WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES
WASHINGTON GEOLOGICAL SURVEY

Geologic Map of the Centralia 7.5-minute Quadrangle, Lewis County, Washington

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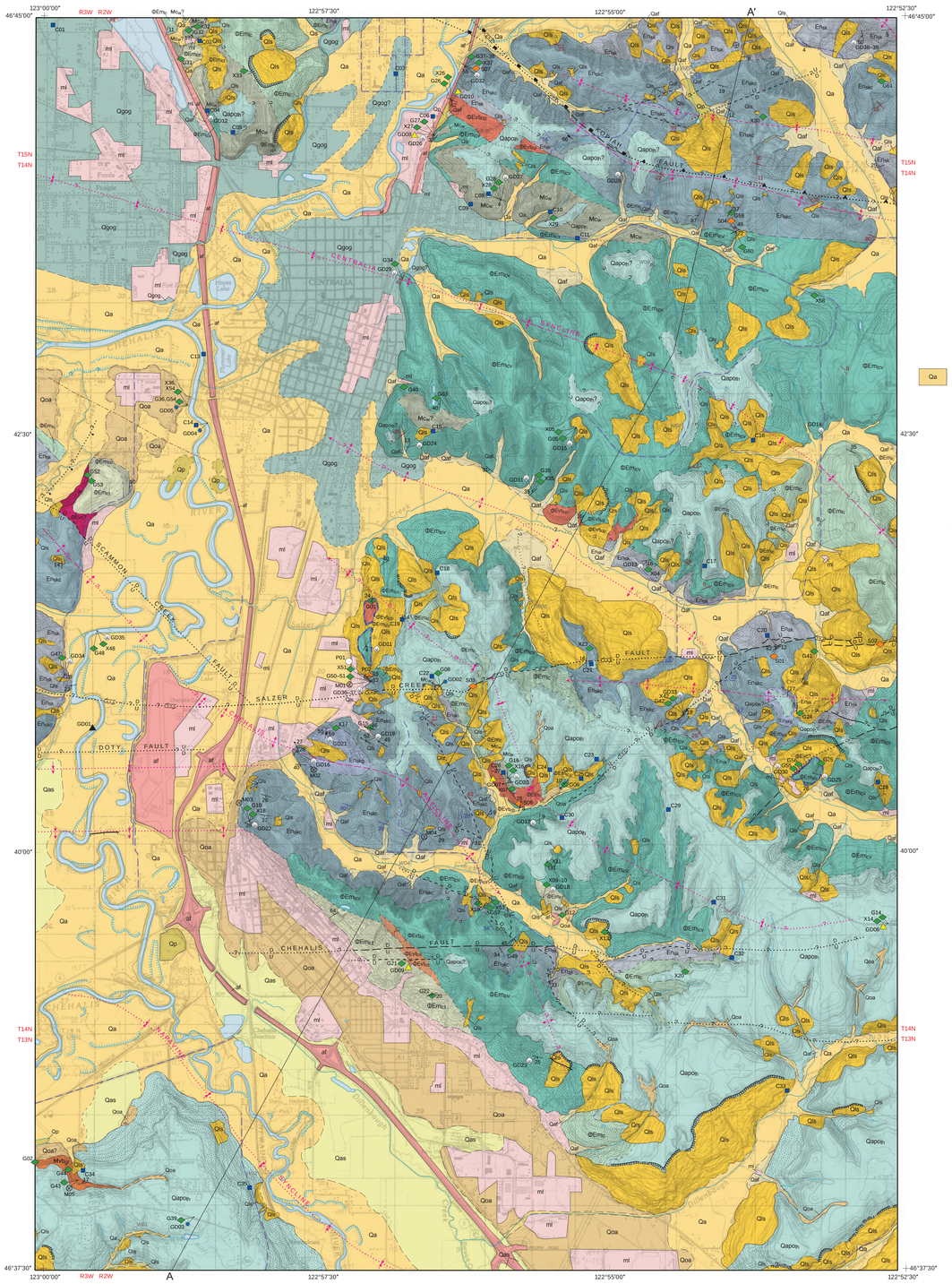

