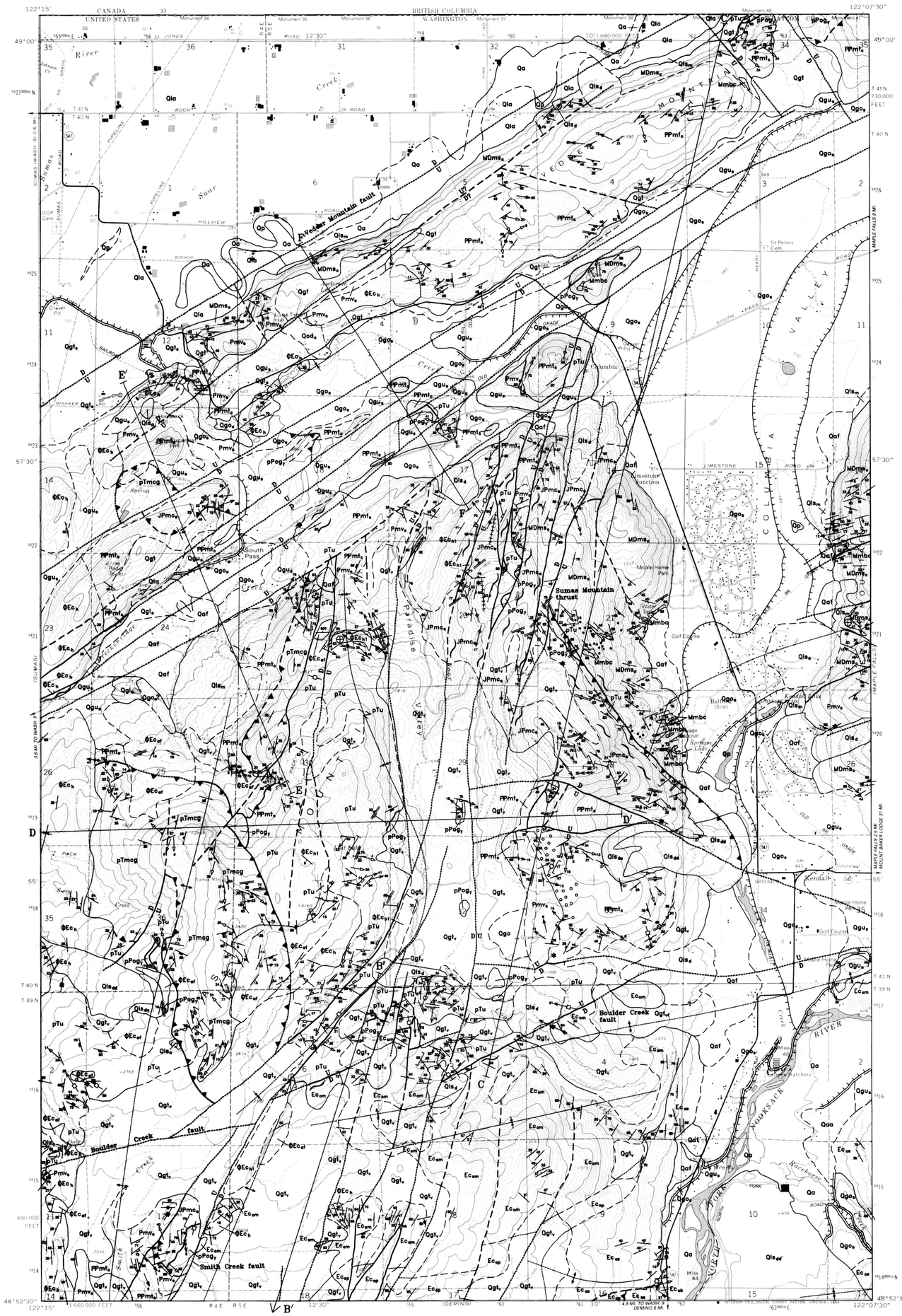
WASHINGTON DIVISION OF GEOLOGY AND EARTH RESOURCES
Raymond Lasmanis, State Geologist

PLATE 1
OPEN FILE REPORT 97-2
GEOLOGIC MAP AND INTERPRETED GEOLOGIC HISTORY OF
THE KENDALL AND DEMING 7.5-MINUTE QUADRANGLES,
WESTERN WHATCOM COUNTY, WASHINGTON

