WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES
WASHINGTON GEOLOGICAL SURVEY

Geologic Map of the Violet Prairie 7.5-minute Quadrangle, Thurston and Lewis Counties, Washington

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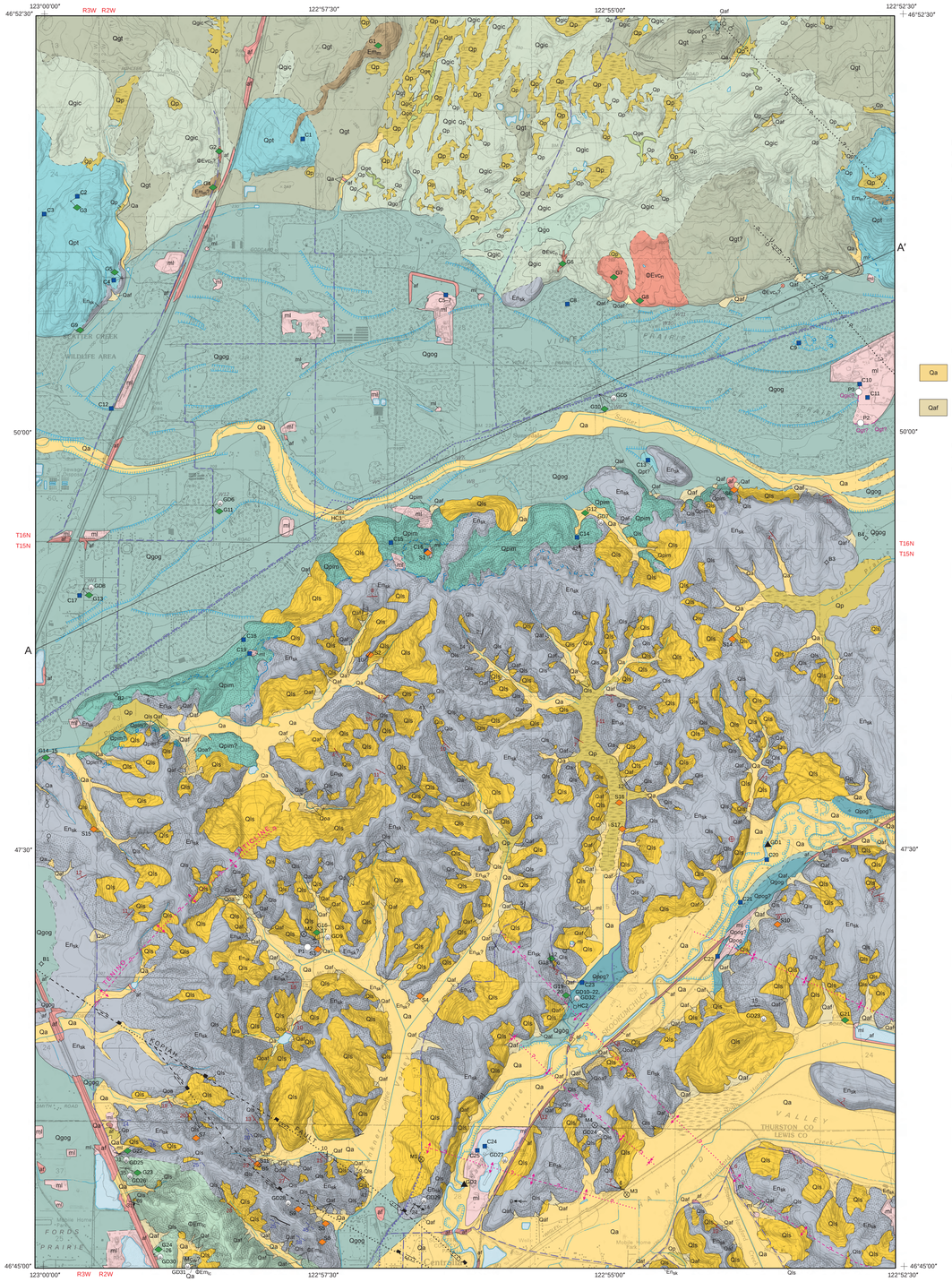

Lambert conformal conic projection
North American Datum of 1927; to place on North American Datum of 1983, move the projection lines approximately 21 meters north and 97 meters east as shown by crosshair corner ticks
Base map from scanned and rectified U.S. Geological Survey Violet Prairie 7.5-minute quadrangle, 1995
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 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

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.

