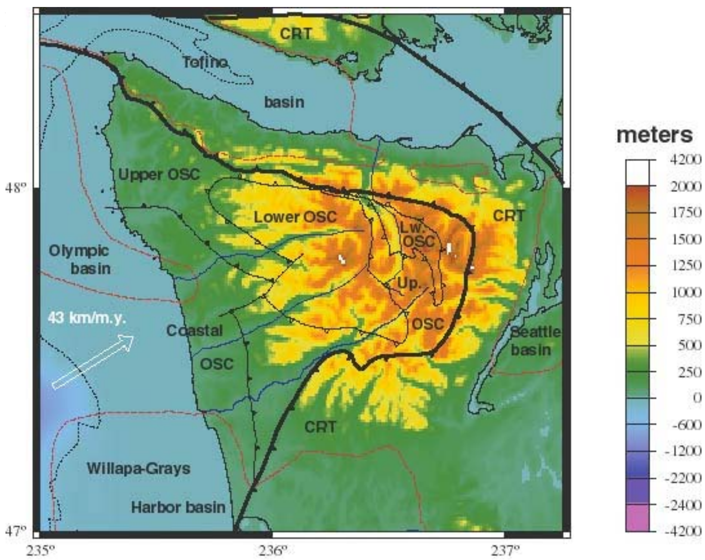
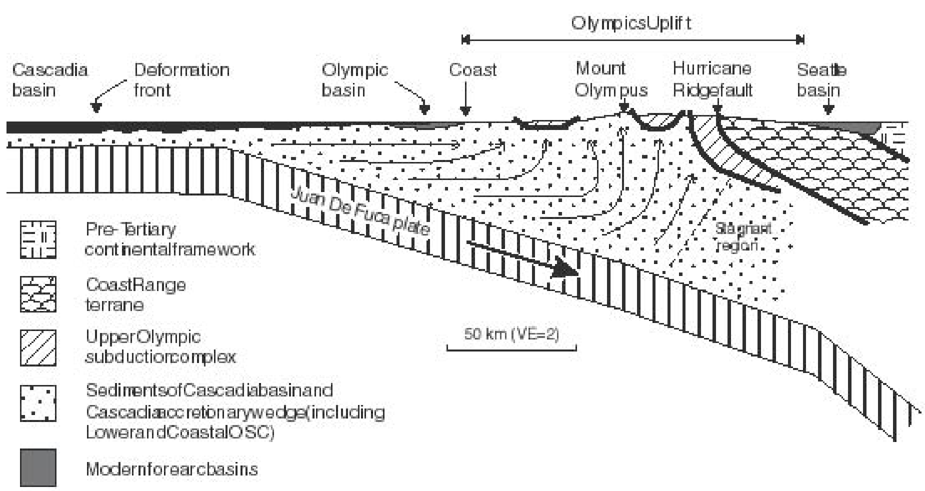
Field Trip Guide to Skokomish Basin, Olympic Mountains

