Puget Lobe Chapter
Seattle, Washington

The Puget Lobe Chapter is named for the lobe of the Cordilleran Ice Sheet that covered the Puget Sound area during the last ice-age advance, the Fraser Glaciation. The ice sheet formed in Canada between the Rocky Mountains and the Pacific Coast. Contributions from the areas between Kamloops, BC, and Vancouver Island flowed south but couldn’t overtop the Cascade Range and the Olympic Mountains. The sheet split into two lobes near the eastern margin of the Olympic Mountains. The Puget Lobe flowed south into the Puget Lowland trough, and the Juan de Fuca Lobe flowed west into the Strait of Juan de Fuca to the Pacific Ocean.

To help the public see and understand this story, the Puget Lobe Chapter sponsors guest speakers at bi-monthly meetings and hosts field trips throughout the year. These presentations benefit from our large contingent of professional geologists, scientists, and engineers who share technical presentations, field guides, and public displays. To learn more about the chapter and attending a presentation, contact us at https://IAFI.org/puget-lobe-chapter/

Learn MORE at IAFI.org or facebook.com/IceAgeFloods/

Interesting Puget Lobe Facts!

Ice-age sea level was 300 to 400 feet lower worldwide because so much water was stored in northern ice sheets.

Ice moved south of the Canadian border 19,000 years ago, blocked the Strait of Juan de Fuca 18,300 years ago, passed Seattle 17,900 years ago, and reached its maximum extent south at Olympia 16,800 years ago.

The Puget lobe was 150 miles long and 80 miles wide south of the Canadian border, and advanced southward at 450 feet/year.

As the ice advanced southward, its weight depressed Earth’s crust 275 feet at Seattle and 130 feet at Olympia.

The thickness of the ice lobe was 5000 feet at the Canadian border, 3000 feet at Seattle, and 700 feet at Olympia.

By 16,000 years ago, ice had retreated (melted) sufficiently for Puget Sound to again drain to the Strait of Juan de Fuca.

By 11,000 years ago, rise of the depressed crust (isostatic rebound) to pre-ice levels in the Puget Lowland was nearly complete.

Humans were in the area by at least 13,800 years ago, as shown by the butchered remains of the Manis mastodon.

Scan this QR code for an animated advance and retreat of the Puget lobe critical to understanding this story.

The Puget Lobe Story of Ice and Water

During the peak of the most recent ice age, the vast Cordilleran continental ice sheet covered southwestern Canada and northern parts of Washington, Idaho, and Montana. An eastern “Purcell” lobe of the ice sheet descended into the Idaho panhandle, damming the Clark Fork River with ice and impounding Glacial Lake Missoula. The ice dam failed and rebuilt repeatedly, resulting in cataclysmic floods that roared across northern Idaho, eastern and central Washington, through the Columbia River Gorge, and into Oregon’s Willamette Valley before emptying into the Pacific Ocean.

Western Washington was isolated from the Missoula Floods, but it experienced similar significant sculpting by ice and water. Ice from mountain ranges in western Canada expanded south into Washington. One lobe occupied the Strait of Juan de Fuca, and another lobe covered the Puget Lowland. Water that pooled south of the ice sheet in the Puget Lowland escaped to the Pacific Ocean via the Chehalis River valley. Rivers from the western Cascade Range and eastern Olympic Mountains added to the huge volumes of meltwater from the ice sheet. Finally, the ice melted back sufficiently to reconnect Puget Sound with the Strait of Juan de Fuca, and drainage to the Pacific Ocean was restored.

Although largely hidden by extensive vegetation, roads, housing, and commercial development, the Puget Lowland exhibits a rich variety of ice-age geologic features. Five selected sites illustrate (1) Sorting and plucking of bedrock as ice moved south from Canada; (2) Erosion by ice and meltwater as ice moved farther south; (3) Southwestern release of meltwater to the Pacific Ocean via the Chehalis River; (4) Outburst floods from impounded streams in the Cascade Range foothills; and (5) Large lakes and valleys excavated by ice and water with many glacial erratics strewn over the landscape. The IAFI.org website provides more details and lists additional Ice Age geologic sites of interest.
Explore Prominent Ice Age Features in the Puget Sound Basin

Jump into the Continental Glacial history with a DRIVE/HIKE/LEARN day tour. Discover why our region is like nowhere else.

1. Mt. Erie & Washington Pk
   Ice Plucking and Bedrock Scouring

   MODERATE DRIVE / EASY ACCESS - ROUNDTRIP 5 hours from Seattle, plus drive/hike Mt. Erie and Washington Park

   The Canadian ice sheet encountered numerous bedrock hills and mountains in its first 600 miles south of the border between the San Juan Islands and on the mainland to the east (Bellingham area).

