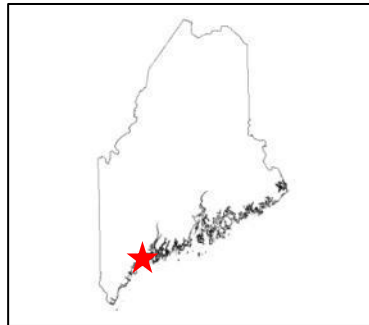


Maine Geologic Facts and Localities

April, 2008

Sandy Point Beach, Cousins Island, Yarmouth, Maine



43° 46' 25.46" N, 70° 8' 44.84" W

Text by
Tom Weddle



Introduction

Sandy Point Beach in Yarmouth is an excellent place for a school group or an individual to see some diverse geology and evidence of active geological processes. The beach parking area is located on the Cousins Island side of the Ellis C. Snodgrass Memorial Bridge, commonly called the Cousins Island Bridge ([directions to Cousins Island](#)). An access road leads from the west side of the lot down to the beach near the bridge. Most of the beach is covered at high tide, so it is best to arrive close to low tide and you can begin the walk here at the sandy beach adjacent to the bridge (Figure 1).

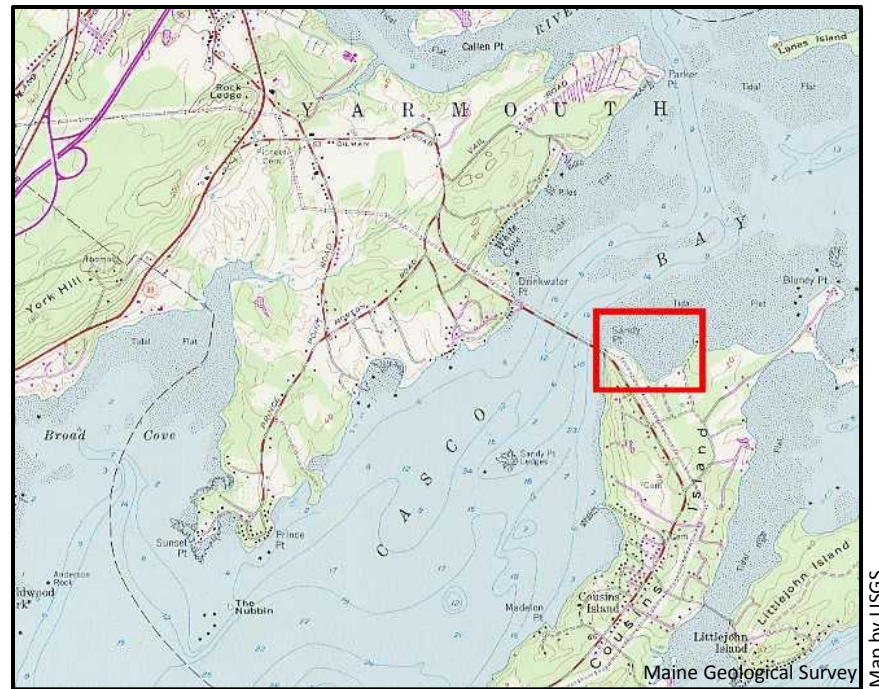


Figure 1. Portion of topographic map showing location of study area. Red box shows location of field trip area.



Introduction



Figure 2. Aerial photo showing vicinity of Sandy Point Beach and locations of figures.

Introduction



Figure 3. Cousins Island Bridge, officially named the Ellis C. Snodgrass Memorial Bridge and the sign for Sandy Point Beach at parking lot entrance. (Location 1)

Sandy Point Beach

The beach adjacent to the bridge includes a sand spit that one can walk along at low tide (Figure 4). It is formed by currents moving and depositing sand in the channel beneath and beyond the bridge.



Photos by Tom Weddle

Figure 4. Sandy Point Beach spit (Location 2) from shoreline; at high tide this part of the beach is covered by water (Left). Sandy Point Beach spit as seen from the bridge (Right).

Sandy Point Beach

If you look at the sand closer to the high tide mark near where you enter from the access road, you will notice in places that there are purple bands of sand (Figure 5). If you look closely at the purple sand, especially with a hand lens, you will see that it contains mostly small crystals or fragments of the purple mineral garnet, known as [almandine](#). The garnet is heavier than the surrounding lighter-colored sand. It is often found in segregated patches because wind and water currents can't move it as easily as the lighter minerals that make up the lighter-colored sand (mostly quartz and feldspar mineral fragments).



