

The IAFI Puget Lobe Chapter monthly newsreel:

Introduction to the Milankovitch Theory, Ch 6, (p. 1)

Last time we talked about: Setting the stage for glacial activities during the Pleistocene. And a look at how complex a Continental Ice Sheet is during its life. Also, we went back and got a perspective in time and looked at how climate / geological features set up the Pleistocene.

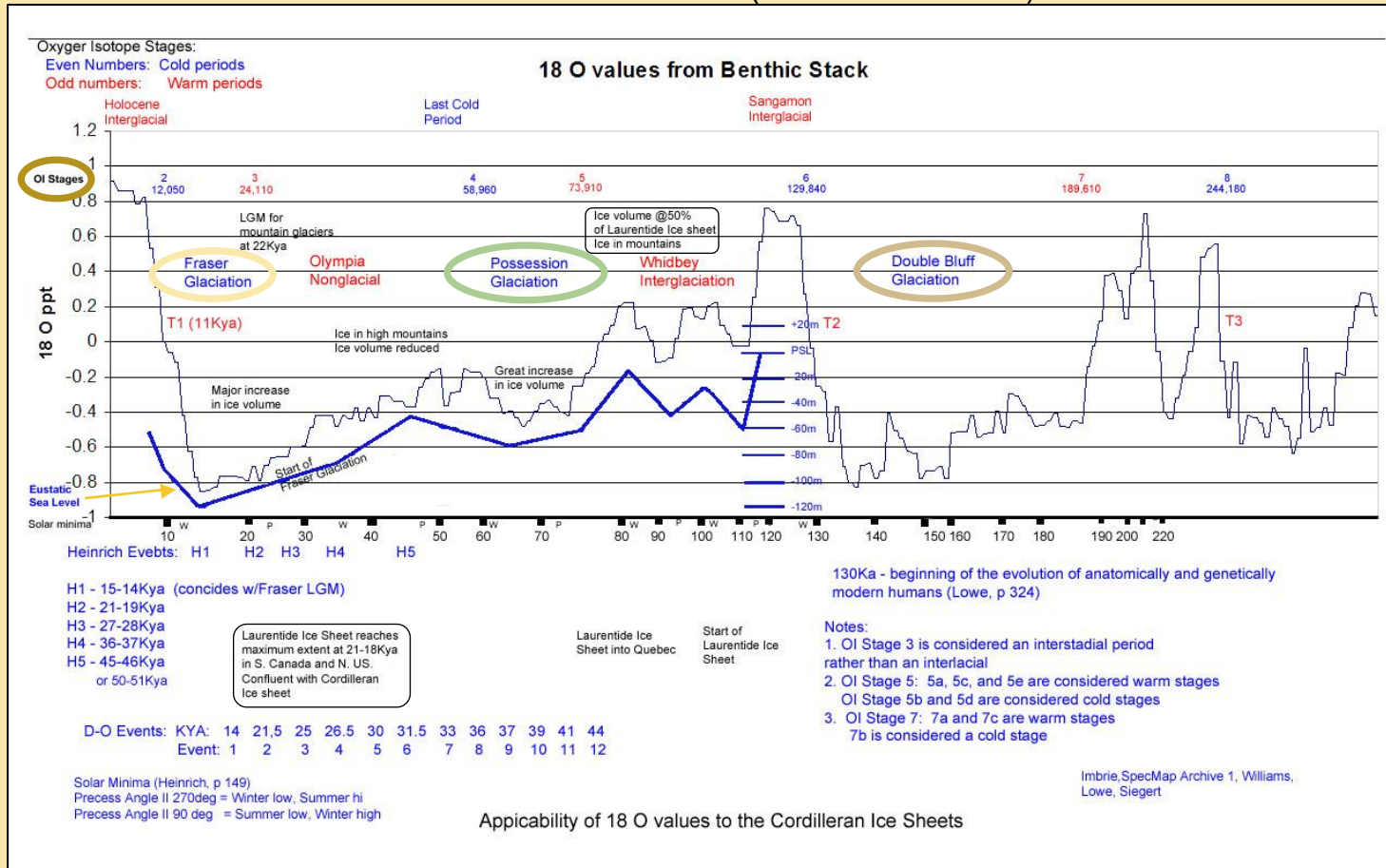
This Chapter is a review:

Double Bluff, Possession, and Fraser Continental Ice Sheets and where we find the last exposed sediments.

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We've seen this non-normalized time chart* several times. Take particular note of the Possession Glaciation. There is no "Tn" (Termination no.) associated with it



*The time is not normalized – meaning the time tick marks at the bottom of graph are not equally spaced. And in this version each data point in the ¹⁸O graph line is entered twice.

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...like there is at the ends of the Fraser (T1) and Double Bluff (T2) Glaciations. Possession glaciation (OI 4 [58,904 Kya] and OI 5 [73,910 Kya]) is not considered a true stadial (Lowe, p.284 - 285) .