Geology and Art
Fall, 2004



Regional Geology

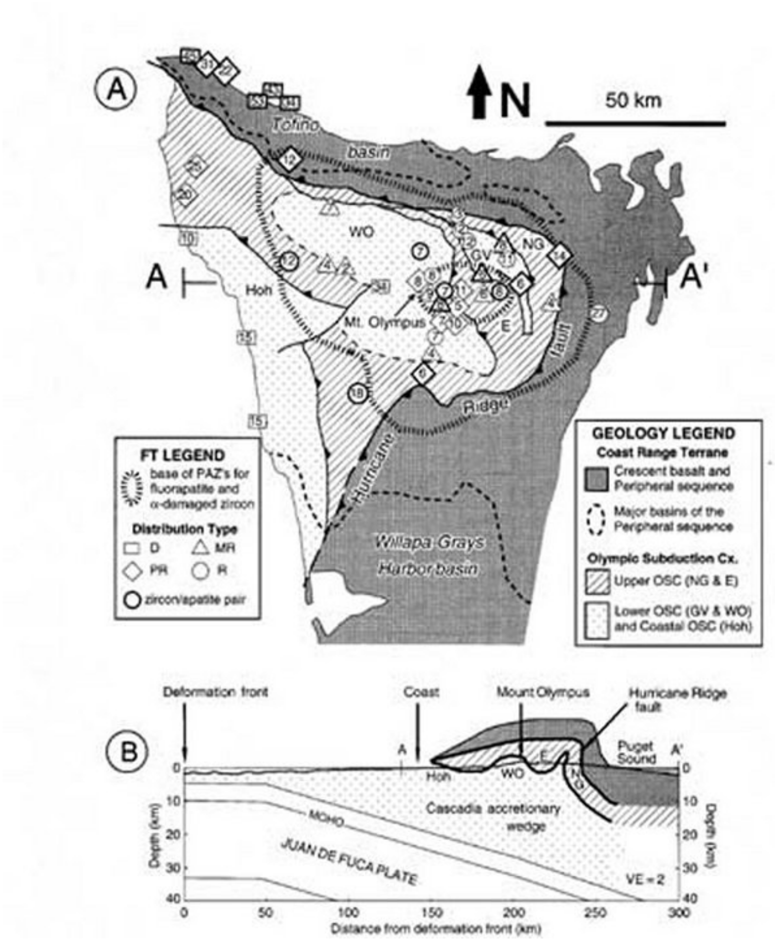
The Olympic Mountains are part of the Washington Coast Ranges, a geologic province that extends from the Pacific Ocean to the Puget Lowlands. The massive topographic feature is the result of plate tectonics; subduction of the Juan de Fuca plate underneath the North American plate caused the superficial rocks of the descending plate to be scrapped off and deposited on the western edge of the North American plate. The Olympic Peninsula is divided into two domains, the peripheral domain and the core domain. The peripheral domain is dominated by volcanic rocks and the core (also known as the Olympic Subduction Complex) is mélange scraped off the Juan de Fuca plate. This wedge of volcanic and sedimentary rocks tends to go from older (accreted first) to younger (accreted later) from east to west. The subduction process at the Cascadia subduction zone still occurs today and mélange continues to be accreted to the western margin of the Olympic Peninsula. Rocks of the Olympic Subduction Complex were first thrust above sea level about 12 million years ago and accretion and uplift presently outpace erosion in some parts of the range and so the Olympic Mountains are still rising (Thackray and Pazzaglia, 1994).



Crescent Formation (Peripheral Rock)

The Crescent terrane is the peripheral rocks of the Olympic mountains. This formation is dominated by basalts that were extruded in the Late Paleocene to Middle Eocene ocean (63 – 46 Ma). Abundant pillow basalts are evidence of this under-water extrusion. There are some marine mudstones, sandstones, conglomerates, chert and limestones interbedded with these basalt flows. The limestones and cherts originated from accumulations of microscopic marine organism shells. These rocks have gone through considerable deformation and low-grade metamorphism. This has converted some of the fine-grained sediments to slate and phyllite, and the basalts to greenstone (due to growth of the green minerals chlorite and epidote). This metamorphism pretty much destroyed the original planktonic shells, but the bedding is still clearly visible.

Contact metamorphism:
Diabase (basalt) dikes intrude the basalt and red limestone of the Crescent formation. The diabase is a darker green than the basalt and has a more phaneritic texture (coarser-grained). As you traverse the dike the grains become finer, or glassy, toward the margins because of the different cooling rates. The hot diabase resulted in contact metamorphism (high temperature and low pressure) of the limestone bed, changing the mineralogy of the sediment. The hematite (Fe_2O_3) that produced the red color in the limestone combined with calcium carbonate ($CaCO_3$), silica (SiO_2), and water to produce epidote ($Ca_2FeAl_2O(SiO_4)(SiO_7)(OH)$) and possibly the pyroxene wollastonite ($CaSiO_3$).



