# GEOLOGY OF THE NACHES RANGER DISTRICT, WENATCHEE NATIONAL FOREST, KITTITAS AND YAKIMA COUNTIES, WASHINGTON

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OPEN FILE REPORT 92-3

March 1992

This report has had no peer review. References and the formality of formation and geographic names have been verified.

WASHINGTON STATE DEPARTMENT OF
**Natural Resources**
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Plate 1. Geologic map of the Naches Ranger District, Wenatchee National Forest

Plate 2. Correlation chart for units shown on the geologic map of the Naches Ranger district

# GEOLOGY OF THE NACHES RANGER DISTRICT, WENATCHEE NATIONAL FOREST, KITTITAS AND YAKIMA COUNTIES, WASHINGTON

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## INTRODUCTION

Although the Naches Ranger District has been the focus of much detailed geological mapping during the past 20 years, the work was at various scales and thus difficult to correlate. This report is a compilation of all published geological mapping and was prepared primarily for U.S. Forest Service use. This text accompanies a single 1:62,500-scale geologic map of the district (Plate 1). More detailed mapping at 1:24,000 scale is available at the Naches District Office, Naches, Wash.

The symbols used in this text follow this scheme: Q indicates a Quaternary age (as in Qaf); QT indicates a Quaternary and (or) Tertiary age (as in QTb); T indicates a Tertiary age, as in Teu); and P or PT indicate pre-Teriary ages (as in Pvt and PTlm); KJ indicates Jurassic to Cretaceous ages (as in KJrg); and J indicates Jurassic ages (as in Jif). Other lower-case letters indicate either rock type or formation or unit name. Unit correlations are shown in Plate 2.

## DESCRIPTION OF MAP UNITS

### Quaternary Surficial Deposits

Qal *Stream deposits*--Fluvial clay, silt, sand and gravel; clasts commonly round or subround and poorly sorted; mostly confined to valley bottoms; composition varies with location, but resistant igneous and metamorphic rock sources provide most of the material; widely distributed throughout the Naches Ranger District.

Qaf *Alluvial fans*--Fluvial clay, silt, sand, and gravel; clasts commonly angular or subangular and poorly sorted; mostly cone-shaped deposits at the mouths of tributaries; formed by rapid runoff or flash flooding; widely distributed throughout the Naches Ranger District.

Qls *Landslides*--Rotational-translational slides and flows of clay, silt, sand, and gravel; includes boulders and blocks of partially intact rock units embedded in muddy matrix; surface commonly hummocky; includes both ancient and recent slides, as well as some active slides in the Tieton and Milk Creek drainages; widely distributed throughout the district.

Qde *Evans Creek Drift*--Alpine till, moraines, and outwash; silt, sand, and gravel; clasts commonly poorly sorted and slightly weathered; present in high Cascade valleys as benches along mountain streams and tributaries (Crandell and Miller, 1974).

Qg *Glacial deposits, undifferentiated*--Alpine till, moraines, and outwash; silt, sand, and gravel commonly poorly sorted and slightly weathered; present in high Cascade valleys and benches along mountain streams and tributaries; probably equivalent to unit Qde.

## Quaternary and Upper Tertiary Volcanic Rocks

Qbtc *Basalt of Tumac Mountain, cone facies*--Olivine basalt and andesite flows and breccias; well-formed and uneroded cinder cone; confined to cone at Tumac Mountain (Clayton, 1983).

Qbt *Basalt of Tumac Mountain*--Several olivine basalt and andesite pahoehoe flows; light- to dark-gray, platy or flow layered and very fine grained; occurs in the Tumac Mountain area (Clayton, 1983).

Qdp *Andesite of Deep Creek*--Several hornblende andesite flows; light- to dark-gray, platy or flow layered and very fine grained; present in the Deep Creek area (Abbott, 1953).

Qhapl *Andesite of Pear Lake*--Hornblende andesite flows; mixed magma chemistry; outcrops in the White Pass area (Clayton, 1983).

Qhadl *Andesite of Deer Lake Mountain*--Hornblende andesite flows; mixed magma chemistry; exposed in the White Pass area along the east and northeast edge of Tumac plateau (Clayton, 1983).

Qhd *Dacite of Spiral Butte*--Well-preserved plug dome of hornblende dacite; very fine grained, light-gray and platy; occurs east of White Pass (Ellingson, 1968).