However, Geological Map 2011-5, Holly quadrangle, shows the southern-most Possession sediment (Qgd_p) to be around Anderson Creek on the Kitsap Peninsula. Note that in the cross section on next slide, it “peters out” at both ends of the A—A line. No unit named for Possession sediments has been found on the quadrangles to the south.

Double Bluff sediment appears on the Lilliwaup 7.5 Quadrangle OFR-2010-4.

There are pre-Fraser sediments mentioned on Quadrangles to the south; however, there are Qpd (Lilliwaup quadrangle) and Qgp sediments that are inferred to be Double Bluff. So they are referred to and discussed here as Double Bluff sediments. More research is required.

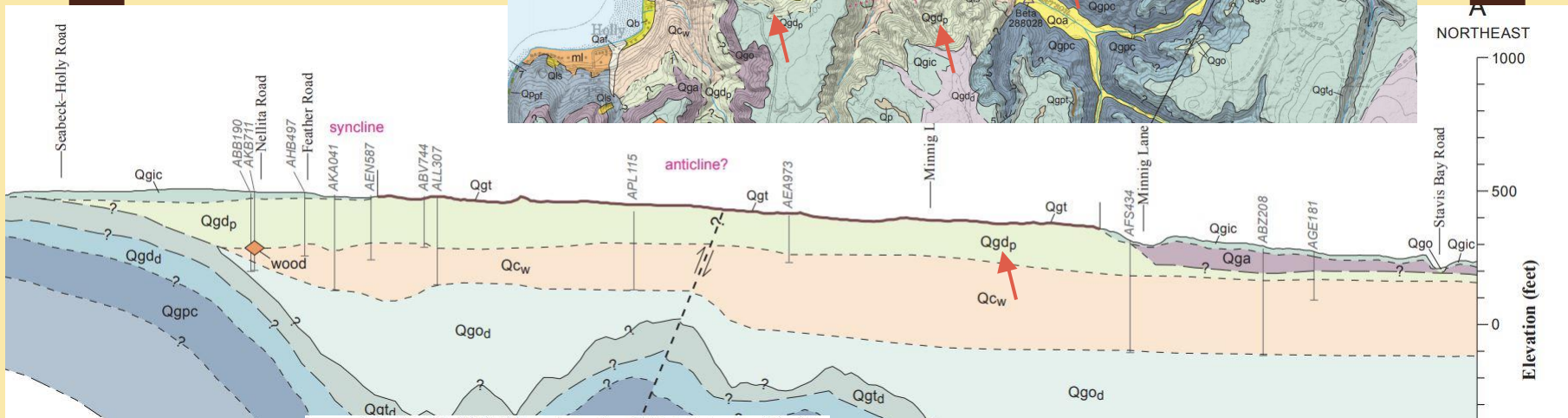
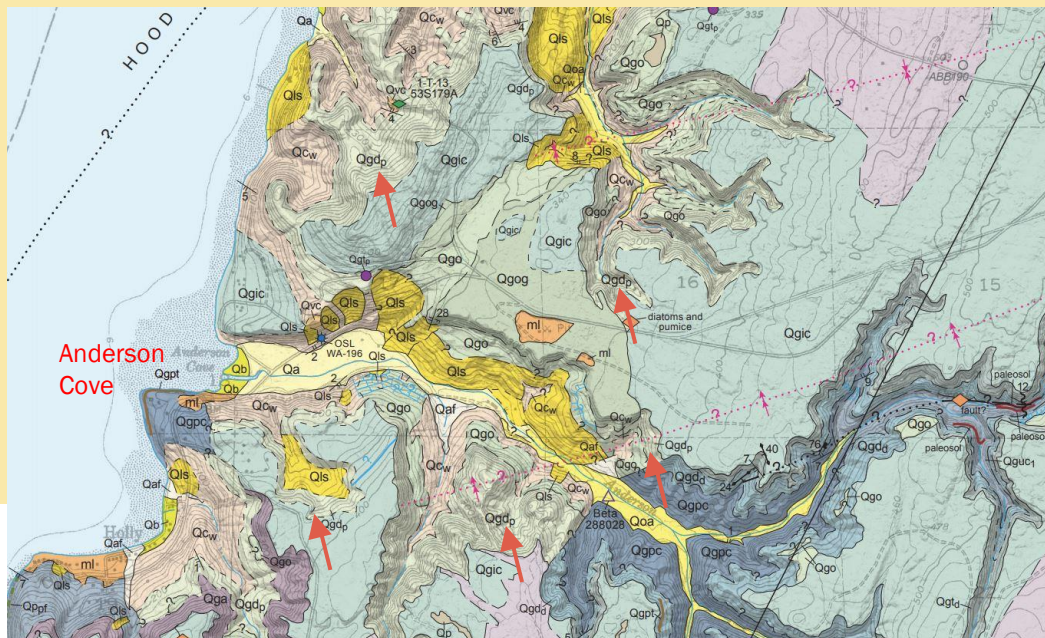
Note: “OI” is Oxygen Isotope Stage and is equivalent to MIS. More later

