WASHINGTON STATE DEPARTMENT OF
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WASHINGTON DIVISION OF GEOLOGY AND EARTH RESOURCES
MAP SERIES 2015-02

Port Ludlow and Hansville 7.5-minute Quadrangles

Pamphlet accompanies map

Geologic Map of the Port Ludlow and Southern Half of the Hansville 7.5-minute Quadrangles, Kitsap and Jefferson Counties, Washington

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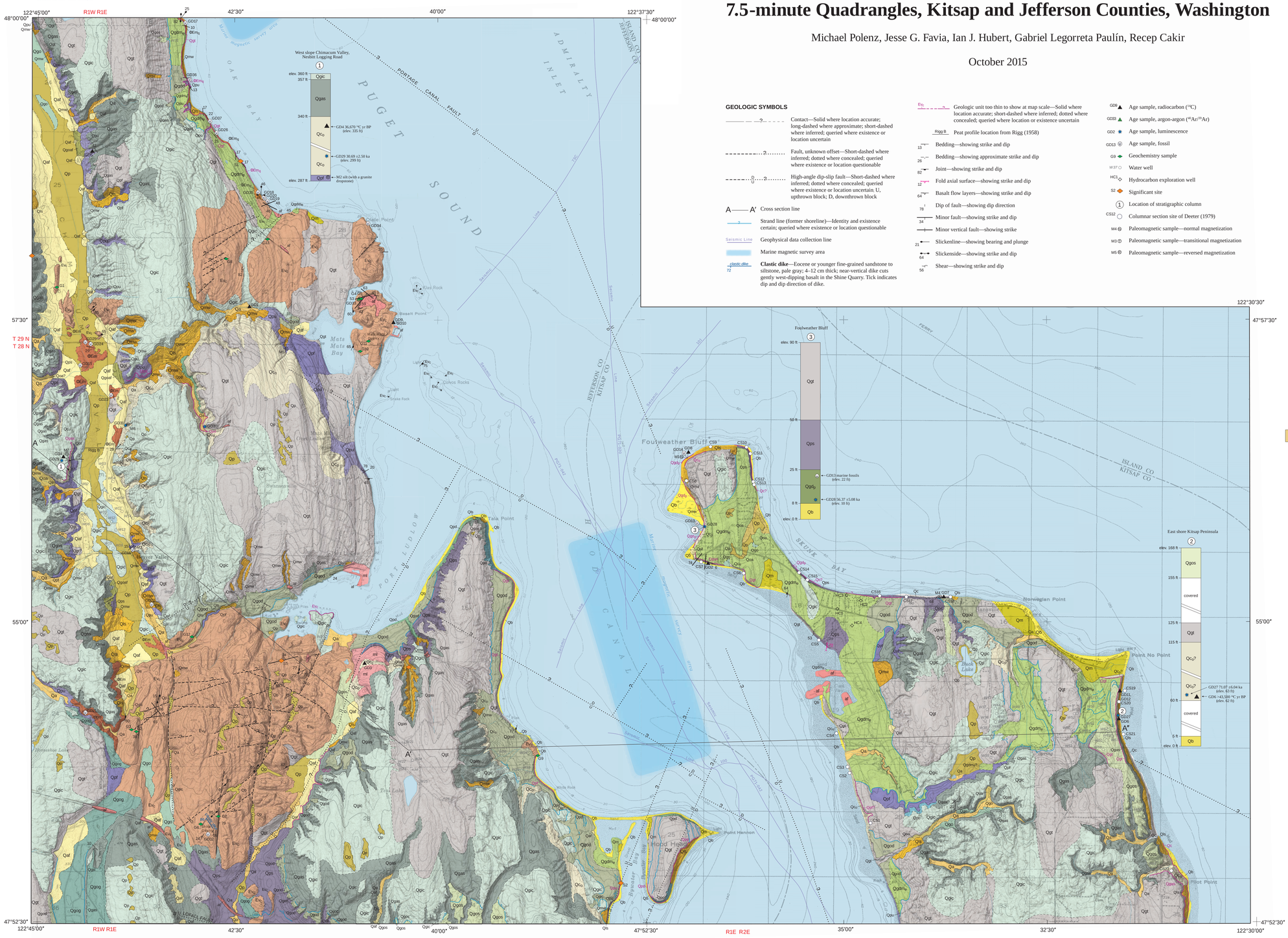