Qah *Andesite of Ives Peak*--Hornblende and pyroxene andesite flows at Ives Peak; light-gray oxidized flows with sparse plagioclase phenocrysts; exposed in the Goat Rocks area (Swanson and Clayton, 1983).

Qhau *Unnamed andesite*--Hornblende andesite flows; present in the White Pass area (Clayton, 1980).

Qrm *Andesite of Round Mountain*--A 250-m-thick sequence of hornblende andesite lavas and tuff; caps Round Mountain east of White Pass; K-Ar age estimate of 0.79 ± 0.13 Ma (Clayton, 1983).

Qhar *Andesite of Russell Ridge*--Hornblende andesite dike and flow; exposed in small outcrops on Russell Ridge east of White Pass (Clayton, 1983).

Qta *Tieton and andesite and related rocks*--Phyric hypersthene augite andesite; dark-gray with abundant plagioclase phenocrysts; minor tephra; erupted from vents southwest of Pinegrass Ridge in Goat Rocks (includes part of the Goat Rocks stratovolcano); one flow extends down the Naches River to Yakima. K-Ar age estimate of 1.0 ± 0.1 Ma (Swanson, 1978).

Qb *Olivine basalt of Bethel Ridge*--Phyric and aphyric olivine basalt; one or more flows filling channels near Rimrock Lake; vent location unknown; includes unit Tob of Swanson (1978) and some younger(?) olivine basalt.

Qbu *Olivine basalt*--Basalt flows near Leech Lake (Clayton, 1980).

QTb *Basalt of Hogback Mountain*--Olivine-bearing basalt and basaltic andesite; includes minor dacite and andesite; forms a thin shield centered on Hogback Mountain in Goat Rocks; K-Ar age estimate of 1.0 ± 0.18 Ma (Clayton, 1983).

Tpr *Devil's Horns rhyolite*--Domes, ash-flow and air-fall tuffs, and rhyolite breccia; high silica content; present as thick deposits underlying the Devil's Horns area along the upper South Fork Tieton River; K-Ar age estimate of 3.20 ± 0.2 Ma (Clayton, 1983).

Tpd *Unnamed dacite flows*--Light-colored, porphyritic, fine-grained hornblende dacite; coarse plagioclase and hornblende phenocrysts; in dike-like bodies on ridge tops near Twin Peaks; exposed in Goat Rocks area (Clayton, 1980).

Pvt *Unnamed tuff*--Tuff and tuff breccia; dacitic ash-flow tuff; confined to area of the upper South Fork Tieton River; may be coeval with unit Tpr (Korosec, 1987).

**Middle Tertiary Sedimentary and Volcanic Rocks**

Ellensburg Formation

Teu *Upper Ellensburg Formation*--White to red-brown clay, silt, sand, and gravel; tuffaceous and pumice-bearing mudflows, lahars, and related fluvial rocks; clasts are of andesitic and dacitic composition; thicknesses to 1,000 feet; exposed in the Nile and Rattlesnake Creek drainages; volcanic source of the Ellensburg Formation is thought to be in the Bumping Lake area (Smith and others, 1988); numerous K-Ar age estimates between 5 and 11 Ma (Smith and others, 1989).

Tes *Interbeds, Ellensburg Formation*--White to yellow clay, silt, sand, and gravel; tuffaceous and arkosic; occur as sedimentary layers between lava flows of the Columbia River Basalt Group, especially between units of the Grand Ronde Basalt; the source is both the ancestral Columbia River and local Cascade streams; thickness of individual interbeds is generally less than 50 feet; contributes to massive sliding in basalt along the eastern part of the Naches Ranger District.

Columbia River Basalt Group

$Tgn_2$ *Grande Ronde Basalt ($N_2$)*--Upper basalt flows of normal magnetic polarity; mostly fine-grained, aphyric, dark-gray basalt; vents in the Pullman-Lewiston area; thicknesses exceed 1,000 feet on Divide Ridge; occurs along eastern edge of the Naches Ranger District; K-Ar age estimates between 15.6 and 16.5 Ma (Watkins and Baksi, 1974).