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The last instance of Possession Drift listed by name on the USGS/DNR geologic maps

Holly 7.5 Quadrangle
OFR-2011-5

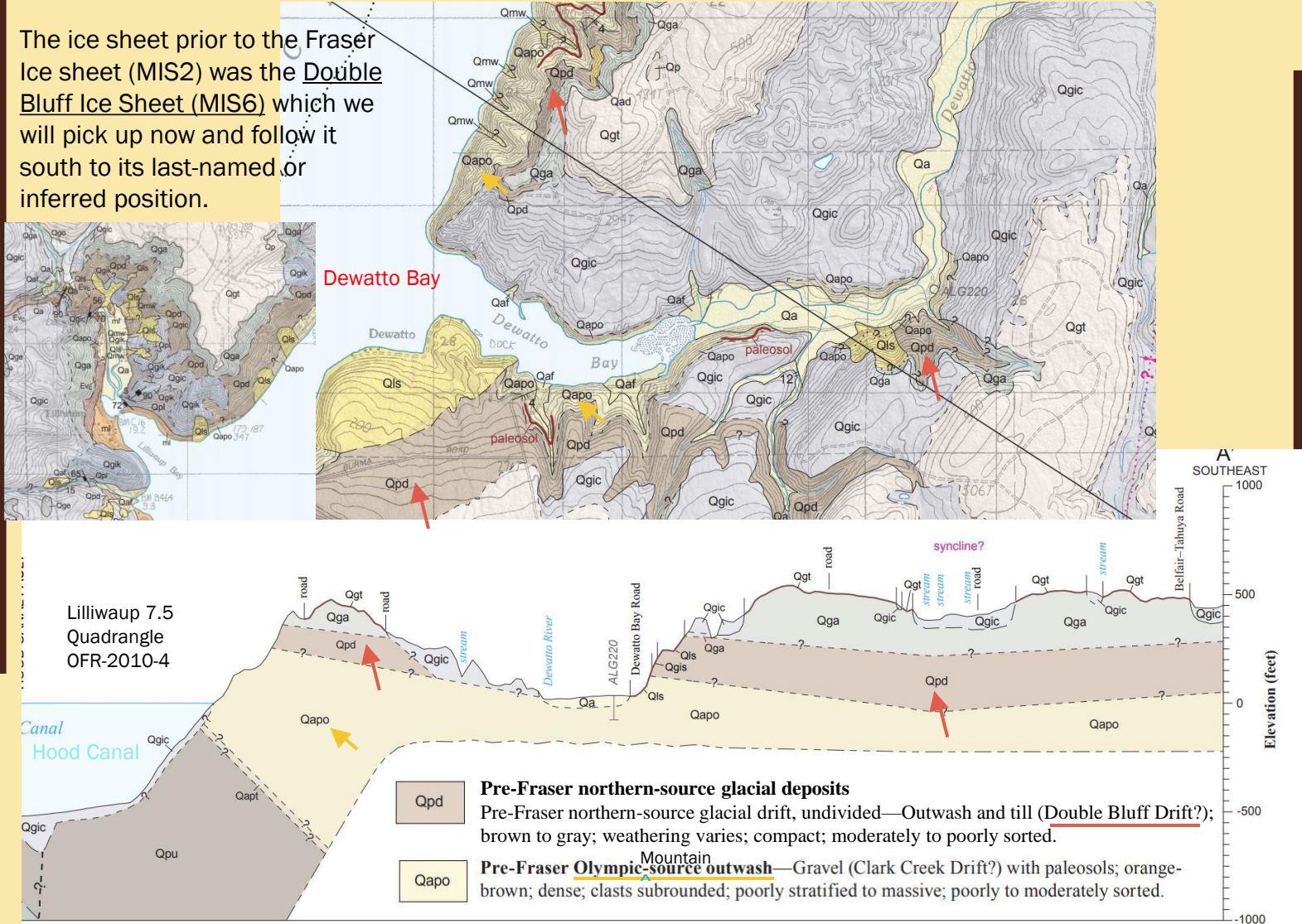


Qgd_p Glacial drift of MIS 4 (Possession age), undivided—Outwash and diamic; brown to gray; weathering varied; compact; well- to poorly sorted; may inadvertently include sand of MIS 3 and (or) 5 (Whidbey to Olympia age); found only north of Anderson Creek; where too small to show at map scale, shown as a point or line unit.

