WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark - Commissioner of Public Lands

Division of Geology and Earth Resources
David K. Norman - State Geologist

WASHINGTON DIVISION OF GEOLOGY AND EARTH RESOURCES
OPEN FILE REPORT 2010-4

Lilliwaup 7.5-minute Quadrangle
June 2010

Pamphlet accompanies map

MAJOR FINDINGS

- Pre-Vashon glacial deposits include at least one northern-source drift (likely Double Bluff Drift) and an older alpine drift (Clark Creek Drift) older than 245 ka and likely reversely magnetized.
- Glaciolacustrine silts on the north end of the map dip southeast into the Dewatto basin (defined by regional gravity anomalies).
- Northerly dipping glaciolacustrine deposits (likely Double Bluff Drift) may indicate the existence of the Tacoma fault in the southern part of the map.
- Sediments previously mapped as landslides along the Dewatto valley and near Lilliwaup are reinterpreted as stagnant-ice deposits.
- Sediment from 2007 debris torrents covered beaches and shellfish habitat at debris fans along Hood Canal.

DESCRIPTION OF MAP UNITS *(see pamphlet for detailed map unit descriptions)*

Quaternary Unconsolidated Deposits

HOLOCENE NONGLACIAL DEPOSITS

ml—**Modified land**—Locally derived sediment ranging from clay to gravel and diamicton; mixed and reworked by excavation and redistributed to modify topography.

Qa—**Alluvium**—Sand to cobble gravel; gray and generally unweathered; loose; clasts subrounded to rounded; moderately to well sorted; deposited in stream valleys and estuaries.

Qb—**Beach deposits**—Transient sand to boulder gravel with shells; gray to brown-gray; clasts moderately to well rounded and spherical; may be well sorted; loose; derived locally.

Qmw—**Mass wasting deposits**—Pebble to boulder gravel and diamicton; loose or soft; clasts sub- to well rounded; poorly to moderately sorted; includes debris fans, alluvial fans, and landslides.

HOLOCENE TO LATEST PLEISTOCENE NONGLACIAL DEPOSITS

Qp—**Peat**—Organic-rich sediment, including peat, muck, silt, and clay; dark brown to black; very soft to medium soft; typically in closed depressions.

Qls—**Landslide deposits**—Clay, silt, and gravel (diamicton); loose or soft; clasts angular to rounded; unsorted to poorly sorted and nonstratified; includes underlying units in scarp areas.

Qaf—**Alluvial fan deposits**—Debris-flow diamicton and alluvial sand and gravel; gray; loose; clasts subrounded to rounded; forms concentric lobes where streams emerge from confining valleys.

PLEISTOCENE GLACIAL DEPOSITS

Recessional Deposits of the Vashon Stade of the Fraser Glaciation (northern source)

Qgo—**Vashon recessional outwash (latest Pleistocene)**—Fluvial cobble to pebble gravel and sand; gray; loose; clasts rounded to subangular; moderately to well sorted; beds crudely stratified.

Qgic—**Vashon ice-contact deposits**—Gravel, diamicton, and till; yellow-tan to gray; loose to dense; clasts subangular to rounded; variably sorted; massive to well stratified. Locally divided into:

- **Qge**—**Vashon esker deposits**—Gravel and sand; tan to brown; clasts moderately to well rounded; loose; well sorted; forms low, elongate, sinuous hills.
- **Qgik**—**Vashon kame deposits**—Gravel and sand; yellow-gray; loose; clasts rounded; moderately to well sorted and stratified; deltas, crossbedding, and slumped bedding.

Advance Proglacial and Subglacial Deposits of the Vashon Stade of the Fraser Glaciation

Qgt—**Vashon lodgment till**—Sand, pebbles, cobbles, silt, and clay (diamicton); gray; compact; clasts subangular to rounded; unsorted and unstratified; includes northern- and local-source material.

Qga—**Vashon advance outwash**—Gravel, sand, silt, and dropstone diamicton; gray to tan; stiff or dense; northern-source clasts well rounded and well sorted; stratified; thinly to thickly bedded.

Pre-Vashon Glacial Deposits

Pre-Vashon Olympic-source glacial deposits of probable Fraser age (may include pre-Fraser deposits)

Qad—**Uppermost Olympic-source glacial drift, undivided**—Outwash consisting of gravel, till, and diamicton; light brown to buff; compact; clasts rounded to angular; well sorted to unsorted.

Pre-Fraser northern-source glacial deposits

Qpd—**Pre-Fraser northern-source glacial drift, undivided**—Outwash and till (Double Bluff Drift?); brown to gray; weathering varies; compact; moderately to poorly sorted.

