GEOLOGIC MAP OF THE SHELTON VALLEY 7.5-MINUTE QUADRANGLE, MASON COUNTY, WASHINGTON

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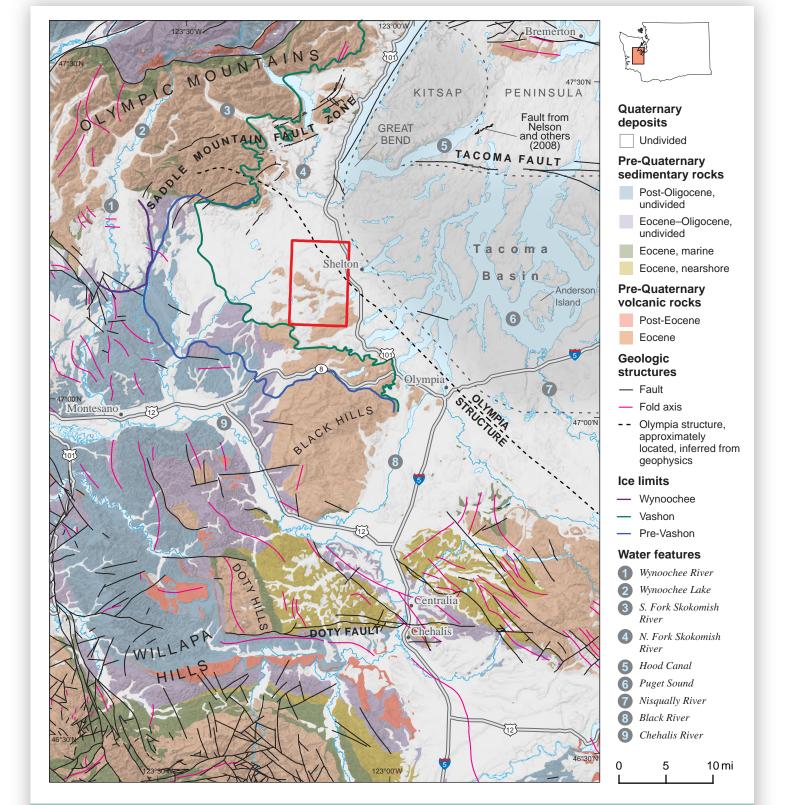
Abstract—No. 387-1 (308198):

We present a 1:24,000-scale geologic map of the Shelton Valley 7.5-minute quadrangle, which straddles the northern Black Hills and the western Puget Lowland, just west of the town of Shelton. We support the map with new field work, geochemistry, palynology, and U-Pb, luminescence, radiocarbon, biostratigraphic chronology, lidar, and existing subsurface explora-

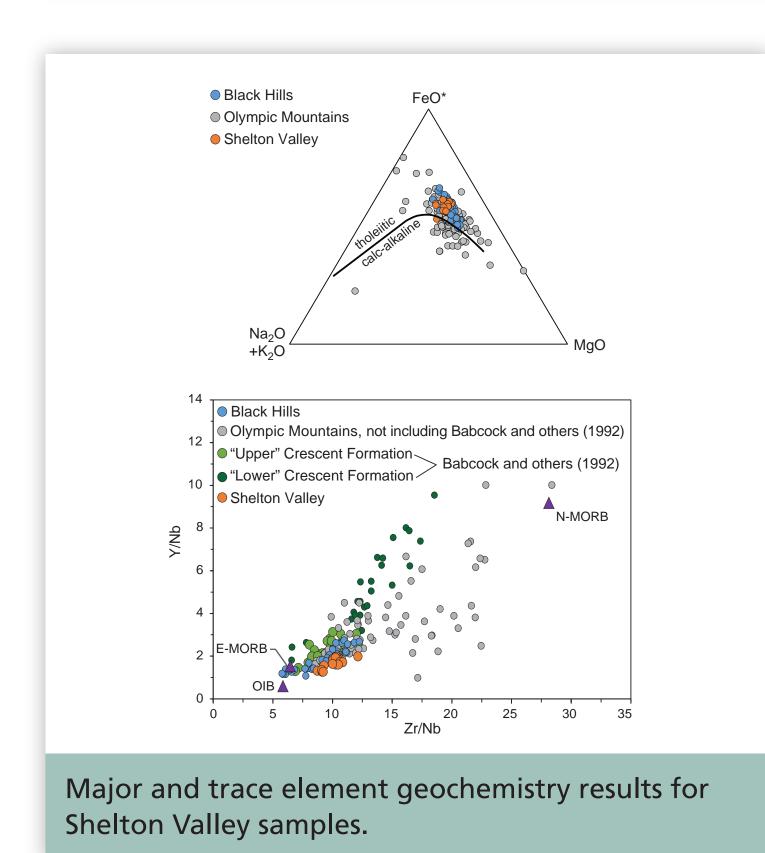
Our findings include that bedrock geochemistry and two new 50.51 and 50.14 Ma 40Ar/39Ar dates support the notions that (1) basalt in the northern Black Hills is part of the Crescent Formation and (2) these rocks may be slightly younger than earlier analyses suggested. Subsurface sediment north of the Black Hills is largely sourced from the basalt-rich Olympic Mountains. New radiocarbon, luminescence, and pollen analyses suggest that alpine glaciers from the Olympic Mountains advanced into the north half of the map area and deposited voluminous drift.