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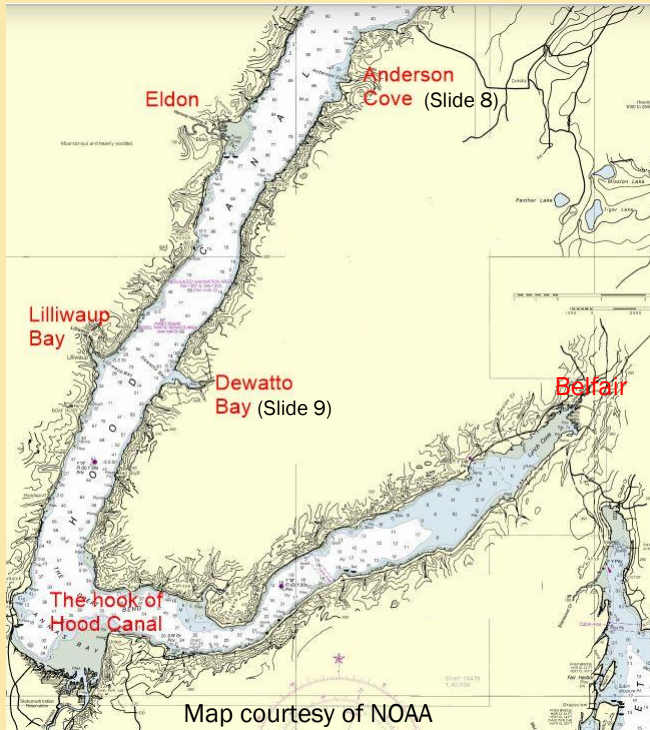
The ice sheet prior to the Fraser Ice sheet (MIS2) was the Double Bluff Ice Sheet (MIS6) which we will pick up now and follow it south to its last-named or inferred position.



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Perspective is shown here as to location of sediments referenced on last two slides. Previous research located Possession sediments just south of Bremerton and are not shown.



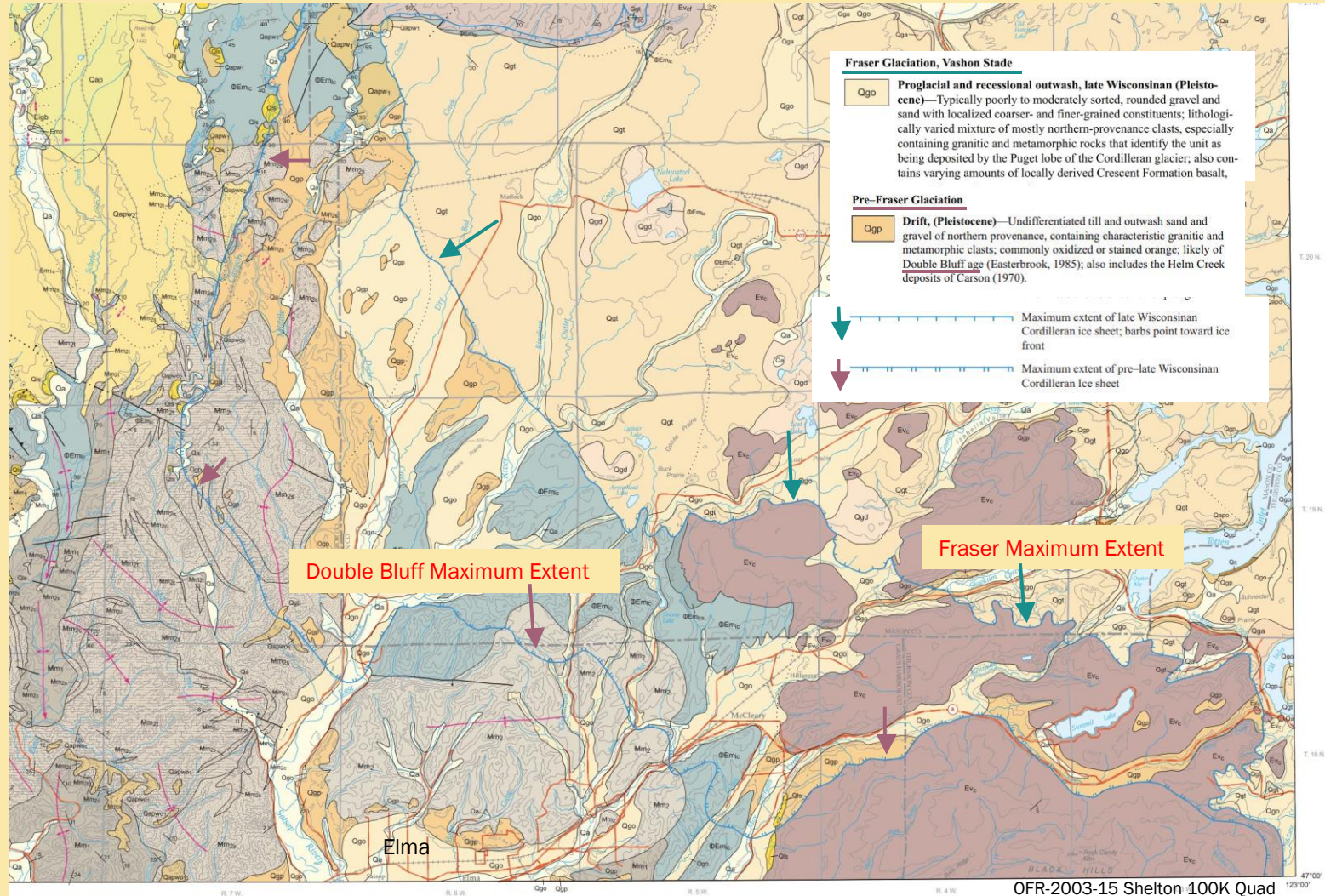
Map courtesy of NOAA

At this point we want to peruse the Fraser Glaciation Maximum Extent and see if we can possibly locate a portion of the Double Bluff Maximum Extent. We looked at the area above Elma and found the Maximum Extent for both glaciations. With interesting results. That result concerns what a later glaciation can do to pre-existing sediment. And it is very apparent on the geological map that is shown.