Lambert conformal conic projection
North American Datum of 1927; to place on North American Datum of 1983, move the projection lines approximately 22 meters north and 95 meters east as shown by crosshair corner ticks
Base map from scanned and rectified U.S. Geological Survey Centralia 7.5-minute quadrangle, 1986
Shaded relief generated from a lidar bare-earth digital elevation model (available from the Washington Geological Survey, http://lidarportal.dnr.wa.gov/)
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Digital cartography by Daniel E. Coe
Editing and production by Susan R. Schnur and Jessica L. Czajkowski

SCALE 1:24,000

1 MILE: 1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER: 1 0.5 0 1

contour interval 20 feet

TRUE NORTH / MAGNETIC NORTH 15.5°

APPROXIMATE MEAN DECLINATION, 2018

This geologic map was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program under USGS award number G17AC00262, 2017–2018.

DESCRIPTION OF MAP UNITS

(see pamphlet for detailed map unit descriptions)

Quaternary Unconsolidated Deposits

POSTGLACIAL DEPOSITS

Holocene Nonglacial Deposits

af — **Artificial fill**—Rubble of mostly northern-sourced cobbles, pebbles, sand, and boulders differing from local rocks and used for construction.

ml — **Modified land**—Rubble of northern-sourced cobbles, pebbles, sand, and boulders in varied amounts; locally sourced but redistributed to modify topography.

Qp — **Peat**—Organic and organic-rich sediment; includes peat, gyttja, muck, silt, and clay; typically in closed depressions; mapped in wetland areas and distinctly flat-bottomed depressions.

Qls — **Landslide deposits**—Sand, silt, clay, cobbles, pebbles, boulders, and diamicton of sandstone and siltstone of varied amounts; degree of weathering varies; clasts angular to rounded; generally loose; unsorted and unstratified, but locally retaining primary bedding and compaction.

Holocene to Pleistocene Nonglacial Deposits

Qa, Qoa — **Alluvium**—Stream channel, flood plain, and older terrace deposits; pebbles, cobbles, sand, silt, clay, peat, and boulders in varied amounts; color ranges from light tannish gray to dark brown; loose; thinly bedded to massive. Unit Qa where youngest, lowest lying, and active. Unit Qoa where relict or terraces overlie flood plain.

Qas — **Alluvial fines (silt)**—Fine alluvial material near the main alluvial deposits; silt to very fine sand; tannish gray to light brown color; fresh to lightly weathered; not compacted and not cemented. Lacks meandering channel morphologic texture.

Qaf — **Alluvial fan**—Sand, silt, clay, pebbles, and cobbles in varied amounts; gray to brown; loose; subangular to rounded; moderately to poorly sorted; stratified to unstratified; derived largely from sedimentary bedrock. Most instances of the unit are inferred from distinctive, lobate landforms where streams emerge from a confined valley.

PLEISTOCENE GLACIAL DEPOSITS

Vashon Drift of the Fraser Glaciation
(Vashon unit is northern-sourced.)

Qgog — **Vashon recessional outwash, gravel**—Northern-sourced cobbles and pebbles with coarse sand matrix; gray, medium brown, tan, and where weathered red-orange; mildly weathered to fresh; loose to lightly cemented; clasts well-rounded to subrounded; moderately sorted; massive; clasts composed of mostly extrusive volcanic rocks with appreciable amounts of granitic and metamorphic rocks.

Pre-Vashon Glacial Deposits

$Qapo_{fl}$ — **Logan Hill Formation (Pleistocene)**—Cascades-sourced, glaciofluvial outwash of cobbles, pebbles, and sand; cobbles and pebbles are light brown, medium brown, yellowish brown, medium gray, maroon, reddish brown, and bluish light gray in a yellowish brown to reddish yellow medium sand matrix; clasts severely weathered to clay and can be cut with a knife or broken by hand; slightly to very compacted; rounded to subangular; massive; clasts are predominantly andesite and porphyritic volcanic rocks.