Pre-Fraser Olympic-source glacial deposits

Qapd—**Pre-Fraser Olympic-source glacial drift, undivided**—Outwash and till; orange-brown to gray; weathering varies; compact; clasts subangular to rounded; moderately to poorly sorted.

Qapo—**Pre-Fraser Olympic-source outwash**—Gravel (Clark Creek Drift?) with paleosols; orange-brown; dense; clasts subrounded; poorly stratified to massive; poorly to moderately sorted.

Qapt—**Pre-Fraser Olympic-source till**—Diamicton (lodgment till, correlated with Clark Creek Drift); brown; dense; matrix supported; clasts rounded to subangular and commonly faceted.

Pre-Fraser northern-source glacial and nonglacial deposits

Qpl—**Pre-Fraser fine-grained glaciolacustrine sediments**—Silt and fine sand; light buff, gray when wet; dense; thinly bedded to thickly laminated with a pervasive set of near-vertical joints.

Qpu—**Pre-Fraser sediments, undivided (cross section only)**—Glacial and nonglacial sediments below unit Qapt; likely contains northern-source Annas Bay Drift and other sediment.

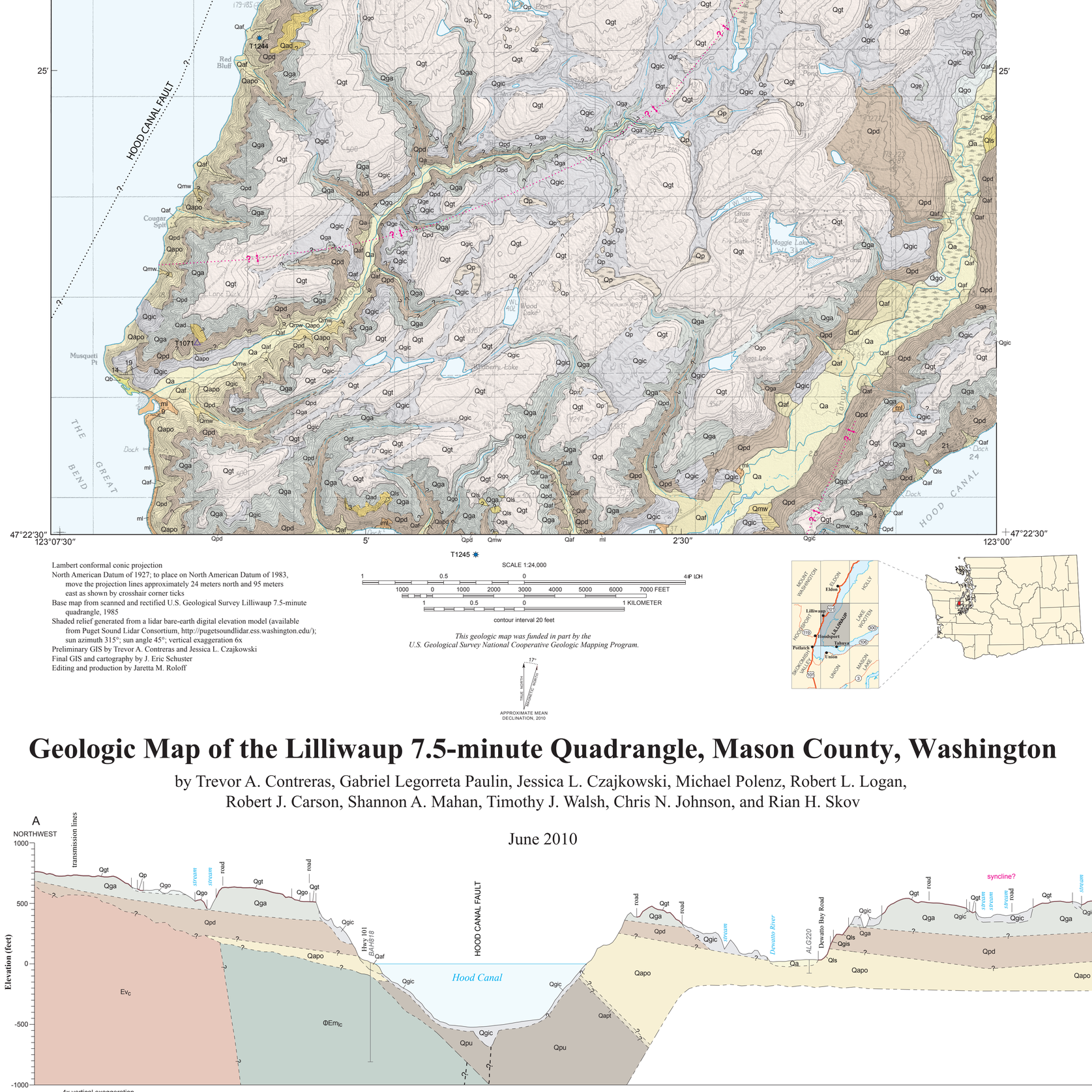
Tertiary Volcanic and Sedimentary Rocks

ΦEmlc—**Lincoln Creek Formation(?) (Oligocene to Eocene)**—Marine tuffaceous siltstone and sandstone; gray; fine- to coarse-grained; moderately to poorly sorted; massive.

Evc—**Crescent Formation basalt, undivided (lower to middle Eocene)**—Basalt sills and submarine flows; black; fine- to coarse-grained, includes zeolite and chlorite-group minerals.

GEOLOGIC SYMBOLS

- Contact—identity and existence certain, location accurate
- Contact—identity and existence certain, location concealed
- Contact—scratch boundary
- Contact—identity and existence certain, location approximate
- Contact—identity and existence certain, location inferred
- Contact—identity or existence questionable, location accurate
- Contact—identity or existence questionable, location concealed
- Contact—identity or existence questionable, location approximate
- Contact—identity or existence questionable, location inferred
- Fault, unknown offset—identity or existence questionable, location concealed
- Fault, unknown offset—identity or existence questionable, location inferred (cross section only)
- Syncline—identity or existence questionable, location concealed
- Lineament
- Paleosol
- Qgt — Surficial unit too thin to show at scale (between ticks) (cross section only)
- A — A′ — Line of cross section
- ALG220 ○ — Water well
- T1244 △ — Age-date site, carbon-14 (^{14}C)