Note: **Maximum Extent** covers both LGM and width (a silhouette or outline of the extent of the footprint of the glacier)

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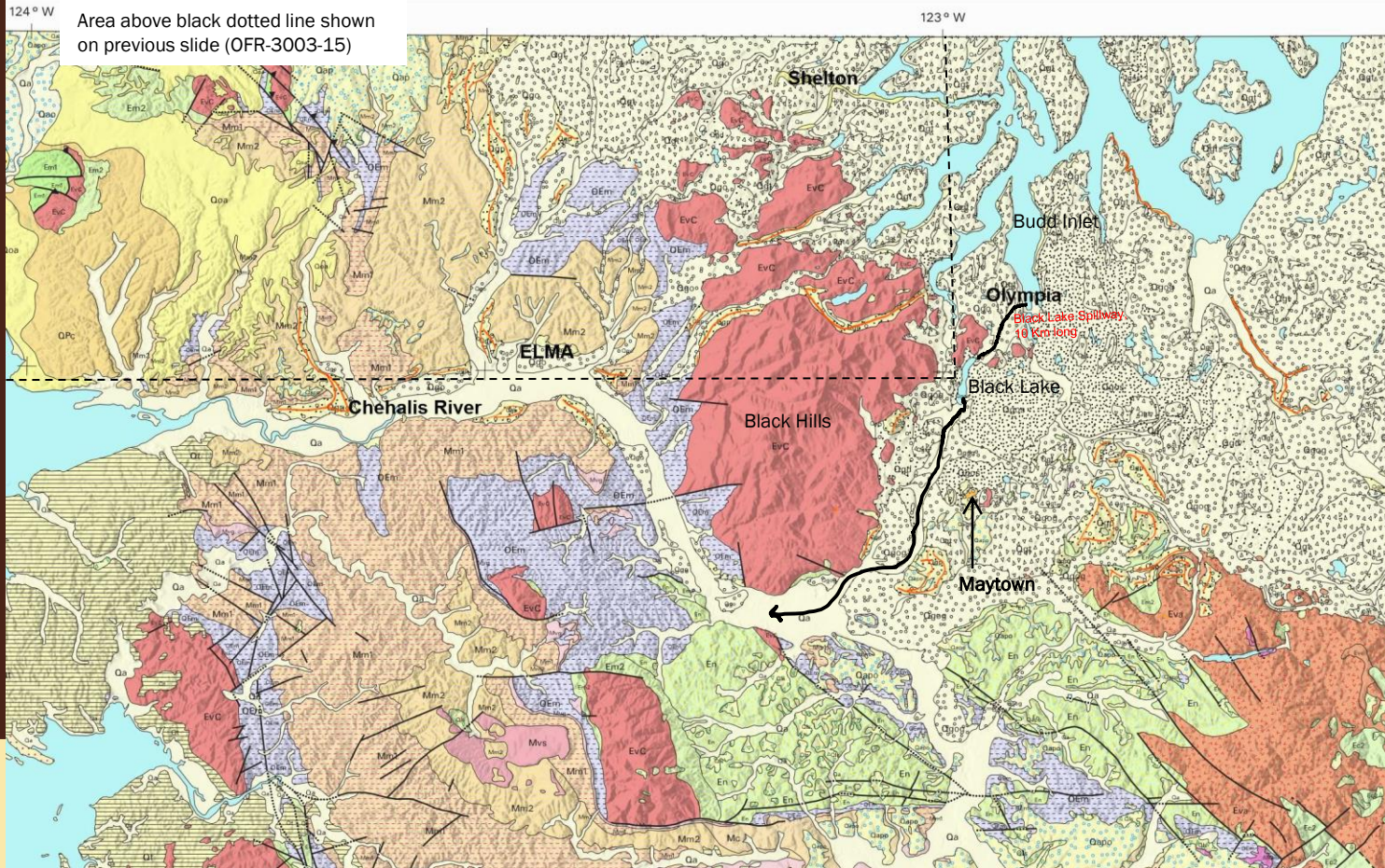
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Note: there are no Qgp deposits east of the “late Wisconsinan Cordilleran Ice sheet” line (Fraser).
The Qgo and Qgt (unit description not shown) units are Fraser Glaciation sediments.

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Source: OFR 99-382, sh1 GM of SW Washington

Note: Unit **Qgp** on this geo map is a different “color” than shown on OFR-2003-15 (Shelton 100K quad), the previous slide. Therefore, **Qgp** on this map, an “orange” line is drawn within the sediment unit, i.e., the unit next to the “Chehalis River” nomenclature.