Photos by Tom Weddle

Figure 5. Two views of the garnet lag deposit at high tide position at Sandy Pont Beach. (Location 3)



Sandy Point Beach

The part of beach that is below the north side of the parking lot has large stones in the near-shore tidal area and the beach is generally of coarser sand and pebbles than the sandy spit beach (Figure 6). This part of Sandy Point Beach was formed by wave activity eroding the bluff that the parking lot sits atop.



Figure 6. Coarse cobble and boulder gravel beach below parking area. (Location 4)

Slump Scars

Numerous small and medium size slump scars are found along the bluff face, and many trees have been toppled or rotated by the slumping (Figure 7). A large slump scar is found on the other side of the bridge, best accessed from below the bridge (visit on return if there is time).



Photos by Tom Weddle

Figure 7. An old slump with tilted trees at bluff base (Left) and a fresh slump (Right); note proximity of upper high-tension wire tower to edge of bluff. (Locations 5 and 6)

Slump Scars

When fresh, the slump scars expose the deposits left during the last ice age (Figure 8). These include bouldery sediment called till by geologists, but more commonly called hardpan. Also, there are sandy and silty deposits above the till that were laid down in the ocean as the ice front retreated from the area. Because of the weight of the massive ice sheet, the earth's surface was depressed. When the glacier began to melt and retreat, the sea flooded the depressed region and the glacier front, so that it was in contact with the ocean as it retreated (Retelle, 1997).



Figure 8. Eroded bluff below parking lot. Note large boulders at base, eroded from till deposit at the base of the slump.
(Location 7)

Erosion

Clearly the erosion poses a potential problem for the parking lot and for the power line towers that are set there. The larger boulders in the near-shore area give an indication of how much erosion has gone on since the ocean has risen near to its present position in the last few thousand years (Figure 9). The large boulders were eroded from the bluff when it stood seaward of where it is today.



Photo by Tom Weddle

Figure 9. Boulders in the nearshore were eroded from the bluff when it stood seaward of where it is today. (Location 8)

Erosion Prevention

Continue walking eastward along the shore away from the bridge and parking lot. You will approach a home that has a large wooden retaining wall engineered to prevent erosion (Figure 10) like the slumping seen below the parking lot.



photos by Tom Weddle

Figure 10. Wooden retaining wall and rip-rap blocks in front of home to prevent erosion (Left). Erosion at base of stairs leading from top of bluff to shoreline (Right). (Location 9)

Eliot Formation

Here you will cross a small stream where the bluff angles to the north (left). Continue walking along the shore until you come to an exposure of bedrock. The outcrop and the rock you will see farther along the shore is mapped as the Eliot Formation (Berry and Hussey, 1998).

