U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

GEOLOGIC MAP OF THE TONASKET QUADRANGLE, OKANOGAN COUNTY, WASHINGTON

by

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

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

[2] 345 Middlefield Road, MS 901, Menlo Park, California 94025

1994

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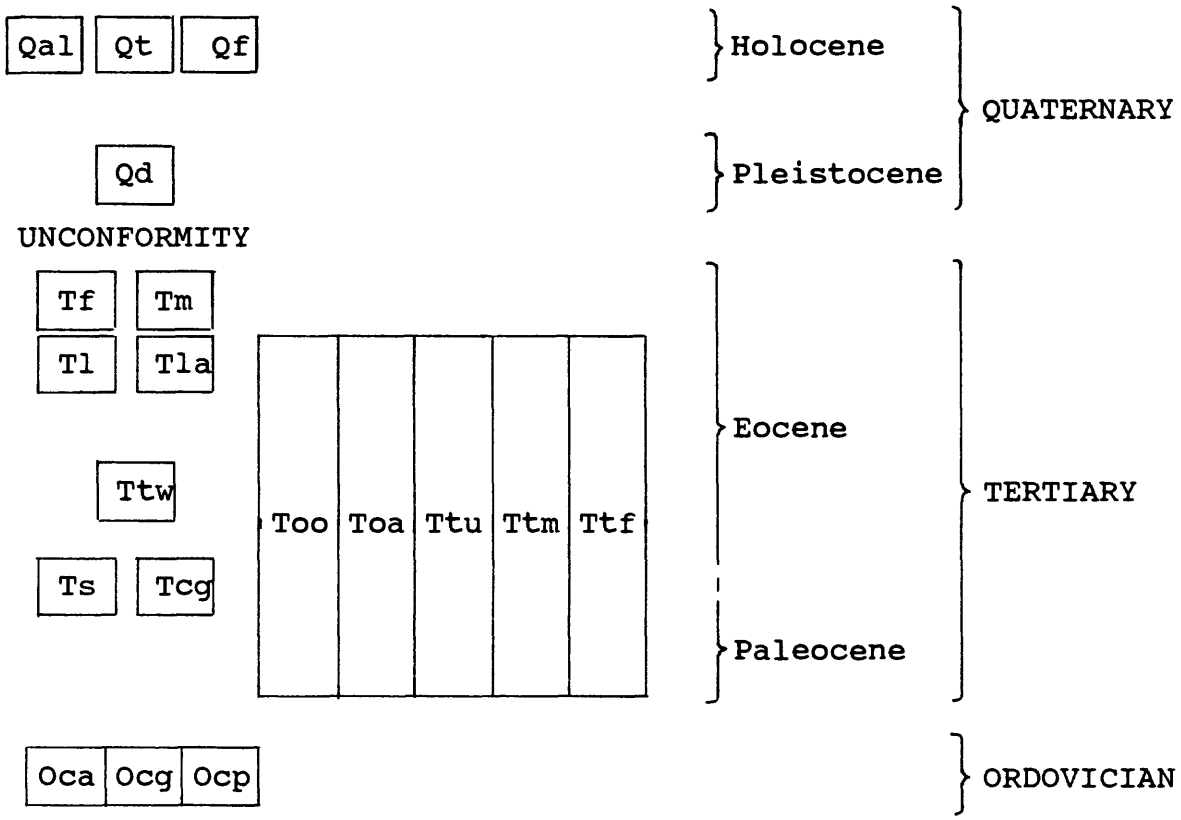
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSTS

Qal **Alluvium (Quaternary)**--Chiefly silt, sand, and gravel in floodplain of Okanogan River; includes clay in small lake basins

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

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

Qd **Glacial drift (Pleistocene)**--Terraced deposits of stratified gravel, sand, and silt in major valleys, and formless deposits of gravel, bouldery gravel, and pebbly sand mantling upland surfaces

SEDIMENTARY AND VOLCANIC ROCKS

Tf **Fanglomerate, fluvial deposits, and lacustrine deposits (Eocene?)**--Fanglomerate (sedimentary breccia and conglomerate) at base with clasts as long as 20 cm (locally as long as 1 m) of metamorphic, granitic, and volcanic rock, with thin interlayers of fluvial deposits (chiefly wacke as interbeds 5 to 25 cm thick), overlain by lakebeds (chiefly tuff, sandstone, and shale) with interlayers of conglomerate. Distinguished from sedimentary deposits at base of Tertiary section (units Ts and Tcg) by presence of dacite and andesite clasts presumably derived from unit Tl.