Geologic Map of the Kendall 7.5-minute Quadrangle, Washington

by

Joe D. Dragovich, David K. Norman, Ralph A. Haugerud,
and Patrick T. Pringle
1997



Geologic Units

SEDIMENTARY AND VOLCANIC DEPOSITS AND ROCKS

Quaternary Sedimentary Deposits

Nonglacial Deposits

- Qs — Surficial deposits, undivided (cross sections only)
- Qa — Alluvium; cobbly gravel, gravel, sand, silt, clay; peat (Holocene)
- Qoa — Undivided older alluvium and overbank deposits; sand, silt, and clay (Holocene)
- Qp — Peat (Holocene)
- Qta — Talus; bouldery cobbly gravel; local diamicton (Holocene)
- Qla — Lacustrine deposits of Sumas Valley; sand and silt (Holocene)
- Qls_a — Rock to debris avalanche deposits; bouldery to cobbly gravel or gravel diamicton (Holocene)
- Qaf — Alluvial fan deposits; diamicton (Holocene and Pleistocene?)
- Qls_m — Mass-wastage deposits, undivided; diamicton; may locally include glacial deposits; locally grades to alluvial fan deposits, rock or debris avalanche deposits, or talus (Holocene and Pleistocene?)
- Qls_{ds} — Deep-seated landslide main scarp; exposes adjacent geologic units (Holocene and Pleistocene?)
- Qls_{dd} — Deep-seated landslide deposits; diamicton (Holocene and Pleistocene?)
- Qls_d — Deep-seated landslide deposits, scarp not divided; diamicton (Holocene and Pleistocene?)

Glacial Deposits, Fraser Glaciation (Pleistocene)

Sumas Stade

- Qgl_s — Lacustrine deposits; silty sand, silt and clay
- Qod_s — Deltaic(?) deposits; gravel and sand
- Qgo_s — Outwash; sandy cobbly gravel, gravel, and minor gravelly sand; rare silt and clay
- Qgt_s — Ice-contact till deposits; bouldery cobbly diamicton; locally includes outwash
- Qgu_s — Till and/or glacial-lake deposits; may locally include Vashon till

Vashon Stade

- Qgt_v — Till; diamicton
- Qgt_{vf} — Flow till?; diamicton

Fraser glacial deposits, undivided

- Qgt — Till of Vashon or Sumas Stade; diamicton

Tertiary Sedimentary Rocks

Huntingdon Formation (Oligocene to upper Eocene?)

- ΦEc_h — Fluvial lithofacies, dominantly northern clast derivation; conglomerate with lesser arkosic, sub-arkosic to lithic arenite, siltstone and claystone and rare crystal lithic tuffs and coal
- ΦEc_{hl} — Fluvial lithofacies, mostly local clast derivation; conglomerate, lithic arenite to feldspathic litharenite
- ΦEc_{af} — Alluvial fan lithofacies; serpentinite clast-rich diamictite

Chuckanut Formation (Oligocene? to Eocene)

- Ec_{cm} — Maple Falls Member; conglomerate, litharenites to feldspathic litharenite with lesser bouldery cobbly diamictite, siltstone, and shale
- Ec_{cp} — Padden Member; conglomerate, conglomeratic sandstone, arenite, arkosic to lithic arenite, siltstone, and shale with lesser coal
- Ec_{cs} — Silde Member; arkose, siltstone, shale, coal and rare polymictic conglomerate
- Ec_{cb} — Bellingham Bay Member; polymictic conglomerate, arkose, siltstone, shale, and coal

Tertiary Volcanic Rocks

- ++++ — Andesitic dikes

LOW-GRADE LAYERED METAMORPHIC ROCKS OF THE NORTHWEST CASCADE SYSTEM

Mesozoic and Older Metamorphic Rocks of the Welker Peak Nappe of Tabor and others (1994)

Rocks of the Bell Pass melange (Mesozoic and older)