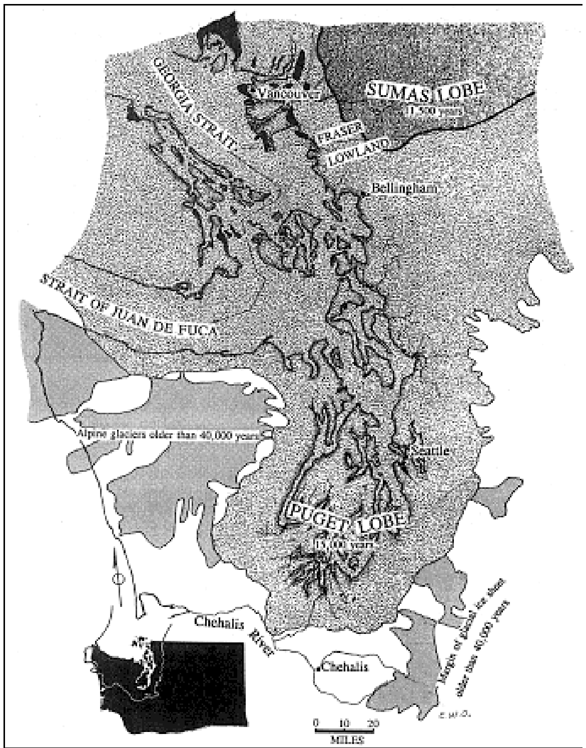
Olympic Subduction Complex (Core Rocks)
The Core of the Olympic mountains is composed of marine sediments that have been scraped of the subducting oceanic plate and obducted onto the North American plate. This is referred to as an accretionary wedge. The Core has been differentiated into several formations that have been lumped into the Upper Olympic Subduction Complex (OSC) and Lower OSC.

The Hoh formation is part of the Lower OSC. This formation is located along the west-central Olympic Peninsula and consists of a series of turbidites and tectonic melanges that are Miocene in age. The Hoh assemblage is unconformably overlain by the Latest Miocene to Pliocene rocks of the Quillayute and Quinalt formations, constraining the deformational event which emplaced the OSC against the older “core rocks” to the Late Miocene (Harris and Tuttle, 1977**;** Brandon, M.T., Roden-Tice, M.K., and Garver, J.I., 1998**)**.

In order to get to the OSC we would need to hike west and cross the Hurricane Ridge fault approximately 2 kilometers up the Straicase trail.

Turbidites: rocks that were deposited in a marine environment by the settling of sediment from a submarine turbid flow of sediment-laden water (turbidity current). The flows, which are initiated by earthquakes, flooding, or oversteepening of a slope, flow down the continental shelf and slope. As the turbidity current slows down, the clastic sediments tend to sort (or grade) themselves by size with the coarsest grains being deposited first and the finest last. Turbidites are frequently referred to as graywacke.

Tectonic Melanges: these are rocks that are associated with extreme deformation and shearing. They are a chaotic mix of various sized blocks embedded in a sheared matrix. Tectonic melanges are frequently associated with accretionary wedges and subduction zones.



Pleistocene Glaciation

Today, the glaciers of the Olympic Mountains occupy small cirques near the peaks and most of the perennial ice is in the form of snow fields and not glaciers (implies down-hill movement). This was not so in the past. During the Pleistocene glaciation of the Olympic Peninsula was much more extensive, mountain glaciers that originated in these peaks extended well beyond the mountain front, burying the Olympic Peninsula under a mountain ice cap.

On the north and east side of the Olympics, the mountain glaciers merged with the Cordilleran Ice Sheet which originated in the coastal mountains of British Columbia. The Puget lobe south, carving out the Hood canal and extending south of Olympia. The maximum extent of the mountain glaciers occurred about 18,000 years ago, a bit earlier than the maximum extent of the continental glaciers (15,000 ybp).

Extent of the glacial ice: Juan de Fuca Lobe and Puget Lobe (Cordilleran Icesheet) and Alpine glaciers.

References

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