   Mt. Erie, a city in Anacortes park on Fidalgo Island, is an excellent example of ice-plucked bedrock. Mt. Erie has a ridge (up-ice, north-south) that is the result of ice-plucking as the ice passed over the mountains. From the top of Mt. Erie, fine views of Puget Sound to the south and vistas to the west and east, including Mt. Baker, Glacier Peak and other hills, such as Mt. Constitution in the San Juan Islands, that were similarly ice-scoured.

2. Major Troughs & Drumlins in the Seattle Area

   MODERATE DRIVE / EASY ACCESS - Walking & biking tours, plus the Space Needle

   Major troughs in the Puget Lowland may have been excavated by previous glaciations before the latest Yukon Glacial Stage. Water-filled glacial lakes, such as Lake Sammamish, have since been excavated by the ice sheet. Glacial lakes on Puget Sound may have been temporarily excavated by the ice sheet. Glacial lakes on Puget Sound are a relic of the last ice age.

3. Southwest Meltwater Escape
   Black Lake & Chehalis River

   The Black Lake spillway southwest of Olympia was the main outlet for meltwater that poured ahead of the advancing ice lobe in proglacial Lake Russell. Black Lake, elevation 110 feet and 20 feet deep, is surrounded by glacial outwash and 80 feet below a low point in the Puget basin's terminal moraine area. From Black Lake, the Black River runs south and joins other meltwater paths west from Tenino to converge with the Chehalis River near Oakville. The meltwater path via Mattlock joins the Chehalis River at Satsop, 27 miles downstream.

   Today's slow, meandering Chehalis River in the valley from Oakville to Aberdeen is nothing like the raging torrent it was in ice-age times. Proglacial Lake Russell continued to drain through the Chehalis River valley until the outlet at the Strait of Juan de Fuca reopened near the end of the Yukon glacial retreat. Some estimates equate seasonal ice-age Chehalis River flow rates of meltwater, precipitation, and period of postglacial flows from the eastern ice margin with present-day Chehalis River flow rates. The Chehalis River valley was deeper when sea level was 300 to 400 feet lower, and it connected across the continental shelf to the submarine Grays Harbor Canyon 30 miles west of Grays Harbor. Post-glacial sediment has since filled both the valley and its continental shelf.

   Visit https://iafi.glaciarscapesvenir.org/ or scan this QR code for an online interactive map and additional details about these features, associated road tours, trails, and other ice-age features in the Puget Sound area.

4. Ice-Marginal Meltwater Channel and Jökulhlaups

   MODERATE DRIVE / HIKE - Roundtrip 2 hours from Seattle, plus 3-hour hike

   A meltwater channel at the eastern margin of the ice, formed by meltwater and runoff of western Cascade rivers, ran south along the Cascade foothills. The 90-mile-long channel from the Skykomish River south to the Nisqually River is clearly visible on lidar mapping or Google Earth. Thirty miles of the channel is north of Rattlesnake Lake at North Bend. The lakes occupy the spillway and a U-shaped gap gouged by the ice as it roiled ML. To unload over Rattlesnake Ridge, the ice found a route south past Rattlesnake Ledge. In the process, the Duwamish River was re-routed, as were other rivers in the western Cascades, such as the lower Skagit and Stilaguamish Rivers, which were diverted and created the ice at Rattlesnake Ridge. The ice is 150 feet thick. The Ice Age gap is a remnant of the ice age.

5. Lake Sammamish, Glacial Erratics and the end of the Vashon Stade Glacial Lakes

   SHORT DRIVE/EASY ACCESS - ROUNDTRIP 1 hour from Seattle, plus drive/hike at Lake Sammamish

   Lake Sammamish is a classic ice-age remnant. Its depression, like that of Lake Washington, was excavated by melting ice and water, possibly in a pre-existing trough. Cougar Mountain offers sweeping views of the lake. Seven miles long, more than a mile wide, and 150 feet deep, Lake Sammamish is surrounded by hills 300' to 500' high.

   It was one of the last glacial lakes to empty as the Puget ice melted back. Imagine Glacial Lake Sammamish still full of 500-foothick ice as melting from the maximum ice thickness of 200 feet continued. Stagnant ice trapped in the lake's depression may have taken hundreds of years to melt away. To the east, the top of Tiger Mountain (elev. 3200') looks down on the ice in a flat bucket. Lower ice-covered hills, like Cougar Mountain (elev. 1850'), reappeared as the ice melted.

   Glacial Erratics are among the most commonly noticed ice-age remnants. They are pieces of rock that differ from the type of rock native to the area in which they rest. They are carried by glacial ice on ice rafting, often over distances of hundreds of miles. They can be seen in many places on Cougar Mountain.