U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

GEOLOGIC MAP OF THE AENEAS VALLEY QUADRANGLE, OKANOGAN COUNTY, WASHINGTON

by

C. Dean Rinehart[1] and Kenneth F. Fox, Jr.[2]
U.S. Geological Survey

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[1] 345 Middlefield Road, MS 901, Menlo Park, California 94025

[2] Box 25046, Federal Center MS 913, Denver, Colorado 80225

1994

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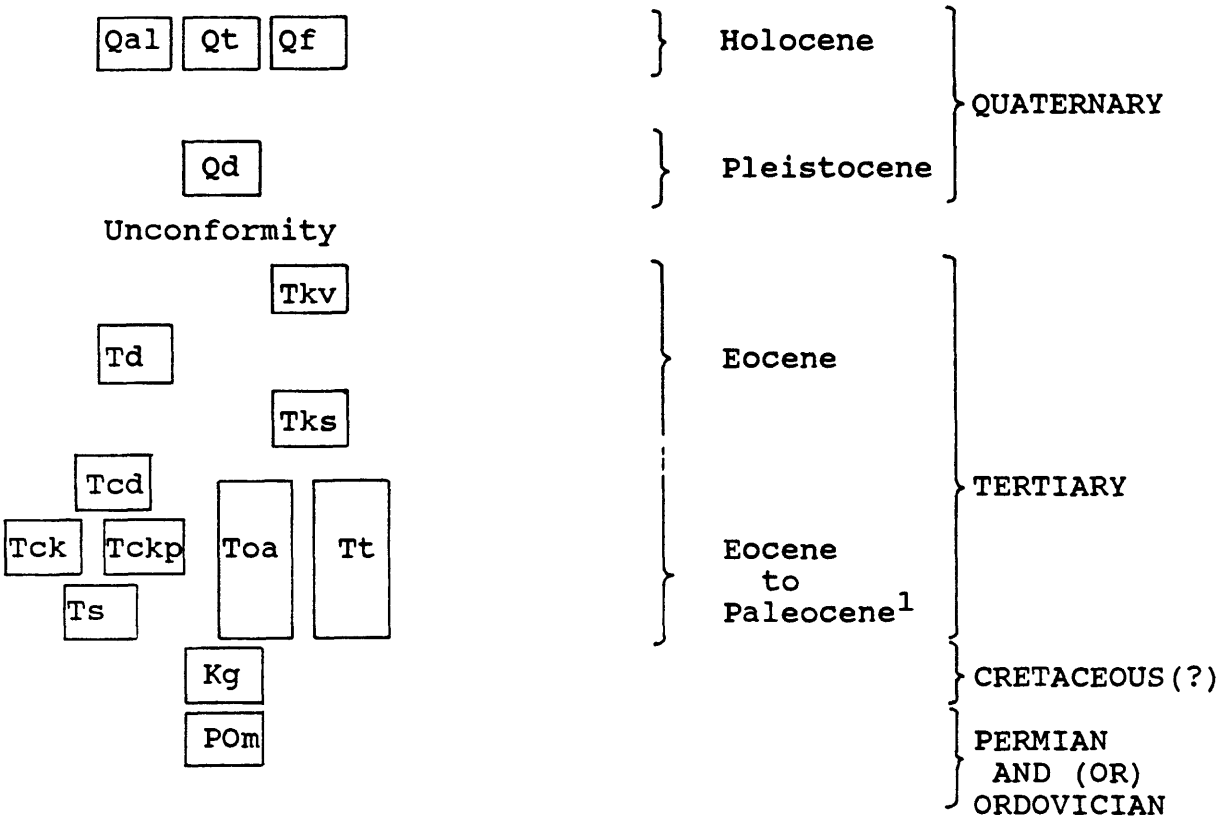
CORRELATION OF MAP UNITS



[1] With respect to units Tt and Toa, refers to age of penetrative dynamic metamorphism. The protolith of these units includes components believed to be Late Cretaceous in age (Fox and others, 1976; Potter and others, 1991) and components correlative with the Permian (?) and (or) Ordovician rocks (unit POm)

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qal **Alluvium (Quaternary)**--Chiefly peat, clay, silt, sand, and gravel

Qt **Talus (Quaternary)**--Coarse, angular rocks fragments

Qf **Fan deposits (Quaternary)**--Chiefly silt, sand, and gravel

Qd **Glacial drift (Pleistocene)**--Stratified water-laid deposits of variably sorted silt, sand, and bouldery gravel covering valley floors and partially mantling upland surfaces. Forms narrow "stair-stepped" terraces covering southeastern flank of valley of Bonaparte Creek and broad, kettled terraces within Aeneas Valley. Deposited chiefly from meltwater streams and lakes ponded along the flanks of the receding Okanogan lobe of the Cordilleran ice sheet. Unit also includes thin, formless, unsorted and unstratified deposits of clay, silt, sand, and bouldery gravel (till) partially mantling upland surfaces. The till was troweled against subjacent bedrock by the overriding ice sheet