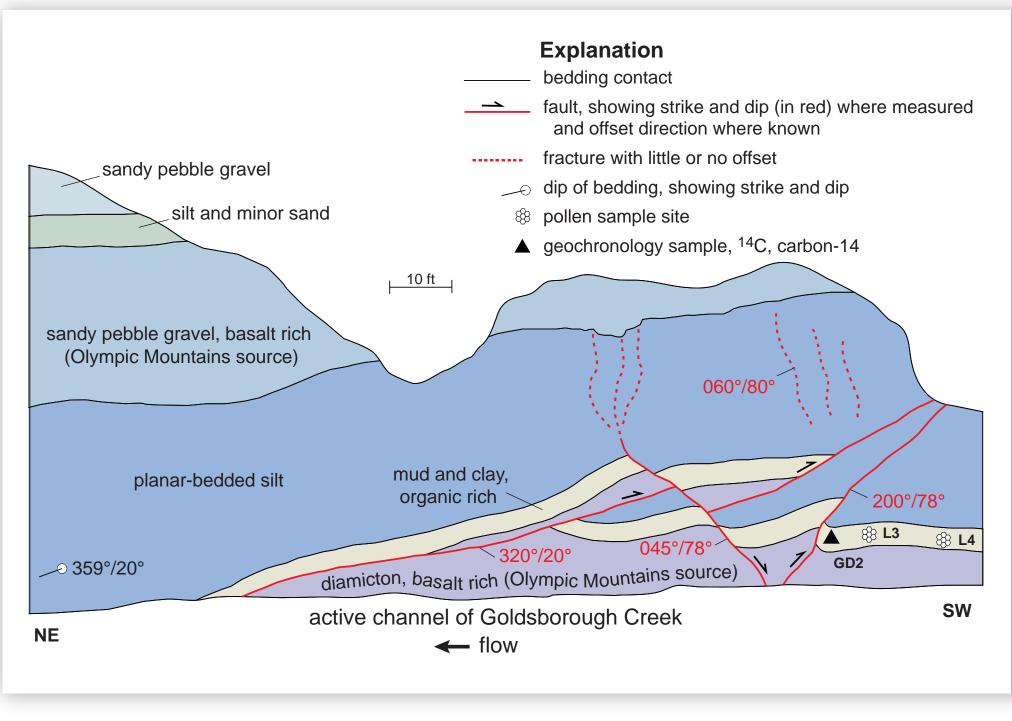
Sediment farther south in the Black hills is mostly polymict, northern-sourced material deposited by incursions of the Cordilleran ice sheet, or locally reworked from such glacial sediment. Geologic mapping suggests that the southern limit of the Vashon ice advance is slightly farther south than previously inferred.

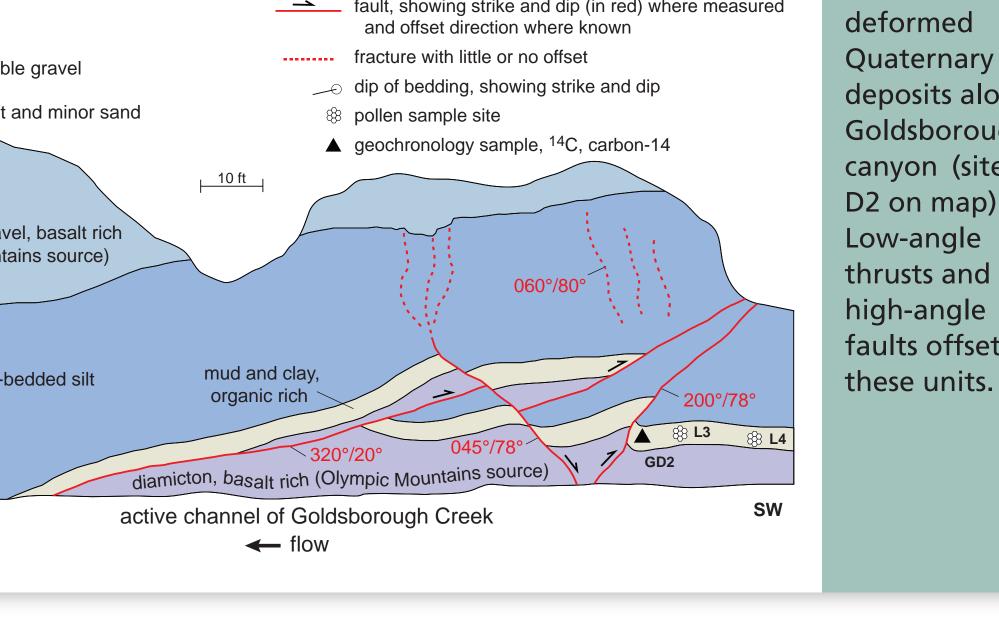
Intense deformation of Quaternary sediment in the quadrangle is collocated with strong northwest-trending geophysical anomalies previously interpreted as the Olympia structure. Orientations of deformation measured in both Quaternary and bedrock exposures are consistent with strain expected for the kinematics previously proposed for the Olympia structure. However, glaciotectonic forces cannot be ruled out as a possible source of the observed deformation.

