Geologic Site of the Month

June, 2000

Jasper Beach, Machiasport, Maine

44° 38′ 30.28″ N, 67° 22′ 31.96″ W

Text by
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Introduction

Jasper Beach is located in Howard Cove, Machiasport, just west of Machias Bay (Figure 1). It is a dominantly gravel beach, about 800 m long, and oriented East-West (Timson, 1981). Bedrock frames Howard Cove, making Jasper a pocket beach. It is also a barrier spit that originates at an eroding bluff of glacial material on the west and terminates at a tidal inlet on the east.

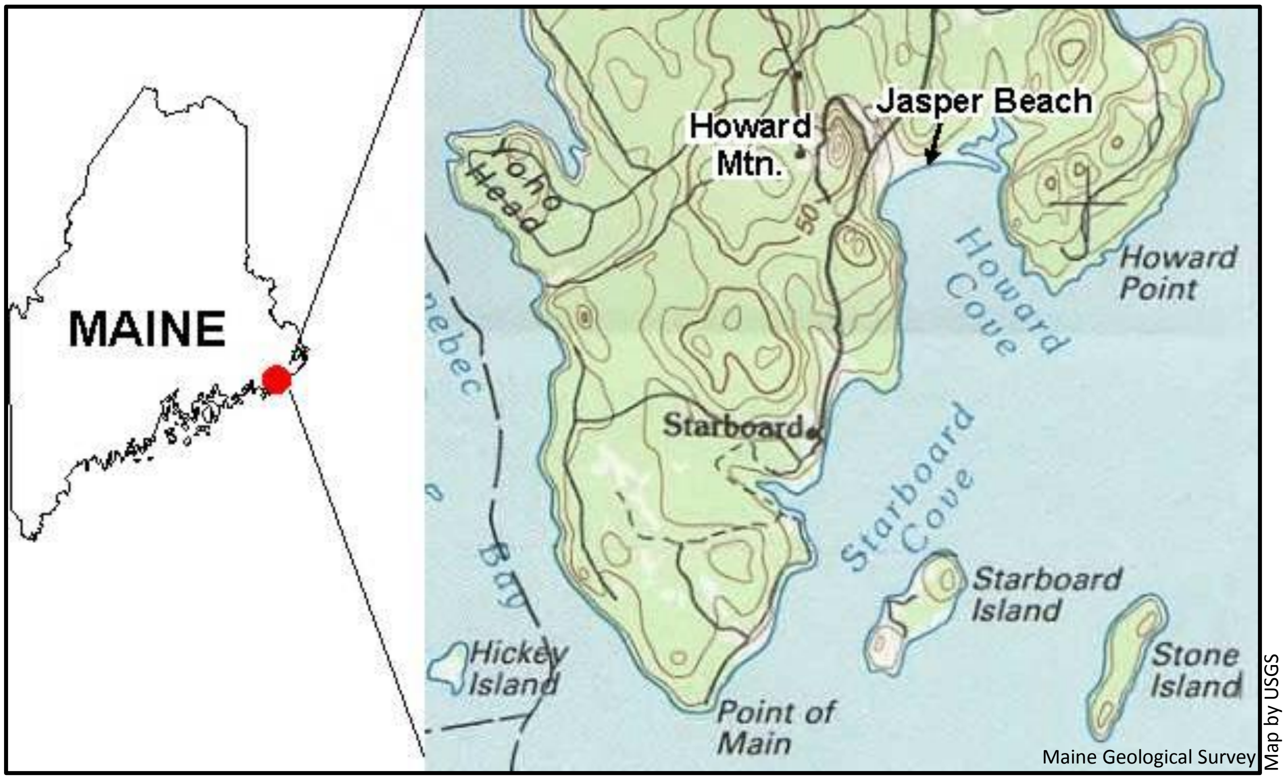

Figure 1. Location map of Jasper Beach.

Jasper Beach

In addition to the bluff, the beach is backed by fresh and saltwater lagoons and a salt marsh (Figure 2). Jasper Beach is operated as a Town Park by Machiasport and is located on Rt. 92, beneath the abandoned Distant Early Warning Station radar facility on Howard Mountain. Limited parking space is provided.

Photo by Joe Kelley

Figure 2. Jasper Beach backed by fresh and saltwater lagoons and a salt marsh.

Bedrock Geology

The local bedrock is a complicated mix of volcanic rocks within the Eastport (Osberg et al., 1985) or Leighton Formations (Gates and Moench, 1981). The rocks are highly fractured and easily eroded by waves. At the eastern end of the beach, several sea caves and sea arches have formed in the bedrock and collapsed in the past 15 years.