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Problems with Geologic Unit Descriptions.

In tracking Unit **Qgp** we found several definitions to describe the sediments on different Quadrangles:

Qgp:

Pre-Vashon Drift

Qgp

Pre-Vashon drift—Sand and gravel with some clay and silt; light brown or gray to yellowish brown to brick red; generally compact; clasts well rounded; dominated by northern-source polycrystalline quartz, plutonic, and minor metamorphic grains. The unit crops out in an area near the southern margin of the quadrangle that was mapped by Noble and Wallace (1966) as Logan Hill Formation, but the purely northern provenance makeup of the clasts indicates that this may be Double Bluff Drift (Easterbrook and others, 1967; Lea, 1984).

GM-72 Maytown 24K Quad

Pre-Fraser Glaciation

Qgp

Drift, (Pleistocene)—Undifferentiated till and outwash sand and gravel of northern provenance, containing characteristic granitic and metamorphic clasts; commonly oxidized or stained orange; likely of Double Bluff age (Easterbrook, 1985); also includes the Helm Creek deposits of Carson (1970).

OFR-2003-15 Shelton 100K Quad

Pre-Fraser Glacial Deposits



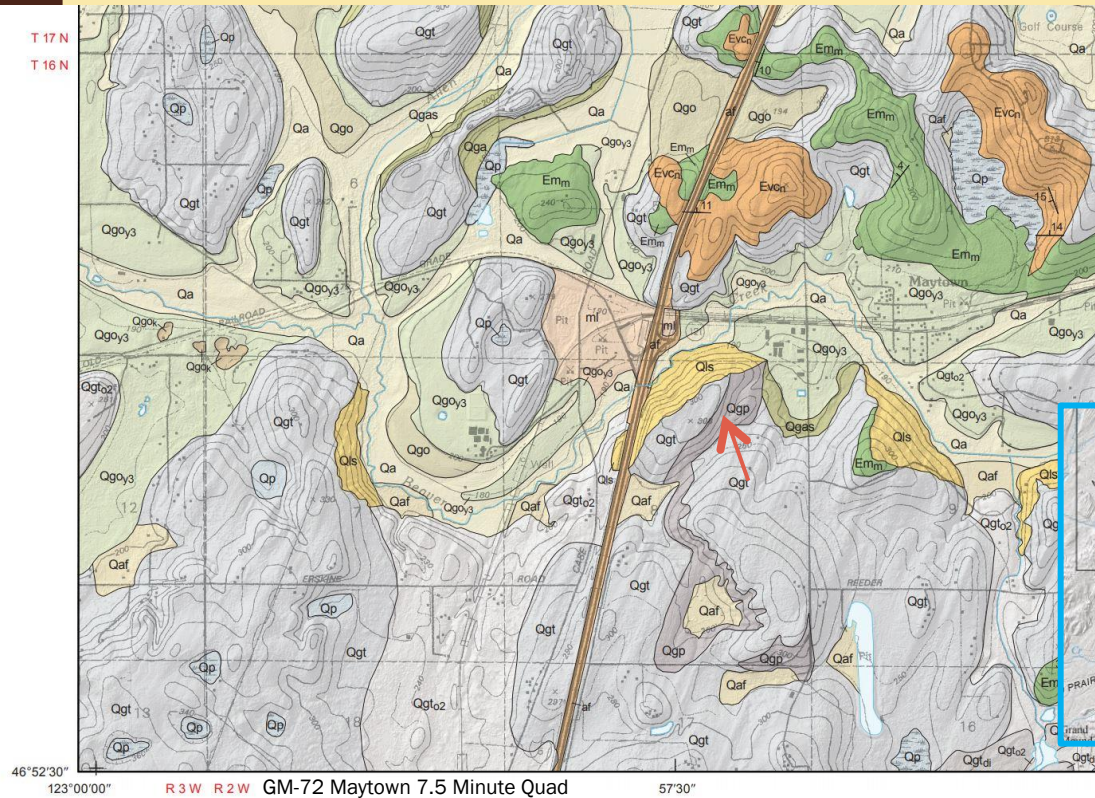
Undifferentiated drift—Till and outwash sand and gravel; commonly oxidized. Includes Salmon Springs, Orting, and Stuck Drifts, and Helm Creek drift of Carson (1970)

OFR-99-392, Sh 1, GM of SW Washington

For this newsreel, the **Qgp** unit will identify Double Bluff sediments. However, on the Lilliwaup Quadrangle Double Bluff sediments are identified as **Qpd**. And **Qpd** is interesting as it is defined as sediments of a northern provenance versus alpine.

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Maytown is south of Olympia about 9 miles (exit 95). At US12 near Rochester (exit 88) is potentially the southern most extent of visible Double Bluff sediments. On OFR-99-382 Sh 1 there are no Double Bluff sediments visible south of the Black Hills (EcV) with a line drawn west to east at that point (map boundaries) except for some towards the Cascades.