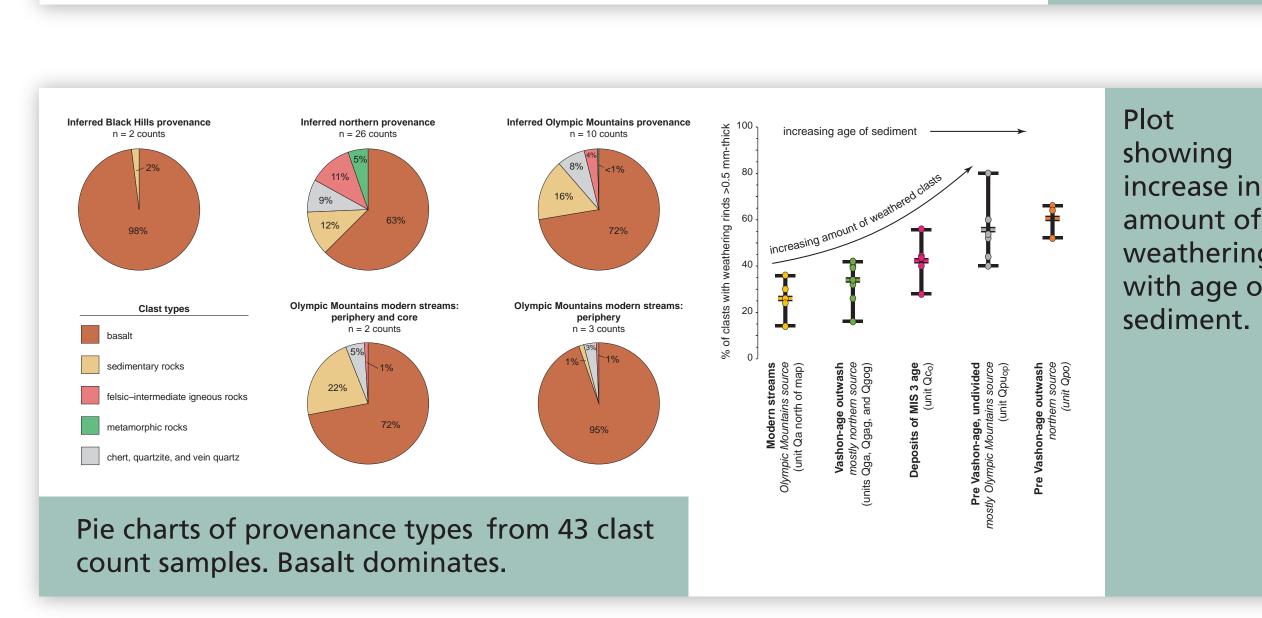


quadrangle (red outline).