$Tgr_2$ *Grande Ronde Basalt ($R_2$)*--Upper basalt flows of reversed magnetic polarity; underlie $Tgn_2$ flows; mostly fine-grained; aphyric, dark-gray basalt; thickness is at least 500 feet, but base is rarely exposed; vents in the Pullman-Lewiston area; occurs along the eastern edge of the Naches Ranger District and near Longmire Meadows; K-Ar age estimates between 15.6 and 16.5 Ma (Watkins and Baksi, 1974).

$Tgn_1$ *Grande Ronde Basalt ($N_1$)*--Lower basalt flows of normal magnetic polarity; underlie $Tgr_2$ flows; mostly fine-grained, aphyric, dark-gray basalt; base rarely exposed, but thickness exceeds 200 feet along Rattlesnake Creek and on Divide Ridge; K-Ar age estimates between 15.6 and 16.5 Ma (Watkins and Baksi, 1974).

Fifes Peak Formation

Tfta *Tieton volcano, apron facies*--Andesitic tuff, tuff-breccia, pumice, and lava flows; tuffs and breccias were deposited as lahars, debris flows, and fluvial slurries; present as apron debris around the old Tieton volcanic cone; contributes to large landslides in the Tieton River drainage; vents are exposed on Bethel Ridge near Trout Lodge; K-Ar age estimates range from 22 to 26 Ma (Vance and others, 1987).

Tftc *Tieton volcano, cone facies*--Andesitic and basaltic lava flows, breccia, and tuff; remnants of the two phases of cone building of the Tieton volcano; includes radial dike swarm of andesite dikes on Bethel and Divide Ridges (not shown on map); vent and partial cone exposed at Trout Lodge and on Bethel Ridge; K-Ar age estimates range from 22 to 26 Ma (Vance and others, 1987).

Tftu *Tieton volcano, volcanic rocks, undifferentiated*--Andesitic flows, breccia, and tuff; remnants of an older Fifes Peak volcano near Tieton volcano; exposed along the middle Tieton River drainage; K-Ar age estimates range from 22 to 26 Ma (Vance and others, 1987).

Tftwc *Timberwolf volcano, cone facies*--Andesitic lava flows, breccias and tuffs; remnants of the cone of Timberwolf volcano; vents probably at Timberwolf Mountain; apron facies interbedded with unit Tfta (Schultz, 1988).

Tfea *Edgar Rock volcano, apron facies*--Andesitic and basaltic breccia, tuff, and minor lava flows; breccia and tuff deposited as lahars, debris flows, and fluvial slurries; forms apron facies around the Edgar Rock volcanic cone; causes large landslides in Milk Creek drainage; vent probably east of Edgar Rock near the Naches River; exposures in the Cliffdell, Rock Creek, and Nile Creek areas (Campbell, 1975). K-Ar age estimate of 23.3 ± 2.4 Ma (Carkin, 1988).

Tfec *Edgar Rock volcano, cone facies*--Andesitic and basaltic lava flows and breccia; dark-gray to black phyric andesite with plagioclase phenocrysts; includes radial swarm of andesite dikes within cone facies (not shown on map); remnants of old Edgar Rock volcano are exposed at Edgar Rock and Cliffdell and in the Gold Creek-Rock Creek areas; vent probably lay east of Edgar Rock on Naches River (Campbell, 1975). K-Ar age estimates range between 23.8 and 26.7 Ma (Carkin, 1988).

Tffa *Fifes Peaks volcano, apron facies*--Andesitic and basaltic, breccia, tuffs, and some lava flows; breccia and tuffs deposited mostly as lahars, debris flows, and fluvial slurries; forms apron of Fifes Peaks volcanic cone; causes large landslides in American Fork and Raven Roost areas; vent probably Fifes Peaks; exposures along American Fork and Crow Creek-Raven Roost area; K-Ar age estimates range from 22 to 26 Ma (Vance and others, 1987).

Tffc *Fifes Peaks volcano, cone facies*--Andesitic and basaltic lava flows and breccia; dark-gray to black phyric andesite; part of an old caldera surrounding Fifes Peaks (P. E. Hammond, Portland State Univ., written commun., Sept. 1991). K-Ar age estimates range from 22 to 26 Ma (Vance and others, 1987).

Tffu *Fifes Peaks volcano, undifferentiated*--Andesitic tuff, breccia, and flows; related to the Fifes Peaks volcano (or possibly other nearby cones); exposed near Fifes Peaks; K-Ar age estimates range from 22 to 26 Ma (Vance and others, 1987).