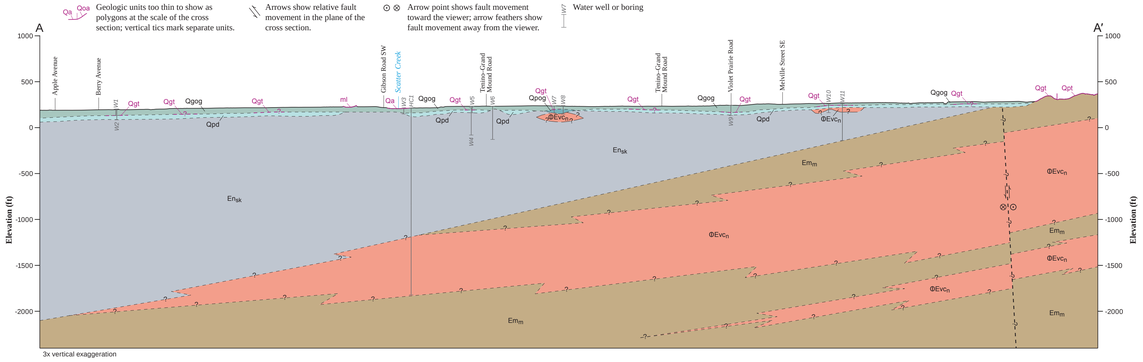
CROSS SECTION EXPLANATION

Qoa — Geologic units too thin to show as polygons at the scale of the cross section; vertical tics mark separate units.

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.

Water well or boring



DESCRIPTION OF MAP UNITS

(see pamphlet for detailed map unit descriptions)

Quaternary Unconsolidated Deposits

POSTGLACIAL DEPOSITS

Holocene Nonglacial Deposits

af — **Artificial fill**—Cobbles, pebbles, sand, silt, clay, and boulders, in varied amounts and mostly of northern-sourced lithologies. Used to raise roadbeds and other infrastructure throughout the map area.

ml — **Modified land**—Boulders, cobbles, pebbles, sand, silt, clay, in varied amounts; locally derived but redistributed to modify topography.

Qp — **Peat**—Organic and organic-rich sediment; includes peat, gyttja, muck, silt, clay, and sand, in varied amounts; usually in closed depressions.

Qls — **Landslide deposits**—Sand, silt, clay, cobbles, pebbles, diamicton, and boulders of sandstone, siltstone, and conglomerate, in varied amounts; clasts angular to rounded; unsorted; mostly loose, jumbled, and unstratified, but blocks locally retain primary bedding and compaction.

Holocene to Pleistocene Nonglacial Deposits

Qa, Qoa — **Alluvium**—Pebbles, cobbles, sand, silt, clay, peat, and boulders, in varied amounts; gray to dark brown, or variedly weathered to yellowish or orange brown; loose; thinly bedded to massive; deposited in streams and on flood plains; unit Qoa where relict.

Qaf, Qoaf — **Alluvial fan deposits**—Pebbles, sand, silt, cobbles, and boulders, in varied amounts; gray to brown; loose; subangular to rounded; moderately to poorly sorted; stratified to poorly stratified; forms concentric lobes; unit Qoaf where relict.

PLEISTOCENE GLACIAL DEPOSITS

Vashon Drift of the Fraser Glaciation
(All Vashon units are northern-sourced.)

Qgo — **Vashon recessional outwash, undivided**—Pebbles, cobbles, sand, and silt, in varied amounts; light gray, weathers light brown, tan, or light orange; loose; moderately to well sorted; subrounded to well rounded clasts; massive to bedded. Locally subdivided into:

Qgog — **Vashon recessional outwash, gravel**—Pebble to cobble gravel with a usually sparse matrix of coarse sand; pale gray, weathers tan or red-orange; mildly weathered; loose; clasts subrounded to well rounded; well sorted; massive to bedded.

Qgic — **Vashon ice-contact deposits**—Varied mix of ablation till, lodgment till, and ice proximal outwash ranging from pebbles to sand, silt, clay, and boulders, in varied amounts; pale gray, weathers tan or reddish brown; mildly to moderately weathered; clasts mostly well rounded, sand and fines angular to well rounded; poorly sorted to well sorted; massive to bedded. Locally subdivided into:

Qge — **Vashon esker**—Pebbles and sand, medium gray; mostly loose; well rounded; well sorted; bedded, with beds commonly oversteepened; forms distinctive long, sinuous hills.

Qgt — **Vashon lodgment till**—Compact diamicton, matrix supported with clasts ranging from pebbles to boulders in a matrix of sand, silt and clay, in varied amounts; light gray, light brown where weathered or basalt rich; lightly to moderately weathered; mostly compact with little porosity; clasts angular to well rounded; mostly unstratified.

Pre-Vashon Glacial Deposits

Qpog — **Pre-Vashon outwash, gravel**—Pebble to cobble gravel with a usually sparse matrix of coarse sand; pale gray, weathers pale brown to light orange; moderately weathered; loose; clasts subrounded to well rounded; well sorted; massive to bedded.

Qpos? — **Pre-Vashon outwash, sand**—Sand, slightly silty; pale yellowish brown to pale gray; slightly to moderately weathered, with most grains and rock fragments showing at least a thin weathering rind in thin section; compact; fine- to medium-grained; subangular; well sorted.

