities of sediment ranging in size from coarse to fine materials. The fine particles such as fine sand, silt, and clay were deposited as a blanket of mud away from and over the coarser materials. This glacial-marine mud is ubiquitous in the region that was flooded, and is called the Presumpscot Formation, named for exposures along the Presumpscot River in Portland ([Generalized Surficial Geologic Map of Maine, PDF format](#)).



Figure 1. Presumpscot Formation overlying till (contact at hammer handle) over bedrock, Carrying Place Cove, Lubec.

Presumpscot Formation

This unit is well known to people who live along the coast or in inland lowlying areas. Anyone who has had to dig through it has found it can be a sticky mess! Water-well drillers have reported thicknesses of the mud as great as 200 feet. More commonly it is a veneer or drape over bedrock or glacial sediments of varying thickness (Figures 1 - 3).



Figure 2. Presumpscot Formation, road cut on Route 9, Chelsea.

Presumpscot Formation



Figure 3. Presumpscot Formation overlying coarse glacial sediment (on flanks of exposure).

Composition of the Presumpscot Formation

The Presumpscot Formation is generally called "blue clay" by the public, but its color is usually gray (Figures 4 - 6), and its composition is more often dominated by silt-sized particles rather than clay-sized ones.



Figure 4. "Blue clay" (Presumpscot Formation) in sharp contact with overlying nearshore deposits; Knight Pit, Pownal.

Composition of the Presumpscot Formation

It contains the ground-up fragments of minerals that make up the bedrock of Maine, such as quartz, feldspar, and mica, but in very tiny pieces.



Figure 5. Construction site in Gardiner showing exposure of oxidized and non-oxidized clay.

Composition of the Presumpscot Formation



Photo by Maine Geological Survey

Figure 6. Maine "blue clay" (Presumpscot Formation) in sharp contact with overlying nearshore deposits; excavation at Route 196 bypass construction, Topsham.



Layering in the Presumpscot Formation

Often it appears to be massive, but on closer inspection it does have layering (Figures 7 - 10). This layering is the result of plumes of sediment emanating from the ice margin over time and the fine particles settling onto the ocean bottom.



Figure 7. Massive Presumpscot Formation (site unknown).

Layering in the Presumpscot Formation

The length of time it takes to form one of these layers is not clear. Do they represent daily or yearly discharge of sediment from the glacier, or do they represent tidal variations, or significant individual discharge events?



Photo by W.B. Thompson

Maine Geological Survey

Figure 8. Layered Presumpscot Formation, Bunganuc Point, Brunswick.

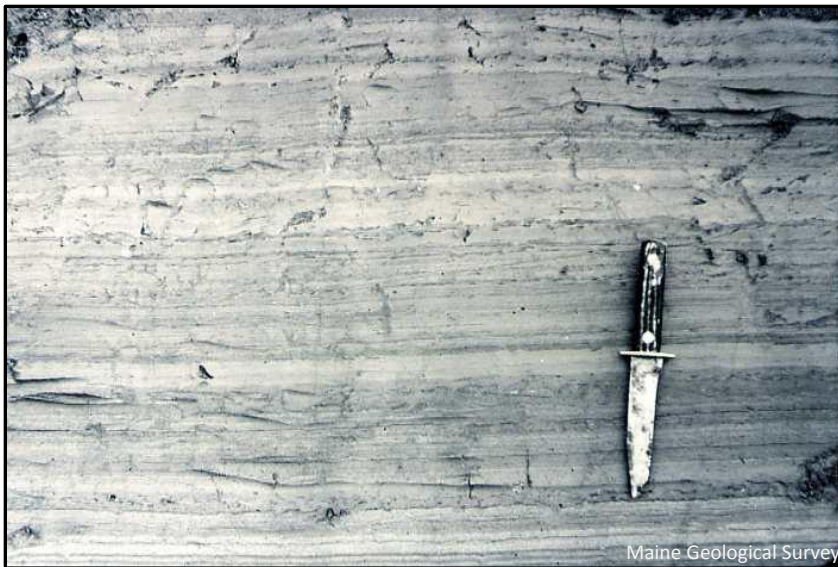


Layering in the Presumpscot Formation

Geologists have studied similar glacial-marine deposits elsewhere in the world and have found microscopic layering within the thicker layered units representing daily deposits during diurnal cycles. No studies like these have been done on the Presumpscot Formation.



Figure 9. Well-bedded Presumpscot Formation, Sabattus River Valley, Sabattus.

Layering in the Presumpscot Formation

Photos by M.J. Retelle



Figure 10. Photos from Bisson Pit, Topsham. (Left) Thinly-bedded Presumpscot Formation with interbedded sand (note dropstone above knife handle). (Right) Thick clay beds separated by thin silt beds (note dropstone in middle silt layer).

Layering in the Presumpscot Formation

In places, fine sediments associated with nearshore environments have layering that appears cyclic, and may be associated with tidal or seasonal changes (Figure 11), but these details have yet to be proven.



Figure 11. Distal beds of the Sabbathday Pond delta, New Gloucester. The interbedded fine-grained deposits are fine sand and silt layers, the dark (silt) and light (sand) layers represent cyclical deposition, possibly daily tidal cycles.

Fossils in the Presumpscot Formation

Fossils of marine organisms have been found in the Presumpscot Formation (Figure 12 - 15). Most commonly found are [invertebrate shells](#) such as clams and mussels, snails, and barnacles. However, fish and mammal remains have been found as well, including a walrus and even a mammoth that was washed into the ocean after it had died (these bones are on display in the Maine State Museum).



Photo by W. A. Anderson

Figure 12. Fossil shells in the Presumpscot Formation from an unknown site; *Mya arenaria* ("steamer" clam) and *Mytilus edulis* (blue mussel).



Fossils in the Presumpscot Formation

An account of all species found in the Presumpscot Formation has not been compiled. There are many areas of geological interest pertinent to the Presumpscot Formation which have yet to be fully understood, including the above, as well as exactly when it was deposited.



Photo by Maine Geological Survey

Figure 13. Fossil shells in the Presumpscot Formation; *Hiatella arctica*, Whorff Pit, Topsham.

Fossils in the Presumpscot Formation

Radiocarbon age-analyses on these shells give a range of about 15,000 to 11,000 years before present, but because of the potential for contamination by "old" carbon in the seawater from which the organisms made their shells, there can be as much as 600 to 1500 years discrepancy between radiocarbon ages determined from marine shell fossils and terrestrial organism fossils assumed to be the same age.



Photo by Maine Geological Survey

Figure 14. Fossil shells in the Presumpscot Formation; barnacles on dropstone, Blackstone Pit, Pownal.



Fossils in the Presumpscot Formation



Photo by Maine Geological Survey

Figure 15. Fossil shells in the Presumpscot Formation; gastropods, site unknown.



Economic Uses

Economically, the glacial-marine mud was used for making bricks for many years, its legacy noted by names such as Brickyard Hill and Brickyard Cove. It was undoubtedly used by Native Americans for making their clay pottery, and by early Maine settlers and later industry for ceramic products including the earthenware known as Maine Redware. It is used today by some local potters and artisans for decorative pieces, many of whom are listed on-line. Today, its most common use is as an impermeable fill to cap landfills or other hazardous-waste sites.

