This 2014-15 research project, *Dating Puget Landslides and Sediment Deposits*, focused on detailed mapping of coastal bluff stratigraphy within the Puget Lowland and was supplemented using C-14 age control to attempt to constrain the sediment record. The purpose was to further comprehend deep-seated landslides in the Puget Lowland – specifically on the western shoreline of Whidbey Island in the aftermath of the 2013 Whidbey Landslide.

The Puget Lowland is fundamentally predisposed to geologic hazards, such as mass wasting events, as a result of climatic and/or stratigraphic forcings – among other reasons. This research project focused on the later of the two forcings - stratigraphy. Particular stratigraphic sequences in a given glacial depositional environment (impermeable clay/till underlying a permeable silt, sandstone, and/or gravel) can induce deep-seated landslide events as groundwater (most especially in regions with heavy precipitation) migrates downward from the ground surface following periods of sustained rainfall. The precipitation infiltrates through an overlying permeable layer(s) to a non-permeable base layer (aquitard bed). Groundwater traveling downward eventually (lag in travel depending on the thickness of the permeable layer) reaches an aquitard where the groundwater ponds and is prevented from further migration. The ponding water builds pore pressure in the subsurface as it accumulates at a geologic interface between permeable and impermeable units. This stratigraphic snapshot is a recipe for reoccurring deep-seated landslides if the stratigraphy can store enough groundwater and the morphology is precipitous in its relief (i.e. a tall, steep coastal bluff). Precipitous topography (often from wave erosion and general weathering) and copious amounts of groundwater (coastal Pacific Northwest climate) cause mass wasting events.

Detailed stratigraphic mapping, coupled with age control, can not only tease-out these stratigraphic regions susceptible to landslides, but also contribute to a well-constrained late-Quaternary glacial paleoenvironment for broader application elsewhere. Stratigraphy revealed at coastal bluffs demonstrates to the observer an often discontinuous and chaotic chronologic sequence as a result of frequently tumultuous past glacial environments and a notorious lack of datable organic material. The known geologic contacts acting as the landslide failure plane are cyclical in their appearance, and can manifest multiple times in one stratigraphic sequence. Past ice sheet advances and retreats are recognizable through detailed costal bluff mapping. Carbon dating can assist by chronologically constraining a paleoenvironmental sequence susceptible to deep-seated landslide events by indexing the failure plane. Organics dated near a slide plane lower in the stratigraphic sequence will appear older than overlying slide plane contacts. The constraining of these sequences helps build a broader paleoenvironmental context that can be applied and identified throughout the Puget Lowland.

The 6 carbon dates acquired for this study, funded by the Quaternary Research Center at the University of Washington, from various locations in the stratigraphic sequence on western Whidbey Island were all near, or outside the range of usable data given the relatively short half-lives of Carbon 14 isotopes. The information gleaned from the dating results demonstrated that the sequences mapped in this project were most likely near or older than ~45,000 years old. The goal of the dating, indexing the slide planes and constraining the chronology of the stratigraphy, was not achieved given the age of the samples. However, the sediments mapped were usually overconsolidated which insinuates being overrun by ice sheets multiple times over tens of thousands of years. This was roughly verified through the carbon dates – or lack thereof.