Qpt — **Pre-Vashon lodgment till**—Compact diamicton, matrix supported, with pebbles to boulders in a matrix of clay, silt and sand; pale brown to reddish brown; lightly to moderately weathered; compact where well developed; clasts angular to rounded; unsorted; mostly unstratified.

Qpim — **Pre-Vashon terminal moraine**—Diamicton of silt, clay, sand, pebbles and cobbles, in varied amounts; matrix-supported in most exposures; brownish gray to pale reddish brown, moderately to strongly weathered; mostly loose; clasts subangular to well-rounded; poorly sorted and unbedded.

Qpd — **Pre-Vashon drift (cross section only)**—Mostly pebbles and cobbles, varied amounts of boulders, sand, silt, and till; gray to light brown; outwash facies clast-supported with well-rounded clasts, good sorting, and bedding; till matrix-supported but cobble- and pebble-rich; clast rounding in till subangular to rounded, sorting poor, similar to units Qpt, Qpim, Qgt, Qgic, and Qgim.

Tertiary Volcanic and Sedimentary Bedrock

Mc_w? — **Wilkes Formation (Miocene)**—Pebbly sandstone to sandy conglomerate; matrix very coarse to fine sand; mostly light grey to medium brown; sand weakly to moderately cemented; sub-angular to rounded; moderately to well sorted; moderately to strongly weathered; massive to cross laminated or undulatory. Queried because inferred from adjacent Centralia quadrangle (Sadowski and others, 2018).

$ΦEm_c$ — **Lincoln Creek Formation (Oligocene–Eocene)**—Very fine sandstone to siltstone, rare medium sandstone; tuffaceous; ivory to pale gray where fresh, weathers tan to orange brown; weakly to moderately indurated; sub-angular to sub-rounded; moderately to well sorted; bedding mostly not apparent; commonly hackly.

En_{sk} — **Skookumchuck Formation (late to middle Eocene)**—Sandstone and siltstone; micaceous, arkosic, tuffaceous, locally carbonaceous; rare calcite-cemented concretions; pale gray to bluish gray, weathers light brown to reddish brown; exposures strongly weathered and readily broken with bare hands; bedding mostly subtle.

$ΦEvc_n$ — **Northcraft Formation (Oligocene–Eocene)**—Volcanic flows and breccia of basaltic andesite, andesite, and basalt, and volcaniclastic sedimentary rocks derived mostly from the above-mentioned volcanic rocks.

Em_m — **McIntosh Formation (middle Eocene)**—Volcanic lithic, marine sandstone, siltstone, and claystone; gray to pale brownish gray; mostly heavily weathered; moderately lithified; fine to medium grained; angular to rounded; moderately to well sorted.

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GEOLOGIC SYMBOLS

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

Mima mounds (overlay pattern)—Dark brown to black, organic-rich sand to pebbly sandy loam soil in regularly spaced round to oval mounds about 2 to 6 ft high and 10 to 30 ft across; little or no soil between mounds; black color mostly from burned organic matter. Mounds rest on terraces of highly permeable Vashon recessional outwash of northern- and Cascade Mountains-sourced pebbles and cobbles. Mapped where landforms and (or) field-observed deposits indicate the presence of such mounds.

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

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

Oblique-slip fault, high-angle right-lateral offset—Identity or existence questionable, concealed; relative horizontal motion shown by arrows, relative vertical motion shown by U and D

Anticline—Short-dashed where inferred; dotted where concealed; queried where identity or existence questionable

Syncline—Short-dashed where inferred; dotted where concealed; queried where identity or existence questionable

Geologic unit too thin to show as a polygon—Solid where location accurate; long-dashed where approximate; short-dashed where inferred; queried where identity or existence questionable

Continental ice limit, late Wisconsinan—Inferred; queried where identity or existence questionable

Continental ice limit, pre–late Wisconsinan—Solid where location accurate; long-dashed where approximate; short-dashed where inferred; queried where identity or existence questionable

A — A′ Cross section line

Perennial stream

Intermittent stream

Fluvial terrace—Location accurate; queried where identity or existence questionable; hachures point down slope