- T1071 ✱ — Age-date site, optically stimulated luminescence
- 47 — Bedding—showing strike and dip
- 72 — Joint—showing strike and dip
- 90 — Vertical or near-vertical joint—showing strike
- 90 — Minor vertical or near-vertical fault—showing strike
- 7 — Bedding in unconsolidated sedimentary deposits —showing strike and dip
- 70 — Flow layering in lava flow—showing strike and dip



Lambert conformal conic projection
North American Datum of 1927; to place on North American Datum of 1983, move the projection lines approximately 24 meters north and 95 meters east as shown by crosshair corner ticks
Base map from scanned and rectified U.S. Geological Survey Lilliwaup 7.5-minute quadrangle, 1985
Shaded relief generated from a lidar bare-earth digital elevation model (available from Puget Sound Lidar Consortium, http://pugetsoundlidar.ess.washington.edu/); sun azimuth 315°; sun angle 45°; vertical exaggeration 6x
Preliminary GIS by Trevor A. Contreras and Jessica L. Czajkowski
Final GIS and cartography by J. Eric Schuster
Editing and production by Jaretta M. Roloff

SCALE 1:24,000

1 0.5 0 4 MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0.5 0 1 KILOMETER
contour interval 20 feet

This geologic map was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program.

Geologic Map of the Lilliwaup 7.5-minute Quadrangle, Mason County, Washington

by Trevor A. Contreras, Gabriel Legorreta Paulin, Jessica L. Czajkowski, Michael Polenz, Robert L. Logan, Robert J. Carson, Shannon A. Mahan, Timothy J. Walsh, Chris N. Johnson, and Rian H. Skov

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Data supplement: Polenz, Michael; Miller, B. A.; Contreras, T. A.; Czajkowski, J. L.; Legorreta Paulin, Gabriel; Martin, M. E.; Logan, R. L.; Carson, R. J.; Johnson, C. N.; Skov, R. H.; Mahan, S. A.; Cohan, C. R., 2010, Supplement to geologic maps of the Lilliwaup, Skokomish Valley, and Union 7.5-minute quadrangles, Mason County, Washington—Geologic setting and development around the Great Bend of Hood Canal: Washington Division of Geology and Earth Resources Open File Report 2010-5, 27 p.

Age-date sites. ^{14}C, radiocarbon analysis; IRSL, infrared stimulated luminescence analysis; ka, thousand years. For complete age control data, see Table 1 in the pamphlet.

Age-date site	Analytical method	Age estimate (^{14}C yr B.P. or ka)
T455	^{14}C	>43,100 yr B.P.
T1071	^{14}C	>43,050 yr B.P.
T1244	IRSL	>50 ka, but likely much older
T1245	IRSL	>245 ka, but likely much older