Tertiary Volcanic and Sedimentary Bedrock

Mc_w — **Wilkes Formation (Miocene)**—Quartzose pebbly sandstone and sandy conglomerate; light gray to medium brown; moderately to strongly weathered, similar to unit $Qapo_{fl}$; weakly to moderately cemented; subrounded; moderately to well sorted; massive to crossbedded with planar laminations; contains heterolithic clasts.

Mv_{rbgr} — **Grande Ronde Basalt of the Columbia River Basalt Group (Miocene)**—Aphanitic basalt flows; dark to medium gray, weathers orangeish brown to dark yellowish brown; well indurated where fresh; aphanitic; euhedral to subhedral; no pillows observed; flow-top autobreccia common.

Mm_a — **Astoria Formation (Miocene)(cross section only)**—Marine to continental sedimentary rocks.

ϵEm_c — **Lincoln Creek Formation, undivided (Oligocene–latest Eocene)**—Mica-poor siltstone to very fine sandstone with interfingering dacite ash flow tuff units; medium to pale gray, weathers to medium brown, yellowish brown, and tan; hackly and spheroidally weathered; moderately to poorly lithified; silt to fine-grained sand; subangular to subrounded; moderately to well sorted; massive with rare planar bedding. Subdivided into:

- ϵEm_{ta} — **Tuffaceous siltstone**—Mica-poor tuffaceous siltstone with common pumice; ivory to pale gray, weathers to tan; hackly weathered; poorly lithified; silt to very fine-grained sand; well sorted; massive; total microcrystals (<2%, mostly plagioclase and quartz), biotite and muscovite (<2%, <0.2 mm), and glauconitic pellets (~1%, 0.1–0.2 mm).
- ϵEv_{lsc} — **Lithic tuff**—Poorly welded dacite lithic tuff with common volcanic lithic fragments (<4%, <1.0 mm); light bluish gray to pinkish gray; moderately to well indurated; medium- to fine-grained particles; subangular; poorly sorted; massive; pumice (<3% as much as 10%, <0.8 mm) and total phenocrysts (<6%).
- ϵEm_{cv} — **Volcaniclastic siltstone**—Mica-poor volcaniclastic siltstone to very fine sandstone with common black glass shards; medium gray, weathers to medium brown, yellowish brown, and tan, hackly and spheroidally weathered; moderately to poorly lithified; silt to fine-grained sand; subangular; well sorted; massive with rare planar bedding; black glass shards (3–18%, 0.08–0.2 mm) and muscovite and biotite (<1–2%, 0.1–0.2 mm).
- ϵEm_{bs} — **Basaltic sandstone**—Coarse sandstone with abundant scoria and basaltic rock fragments and lesser pumice, tuff(?), and siltstone fragments; medium brown with multicolored rock fragments of light brown, light orange, light red, maroon, red, pinkish brown, and light to dark gray; mildly indurated; moderately cemented; medium- to very coarse-grained sand to granules; subangular; poorly to moderately sorted; massive.
- ϵEv_{lap} — **Lapilli tuff**—Unwelded, dacite lapilli tuff; light bluish gray with 0.5–5.0 mm diameter, subangular lapilli (~10%); mildly to moderately weathered; moderately indurated; angular/anhedral; massive; dominantly ash with <2% total microphenocrysts and trace, <1 mm volcanic rock fragments.

$\epsilon Ev_{c}?$ — **Volcaniclastic breccia(?) (Oligocene–latest Eocene)**—Volcaniclastic breccia; dark gray to dark brown, weathers to reddish brown; very well indurated; medium-grained; subangular; origin and texture uncertain.