Although Jasper Beach is named after the red volcanic stone that is common on the beach, that rock is not truly jasper. Jasper is a form of silica that is enriched in iron, whereas the red stone on Jasper Beach is a fine-grained volcanic rock called rhyolite. Its attractive appearance is also due to the polished surface formed by constant abrasion against sand grains.

Glacial deposits cover much of the area surrounding Jasper Beach. Till underlies the beach and crops out on the landward side of the lagoon (Thompson and Borns, 1985).

The Bluff

The 10 m high bluff on the western end of the beach is a stratified sand and gravel deposit that is apparently glacial-fluvial outwash (Figure 3). Clasts within the deposit are mostly volcanic rocks with assorted quartzites and granitic clasts. Although local bedrock is eroding, the bluff appears to supply most new sediment for the beach. Boulder and cobble-size clasts are common here, and beach sediment becomes finer grained away from the bluff because of either selective longshore transport of smaller clasts or because of clast abrasion and comminution toward the east. At the eastern end of the beach, well-sorted, coarse sand is common.

Photo by Joe Kelley

Figure 3. The 10 m high bluff on the western end of the beach is a stratified sand and gravel deposit.

Beach Features

Several steps, or storm berms, are typically visible at low tide on the beach (Figure 4). These are complex erosional and depositional features formed during storms when water level is elevated above its average position. Cusps, or regularly spaced curved indentations in the beach, are common along all of the berms, although the spacing between cusps is different at different heights.

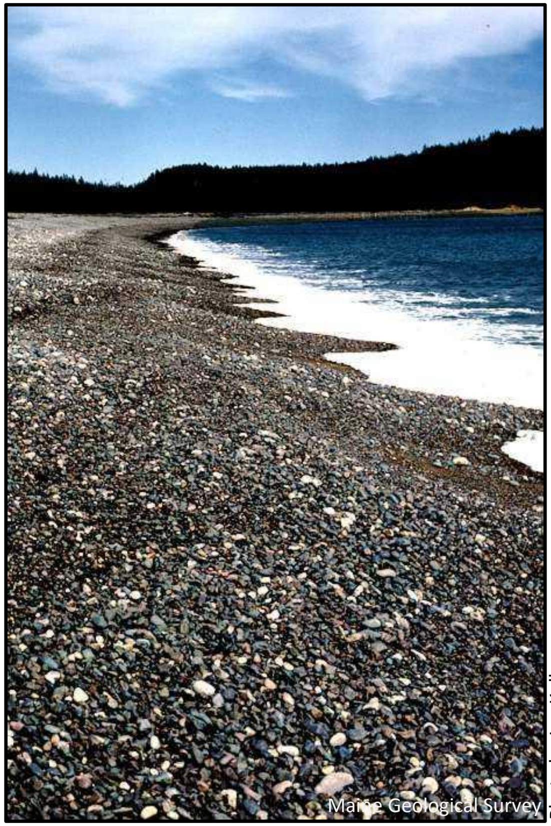

Photo by Joe Kelley

Figure 4. Several steps, or storm berms, are typically visible at low tide on the beach.

Beach Features

The size and shape of the beach sediment becomes generally finer grained from the highest storm berm to the low-tide line. Within cusps there are also changes in the size and shape of clasts. Large, disc-shaped stones collect on the top of the cusp while better rounded, "rollers" tumble to the bottom of the cusp (Figure 5). The disc-shaped clasts are of volcanic rock while the rounder stones are granites and quartzites.

Photo by Joe Kelley

Figure 5. Large, disc-shaped stones collect on the top of the cusp while better rounded, "rollers" tumble to the bottom.

Dunes

About halfway down the beach from the eroding bluff, the size of the upper beach sediment becomes fine-grained enough to trap sufficient water for dune plants to survive (Figure 6). The dunes here are not like "sand" dunes in southern Maine because most of the sediment is brought to the top of the beach by storm waves, not by the wind. Large logs are also commonly found in the dune area. American Beach Grass (*Ammophila breviligulata*), the common dune plant in southern Maine, is observed here, but Beach Pea (*Lathrus japonicus*) is unusually abundant.

Photo by Joe Kelley

Figure 6. Aerial photo of the dune.

