Bar Island Geologic Formations:

Mount Desert Island is the largest island off the coast of Maine and the second largest island off the Atlantic Coast. This land was created by the cooling of magma, has weathered the ice age, and stands here today rich with geologic history. On the island and surrounding ones there is evidence of glacial activity in landforms like U-shaped valleys and roch. Mount Desert Island is home to Acadia National Park, which makes up most of the island.

Bar Island, a part of both Bar Harbor and Acadia National Park, is an iconic landmark of Mount Desert Island. It is accessible during low tide, when a bar of sand is exposed above the surface, forming a natural bridge. The Bar Island trail is open to the public and is a popular destination for tourists. This island is not only culturally and recreationally important, it also contains a multitude of geologic formations. These structures tell us about the formation of sedimentary rock, the effects of tectonic activities and the erosional effects of glaciation. The following geologic features will be used to tell this story, and can be used to better understand the underlying geologic activity that affects Mount Desert Island as a whole.

(Hartford)

Fig 1. The barnacles, or other shelled invertebrates, which biologically infest this tidally weathered rock are the basis for the formation of limestone and other calcium-rich sedimentary rocks. When shelled organisms die, they leave behind their shells, which are composed of $CaCO_3$, which is calcium carbonate. These remains build over time, and through oceanic pressure, become turned into limestone rock. This process can also create micrite, fossiliferous limestone, chalk (Marshack 2015)

Fig 2. These ripple marks are a sedimentary structures which form in the direction of the wave action. These marks are found on the bar to the island, which means that these were created when the bar emerged at low tide. These are defined by their asymmetric “U” shaped curve which is caused by water being pulled back and forth over the curves by the tides. If these marks were lithified, they would be visible, and could help identify a rock as sedimentary, as well as give clues to the environment in which the sediments were deposited(Marshak 2015).

Fig 3. These glacially deposited, rounded rocks found on the north west beach are sorted based on their size. This photo shows the sea-shore which has sand sized sediments closer to the low tide line, and larger cobbles near the edge of the high tide line. This is because the strong wave action pushes the larger rocks further to shore while leaving the smaller sediments near the ocean. This is the same reason that sedimentary rocks which are silt-grained is formed at the bottom of the ocean, where there is less wave action, and sand-grained rock is formed in bays, where there is more wave action (Marshak 2015)

Fig 4. This figure shows an outcropping of sedimentary rock on the north-east side of the island, which has weathered holes. This formed through the erosion of less hard material from the rock which left only the stronger material behind. The eroded material might have been less compact sedimentary rock, or minerals (Marshak 2015).

Fig 5. Veins of minerals exist throughout the bedrock on Bar Island. These cracks are filled with crystalline white minerals. These form when a fracture is made in a rock, and hot geothermal water containing dissolved minerals enters the crack, rushing through it. The minerals then precipitate onto the rock and form large crystalline deposits. These veins can be metamorphosed along with the rock it is contained within during intense heat or pressure, forming folds in the rock (Marshak 2015).

Fig 6. These beds which can be seen on the west coast of the island, show the differences in deposition. The rocks vary in texture from fine-sand to silt textured, and vary in color between grey to orange. This difference comes from the varying times that the sediments were deposited and the environments in which they were deposited. The open boundaries between the layers of rock represent weak planes in the rock which have been opened through erosion and weathering, most likely from tidal and wind action (Marshak 2015).

Fig 7. This geologic feature exists on the south west coast of the island in an ash layer of a large sedimentary outcrop. This feature could be a concretion, which metamorphosed and weathered away. Then, the hole was filled with minerals and then further eroded (Sarah Hall, personal communication, 2019).

Fig 8: 440 Ma, a continent building event accreted the microcontinents of Ganden terrane and Avalon to the North American Plate. The Bar Harbor Formation, the sedimentary rock which composes Bar Island, was metamorphosed during this time period due to tectonic stress. This stress caused the rock to become widely foliated. (Braun et. Braun 2016).

