The ***Quimper Geological Society*** seeks to enhance the understanding and appreciation of geology in our community by offering several illustrated lectures each year, as well as summer field trips. We focus mainly, but not exclusively, on local geologic features and issues. All talks are free and open to the public, although we gratefully accept donations at the door to help cover program expenses.

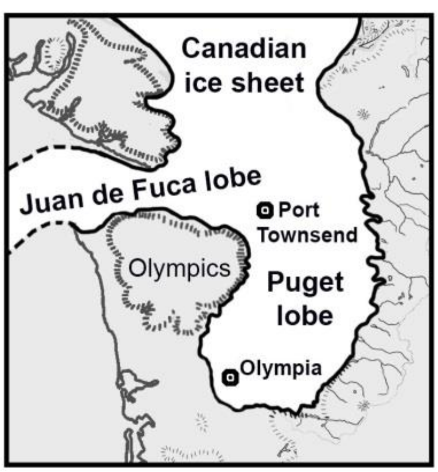
Programs are sometimes announced in the local media, but you can join over 700 other individuals who receive email notification of our upcoming events by making your "subscription" request on our website at www.quimpergeology.org where you will also find information about our activities and the area's geologic features.

We look forward to seeing you at our programs.

A BRIEF LOOK AT OUR LOCAL GEOLOGY

PLATE TECTONICS SETS THE STAGE. Fifty miles offshore from our west coast, two major tectonic plates are colliding at the Cascadia Subduction Zone. This ongoing collision forces the Pacific Plate to subduct under the western edge of the North American Plate, driving uplift of the Olympic Mountains to our west, as well as volcanic activity in the Cascade Range to our east. Tectonic stresses have also fractured the crust of the North American Plate, producing numerous faults including the 100-mile-long Southern Whidbey Island fault zone that lies to the east of Port Townsend. Countless earthquakes have occurred on these faults in the past, and more will undoubtedly occur in the future.

BEDROCK UNDERLIES IT ALL. Bedrock outcrops are scarce because glacial deposits blanket much of our area. Exposures of the oldest bedrock, visible at the New Shine Quarry and along Eaglemount Road, are basaltic lavas formed roughly 50 million years ago on an oceanic island that later joined our mainland. Other exposed bedrock includes marine sandstone (about 40 million years old) at the south end of Marrowstone Island, fossil-bearing marine sandstone and conglomerate (about 35 million years old) on the southeast shore of Discovery Bay, and volcanic rocks that include Tamanowas Rock (pictured at right), the remnants of an explosive volcano that erupted near Chimacum 43 million years ago.



GLACIERS SHAPE THE REGION. About two million years ago, a global Ice Age began. Since then, at least six glacial cycles have occurred in the Puget Sound region, each marked by a southward advance of ice from Canada into the Puget Lowland and west out the Strait of Juan de Fuca (see map at left). The ice gouged the land it flowed across and also brought in immense loads of sand, gravel, and boulders that were deposited when the ice melted. During the warmer interglacial periods, the climate in this area was similar to what we experience today.

The most recent ice advance into Washington began about 18,000 years ago. At its greatest coverage, about 17,000 years ago, the ice extended south of Olympia and was as much as 4000 feet thick at Port Townsend. Its great weight depressed the land surface to about 200 feet below its present level. With more water bound up in ice, global sea level was about 300 feet lower and the Pacific shoreline was about 50 miles farther west than it is today.

The global climate then warmed rapidly, and by about 16,000 years ago most of the ice here had melted, raising sea level and leaving this region under a shallow sea. Relieved of the great weight of the ice, the land rose again and by

4000 years ago had returned to its present level. The flat top of Whidbey Island, visible to the northeast of Port Townsend, is a remnant of this ancient seafloor. Tiny marine fossils in the clay near the top of Artillery Hill in Fort Worden State Park also show us the amount of local rebound of the crust. The valley that San Juan Avenue follows in Port Townsend, as well as Center and Beaver Valleys south of town, were once glacial meltwater channels.

The glaciers left behind layer upon layer of clay, sand, gravel, and cobbles—deposited, overridden, compacted, and eroded—that are the foundation of our local landscape. The north-south trend of many of our ridges and valleys reflects the path of the southbound ice lobe. Below ground, layers of Ice-Age sand and gravel form aquifers that provide water for our wells. The ice also left behind scattered large boulders called erratics. These are especially easy to see on our beaches, and most are of rock types that originated north or east of this area.

BLUFFS RECORD OUR LOCAL GEOLOGIC HISTORY. The ice that moved through this area left evidence of its passage in sediments now exposed in bluffs or identi-fied in well logs. The bluffs display a complex record of deposition in changing environments, as well as of deformation and erosion. No bluff deposits older than about 135,000 years have yet been mapped on the Quimper Peninsula. The young-est layers at the tops of the bluffs are about 12,000 years old.

The almost horizontal bluff layers record both glacial and interglacial activity. In most bluffs, the lower layers are mainly sediment left by interglacial streams. Upper bluff layers include loose sand and gravel carried in streams fed by melting ice. In places, there is till (a dense mix of boulders, cobbles, gravel, sand, and clay) deposited and compacted by the ice, as well as fine sediment that accumulated in glacial lakes. Thin layers of soil or peat developed locally during interglacial times.

Erosion by wind, waves, rain, groundwater emerging above clay layers, and gravity all contribute to the instability of our bluffs. Bluff faces that are largely unvegetated and exposed to erosion fail as debris slides. Erosion is especially active during stormy winter weather. Bluffs are fairly stable where they are protected from wave action by broad beaches and accumulations of logs or where they are covered by vegetation. On well-vegetated slopes, erosion typically involves a slow, downward creep of the upper few feet of material.

BEACHES ARE A LEGACY OF THE GLACIERS. Our beaches display a wide variety of rock types and sizes, brought to light as they erode out of the bluffs. Bluff erosion is essential for providing sand and gravel that feed our beaches.

Driven by waves and wind, beach sediment is constantly on the move in drift cells. Point Wilson and Point Hudson formed where drift cells converge. All beaches change from tide to tide, depending on the weather.

Where a drift cell is interrupted, as by the old 1943-built pier at Fort Worden, beach shape is altered dramatically, as seen in this picture. A modern redesign seeks to re-establish a more natural drift cell movement and restore near-shore habitat.

HUMANS ALTER THE LANDSCAPE. Among the modifications we have made to the local landscape are the large basalt boulders (some from the former quarry at Mats Mats Bay) used to build breakwaters and to armor Point Wilson and Point Hudson, where beach formation has been affected. The steep bluff along Port Townsend's main street was blasted to create space for the town's development. Portage Canal between Indian Island and Port Hadlock, once a tidal marsh, was dredged to accommodate shipping. The U.S. Army placed the fill that makes up much of the beach campground at Fort Worden State Park, and the road that links Indian and Marrowstone Islands was also built on fill. Road, commercial, and residential construction have also had a hand in shaping our terrain, but glaciation remains the main architect of our home ground.

Geologic processes created and shaped the land we see all around us, and the land will continue to change as water, wind, gravity, people, and time influence this part of Washington.