GEOLOGIC SYMBOLS

- Contact—Solid where location accurate; long-dashed where approximate; short-dashed where inferred; queried where existence or location uncertain
- Fault, unknown offset—Short-dashed where inferred; dotted where concealed; queried where existence or location questionable
- High-angle dip-slip fault—Short-dashed where inferred; dotted where concealed; queried where existence or location uncertain. U, upthrown block; D, downthrown block
- A — A′ Cross section line
- Strand line (former shoreline)—Identity and existence certain; queried where existence or location questionable
- Seismic Line — Geophysical data collection line
- Marine magnetic survey area
- clastic dike 72 — **Clastic dike**—Eocene or younger fine-grained sandstone to siltstone, pale gray; 4–12 cm thick; near-vertical dike cuts gently west-dipping basalt in the Shine Quarry. Tick indicates dip and dip direction of dike.
- Evc — ? — Geologic unit too thin to show at map scale—Solid where location accurate; short-dashed where inferred; dotted where concealed; queried where location or existence uncertain
- Rigg B — Peat profile location from Rigg (1958)
- 13 — Bedding—showing strike and dip
- 26 — Bedding—showing approximate strike and dip
- 82 — Joint—showing strike and dip
- 12 — Fold axial surface—showing strike and dip
- 64 — Basalt flow layers—showing strike and dip
- 78 — Dip of fault—showing dip direction
- 34 — Minor fault—showing strike and dip
- Minor vertical fault—showing strike
- 21 — Slickenline—showing bearing and plunge
- 64 — Slickenside—showing strike and dip
- 56 — Shear—showing strike and dip
- GD9 — Age sample, radiocarbon (^{14}C)
- GD39 — Age sample, argon-argon (^{40}Ar/^{39}Ar)
- GD2 — Age sample, luminescence
- GD13 — Age sample, fossil
- G9 — Geochemistry sample
- W37 — Water well
- HC1 — Hydrocarbon exploration well
- S2 — Significant site
- 1 — Location of stratigraphic column
- CS12 — Columnar section site of Deeter (1979)
- M4 — Paleomagnetic sample—normal magnetization
- M3 — Paleomagnetic sample—transitional magnetization
- M5 — Paleomagnetic sample—reversed magnetization

MAJOR FINDINGS

- A new ^{40}Ar/^{39}Ar age of 50.51 ±0.16 Ma and nine new whole-rock geochemical analyses in basalt improve definition of the Crescent Formation along the northeastern margin of the Olympic Mountains.
- New luminescence analyses suggest that pre-Vashon sediment exposures in the Port Ludlow and Hansville quadrangles are mostly of Olympia nonglacial age (MIS3) and include Possession age (MIS4) in the Hansville quadrangle. Magnetically reversed polarity suggests that some deposits in the Port Ludlow quadrangle may predate 780 ka.
- Multiple discrete structural blocks are suggested by faults, bedrock exposure and distribution, and basalt-flow bed orientations.
- Quaternary faulting is demonstrated by offset and deformation of Olympia nonglacial deposits in the Hansville quadrangle and may be related to northwest-striking faults, such as the Portage Canal fault and (or) the southern Whidbey Island fault zone.
- A river sourced from the Olympic Mountains flowed through the Port Ludlow quadrangle during the Olympia nonglacial interval, implying a markedly different topography than today.