The red lines on this map indicate the mound areas



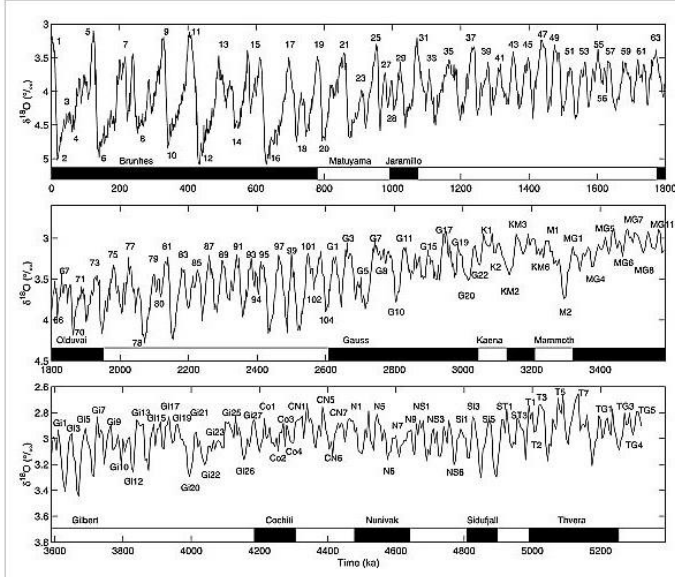
Approximate location of LGM and showing outwash channels

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Two items for greater understanding of glaciers:

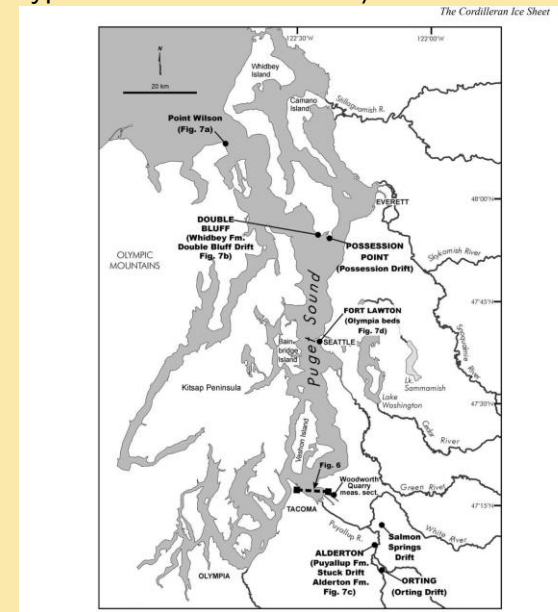
MI sequences for Glacial/Interglacial periods



The source document extended the Marine Isotopic Sequences past what we normally see on page 6; however, it is very hard to study something where the physical evidence is non-existence or buried so deep that there may be no surface deposits. Note the $\delta^{18}\text{O}$ values at left are staggered.

Source: Lisiecki, L.E., Raymo, M.E., A Pliocene-Pleistocene Stack of 57 Globally Distributed Benthic $\delta^{18}\text{O}$ Records, [Paleoceanography](#) and [Paleoclimatology](#). Vol 20 Issue 1, 2005