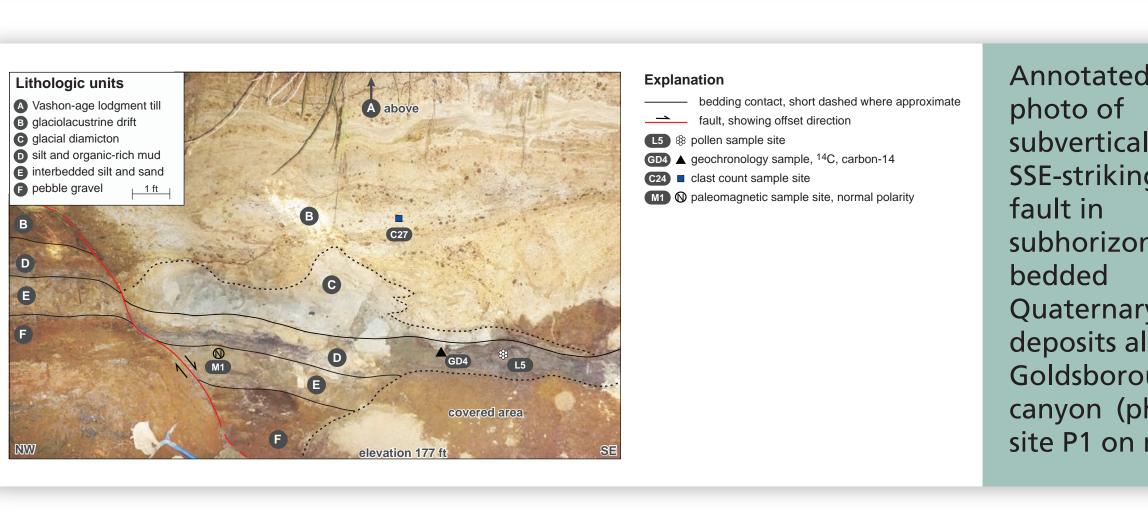




Photo of sedimentary interbeds in basalt flows of the Crescent Formation (photo site P2 on map).

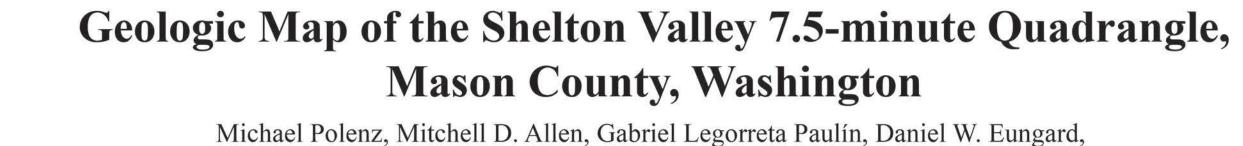


Photo of sub-horizontal interbed of siltstone to very fine sandstone petween basalt flows of the Crescent Formation (photo site P4 on map).



Photo of steep shear zone in pillow basalt flow of the Crescent Formation (photo site P3 on map).





Recep Cakir, Spenser P. Scott, and Shannon A. Mahan

eformation of Quaternary sediment in the quadrangle; however, that deformation could be glaciotectonic. Two new 40 Ar/ 39 Ar ages of 50.51 ± 0.21 and 50.14 ± 0.17 Ma from the Black Hills suggest that the Crescen formation may be slightly younger than indicated by some earlier analyses. Sixteen new whole-rock geochemical analyses in the quadrangle suggest that basalt of the Black Hills is North of the Black Hills, subsurface sediment is mostly sourced from the basalt-rich Olympic Mountains; glacia nd nonglacial sediment in the Black Hills is generally derived from polymict, northern-sourced material. New radiocarbon, luminescence, and pollen analyses indicate that alpine glaciers from the Olympic Mountains ikely advanced into the quadrangle, producing voluminous drift, during Marine Isotope Stage 3 (MIS 3).

DESCRIPTION OF MAP UNITS see pamphlet for detailed map unit descriptions **Quaternary Unconsolidated Deposits**

HOLOCENE NONGLACIAL DEPOSITS sand, cobbles, pebbles, boulders, silt, clay, organic matter, rip-rap, and concrete, in varied abundance.

Modified land—Boulders, cobbles, pebbles, sand, silt, clay, diamicton, and organic matter, in varied

- LATEST PLEISTOCENE TO HOLOCENE NONGLACIAL DEPOSITS
- Peat—Organic and organic-rich sediment; includes peat, gyttja, muck, silt, and clay; typically in closed Landslide deposits—Cobbles, pebbles, sand, silt, clay, boulders, and diamicton, in varied abundance, in slide bodies and toes; angular to rounded clasts and grains; unsorted; generally loose, jumbled, and
- nstratified, but locally retains primary bedding and compaction. Mass-wasting deposits—Cobbles, pebbles, sand, silt, clay, boulders, and diamicton, in varied abundan
- Alluvium—Sand, pebbles, silt, clay, peat, and cobbles; loose; moderately to well sorted; stratified to Iluvial fan deposits—Pebbles, sand, silt, cobbles, and boulders, in varied abundances; loose; moderately

PLEISTOCENE GLACIAL AND NONGLACIAL DEPOSITS

Deposits of the Vashon Stade of the Fraser Glaciation

amounts; locally derived but redistributed to modify topography

- Vashon Stade recessional outwash—Sand and pebble to cobble gravel; some silt and clay; moderately fresh; loose; subrounded clasts; moderately to well sorted; unstratified. Locally subdivided into: Vashon recessional outwash, gravel—Pebble gravel with cobbles and sandy matrix; brown and gray, loose to moderately dense; subrounded to rounded clasts; well sorted.
- Vashon recessional outwash, sand—Sand with pebble lenses, silt, and clay; gray to pale-brown; clasts moderately to well rounded; moderately to well sorted; loose.