En_{sk} — **Skookumchuck Formation, undivided (late–middle Eocene)**—Micaceous, arkosic sandstone to siltstone, uncommonly tuffaceous; light gray to medium brown, weathers multi-colored; highly friable, weakly lithified; medium-grained; subrounded; well sorted; massive to medium bedded to thinly laminated with common trough crossbedding; muscovite and biotite (1–6%, 0.05–0.4 mm). Subdivided into:

- En_{sac} — **Carbonaceous sandstone**—Micaceous, arkosic sandstone to siltstone that contains coal beds of Snavely and others (1958), which include ash layers within coal (tonsteins); where fresh and carbonaceous, color is bluish medium gray and contains dark gray to black coal beds with sulfurous smell and micaceous laminations; otherwise similar to undivided unit.
- En_{sag} — **Glauconitic sandstone**—Micaceous sandstone containing glauconitic pellets (coprolites); light brown to yellowish brown speckled with dark greenish to brownish gray, medium- to fine-grained glauconite particles; friable, weakly lithified; medium-grained; subangular; well sorted; massive.

ϵEv_{cn} — **Northcraft Formation (Oligocene–Eocene)(cross section only)**—Basalt to andesite, volcaniclastic debris flows, and volcanic breccia.

Em_m — **McIntosh Formation (middle Eocene)(cross section only)**—Marine sandstone to mudstone with volcanic and pyroclastic interlayers.

Ev_c — **Crescent Formation (Eocene)(cross section only)**—Submarine basalt flows with thin sedimentary interlayers associated with the Siletzia terrane (basement).

GEOLOGIC SYMBOLS

Mass-wasting landforms (overlay pattern)—Landforms that suggest mass movement on unstable slopes, but evidence for landslide deposits is inconclusive.

Contact—Solid where location accurate; long-dashed where approximate; short-dashed where inferred; dotted where concealed; queried where identity or existence questionable

Fault, unknown offset—Solid where location accurate; long-dashed where approximate; short-dashed where inferred; dotted where concealed; queried where identity or existence questionable

Normal fault—Concealed; identity or existence questionable; bar and ball on downthrown block

Thrust fault—Concealed; identity or existence questionable; sawteeth on upper plate

Oblique-slip fault, reverse right-lateral offset—Identity or existence certain, long-dashed where approximate; dotted where concealed; arrows show relative motion, rectangles on upthrown block

High-angle dip-slip fault—Solid where location accurate; long-dashed where approximate; short-dashed where inferred; dotted where concealed; relative vertical motion shown by U and D; queried where identity or existence questionable

Oblique-slip fault, high-angle left-lateral offset—Long-dashed where approximate; short-dashed where inferred; dotted where concealed; relative horizontal motion shown by arrows, relative vertical motion shown by U and D; queried where identity or existence questionable

Anticline—Long-dashed where approximate; short-dashed where inferred; dotted where concealed; queried where identity or existence questionable

Syncline—Long-dashed where approximate; short-dashed where inferred; dotted where concealed

Monocline, synclinal bend—Concealed; arrows show direction of dip; shorter arrow on steeper limb

Monocline, anticlinal bend—Concealed; arrows show direction of dip; shorter arrow on steeper limb; queried where identity or existence questionable

A — A′ Cross section line

Perennial stream

Intermittent stream

Fluvial terrace—Solid where location accurate; short-dashed where inferred; queried where identity or existence questionable; hachures point down slope

Landslide scarp—Long-dashed where approximate; short-dashed where inferred; dotted where concealed; queried where identity or existence questionable; hachures on down slope side

Fault scarp—Location accurate; identity or existence questionable; hachures point down slope

Scarp of unknown origin—Identity or existence certain, location accurate; hachures point down slope

Geophysical data collection line—Solid for seismic reflection profile; long-dashed for magnetics

Geophysical lineament

Questionable, inferred base of intact block resting on a landslide

Black structural symbols indicate surface data collected by Washington Geological Survey; **red symbols** indicate approximately located surface data compiled from Snavely and others (1958); **blue symbols** indicate subsurface data compiled or derived from mining records