Tfu *Fifes Peaks Formation, undifferentiated*--Andesitic and basaltic lava flows, breccia, tuff, lahars, and debris flows not associated with a known volcanic cone; present along the middle Tieton and Naches River drainages (Swanson, 1978).

Tvu *Unnamed volcanic rocks at Edgar Rock*--Reddish-brown and green andesitic breccia, tuffs, and related dikes; strongly altered and sheared; exposed in the core, but older than the Edgar Rock volcano (unit Tfec); may be altered units To or Tnn (Warren, 1941).

**Lower and Middle Tertiary Volcanic and Sedimentary Rocks**

Tbr *Tuff at Bumping River*--Yellow and gray-brown ash-flow tuffs; pumice-bearing and vitric tuff as much as 1,000 feet thick; some interbedded phyric andesitic lava flows; tuffs deposited as lahars and debris flows; confined to the Bumping River drainage; zircon fission-track age estimates of 27.7 ± 5 and 26.6 ± 3.6 Ma (Vance and others, 1987).

Timx *Mount Aix volcanic complex*--Andesitic flows and intermixed volcaniclastic rocks, tuff, and breccia; intrusive and extrusive; present only in a fault-bounded, 5-mile-wide caldera in the upper Rattlesnake Creek drainage; zircon fission-track age estimates of 27.6 ± 1.4 and 26.3 ± 1.3 Ma (Schreiber, 1981; Vance and others, 1987).

Tot *Ohanapecosh Formation, Timberwolf Mountain facies*--Andesitic lava flows, breccia, ash flow tuff, and lapilli tuff; includes tuff deposits along Rattlesnake Creek; confined to the Timberwolf Mountain and upper Rattlesnake Creek areas (Schultz, 1988).

Thm *Ohanapecosh Formation, Huckleberry Mountain facies*--Andesitic and basaltic lava flows, breccia, tuff, and interbedded volcanic sandstone, siltstone, and conglomerate; green and maroon well-bedded volcaniclastic rock; confined to the area of the upper Little Naches River drainage north of the river; K-Ar and fission-track age estimates range from 24 to 35 Ma (Frizzell and others, 1984).

Tow *Ohanapecosh Formation, Wildcat Creek facies*--Andesitic and dacitic volcaniclastic rocks; green and violet pumice-bearing and lapilli-rich tuff and ash-flow tuff; includes volcaniclastic sandstones and conglomerates; fluvial and laharic deposits; includes tuffs along Milk Creek (Swanson, 1978).

To *Ohanapecosh Formation*--Andesitic and basaltic lava flows and interbedded tuff, breccia, and volcaniclastic rocks; phyric brown to green-gray andesite flows; greenish and maroon tuff, sandstone and conglomerate; total thickness probably exceeds 10,000 feet; exposed in the Naches Ranger District along the western margin near the Cascade crest; fission-track age estimates range from 28 to 36 Ma (Frizzell and Vance, 1983).

Tsc *Sandstone of Spencer Creek*--Volcanic sandstone, tuff, shale, and conglomerate; lithic sub-graywacke with highly altered interbedded tuff; less than 300 feet thick; confined to the Spencer Creek area south of Rimrock Lake (Swanson, 1978).

Tlc *Sandstone of Lookout Creek*--Fluvial sandstone; thin-bedded lithic and feldspathic sandstone underlying unit Tow; as much as 600 feet thick; confined to Lookout Creek and nearby areas in the upper Rattlesnake Creek drainage (Schreiber, 1981).

Tpg *Rocks of the Puget Group*--Sandstone, siltstone, claystone, and coal; dominantly massive fluvial micaceous, feldspathic and quartzose sandstone; most exposures are west of the Naches Ranger District; confined to the area southwest of Bumping Lake (Abbott, 1953).

Tas *Unnamed ash flow tuff*--Dacitic or rhyodacitic ash-flow tuff; lapilli and pumice-rich; highly altered and clayey; probably equivalent to unit Tow; confined to the area 5 miles south of the Rimrock community (Swanson, 1978).

Txb *Unnamed basalt, South Fork Tieton River*--Basalt flows and tuffaceous interbeds; overlie pre-Tertiary rocks and unit Txs but lie below unit To; best exposures along South Fork Tieton River (Campbell, 1988).