Deltas

At the eastern end of the beach, large flood and ebb-tidal deltas occur on the ocean and lagoon sides of the tidal inlet, respectively (Figure 7). These form in response to deposition of sediment as tidal currents slow upon entering the ocean on ebb tides and the lagoon on flood tides. Waves also influence the ebb tidal delta, and wave-formed swash bars are usually visible at low tide. These are driven onto the beach by waves over a period of months. It is interesting to observe that at low tide, the tidal inlet water disappears into the coarse sand of the tidal delta.

Photo by Joe Kelley

Figure 7. Eastern end of the beach. Large flood and ebb-tidal deltas occur on the ocean and lagoon sides of the tidal inlet, respectively.

Beach Migration

As sea-level has risen during the past few thousand years, Jasper Beach has been driven more and more into Howard Cove. Evidence for the landward migration of the beach is seen in the burial of shrubs and trees by beach sediment on the landward side of the beach. At low tide, on the seaward side of the beach, preserved terrestrial environments emerge from burial by the beach for millennia (Figure 8). Here, remnants of beach gravel lie above salt marsh peat and a forest rooted in glacial till.

Photo by Joe Kelley

Figure 8. Remnants of beach gravel lie above salt marsh peat and a forest rooted in glacial till.

Beach Migration

The dense nature of the salt marsh peat is a mark of how heavy the weight of the beach was as it passed over this former wetland. Cores through the salt marsh and lagoon (Figure 9) allow us to depict a cross section of the overall geology of the beach. Till provides a foundation for the marine deposits, and is slowly being drowned on the landward side of the lagoon by salt marsh. The marsh exists at mean high water today and rises several millimeters per year in response to sea-level rise. The lagoon is slowly rising over the marsh peats and is, in turn, being overridden by the landward-migrating beach. Radiocarbon dates from the bottoms of cores in these environments demonstrate that thousands of years are required for the beach to move landward. Based on this, we might estimate that the material cropping out today on the beach is considerably more than 4,000 years old.

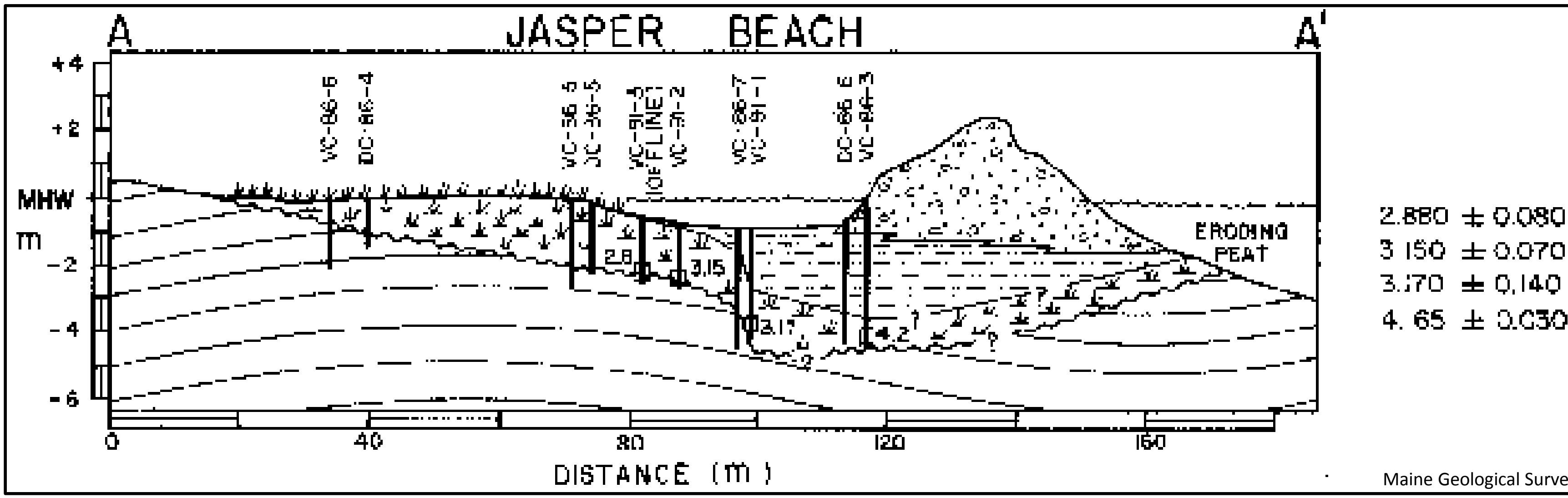

Figure by Joe Kelley

Figure 9. Cross-section of Jasper Beach geology.

References and Additional Information

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