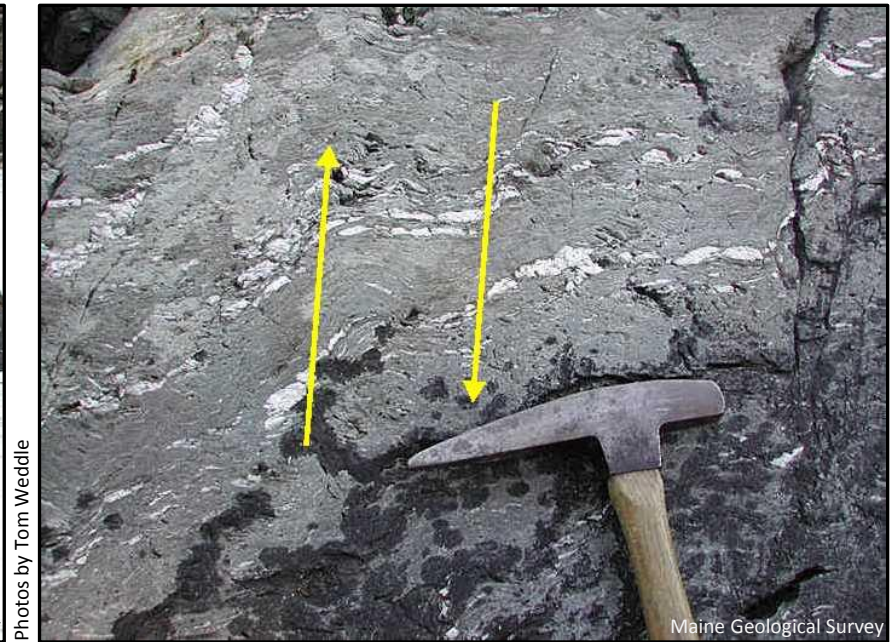


Figure 11. Layered beds of the Eliot Formation trending perpendicular to the shovel handle. This rock was originally deposited horizontally as muddy sediment millions of years ago and eventually became a rock by burial and pressure. The rock now is no longer horizontal but has been folded and is standing on end. If you trace the layers near the head of the shovel walking to the north (into the photo) you can see a gentle warping of the beds in the exposure (Right). (Locations 10 and 11)

Elliot Formation

The Eliot Formation is part of a sequence of rocks known as the Merrimack Group, and can be traced from southeastern coastal New Hampshire to as far north as Freeport, Maine. The rock has been deformed by folding and shearing of the rock layers (Figure 12) during episodes of dynamic earth activity associated with a now inactive fault zone known as the Norumbega fault system (Ludman and West, 1999; Swanson, 1995). During these episodes the original mineral composition of the rock was altered by pressure and temperature over time to become a metamorphic rock known as a phyllite (an altered shale or mudstone).

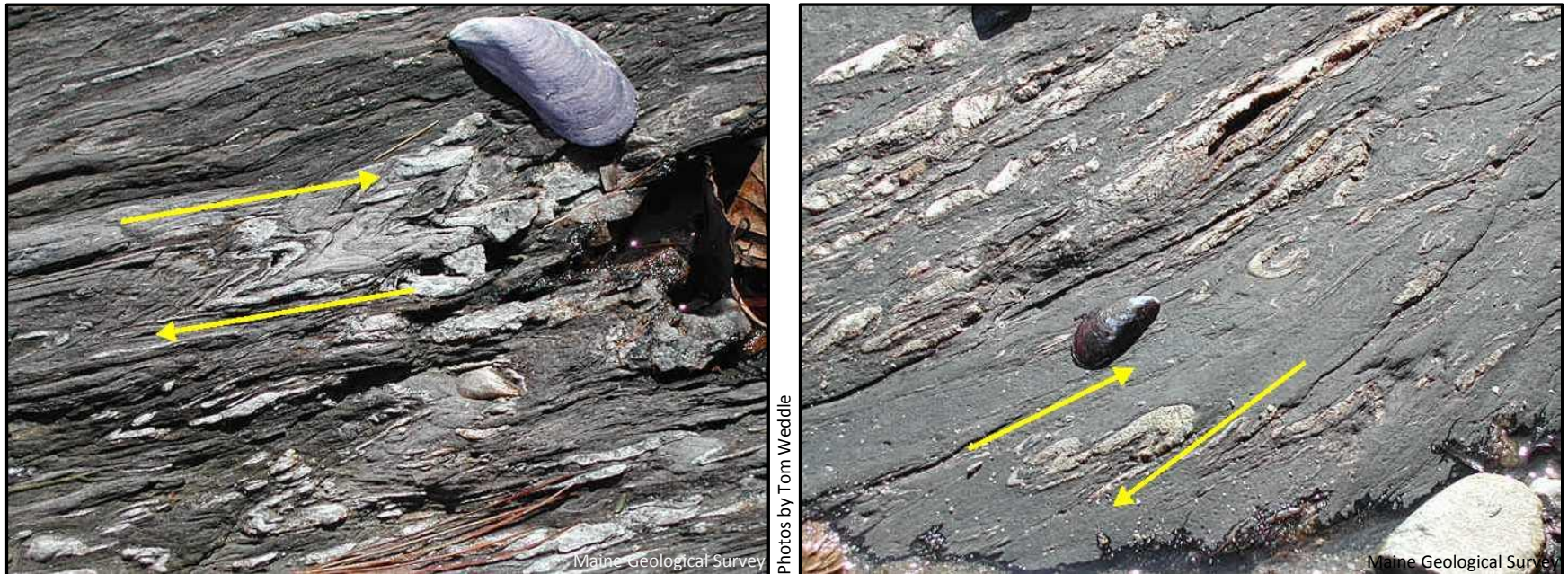


Figure 12. Fine layering in the rock shows very tight folding in the rock in both images (arrows show shear sense; shell is about 2 inches long). (Locations 10 and 11)

Evidence of Glaciers

Many millions of years after the deformation and metamorphism of the bedrock, a much younger geological event took place; the last ice age. As the ice advanced over the land surface, boulders and rock fragments at the base of the ice scraped and gouged the underlying solid rock leaving features on it called striations and grooves. The orientation of these features parallels the direction of the flowing ice (Figure 13). Compass measurements of these ice-flow indicators show that during the last ice age, the flow direction of the ice in this region of Maine changed from a southeasterly flow (160°) to a southerly flow (175°) as the ice began to melt and retreat.