Geophysical data collection line—Long-dashed for magnetics, dotted for gravity

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

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

Inclined bedding—showing strike and dip

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

Approximate horizontal bedding

Horizontal bedding

Small, minor inclined joint—showing strike and dip

Inclined fold hinge of small, minor anticline—showing bearing and plunge

Inclined fold hinge of small, minor syncline—showing bearing and plunge

Shear—showing strike and dip

Spring—angle indicates downslope direction

Age site, fossil

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

Geochemistry sample location

Water well

Significant site

Drill hole for hydrocarbon exploration

Location of photograph

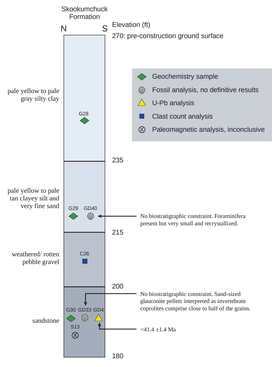
Drill hole or test pit

Paleomagnetic sample—inconclusive magnetization

Clast count sample

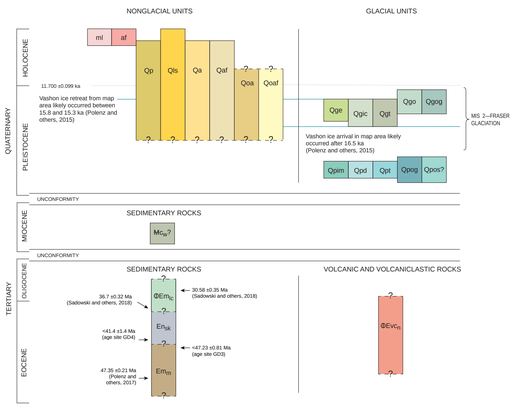
I-5 Great Wolf Columnar Section 1

See Fig. M1 for location (sec. 12, T15N R3W)



CORRELATION OF MAP UNITS

PERIODS AND EPOCHS BASED ON USGS FACT SHEET 2010-3059



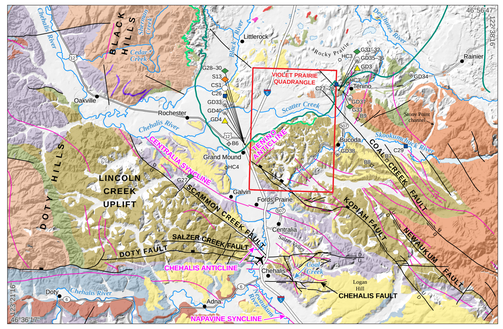


Figure M1. Regional geologic map for the Violet Prairie quadrangle. Geologic units and ice limit lines within the quadrangle are simplified from this study. Geologic units, faults, and folds outside the mapping area are adapted from published 1:24,000- and 1:100,000-scale geologic maps (Sadowski and others, 2018; Polenz, 2017; Snavely and others, 1958; Washington Division of Geology and Earth Resources, 2016). The ice limit outside the quadrangle is approximate and modified from Logan and others (2009), Thorson (1980), and Polenz and others (2017). Samples shown outside the quadrangle provide new reference data (see pamphlet).

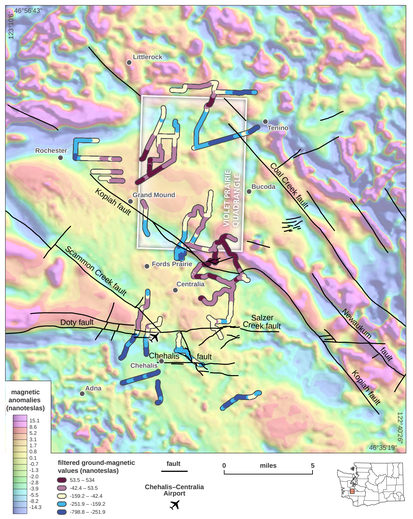


Figure M2. Aeromagnetic map of the Violet Prairie quadrangle and vicinity. Aeromagnetic image is reduced to pole and filtered to emphasize shallow sources (courtesy of Richard Blakely, USGS, written commun. 2016). Multi-colored lines are ground-level magnetic survey lines. Faults of Snavely and others (1958) are generally supported by the more recent aeromagnetic data, although well-defined anomalies locally suggest adjustments and additions. A fabric of northwest-oriented anomalies across most of the image is weakened or absent northeast of the Kopiah fault in the Violet Prairie quadrangle, where bedding orientations are gentle (Fig. 10).

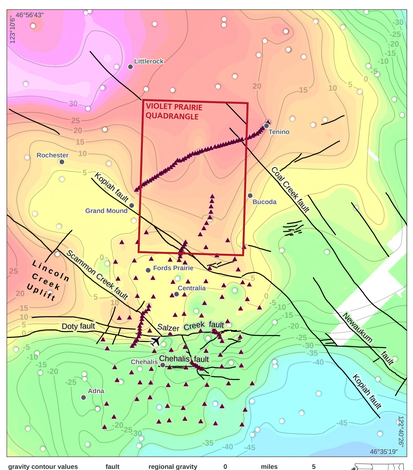


Figure M3. Complete Bouguer gravity anomaly map of the Violet Prairie quadrangle and vicinity. Map integrates regional gravity data (Bowman, 2013) with new gravity measurements (maroon triangles). Faults outside the quadrangle are adapted from Snavely and others (1958), Polenz and others (2017), and Sadowski and others (2018).

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