Vashon recessional outwash sediment, fine-grained—Silt, clay, and mixtures of both, locally

- contains fine sand; may contain dropstones; pale gray to light-green-gray; loose, soft, planar Vashon recessional glacial delta deposits—Pebble gravel, sand, and silt; gray to pale brown; loose; moderately sorted; delta sedimentary structures with topset, foreset, and bottomset beds.
- Vashon ice-contact deposits—Diamicton (ablation till, flow till, and poorly compacted or patchy lodgmen till), less commonly contains pebble and cobble gravel, sand, mud, and isolated boulders; pale gray, tan, or brown; slightly weathered; compaction, sorting, and stratification vary. Locally subdivided into: Vashon Puget lobe end moraine—Deposits similar to unit Qgic, but specifically interpreted as a
- Vashon ablation till—Diamicton, sand, silt, clay, and gravel; gray to tan and reddish brown; loose to compact; unsorted; unstratified; clasts commonly striated and faceted. Vashon esker—Pebble to cobble gravel and sand; gray; loose; clasts rounded to well rounded;
- typically well sorted; forms elongate, sinuous hills deposited by water beneath stagnant ice. Vashon lodgment till—Diamicton; gray to brown; lightly to unweathered; unsorted; unstratified; compact, commonly resembles concrete.
- Vashon advance outwash, undivided—Sand, pebble gravel, cobble gravel, silt, and clay, in varied amounts, commonly coarsening-upsection; gray to tan; compact; typically well rounded and sorted; very thinly to very thickly bedded. Locally subdivided into: Vashon advance outwash, gravel—Cobble and pebble gravel, some sand, silt, and clay; pale
- gray to gray or yellowish brown; well-rounded; well-sorted; compact; thinly to very thickly Vashon advance outwash, sand—Sand, locally pebbly; locally planar-bedded with silt interbeds; gray, pale gray, or pale brown; compact; subrounded to well rounded; moderately to well sorted; mostly lacustrine, planar-bedded, and quartzo-feldspathic.

- **Pre-Vashon alpine till?**—Basalt-rich diamicton; reddish brown to dark brown; unsorted; unstratified; compact; commonly resembles concrete, except for dark color; lightly to severely weathered, suggesting age(s) significantly older than the Vashon Stade; interpreted as likely lodgment till of unknown age deposited by glaciers from the Olympic Mountains.
- Pre-Vashon outwash, undivided—Pebble gravel, sand, laminated silt (locally contains dropstones), and diamicton in varied amounts; gray, light brown, or tan; compact; moderately to well sorted (except where diamicton); rounded to subangular clasts; laminated, cross-bedded, or massive; clasts are northern-sourced; includes both advance and recessional outwash. Pre-Vashon till—Diamicton; gray to brown or tan; lightly or moderately weathered; unsorted; unstratified; compact, locally resembles concrete; clasts are northern-sourced.
- Pre-Vashon Glacial and Nonglacial Deposits, Undivided Pre-Vashon sediment of MIS 3—Pebble gravel, and less commonly sand, silt, clay, diamicton (including possible till), peat, and detrital wood; light brown, brown, gray, or dark gray; compact; moderately well orted (except where diamicton); planar bedded, cross-bedded, or massive; northern-sourced clasts in the
- Black Hills, but mostly Olympic Mountains-sourced clasts farther to the north. Pre-Vashon sediment, fine-grained—Silt, clay, and mixtures of both, locally ranges to fine sand, dropstones common; pale to dark-gray or brown; compact; planar bedded or massive.
- Pre-Vashon sediment, undivided—Pebble gravel, sand, silt, clay, diamicton, organic sediment, and boulders, in varied amounts; color, weathering, rounding, sorting, and bedding vary; compact. Locally Pre-Vashon sediment, undivided, mostly Olympic Mountains-sourced—Pebble gravel, sand, diamicton (including some tills), silt, clay, and peat; reddish brown to tan or gray; variously

Pre-Quaternary Bedrock

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including, but not limited to, the implied warranties of merchantability and fitness for a particular use. The

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Undifferentiated sedimentary rocks (Eocene to Oligocene) (Cross Section A only)—Sandstone, siltstone, mudstone, and conglomerate, in varied amounts; inferred above Crescent Formation in the Tacoma Basin. Not exposed in outcrop or intersected by borings or wells; inferred based on geophysics and regional

weathered; compact; moderately sorted.