Figure 13. Glacially scoured grooves (Location 11) parallel to shovel handle trend 160° (Left). Within the grooves are finer scour features, called striations; one set trends parallel to the grooves at 160° , and a younger set trends 175° (Right). (Locations 10 and 11)

Evidence of Glaciers

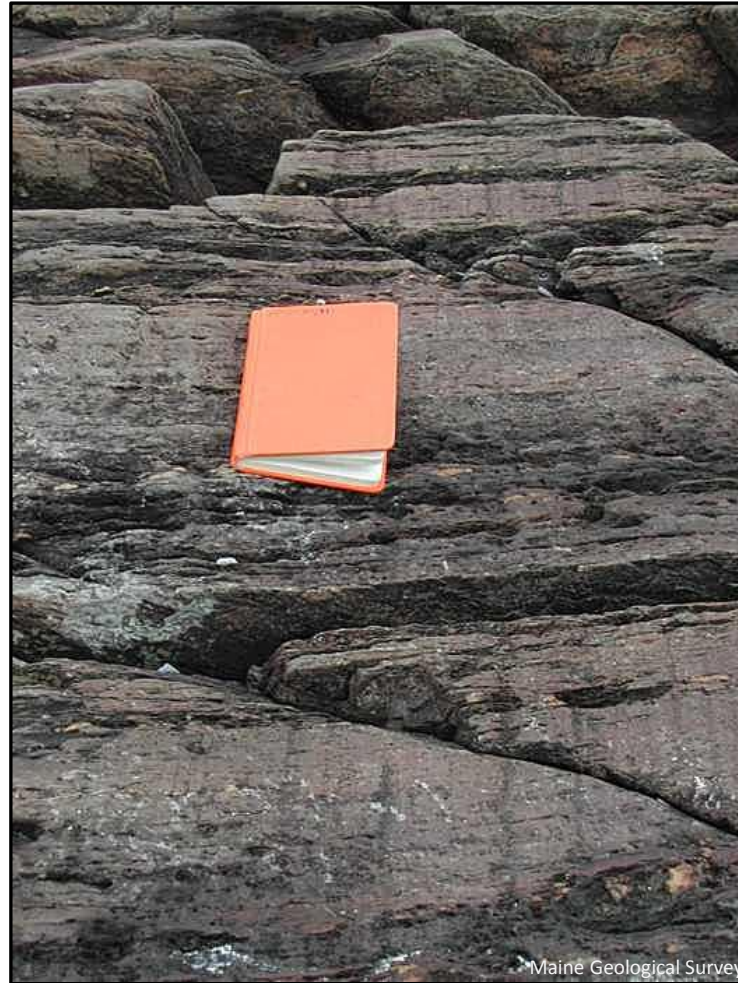


Photo by Tom Weddle

Figure 14. Weathered striations trending 160-degrees.

Evidence of Glaciers

Photos by Tom Weddle



Figure 15. Close-up of large boulder with fractures and crescentic marks on its surface, called chattermarks (Left). They formed as the boulder slid over bedrock, cracking and chipping the boulder surface. Faint striations on the boulder are parallel to the arrow on the photo and are near perpendicular to the chattermarks (Right). Found on bedrock surfaces, chattermarks may be used as ice-flow direction indicators (Location 7).

References and Additional Information

- Berry, H. N. IV, and Hussey, A. M. II, 1998, Bedrock geology of the Portland 1:100,000 quadrangle, Maine: Maine Geological Survey, Open-File Map 98-1 ([online version - 4.3Mb PDF file](#)).
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- Swanson, M. T., 1995, Distributed ductile dextral shear strain throughout the Casco Bay area, in Hussey, A. M. II, and Johnston, R. J. (editors), Guidebook to field trips in southern Maine and adjacent New Hampshire: New England Intercollegiate Geological Conference, 87th Annual Meeting, Brunswick, Maine, p. 1-13.

