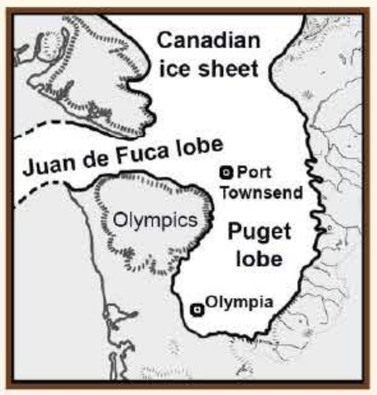
The Geology of Fort Townsend State Park

GLACIERS ~ *The land you see all around you is a legacy of glacial activity*



About **two million years ago** a great, global Ice Age began. At least six glacial cycles occurred in the Puget Sound region. Each glacier ground its way south from a Canadian ice sheet, gouging and shoving the ground it crossed. The ice carried immense loads of rock from the north that were deposited here as the ice melted.

18,000 years ago, the most recent ice advance entered Washington. Global sea level dropped as water was bound up in the Earth's ice masses. **17,000 years ago**, at its greatest extent regionally, 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.

By about **16,000 years ago**, as the global climate started to warm, 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. 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.

From the beach landing, you can see evidence of our glacial legacy.

- Look southeast to the Port Townsend Ship Canal between Indian Island and Port Hadlock. An ancient *fault* 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. In 1915, the canal was dredged for ship passage, and the bridge was constructed in 1952.
- Glacial deposits form 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.

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 RV site #40, enter the Historic Walk Trail. Walk south-southwest for about 300 feet. Just beyond the historic Cistern site, there is a moss-capped erratic next to the trail. This light colored, granitic boulder is not native to this area. It was transported here by glaciers from the granite-rich 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 670 feet to another trailside erratic. This dark gray, fine-grained basaltic boulder was also transported from elsewhere by glacial ice.

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. In the bluff face, you will see layers of loose sand and gravel that were carried by streams that flowed from the ice, as well as jumbled 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 gravel deposits from later glacial activity. About 80 feet south of the landing, there is a particularly nice 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 sedimentary 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 erosion by wave action.

Wind, waves, rain, emerging groundwater, and gravity all contribute to the instability of coastal bluffs. 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 rock types, 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 to tidal currents and 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 toward the paper mill in 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.

As time passes, geologic processes will continue to shape and reshape this ground.

Enjoy our local geology!

Jefferson Land Trust Geology Group