Crescent Formation basalt (early to middle Eocene)—Basalt flows and pillows, with minor lenses and interbeds of sedimentary rock between pillows or flows; dark gray, weathers to brown and yellowish brown; aphanitic to porphyritic; locally vesicular.

Contact—Solid where location accurate; long-dashed where approximate short-dashed where inferred

approximate. Arrows show direction of dip; shorter arrow on steeper limb

↓ —?— Monocline, anticlinal bend—Identity or existence questionable, location

A — A' Cross section line Geologic unit too thin to show as a polygon—Solid where location accurate; short-dashed where inferred; queried where identity or existence questionable

Fluvial terrace—Identity and existence certain, location accurate. Hachures point

Landslide scarp—Solid where identity or existence certain; queried where identity or existence questionable. Location accurate. Hachures on downslope side

Direction of downslope movement of landslide

- 10 Inclined bedding—showing strike and dip Horizontal bedding
- 11 Inclined bedding in unconsolidated sedimentary deposits—showing strike and dip
- Inclined warped, undulatory, or contorted bedding—showing approximate strike and dip
- 10 Inclined flow bands, lamination, layering, or foliation in igneous rock—showing strike and dip 49 > Small fault or shear—showing strike and dip
- Inclined slickenline, groove, or striation on fault surface—showing bearing and plunge
- Small, minor inclined joint—showing strike and dip
- channel in sedimentary materials—showing bearing and plunge
- Age site, fossil Age site, ¹⁴C, carbon-14
- Age site, ⁴⁰Ar/³⁹Ar, argon-argon GD8 ★ Age site, infrared stimulated luminescence (IRSL)

Geochemistry sample location

- W21 O Water well Significant site
- CS1 (1) Location of columnar section (CS) Geophysical data collection location

P2 Cocation of photograph (P) or schematic diagram (D)

- M2

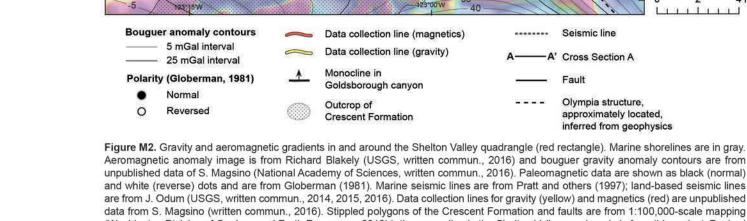
 Paleomagnetic sample—normal magnetization L5

 ⊗ Pollen sample
- C5 Clast count sample

- (sec. 15, T20N R4W) Columnar section in tributary of Gosnell Creek
- (sec. 16, T19N R4W)
- - C30 Olympic Mountains source, mildly weathered (west of channel) (west of channel) M4 sand (east of channel)
 - C31 northern source, mildly weathered , GD7 47.31 ±4.9 ka (east of channel) C26 Olympic Mountains source

Composite columnar section

in Goldsborough canyon



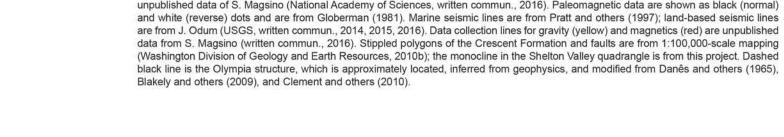
nd blue (pre Vashon) lines and are modified from Carson (1970) and Logan (1987, 2003). The location of the Shelton delta is modified

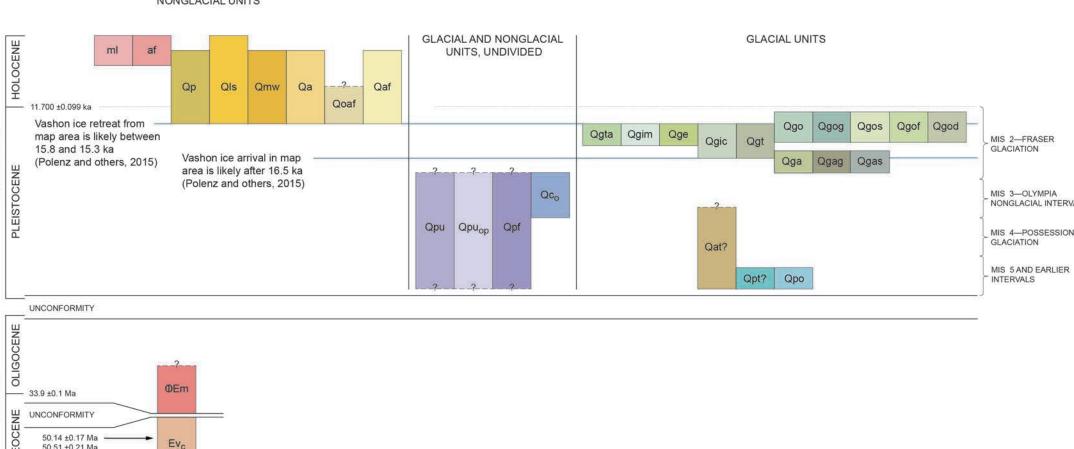
om Bretz (1910, 1913) and Thorson (1981). Gray dotted lines show the margins of the Tacoma basin. Lucky Dog fault is from Polenz and