Fig 9: These cliffs are an example of a “roche moutonnée”, which occurs when glaciers travel over material which is stronger than the surrounding formation. The glacier travels over this material, melting on the bottom into a layer of water which freezes to the rock. As this occurs, the side of the formation which the glacier is traveling toward becomes wet, then frozen. As the glacier moves, it rips chunks of rock from the formation, causing a steep cliff. This cliff can be found on the south-east coast of the island (Marshak 2015).

Fig 10: Landslides are sedimentary events which can occur when water either saturates the soil on a cliff face, or when water uncuts the sedimentary formation. These events can cause the creation of conglomerate, which is composed of large inclusions bound within a silt to sand grained sedimentary matrix. This is due to the lack of sorting wave action, so there can be lithification of materials of different sizes. On this location on the north-east coast of the island, this is caused by undercutting wave action caused by a large storm surge(Marshak 2015)

Fig 11:This is a view of a roche moutonnee on one of the porcupine islands. Roche moutonnees are formed by the passing of a glacier over raised bedrock. You can tell which direction the glacier moved over the rock by how it is shaped. The glacier carved a gradual incline upstream and a short decline on the opposite end. This creates the diagonal mountain shape that is a roche moutonnee, which we see here. There are many other roche moutonnees on Mount Desert Island and surrounding it.

Fig 12: This is a glacially carved bay. To form this inlet along the shore, glaciers eroded the least resistant rocks such as sand and clay from this land. The resistant rocks reaching out on both sides of the inlet are called headlands. Due to how deep this bay is, cruise ships are able to sail on its water.

Fig 13: Bar Island hosts many tree species such as pine, spruce, oak, and beech. This island is covered glacially deposited silt, which became soil through the colonization and decomposition of plants. Some species found on the slope of the island such as oak and beech thrive on deep soils. Other species, such as pine and birch are known for their presence in rocky mineral soils. (Maine Department of Conservation 2008)