DESCRIPTION OF MAP UNITS

(See pamphlet for detailed unit descriptions)

Quaternary Unconsolidated Deposits

HOLOCENE NONGLACIAL DEPOSITS

- af — **Artificial fill**—Sand, cobbles, pebbles, boulders, silt, clay, organic matter, rip-rap, and concrete; placed to elevate the land; fill may be engineered.
- mf — **Modified land**—Boulders, cobbles, pebbles, sand, silt, clay, diamicton, and organic matter; locally derived but redistributed to modify topography.
- Qb — **Beach deposits**—Sand, pebbles, pebbly sand, cobbles, silt, clay, shells, and isolated boulders; loose; clasts moderately to well rounded and oblate; locally well sorted.
- Qm — **Salt marsh deposits**—Organic sediment and (or) loose clay, silt, and sand in a saltwater to brackish coastal wetland.

LATEST PLEISTOCENE TO HOLOCENE NONGLACIAL DEPOSITS

- Qp — **Peat**—Organic and organic-rich sediment; includes peat, gyttja, muck, silt, and clay; typically in closed depressions.
- Qls — **Landslide deposits**—Cobbles, pebbles, sand, silt, clay, boulders, and diamicton; in slide bodies and toes; angular to rounded clasts and grains; unsorted; generally loose, jumbled, and unstratified.
- Qmw — **Mass-wasting deposits**—Cobbles, pebbles, sand, silt, clay, boulders, and diamicton; loose; generally unsorted, but locally stratified; shown along potentially or demonstrably unstable slopes; includes colluvium and (or) landslides too small to map as individual features.
- Qa / Qoa — **Alluvium**—Sand, silt, clay, pebbles, cobbles, and peat; loose; moderately to well sorted; stratified to massive; deposited in flood plains and on terraces. Unit Qoa where relict.
- Qaf — **Alluvial fan deposits**—Pebbles, sand, silt, cobbles, and boulders; loose; moderately to poorly sorted; stratified; lobe-shaped where streams emerge from valleys.

PLEISTOCENE GLACIAL AND NONGLACIAL DEPOSITS

- Qgdm$_{Ev}$ — **Everson Glaciomarine Drift**—Silt and clay with sand and lenses of diamicton; pale gray to buff, weathers orange-tan; soft to moderately soft; poorly sorted; commonly columnar jointed; may contain marine shells.

Deposits of the Vashon Stade of the Fraser Glaciation

- Qgo — **Vashon Stade recessional outwash**—Sand and pebble to cobble gravel; some silt and clay; moderately fresh; loose; subrounded clasts; moderately sorted and unstratified. Subdivided into:
  - Qgog — **Vashon Stade recessional outwash gravel**—Pebble gravel with cobbles and sandy matrix; brown and gray, loose to moderately dense; rounded clasts; moderately sorted; typically fluvial.
  - Qgos — **Vashon Stade recessional outwash sand**—Sand with pebble lenses, silt, and clay; gray to pale brown; moderately rounded clasts; moderately sorted; loose.
  - Qgoaf — **Vashon Stade recessional alluvial and delta fan deposits**—Pebble gravel, sand, silt, and boulders; loose; moderately to poorly sorted and stratified; lobe-shaped where streams emerged from valleys; incised by post-Vashon-age streams.
  - Qgod — **Vashon Stade recessional glacial delta deposits**—Silt with sand and rare gravel; gray to pale brown; loose but commonly cohesive and slightly indurated; moderately sorted.
- Qgic — **Vashon Stade ice-contact deposits**—Diamicton; pebble and cobble gravel, sand, lacustrine mud, and isolated boulders; pale to ash-gray, tan, or brown, lightly weathered; loose to compact; poorly to well sorted; massive to well stratified; includes sub-ice-flow and collapse features.
- Qgt — **Vashon Stade lodgment till**—Diamicton; brown to gray; lightly weathered or unweathered; unsorted; unstratified; compact, commonly resembles concrete.
- Qgas — **Vashon Stade advance outwash sand**—Sand with less abundant silt, clay, pebbles, cobbles, or diamicton; pale gray to tan; compact; subrounded to well rounded and well sorted; thinly to thickly bedded and locally crossbedded.