SEDIMENTARY, VOLCANIC, AND HYPABYSSAL ROCKS

Td **Diorite (Eocene)**--Dikes of dark-greenish-gray, fine- to medium-grained diorite. Composed chiefly of hornblende, plagioclase, and biotite; contains minor quartz and traces of potassium feldspar, sphene, and apatite. Contains inclusions of mylonitic gneiss and pegmatite

Klondike Mountain Formation (Eocene)

Tkv **Volcanic rocks**--Massive, aphanitic rhyodacitic lava flows; locally have weakly developed columnar jointing. Overlies sedimentary rocks (unit Tks) at east-central edge of quadrangle

Tks **Sedimentary rocks**--Flaggy brownish-gray to yellowish-brown volcaniclastic sandstone, siltstone, and shale. Strata commonly disrupted, locally brecciated. Basal contact not exposed, but interpreted as low-angle fault

PLUTONIC AND HIGHLY METAMORPHOSED ROCKS

Colville batholith (Eocene to Paleocene)

Tcd **Devils Elbow suite** (informal usage of Holder and Holder, 1988)--Mafic fine-grained hornblende (pyroxene) biotite monzodiorite; locally mylonitic and lineated. Forms part of Swimptkin Creek pluton of Fox and others (1976). Mapped only near southern margin of quadrangle; distribution from Gulick (1987)

Tck **Keller Butte suite** (informal usage of Holder and Holder, 1988)--Light-gray, coarse to fine-grained granite; composed chiefly of oligoclase, orthoclase, quartz, and minor biotite (locally partially altered to chlorite) and muscovite, with accessory allanite and apatite; commonly megacrystic (orthoclase); lineated and mylonitic within Okanogan gneiss dome (described in Fox and others, 1976; Fox and Rinehart, 1988; and Fox, 1994). In north-central part of quadrangle unit forms southern part of Mount Bonaparte pluton (Fox, 1978). In the southeastern part of quadrangle unit forms northwestern part of Moses Mountain pluton (Atwater and Rinehart, 1984). The granite is commonly cut by dikes of white pegmatite (unit Tckp).

Tckp **Pegmatite dikes**--Typically thin, rarely greater than 30 cm thick, except locally along the eastern side of the Mount Bonaparte pluton, where the pegmatite forms mappable bodies hundreds of meters wide in this quadrangle, and on strike to the north in the Mount Bonaparte quadrangle (Fox, 1978)

Toa **Orthogneiss of Anglin (Eocene to Paleocene)**--Thinly interlayered medium and light-gray mylonitic quartzofeldspathic gneiss. Mylonitic foliation (formed as shear planes during ductile flow of the orthogneiss) and lineation are penetrative. Granodioritic (locally granitic) in composition. Chief mafic constituent is biotite; also commonly contains accessory hornblende. Layering is defined by slight differences in color index, which is commonly low

Tt **Tonasket Gneiss (Eocene to Paleocene)**--Thinly interlayered light- to medium-gray quartzofeldspathic gneiss, dark-gray sillimanite-biotite-muscovite schist, white marble (rare), white pegmatite, and dark-greenish-gray amphibolite. Mylonitic foliation (formed as shear planes during ductile flow of the gneiss) and lineation are penetrative. Rocks are commonly mylonitic or blastomylonitic. Small recumbent isoclinal folds, with fold axes parallel to lineation, are common. Locally includes layers of quartzofeldspathic orthogneiss

Ts **Syenitic gneiss (Eocene to Paleocene)**--Light gray, medium- to coarse-grained, quartz-bearing syenitic gneiss; chief mafic constituent is hornblende; contains accessory titanite. Present only as small body in northeastern corner of quadrangle. Unit continues northward into Mount Bonaparte 15' quadrangle, forming border zone between Mount Bonaparte pluton to west and metasedimentary rocks to east (see Fox, 1978). Locally cut by pegmatite dikes (unit Tckp)

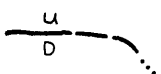
Kg **Wauconda pluton (Cretaceous?)**-- Medium-gray, medium- to coarse-grained, weakly gneissic, porphyritic granodiorite. Phenocrysts are large, blocky potassium feldspar. Color index 5 to 10. Chief mafic mineral is hornblende; contains minor biotite and abundant accessory sphene, allanite, and apatite. Foliation increases in intensity toward contact with Mount Bonaparte pluton