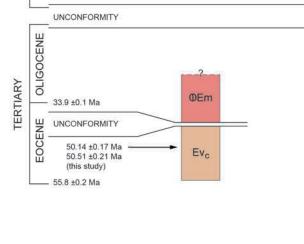
1:250,000-scale mapping (Washington Division of Geology and Earth Resources, 2010a). Dashed black line is the Olympia structure, which is approximately located, inferred from geophysics, and modified from Daneš and others (1965), Blakely and others (2009), and Clement

Geologic structures

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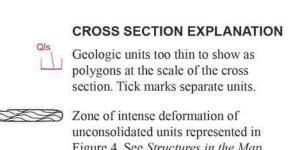
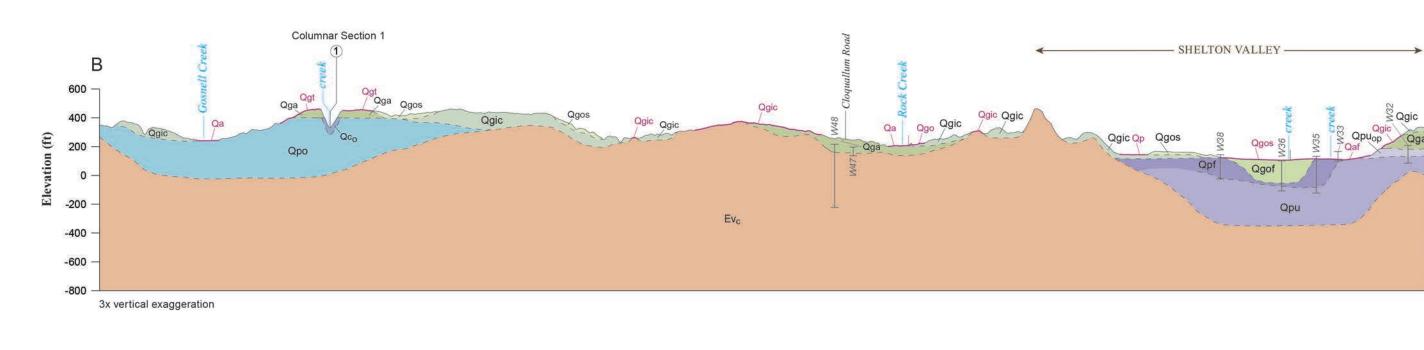
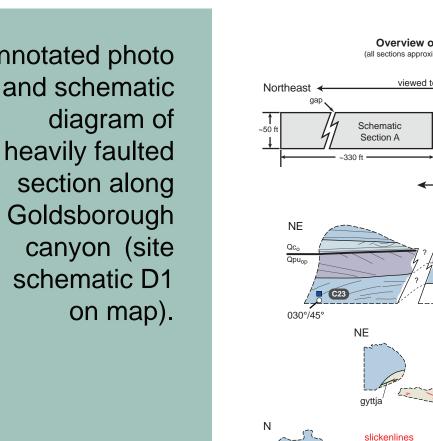
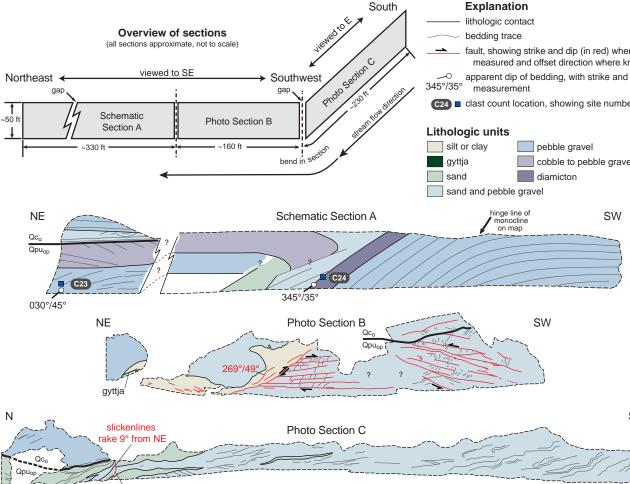