Pre-Vashon Glacial Deposits

- Qpo — **Pre-Vashon outwash, undivided**—Sand, pebble gravel, and silt; light-gray to tan; compact; moderately to well sorted; rounded to subangular clasts; laminated, cross-bedded, or massive.
- Qpd — **Pre-Vashon drift, undivided**—Sand, silt, and diamicton; tan, brown, or gray; compact; silt facies very stiff and indurated; clasts subrounded to subangular; well sorted where mostly sand, poorly sorted where diamicton; northern-sourced clasts. Locally subdivided where age control allows into:
  - Qpd$_{Ps}$ — **Possession Drift** —Diamicton, sand and pebble gravel, and massive to cross-bedded sand; found at and near Foulweather Bluff.

Pre-Vashon Nonglacial Deposits

- Qc — **Pre-Vashon alluvium**—Sand, with clay or clayey sand less common; may contain wood and peat; mostly gray, less commonly brown; compact. Locally subdivided into unit Qc$_O$ where age control or lateral relationships permit.
  - Qc$_O$ — **Pre-Vashon alluvium of the Olympia nonglacial interval**—Sand with less common silt, pebble gravel, minor clay, and minor wood and peat; mostly gray to tan, locally brown or bluish-gray; compact; moderately sorted; mostly horizontal and planar-bedded, with some low-angle crossbeds.

QUATERNARY GLACIAL AND NONGLACIAL DEPOSITS, UNDIVIDED

- Qps — **Pre-Vashon sediment, sand**—Sand with minor silt and gravel; brown and orange-brown; dense to very dense, locally cohesive.
- Qpf — **Pre-Vashon sediment, fine-grained**—Silt, clay, and mixtures of both; locally ranges to fine sand.
- Qpu — **Pre-Vashon sediment, undivided**—Sand, pebble gravel, silt, clay, diamicton, organic sediment, and boulders; gray, brown, and orange-brown; compact; varied grain size, rounding, sorting, and bedding.
- Qu — **Quaternary sediment, undivided (cross section only)**—Sediment of unknown lithology, texture, age, and paleoenvironmental association; we speculate that it is mainly Vashon drift and post-glacial marine sediment.

Tertiary Sedimentary and Volcanic Bedrock

- Ev$_{Ec}$ — **Crescent Formation (early to middle Eocene)**—Basalt, typically aphanitic; massive or columnar flows locally brecciated with rare pillows; gray, weathers to brown and yellowish brown. Age site GD33 (sec. 33, T29N R1E) yielded a 50.51 ±0.16 Ma ^{40}Ar/^{39}Ar age plateau.
- ΦEm — **Undifferentiated sedimentary rocks (late Eocene to early Oligocene)**—Mudstone and siltstone with less common sandstone or claystone; some exposures micaceous; dark to pale brown in weathered exposures, light to dark gray where fresh.
- ΦEm$_{Q}$ — **Quimper Sandstone (Eocene to Oligocene)**—Feldspatholithic sandstone, locally siltstone; gray to olive gray, weathers to yellowish tan; sand is moderately well sorted and medium grained; mostly massive to faintly bedded.

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 93 meters east as shown by crosshair corner ticks
Base map from scanned and rectified U.S. Geological Survey Hansville and Port Ludlow 7.5-minute quadrangles, 2002 and 1973, respectively
Shaded relief from a lidar bare-earth digital elevation model (available from Puget Sound Lidar Consortium, http://pugetsoundlidar.ess.washington.edu)
GIS by Michael Polenz and Jesse G. Favia
Digital cartography by Ian J. Hubert and Anne C. Olson
Editing and production by Alexander N. Steely and Jessica L. Czajkowski

SCALE 1:24,000

1 0.5 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0.5 0 1 KILOMETER
contour interval 20 feet
depth contours in feet—datum is mean lower low water

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APPROXIMATE MEAN DECLINATION, 2015

CROSS SECTION EXPLANATION

- Qls / 1 — Geologic units too thin to show as polygons at the scale of the cross section. Black ticks mark separate units.
- Arrows show relative fault movement in the plane of the cross section
- W346 — Water well or boring
- Bedding form lines identified from seismic sections

CORRELATION OF MAP UNITS

PERIODS AND EPOCHS BASED ON USGS FACT SHEET 2010-3059