Tm **Monolithologic breccia (Eocene)**--Brecciated to closely fractured medium-greenish gray limy phyllite and limy greenstone

Dacite and rhyodacite (Eocene)

Tv **Porphyritic lava flows**--Massive to flow-banded greenish- to brownish gray aphanitic volcanic rock containing scattered rosettes of black, euhedral hornblende, and small light-gray phenocrysts of plagioclase. Locally contains phenocrysts of green augite in lieu of--or in addition to--hornblende. Where fresh, plagioclase is andesine or labradorite, but typically the lava is altered, with laumontite replacing plagioclase; relict plagioclase is albite or oligoclase and chlorite replaces hornblende and pyroxene. Other secondary minerals commonly present include prehnite and calcite

Tva **Altered lava**--Rubbly greenish-gray altered volcanic rock cut by numerous fractures and gashes up to 1/2 cm wide filled with porcelaneous quartz

Tw **Tuff and volcanic wacke (Eocene)**--Flaggy greenish-gray medium-grained crystal-lithic tuff. Commonly massive; locally contains thin beds of siltstone and lenses of conglomerate. Uppermost part includes ash-flow with flattened pumice; grades upward to welded tuff megascopically similar to overlying dacite and rhyodacite

Sedimentary rocks (Eocene)

Ts — **Siltstone and wacke**--Friable, pinkish-white, pebbly wacke and tuffaceous siltstone. Thin bedded; locally contains lenses of conglomerate; interfingers with conglomerate described below

Tcg — **Conglomerate**--Hard, ledge-forming greenish- to brownish-gray conglomerate, composed of well-rounded cobbles and pebbles of granitic and metamorphic rocks packed in an arkosic matrix. Contains interbeds of pinkish-white to light-gray wacke

HIGHLY METAMORPHOSED ROCKS
(Indicated age refers to age of metamorphism)

Okanogan gneiss dome

Too — **Orthogneiss of Omak Lake (Eocene to Paleocene)**--Medium-gray, fine- to medium-grained quartzofeldspathic gneiss containing hornblende, biotite, and minor orthoclase. May be southern continuation of Orthogneiss of Anglin (unit Toa)

Toa — **Orthogneiss of Anglin (Eocene to Paleocene)**--Thinly interlayered medium- and light-gray quartzofeldspathic gneiss. In central part, contains 20-40 percent orthoclase, and chief mafic constituent is biotite. Grades eastward to gneiss containing 5 percent orthoclase and accessory hornblende. Layering is defined by slight differences in color index, which is commonly low except in westernmost parts (in section 29, T.37N., R.27E.), where the gneiss is mafic, dark-greenish gray, and massive. Unit may continue to the south as the Orthogneiss of Omak Lake (unit Too)

Tonasket Gneiss (Eocene to Paleocene)

Ttu — **Ultramylonite and mylonite**--Brittle, medium- to light-greenish gray; composed of thick, massive layers locally with penetrative thin lamination and streaky lineation. Grades westward to less cataclastic rock in which relic textures and mineralogy indicate derivation from potassium-feldspar bearing wacke or arkose, similar to that of Ordovician Covada Group to west

Ttm — **Mafic gneiss (with interlayers of felsic gneiss)**--Black to dark greenish-gray amphibolite and hornblende-plagioclase (andesine, labradorite, or bytownite) gneiss forming layers up to 10 m-thick, with thinner interlayers of white to light-gray felsic gneiss

Ttf — **Felsic gneiss (with interlayers of mafic gneiss)**--Thinly interlayered light- to medium-gray quartzofeldspathic gneiss with thick interlayers of dark greenish-gray amphibolite and hornblende-plagioclase (andesine, labradorite, or bytownite) gneiss. Also contains interlayers of marble (rare) and calc-silicate rock

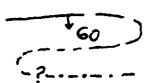
WEAKLY METAMORPHOSED STRATIFIED ROCKS

Covada Group (Ordovician)--Low-grade metamorphic rocks constitute the exposed basement of the upper-plate forming the western (hanging) wall of the shallowly west-dipping Wagonroad Coulee fault. The low-grade rocks consist chiefly of phyllite, slate, greenstone and weakly metamorphosed arkose and graywacke. These rocks are described below. The low-grade rocks are unfossiliferous. However, they closely resemble rocks of the Covada Group, which contains Ordovician fossils at localities located approximately 85 km east of the Tonasket 15' quadrangle (Snook and others, 1981)