18 Inclined bedding—showing strike and dip

25 Approximate orientation of inclined bedding in unconsolidated deposits or bedrock—showing approximate strike and dip

40 Overturned bedding—showing strike and dip

Horizontal bedding

27 Inclined bedding, where top of direction of beds is known from local features—showing strike and dip

59 Small, minor inclined joint—showing strike and dip

17 Inclined flow banding, lamination, layering, or foliation in igneous rock—showing strike and dip

82 Shear—showing strike and dip

Spring—angle indicates downslope direction

GD32 Age site, fossil

GD10 Age site, U-Pb, uranium-lead

GD01 Age site, ^{14}C, carbon-14

G22 Geochemistry sample location

W04 Water well

S06 Significant site

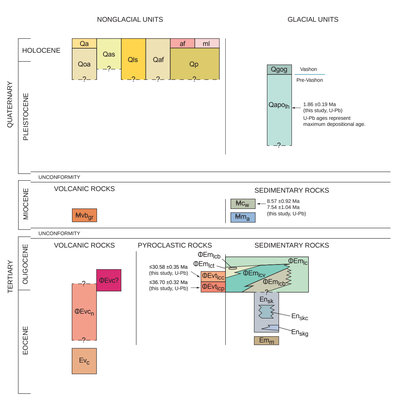
P01 Location of photograph

M05 Paleomagnetic sample—inconclusive magnetization

C10 Clast count sample

CORRELATION OF MAP UNITS

PERIODS AND EPOCHS BASED ON USGS FACT SHEET 2010-3059



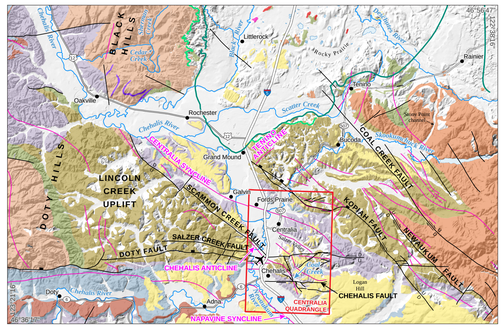


Figure M1. Regional geologic map for the Centralia quadrangle (red outline). Geologic units within the quadrangle are from this study. Geologic units, faults, and folds outside of the mapping area are adapted from published 1:24,000 to 1:100,000-scale geologic maps (Pease and Hoover, 1957; Snavely and others, 1958; Polenz and others, 2017; Washington Division of Geology and Earth Resources, 2016).

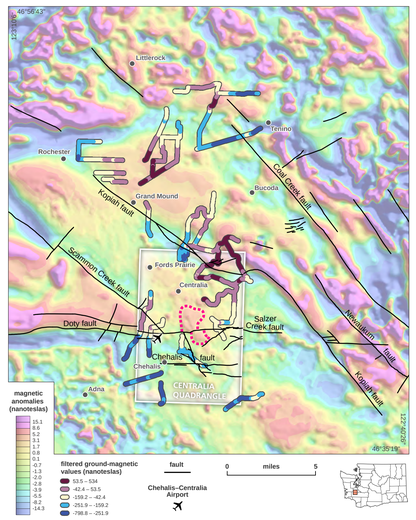


Figure M2. Aeromagnetic map of the Centralia quadrangle and vicinity with ground magnetic geophysical survey results (color coded lines). Faults (black) are from this study and Snavely and others (1958) and mark significant magnetic contrasts (Doty, Kopiah, and Scammon Creek faults). Aeromagnetic image is reduced to pole and processed to highlight shallower magnetic anomalies (R. Blakely, USGS, written commun., 2017). Strong magnetic highs (purples and reds) are associated with areas where highly magnetic rocks are in the shallow subsurface, notably basalt of either the Northcraft or Crescent Formations. Strong magnetic lows (dark blues) are associated with thicker sedimentary stratigraphy (east of map area) and (or) with Columbia River Basalt (west of map area). The Centralia quadrangle is centered on an area of moderate magnetic values (oranges, yellows, and greens) between the Scammon Creek and Kopiah faults. This suggests appreciable thicknesses of sedimentary bedrock overlying more magnetic basaltic basement. A trough of low magnetic anomalies resides between the Chehalis and Doty–Salzer Creek fault system. A shallow magnetic anomaly (dashed red outline) is possibly left-laterally offset along the Salzer Creek fault.