- $JPmc_e$ — Elbow Lake Formation (Jurassic to Permian) – Metachert with minor interlayered meta-argillite; rare serpentinite pods, metabasalt, tuff
- pTu — Serpentinite, dunite, pyroxenite, and pyroxenite (pre-Cretaceous)
- * — Ultramafite pods
- pTmcg — Metaconglomerate of Sumas Mountain (pre-Cretaceous) – Chert and volcanic pebble conglomerate with lesser lithic sandstone
- $pPog_y$ — Yellow Aster Complex (pre-Permian) – Intermediate to basic orthogneiss; rare massive gabbro and diopsidite

Paleozoic Metamorphic Rocks of the Excelsior Nappe of Tabor and others (1994)

Chilliwack Group (Permian to Devonian)

- Pmv — Metavolcanic rocks; dacitic to basaltic flows (tuffs?)
- $PPmt_s$ — Metamorphosed volcanic sandstone, volcanic wacke, tuff, breccia; locally contains significant argillite;
  - ° ° ° locally contains conglomerate
- $MDms_s$ — Metamorphosed argillite, volcanic sandstone, volcanic wacke, siltstone, and chert
- Mmbc — Marble
- ⁘ — Marble pods and bodies

Geologic Structure Symbols

Strike and dip of bedding (may be combined with other symbols)

- inclined
- upright
- overturned
- vertical
- inclined primary layering in ultramafite
- horizontal
- inclined bedding parallel to tectonic foliation

Trend and plunge of fold axes

- Minor fold axis (undifferentiated); arrow indicates the direction of plunge
- Minor fold axis (folded penetrative tectonic foliation); arrow indicates the direction of plunge
- Overturned minor fold axis (folded penetrative tectonic foliation); arrow indicates the direction of plunge

Strike and dip of tectonic foliation (may be combined with other symbols)

Penetrative tectonic foliation, undifferentiated

- inclined
- vertical

Gneissic foliation in the Yellow Aster Complex

- inclined

Penetrative to semi-penetrative cataclastic foliation or fracture cleavage associated with fault zones

- inclined
- vertical
- Areas of pervasive brittle to semi-ductile shear deformation adjacent to fault zones

Thin (meter-scale) mylonitic inhomogeneous shear zone

- inclined

Strike and dip of fractures and joints (may be combined with other symbols)

Joint, undifferentiated

- inclined
- vertical

Systematic spaced fracture or cleavage

- inclined
- vertical

Subsidiary minor fault or slickensided fracture plane

- inclined
- vertical

Subsidiary minor fault (commonly with gouge zone)

- inclined

Veins (common in mylonites and tectonites adjacent to thrusts)

- inclined
- vertical

Parting or fine jointing in sedimentary rocks

- inclined

Trend and plunge of tectonic lineations

Lineation, undifferentiated (mostly stretching lineations and prominent slickenlines; rarely pencil lineations or boudins); arrow indicates the direction of plunge

- inclined
- horizontal

Slickenline on slickensided fracture, fault, or cataclastic to mylonitic foliation; arrow indicates the direction of plunge

- inclined
- horizontal

Stretching lineation; arrow indicates the direction of plunge

- inclined
- horizontal

Geologic Map Symbols

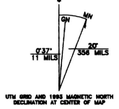
- Contact – Dashed where inferred; dotted where concealed; queried where existence uncertain
- High-angle fault – Dashed where inferred; dotted where concealed; U, upthrown block; D, downthrown block; half arrows in cross section indicate direction of relative motion
- Thrust fault – Dashed where inferred; dotted where concealed; sawteeth on upper plate
- Anticline – Dashed where inferred; dotted where concealed; arrow shows direction of plunge
- Syncline – Dashed where inferred; dotted where concealed; arrow shows direction of plunge
- Overturned syncline – Dotted where concealed; arrow shows direction of plunge
- Terrace scarps – Hachures on scarp side
- Liquefaction site

Base map by U.S. Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken in 1972 and 1989. Map edited 1993
Lambert Conformal Conic projection. 1927 North American datum
10,000-foot grid based on Washington coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 10
Cartographic design and production by Keith G. Ikerd, Washington Division of Geology and Earth Resources

QUADRANGLE LOCATION

SCALE 1:24,000
1 .5 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929



UTM GRID AND 1995 MAGNETIC NORTH DECLINATION AT CENTER OF MAP

WASHINGTON STATE DEPARTMENT OF
Natural Resources
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