Geology of the Port Williams Bluff

In the Puget Lowland of Washington is evidence of at least six Pleistocene ("Ice Age") continental glaciations, but deposits of only three are exposed in our area. The Puget lobe of ice passed roughly south, the Juan de Fuca lobe westward out the strait.

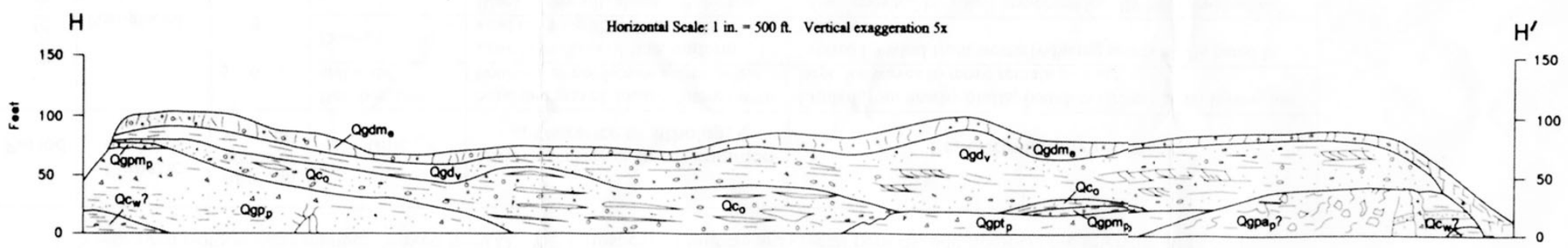
A classic on-land glacial depositional cycle here goes like this: As a continental ice sheet advances, sediment carried by streams draining its snout (terminus) spreads ahead of the ice across the landscape. This 'advance outwash' includes everything from boulders to clay. The coarsest sediment is dropped close to the snout, and the finer portions, clays and fine sands, are carried long distances. The glacier gradually overrides and bulldozes the advance outwash as it grinds along. Overlying the advance outwash, then, is till, the unsorted sediment dragged and smeared along at the base of the ice mass. Till may be boulder-rich to clay- and sand-rich; some till is vaguely or discontinuously bedded. Once the ice is no longer being fed from 'upstream', it stops advancing. Now begins the process of deposition in reverse of advance outwash. The 'recessional outwash' follows the melting ice front, fills depressions, and leaves a rather uniform land surface. The climate warms, we have an interglacial, and the cycle may start again. Both interglacial streams and glacial ice remove parts of the story. This bluff is another 3-D geological puzzle missing many pieces.

There is another twist to the classic story. As the late Vashon Stade (and likely for earlier glacial stades) climate warmed, ice at the west end of the Strait of Juan de Fuca thinned and was light enough for seawater to seep in beneath it. The lifted snout calved, and the break-up continued rapidly eastward, causing all the ice from roughly a bit east of the Port Townsend area northwest to Vancouver to break up. This effectively cut off the 'food' for the Puget lobe, which then melted in place in the lowland. Ice bergs dumped their sediment load in the strait, and the sand and silt were wafted around by sea currents, settling as glaciomarine drift on the sea floor.

Most *inter*glacial sediment in this area was carried by rivers flowing from the Cascades to the Pacific, east to west. This essentially north-south 1.1-mi-long bluff cuts *across* the flow path. The bluff itself was first cut by meltwater flowing from the south, then retreated by slumping and raveling.

From top to bottom *here* are deposits of the Everson (non-glacial, glaciomarine drift) Insterstade (~10.5–11.5 ka*), the Vashon Stade of the Fraser Glaciation (~20–11 ka), the Olympia Interglaciation (~60–20 ka), and the Possession Glaciation (~90–72 ka). Where we reach the beach are sediments of the Whidbey Interglaciation (~195–90 ka). A short-lived terminal pulse of glaciation younger than the Everson, the Sumas Stade, did not reach this far south. Because the bluff continually erodes, exposed features will not precisely match those in the sketch (below) from Schasse and Logan's 1998 report.

In the bluff exposure at the end of the Port Williams road, the Whidbey continental/nonglacial sediment (unit Qc_w?**) is ~7 ft thick. Whibey climate was warmer than it is today, and the area was a broad floodplain. Soft-sediment deformation and concretions may be exposed. The Whidbey lies conformably below Possession drift (poorly developed till, unit Qgp_p)--sandy, silty gravel with cobbles and boulders. Clastic dikes have been reported in this unit. Along the way north is Olympia fluvial sandy pebble to cobble gravel, rounded clasts, moderately sorted (unit Qco) at beach level. Blunt et al. (1987) got radiocarbon dates of about 17,500 yr BP† from peat just below the Vashon drift; subfossil pollen indicates that the climate was a bit cooler then than now. Well along the beach, this unit pinches out against dense Possession till (unit $Qgpt_p$), but there is a lens of Olympia and Possession (glaciomarine drift, unit $Qgpm_p$) a bit to the north of the pinch-out. Near the north end of the bluff is Possession advance outwash (unit $Qgpa_p$?). A large part of the bluff, but not at beach level, is Vashon glacial drift (unit Qgd_v). The Everson (unit $Qgdm_e$) is draped over the whole bluff and drops to the beach at the north end. This draping gives us a hint of what the local topography was like at the time.



References

Blunt, D.J.; Easterbrook, D.J.; Rutter, N.W., 1987, Chronology of Pleistocene sediments in the Puget Lowland, Washington: Washington Division of Geology and Earth Resources Bulletin 77, p. 321-353.

Schasse, H.W., and Logan, R.L., 1998, Geologic map of the Sequim 7.5-minute quadrangle, Clallam County, Washington: Washington Division of Geology and Earth Resources Open File Report 98-7, 2 plates and 22-p. text. (available online from the Division)

*ka, geology-ese for thousand years old;

** The question marks in the unit labels indicate that the units have not been dated at this locality and are named on the basis of stratigraphic position.

† BP, before present, present being 1950