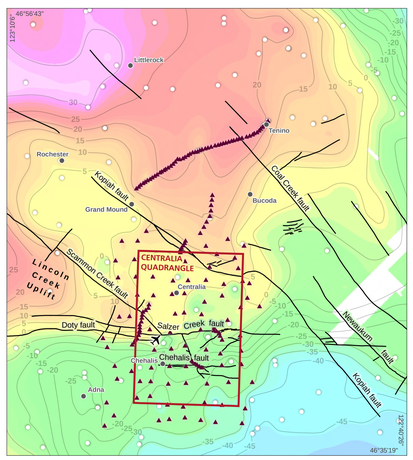
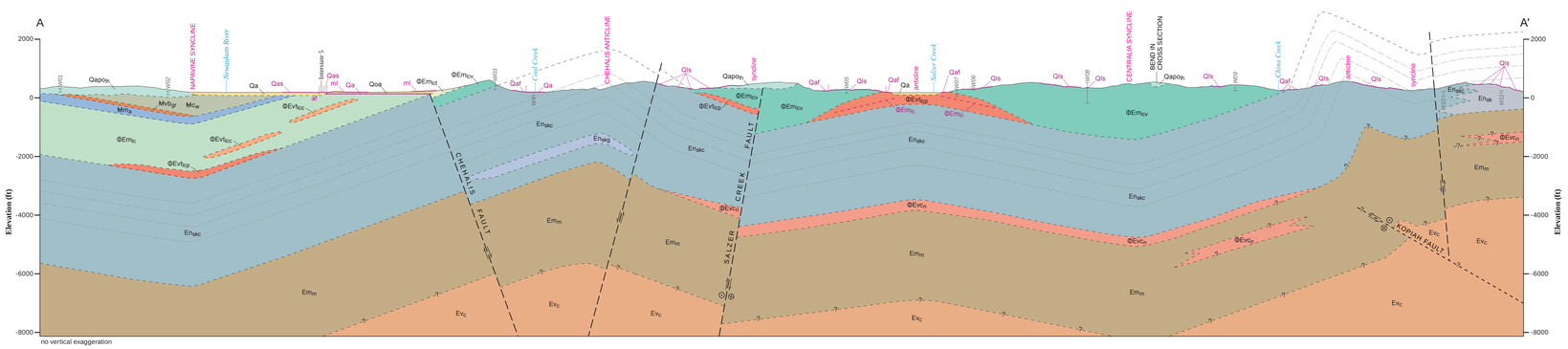


Figure M3. Complete Bouguer gravity anomaly map of the Centralia quadrangle and vicinity with data from this study and regional data (Bowman, 2013). Gravity contours (gray) computed from these data emphasize high and low gravity anomalies. Faults (black) are from this study and Snavely and others (1958) and generally bound significant contrasts in gravity, likely due to juxtaposition of rocks with contrasting density in the subsurface across these faults. Broadly, lower values are found south of the Doty–Salzer Creek fault system, which may be related to greater depth to basement. Conversely, the higher values north of the fault system suggest shallower basement and a structural high, the Lincoln Creek uplift. The Scammon Creek fault bounds the northeast flank of this structural high, and along with the Kopiah fault, bounds a smaller gravity low to the northeast of the Lincoln Creek uplift.



CROSS SECTION EXPLANATION

Qls, ΦEmc, Qa — Geologic units too thin to show as polygons at the scale of the cross section; solid where location accurate; short-dashed where inferred vertical tics mark separate units.

Bedding inferred from coal beds shown in Snavely and others (1958).

Arrows show relative fault movement in the plane of the cross section.

Arrow point shows fault movement toward the viewer; arrow feathers show fault movement away from the viewer.

W07 Water well or boring

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