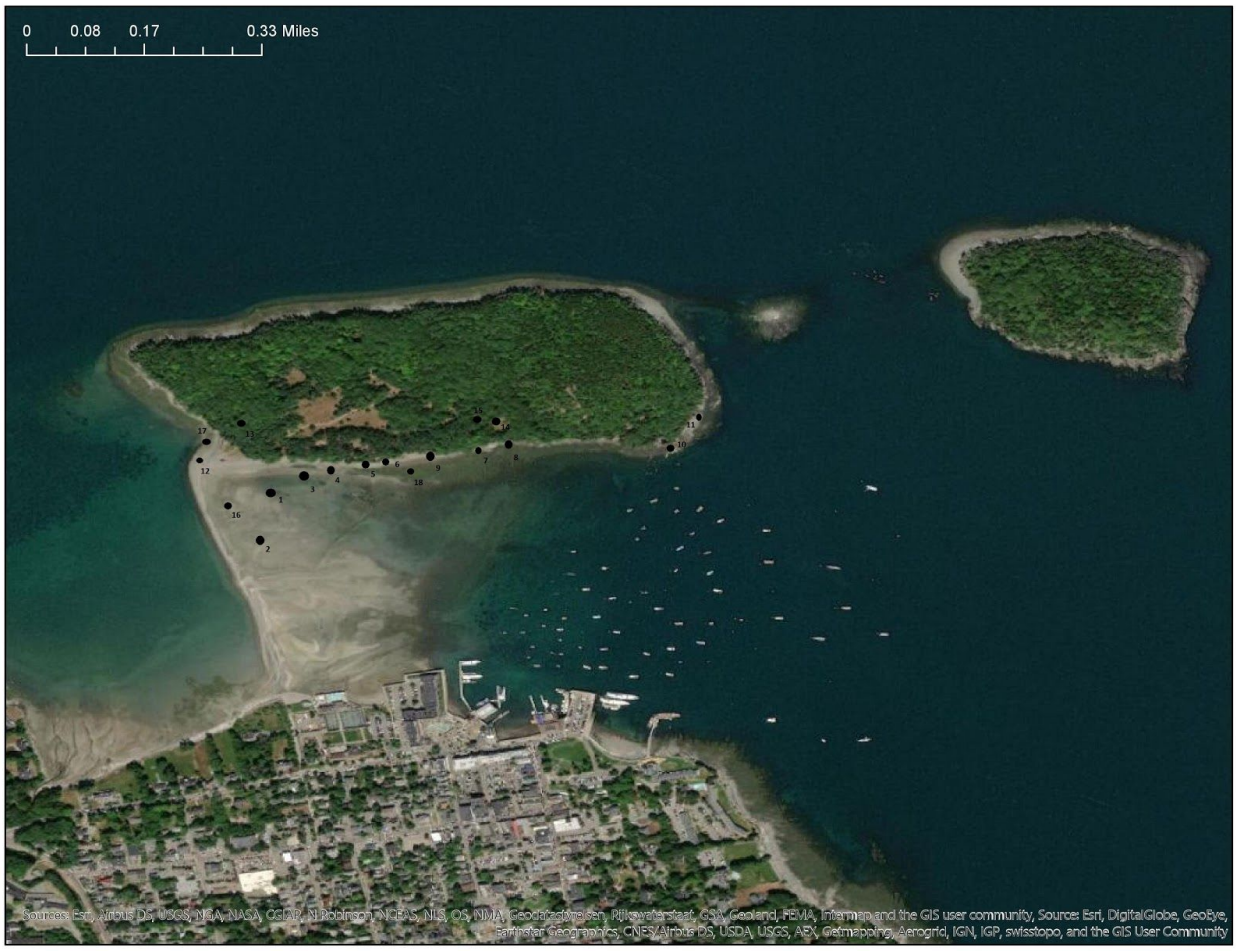
Fig 14: This is a distant image of U-shaped valleys formed by Cadillac Mountain and surrounding peaks. These large U-shaped valleys were carved by glaciers all over Mount Desert Island, and there is a great view of them from Bar Island. These rounded valleys are carved by moving glaciers. The glaciers initially formed in fractures. As they grew, they moved down the valleys and eroded them by scraping and plucking the sides in their path. This glacial activity is what formed U-shaped valleys here.

Fig 15: This is an image of glacial striations. Glacial Striations are scratches or grooves in bedrock that are caused by the movement of glaciers over them. As glaciers moved over the rock, they plucked and collected large amounts of sediments and boulders that grinded over the rock and left many markings. Striations are one of the many trails left behind by glaciers.

Fig 16: Here on the east shore of Bar Island are a mix of sediments and small pieces of sea shells. These sediments have been carried to shore by ocean currents and deposited on land. They are a mix of fine grained and medium grained sediments. The surfaces of these small rocks have been eroded by water and are rounded. The shells have also broken down and their edges are rounded, making them look similar to the surrounding rocks and materials washed up by the ocean.

Fig 17: The coast is crafted by tides both geologically and ecologically. The constant change in tide levels erodes the shore and flattens it. Sedimentation and deposition occur as a result of the moving water. The rising and falling tide makes it so the shore is periodically exposed to air at low tide and then to water at high tide. This creates a specific habitat for many creatures on the island, including green algae and barnacles which grow on the rocks as well as mussels, snails, crabs, and other intertidal zone organisms.

Fig 18: This rock classifies as a glacial erratic, which is a rock carried by glaciers and deposited in a place with different surrounding rock types. Glacial erratics like this one were plucked from the surface of the rocks which glaciers grinded over. The intense pressure of the glaciers cracked the rocks beneath it. These cracks in the surface of the rock filled with water which turned to ice, breaking off big and small rocks which were carried by the traveling glaciers. This glacial erratic found on Bar Island is a fairly large piece of porphyritic granite with fine grained igneous. It stands out due to its large size and darker inclusions.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Sources: Esri, Airbus DS, USGS, NGA, NASA, CSAP, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Citations:

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