WEAKLY TO MODERATELY METAMORPHOSED STRATIFIED ROCKS

POm **Metasedimentary and metavolcanic rocks (Permian and (or) Ordovician)**--In the southeastern part of the quadrangle these rocks consist mainly of medium to dark-gray metasiltstone, quartzite, meta-conglomerate, marble, amphibolite, and light-gray granofels. At the northeastern boundary of the quadrangle, the metasedimentary rocks consist mainly of medium- to dark-gray phyllite and schist. The metasedimentary rocks of this unit (POm) are distinguished from the Tonasket Gneiss by lower metamorphic grade, absence of lineation and mylonitic foliation, absence of migmatite, and absence of pervasive mylonitization. However, in the southeastern part of the map area these metamorphic and deformational features appear within the metasedimentary rocks (unit POm), with intensity increasing from east to west. The contact with the Tonasket Gneiss (unit Ttu) is arbitrarily placed within a broad (1/2 km wide) gradational zone. The metasedimentary rocks (unit POm) appears to be infolded with the rocks of the Tonasket gneiss. Protolith of the metasedimentary rocks (unit POm) in the northeastern part of the quadrangle is likely the Anarchist Group of Permian age (see discussion of age of the Anarchist in Rinehart and Fox, 1972, p. 9-10). In the southeastern part of the quadrangle, the unit may be correlative with the Anarchist Group and (or) the Covada Group. The Covada Group contains fossils of Ordovician age at localities approximately 65 km east of the Aeneas 15' quadrangle (Snook and others, 1981).

Contact--Long dashed where approximately located, short dashed where gradational, querried where inferred, dotted where covered by surficial deposits

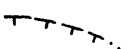
Faults--Dashed where approximately located, dotted where concealed



High-angle normal fault--D, downthrown side; U, upthrown side

Low-angle normal (denudation) fault--Decouples Eocene basin fill (sedimentary and volcanic rocks) from subjacent basement rocks; teeth toward basin fill

Structural facies boundary--Approximate location of shallowly dipping gradational zone between lineated mylonitic, protomylonitic, and blastomylonitic granitic rocks of Okanogan gneiss dome and non lineated, non mylonitic (massive) granitic rocks outside of gneiss dome. The granitic rocks, both mylonitic and nonmylonitic, are part of the Keller Butte suite (unit Tck) of the Colville batholith. Gradational zone is as much as a kilometer wide, and several hundred meters thick. Massive granitic rocks outside gneiss dome (described as the homophanous facies by Waters and Krauskopf, 1941, p. 1387) locally are cut by thin zones (several centimeters to a 1/2 m thick) of mylonite near the structural facies boundary. Massive rocks form an upper plate, overlying the mylonitic rocks of the gneiss dome (see discussion by Fox, 1994).



As shown on map--Tics point towards upper plate. Dotted where covered by surficial deposits.

As shown on cross section

Bedding, inclined--Showing strike and dip

Mylonitic foliation, compositional layering, and (or) schistosity--Showing strike and dip. Shows range where dip varies

Inclined

Inclined--Variable strike

Horizontal

Horizontal--Undulatory, but approximately horizontal

Shear bands, shear zones, and shear surfaces--Closely to widely spaced (commonly 5 cm to 3 m) sub-planar to gently curving and anastomosing non penetrative layers, zones, and surfaces (layers and zones commonly 1/2 cm to 5 m thick) cutting earlier folded to contorted penetrative mylonitic foliation and/or compositional layering. Shear bands composed of lineated, fine-grained granitic gneiss (recrystallized mylonite). Shear zones are zones of closely-spaced lineated mylonitic foliation (unrecrystallized or little recrystallized mylonite). Overprint of these features on the earlier mylonitic foliation and compositional layering produces a distinctive rock fabric referred to as the swirled gneiss facies (Waters and Krauskopf, 1941, p. 1383; Fox and Rinehart, 1994)

Inclined

Inclined--Variable strike

Vertical

Horizontal

Horizontal--Undulatory, but approximately horizontal

Minor fold--Showing bearing and plunge of fold axis. May be combined with other symbols (plunge not shown where fold axis lies in plane of associated foliation)

Inclined

Horizontal

Sense of shear of intrafolial folds--Folded compositional layering and (or) mylonitic foliation. Looking northwest to northeast in direction of fold axis; sense-of-shear symbol combined with fold-axis symbol

Clockwise

Counterclockwise

Lineation--Showing bearing and plunge (shows range of plunge where variable). May be combined with other symbols. Plunge not shown where lineation lies in plane of associated foliation; r, rodding

Inclined

Horizontal

Joints--Showing strike and dip. Solid box indicates primary set where compound sets are present; slickensides on joint surface indicated by: - , dip slip; - , strike slip; - , oblique slip (arrow points in direction of plunge)

Inclined

Vertical

Compound set

En echelon

Gravel pit

Patterns on cross sections--Patterns show generalized inclination of rock fabric

Crumpled or contorted foliation--in low-grade metamorphic rocks

Folded blastomylonitic foliation and compositional layering--in layered gneiss

Blastomylonitic foliation and compositional layering--in orthogneiss

Massive granitic rocks

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