The Geology of Fort Townsend State Park

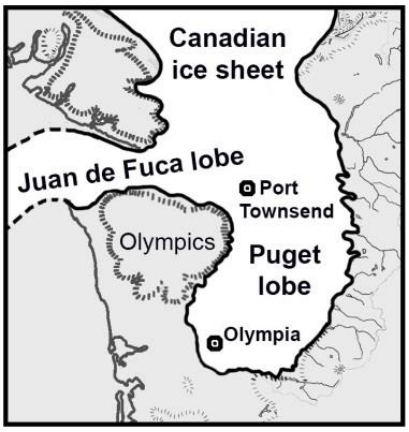
•Glaciers •The Bluff
•The Beach •The Human Hand

Geologic processes produced the land that we now call Fort Townsend—and the land will continue to change as water, wind, gravity, people, and time influence this beautiful part of Washington.

GLACIERS *The land you stand on and see all around you is a legacy of glacial activity*

About two million years ago a great, global Ice Age began. During the Ice Age, at least six glacial cycles occurred in the Puget Sound region. Each glacier ground its way south from a Canadian ice mass, gouging and shoving the terrain it crossed and carrying immense loads of rock from the north that were deposited as the ice moved and when it melted. During warmer interglacial periods, the climate was similar to today's.

The most recent ice advance, the Fraser Glaciation, entered Washington about **18,000 years ago**. While the Puget lobe slowly filled the existing lowland between the Olympic Mountains and the Cascade Mountains, the Juan de Fuca lobe moved westward in the area that is now the Strait of Juan de Fuca.



Global sea level dropped as water was bound up in the ice masses. At its greatest extent regionally, about **17,000 years ago**, the ice was as much as 4,000 feet thick at Port Townsend and its great weight pressed the regional land surface down about 200 feet below its present level.

The global climate soon began to warm. By about **16,000 years ago**, most of the ice here had melted away, leaving this region under a shallow sea. The flat top of Whidbey Island to the northeast of the park is a remnant of this ancient seafloor. Relieved of the great weight of the ice, this whole region rose again within a few thousand years and stabilized at its present level.

Glacial and interglacial processes left layer upon layer of sand, gravel, and boulders—deposited, shoved about, compacted, and eroded—building and shaping the land of the Puget Sound region. Above ground, the north-south trend of most Puget Sound landforms reflects the path of the southbound glaciers. Below ground, deep layers of glacial sand-and-gravel deposits create aquifers that provide water for our wells.

Glaciers also left behind large boulders called *erratics*. As well as the many erratics on the beach, there are two you can easily see in the wooded upland of Fort Townsend:

♦ From the south end of the Parade Ground, near the vault toilets below R.V. site #40, enter the Historic Walk Trail and walk south-southwest for about 300 feet. Just beyond the historic Cistern site, a moss-capped erratic lies next to the trail. This light colored, granitic boulder is not native to this area. It was glacially transported from the granite-rich Coast Mountains of British Columbia to the north.

♦ From the Group Camp parking area next to the Torpedo Tower, walk southeast onto the Cutoff Trail, go 200 feet, turn southwest onto the Madrona Trail and go several hundred feet to another trailside erratic. This dark gray, fine-grained basaltic boulder was also transported from elsewhere by glacial ice.

For a territorial view of the results of glacial action, walk down to the beach landing:

♦ Look southeast to the Port Townsend Ship Canal between Indian Island and the mainland. An ancient *fault* (fracture) in the Earth's crust caused a weak spot here that the glaciers both eroded and filled with material. After the latest glacier retreated, a tidal marsh formed that provided a land bridge for later inhabitants.

♦ Glacial deposits formed both Indian and Marrowstone Islands to the east, the high bluff to the north that overlooks Port Townsend Bay, as well as the land that is now Fort Townsend State Park.

THE BLUFF *The bluff records our local geologic history*

At Fort Townsend, the region's oldest glacially deposited material is buried too deep to be seen; however, the last glacier that moved through this area left traces of its passage in the bluff. For beach walks and bluff viewing, five-foot or lower tides are best. You will see loose sand and gravel that were carried by streams that flowed from the ice, as well as mixtures of cobbles and sand deposited and compacted by the ice.

♦ Glacially deposited layers can be most easily seen on the nearly vertical bluff face to the south of the beach landing. The older, undulating layer of sand at the base of the bluff is covered by coarser, gravelly deposits from later glacial activity. About 80 feet south of the landing, there is a particularly excellent display of glacially deposited layers. At the very top of the bluff there is a thin layer of dark soil that formed after the glaciers had departed. Keep your eyes open for erratic boulders on the beach!

♦ North of the beach landing, extensive landslides have produced a gentler bluff slope. The sediment layers are largely covered with vegetation that helps stabilize the hillside. Erosion here now consists of a slow, downward creep of the upper few feet of material that rests on the ice-compacted sediments, but larger landslides do still occur. This eroded bluff material feeds a broad beach that helps protect the bluff from further erosion by wave action.

Wind, waves, rain, emerging groundwater, and gravity all contribute to bluff instability. The resulting surface erosion and landslides continually bring glacial and interglacial material—from silt and sand to boulders—tumbling down to beach level. This process is especially active during stormy winter weather.

THE BEACH *Rocks and sand also have a story to tell*

Fort Townsend's beach contains a tremendous variety of rocks, and all are gifts from the glaciers. Glacial materials of all sizes erode from the bluffs and land on the beach. Silt and clay are rapidly washed away. Large boulders tend to stay where they fall. Due primarily to wind-driven wave action, masses of sand and fine gravel are moved north and south along the beach in *drift cells* that feed the beach. At Fort Townsend, there are two main drift cells: a southward-driven cell that begins near the park's south boundary, and a northward-driven cell along most of the park's shoreline and continuing to Port Townsend. The sand-and-gravel texture of the beach can change dramatically from tide to tide and from season to season, depending on the strength of the wind and waves.

THE HUMAN HAND *We leave our mark on the land*

Virtually all of the manmade changes to this landscape occurred during its early years of use by the military. The land itself is all glacially transported material, with thin post-glacial soil remaining in undisturbed areas.

♦ The fort property was extensively logged in 1856 and 1857 to provide building material. As the fort's buildings burned or decayed away, trees re-grew in their place. The remaining open areas of the park, such as the Parade Grounds, are manmade.

♦ The glacially sculpted, eastward slope of the park was terraced by the soldiers for the Parade Ground and the fort's building sites. In 1974, the northern portion of the terraces in the Parade Ground area was re-sloped by Washington State Parks to accommodate visitor facilities.

♦ Historically, a stream ran along the path of the Nature Trail. A well and pump house near the stream's mouth supplied water to the fort. By 1874, this stream was drying up. The dry streambed was then used as a road to move supplies from the dock at the beach up to the occupied area. Remnants of the historic dock and pilings have now been removed to re-establish a natural, healthy shoreline.

♦ In 1973, a steep, narrow footpath to the beach was widened to provide better beach access.

♦ From the beach or bluff top, look southeast to the area between the mainland and Indian Island. In 1915, the tidal marsh there was dredged to accommodate commercial and military shipping through the new channel. Rowboats and a small ferry transported island inhabitants. The bridge was built in 1952.

As visitors use and enjoy this public park, there are sure to be more human handprints on the land, and as time passes, geologic processes will continue to shape and reshape the terrain.

Contributors: Leslie Aickin. KM Reed, L Stevens, D Grybeck, V Brooks, K Lull. March 2017