Ocg **Greenstone**--Massive, greenish-gray aphanitic greenstone interlayered with fissile, limy, medium-gray to medium-greenish gray, thin laminated phyllite and greenschist, containing thin interlayers of quartzite with phyllite partings. At west edge of quadrangle (section 12, T.36N., R.28E.) the unit includes a boudinaged interlayer up to 1/2 m thick of white marble

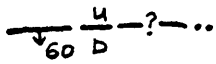
Oca **Arkose and graywacke**--Massive gray, fine- to very coarse grained, weakly metamorphosed arkose and graywacke in graded beds with thin intercalations of dark-gray slate. Arkose and graywacke are composed of angular clasts of quartz, microcline, albite, and muscovite, and rarely, of rock fragments (quartzite and granite) set in a fine-grained micaceous (sericite and/or chlorite) base. The unit is weakly foliated parallel to bedding and moderately crumpled except at Cayuse Mountain, in the extreme northwestern corner of the quadrangle, where the unit is tightly crumpled, multiply cleaved, and mylonitic. The unit is also much deformed and mylonitized north of Tonasket (section 9, T.37N., R.27E.). An interbed of massive white orthoquartzite is present at this locality, and the arkose and graywacke contain interstitial biotite of metamorphic origin

Ocp **Phyllite and slate**--Black slate and dark-gray limy phyllite. Much contorted near Okanogan gneiss dome in Antoine Valley. At western edge of quadrangle (section 12, T.36N., R.28E.) the unit contains an interlayer ranging in thickness from 1 to 3 m of laminated medium gray dolomitic limestone locally mineralized with fluorite

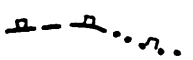


Contact--Long dashed where approximately located, short dashed where gradational, querried where inferred, dot-dashed where interfingering; dip shown where observed

Faults--Dashed where approximately located, querried where inferred, dotted where concealed



High-angle normal fault--D, downthrown side; U, upthrown side; dip shown where observed



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

Low-angle normal (detachment) fault--Penetrates upper crust, forming contact between ductily deformed rocks of the Okanogan gneiss dome (lower plate), and less-sheared, comparatively intact rocks to west (upper plate). Teeth toward upper plate. Referred to as Wagonroad Coulee fault (Fox, 1994)

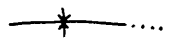
Thrust fault--Teeth toward upper plate

Structural facies boundary--Inferred location of gradational contacts between mylonite, protomylonite, blastomylonite, and swirled gneiss (Waters and Krauskopf, 1941; Fox and Rinehart, 1988) within highly metamorphosed rocks; dotted where covered by surficial deposits

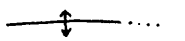
As depicted on map

As depicted on cross-sections

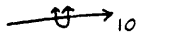
Fold (major)--showing trace of fold axis, dotted where concealed



Syncline

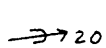


Anticline



Anticline, overturned--showing plunge

Fold (minor)--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)



Isoclinal fold

Inclined fold

Horizontal fold

Fold (minor)--Showing strike and dip of axial plane

Bedding--Showing strike and dip

Inclined

Inclined--variable strike

Vertical

Horizontal--undulatory, but approximately horizontal

Foliation--showing strike and dip

Inclined

Inclined--variable strike

Inclined--variable dip, showing range

Vertical

Vertical-variable strike

Horizontal--Undulatory, but approximately horizontal

Mylonite zone or layer--showing strike and dip

Inclined

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

Flow-banding--In volcanic rocks. Shows strike and dip

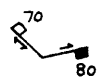
Inclined

Vertical

Joints--showing strike and dip. Solid box indicates primary set; slickensides on joint surface indicated by: - , dip slip; ↔ , strike slip; ↠ , oblique slip (arrow points in direction of plunge)

Inclined

Vertical



Compound set

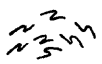
Echelon

Glacial striae--Arrow points in direction of ice movement

Gravel pit

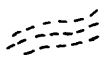
DESCRIPTION OF PATTERNS ON CROSS SECTIONS
(Patterns show generalized inclination of rock fabric)

Planar bedding

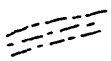


Crumpled or contorted bedding (or foliation)--in low-grade metamorphic rocks

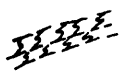
Mylonitic foliation



Folded blastomylonitic foliation and compositional layering--in layered gneiss



Blastomylonitic foliation and compositional layering--in orthogneiss



Planar foliation cutting crumpled foliation--in swirled gneiss

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Waters, A.C., and Krauskopf, Konrad, 1941, Protoclastic border of the Colville batholith: Geological Society of America Bulletin, v. 52, p. 1355-1418