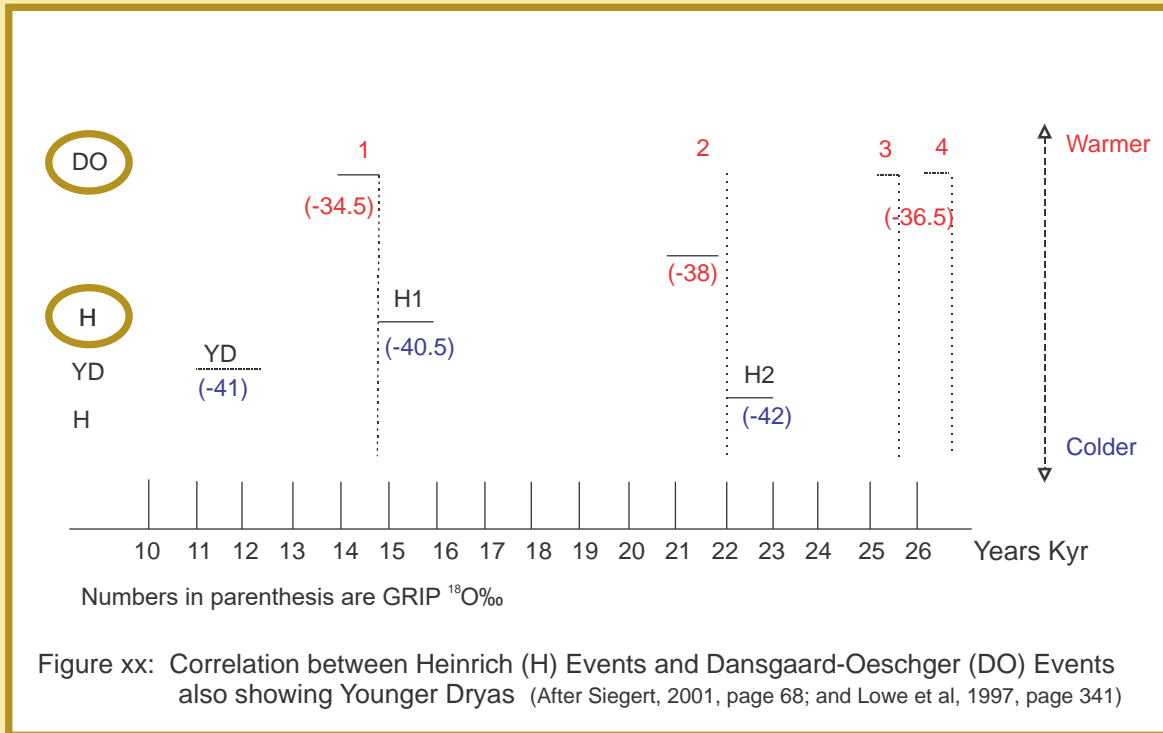
Type Location for Glaciers/Drifts



Type Location wherein the ice sheets are named. Another example, the Crescent Formation, in the Olympic Mountains, is named for a basalt outcrop at the west end of Crescent Beach about 15 miles west of Port Angeles.

Chart Source: Booth, et al., *The Cordilleran Ice Sheet*, Development in Quaternary Science, Vol 1, Elsevier Science B.V., 2003

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Ratio of $\delta^{16}\text{O}$ to $\delta^{18}\text{O}$:
500:1

Ice sheets retain the $\delta^{16}\text{O}$ that would normally be returned to the oceans as runoff and evaporation.

Consequently, more $\delta^{18}\text{O}$ is found in shells as the ocean is enriched with $\delta^{18}\text{O}$ during glacial periods.

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In January 2021, the newsreel will continue with Chapter 7:

A review of: A look at Hood Canal basement rock, sediments, depth, and history and differences in bottom topography

And the optimum location to have your Port Ludlow home during the next LGM.

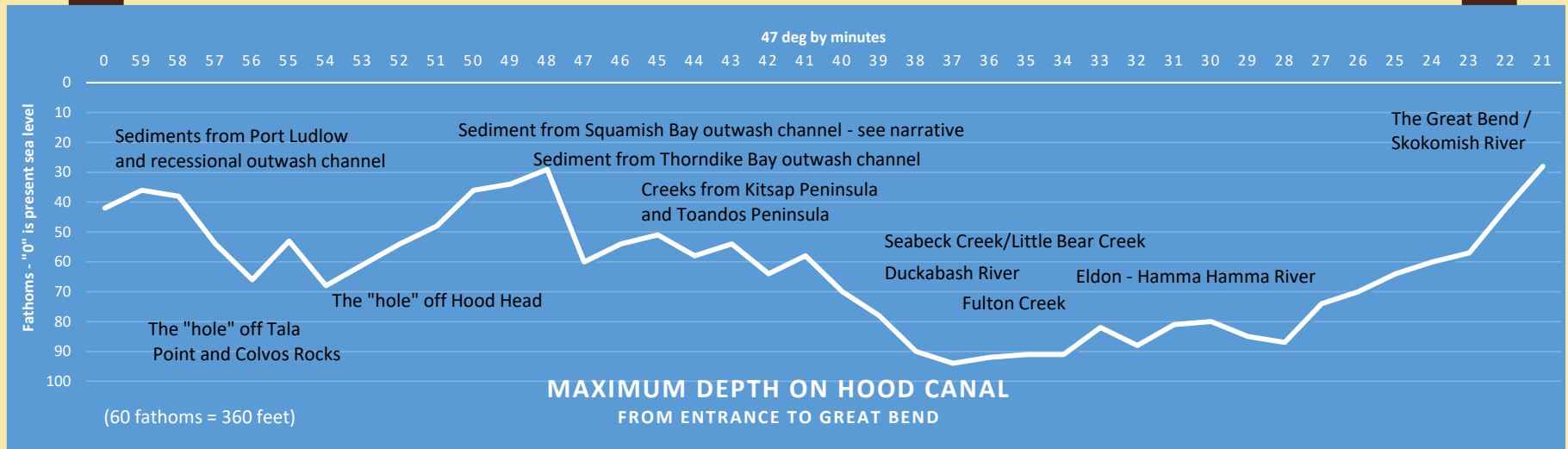
a. (Jan) A catchall of pertinent facts about Continental Ice Sheets including was the last Puget Lobe (Fraser) a true Continental Ice Sheet(CIS) or a piedmont glacier. And a look at Alpine and CIS LGM moraines on the west side of the Olympics.

b. (Jan) And a look at surging glaciers and ...?

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In Jan 2021, a quick-look at the bottom profile taken from NOAA Navigation charts of Hood Canal at the deepest locations from 47 21.000N through 48 00.000N



Depth data from:
Hood Canal to Dabob Bay NOAA Chart 18476
Hood Canal Entrance NOAA Chart 18477
Data represents deepest sounding on above charts -