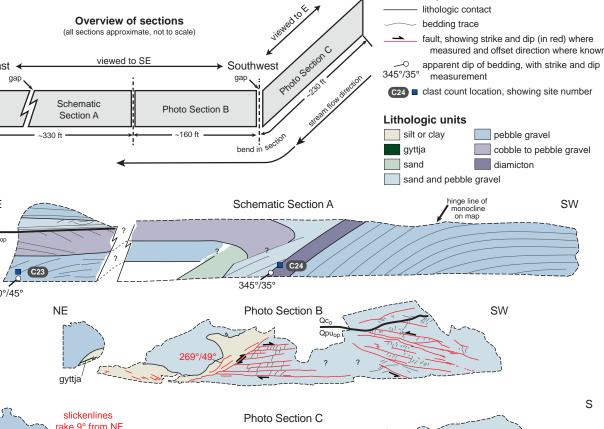
Figure 4. See Structures in the Map Area for further explanation. Water well or boring Bedding form lines

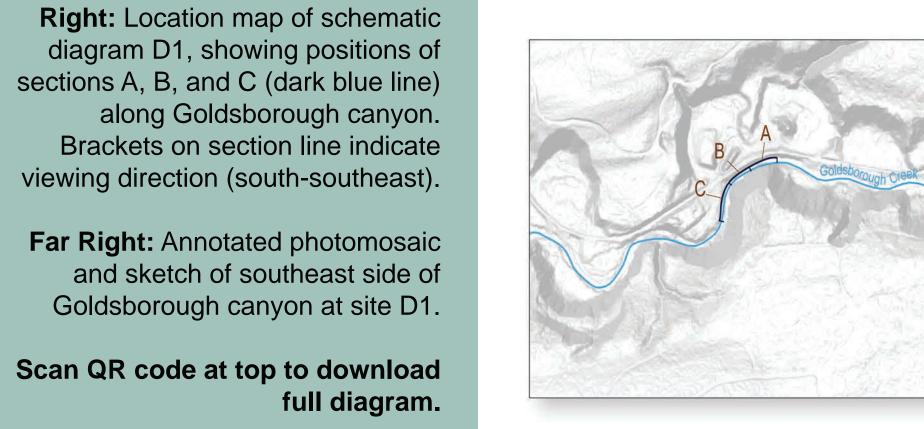


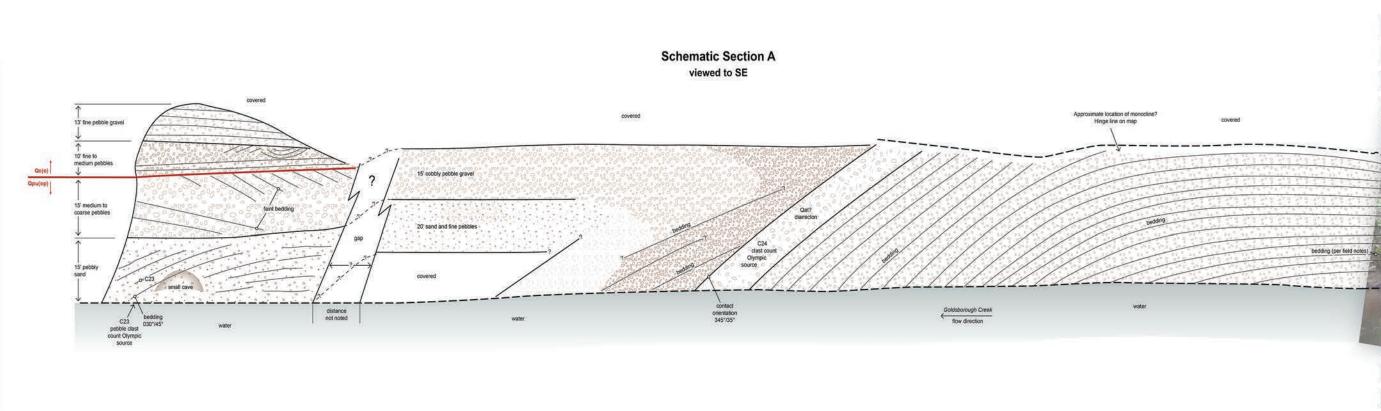












Lambert conformal conic projection

North American Datum of 1927; to place on North American Datum of

Shaded relief generated from a lidar bare-earth digital elevation model

Editing and production by Alexander N. Steely, Jessica L. Czajkowski,

95 meters east as shown by crosshair corner ticks

Base map from scanned and rectified U.S. Geological Survey

(available from Puget Sound Lidar Consortium,

Digital cartography by Daniel E. Coe and Ian J. Hubert

Shelton Valley 7.5-minute quadrangle, 1981

http://pugetsoundlidar.ess.washington.edu/)

GIS by Mitchell D. Allen and Michael Polenz

and Daniel E. Coe

1983, move the projection lines approximately 24 meters north and

contour interval 10 meters

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