Txs *Unnamed rocks, South Fork Tieton River*--Volcaniclastic rocks and tuff; underlie unit Txb but overlie pre-Tertiary rocks; best exposures along South Fork Tieton River (Campbell, 1988).

Tnn *Naches Formation, andesite facies*--Andesitic and basaltic lava flows and minor tuff and breccia; dark-gray, phyric to aphyric; interbedded with volcaniclastic rocks in part (may be unit To); exposed along Milk Creek and north of the Little Naches River (Tabor and others, 1984).

Tnr *Naches Formation, rhyolite facies*--Rhyolite with minor tuff and sandstone; white to gray, flow-banded domes and flows; may be partly intrusive; crops out on the north side of the Little Naches River drainage; fission-track age estimates range from 40 to 44 Ma (Tabor and others, 1984).

Tnb *Naches Formation, basalt facies*--Basaltic lava flows with minor sandstone and siltstone interbeds; dark-gray, mostly aphyric basalt, amygdaloidal in places; present along the north side of the Little Naches River drainage and along Milk Creek (Tabor and others, 1984).

Tns *Naches Formation, sedimentary facies*--Sandstone, siltstone, shale, and coal; minor andesite flows; fluvial, feldspathic, zeolitic, white to tan sandstone with interbedded gray-brown fine-grained sandstone and shale; found interlayered with units Tnb and Tnn; thickness unknown but probably several hundred feet; confined to an area north of the Little Naches River and Milk Creek (Tabor and others, 1984).

**Pre-Tertiary Rocks**

KJr *Russell Ranch Formation, clastic unit*--Interbedded sandstone and mudstone with conglomerate and chert lenses; lithic, partly feldspathic sedimentary rocks containing chert and greenstone blocks; probably highly deformed turbidites; part of basement complex in the South Cascades; found along the South Fork Tieton drainage, in the Rimrock Lake area, and in the upper Rattlesnake Creek drainage; included fossils suggest a Cretaceous to Jurassic age (Miller, 1985, 1989).

KJrg *Russell Ranch Formation, greenstone unit*--Greenstone pods and blocks within unit KJr; pillowed and massive flows with interbedded sandstone and mudstone; exposed in the Rimrock Lake and upper Rattlesnake drainage areas (Miller, 1985).

KJrc *Russell Ranch Formation, chert-tuff unit*--Chert, sandstone, mudstone, and tuff; altered green tuff with chert interbeds; exposed in the Rimrock Lake area; fossils suggest a Cretaceous to Jurassic age (Miller, 1985, 1989).

PTv *Russell Ranch Formation, silicic metavolcanic unit*--Altered rhyolitic volcanic rocks and silicic metavolcanic rocks; found in the Upper Tieton River drainage (Miller, 1985, 1989).

PTgr *Russell Ranch Formation, eastern greenstone unit*--Pillowed greenstone blocks and pods; fault bounded but may be coeval with unit KJrg; both pillowed and massive flows; found along the eastern edge of Rimrock Lake and in the upper Rattlesnake Creek drainage (Miller, 1985, 1989).

PTlm *Lookout Mountain Formation*--Schist, gneiss, amphibolite, and gabbro; minor biotite mica schist containing mafic intrusive bodies; confined to Quartz Mountain area (Stout, 1964).

**Quaternary to pre-Tertiary Intrusive Rocks**

Qai *Andesite intrusions*--Plugs and dikes of hornblende and pyroxene andesite; feeders for unit Qah and part of unit QTa; occurs in the Goat Rocks area (Swanson and Clayton, 1983).

QTai *Andesite and basaltic andesite intrusions*--Plugs and dikes of pyroxene and hornblende andesite and basaltic andesite; possible feeders for unit QTa; present in the Goat Rocks area (Swanson and Clayton, 1983).

Tia *Andesite intrusions*--Andesite and minor diorite and monzonite; dikes, sills, plugs, and shallow plutons; widely distributed in the western half of the Naches Ranger District.

Tai *Mafic to intermediate intrusions*--Mostly phyric pyroxene andesite; some diorite and quartz monzonite; dikes, sills, plugs, and shallow plutons; may feed flows in unit To; occurs in the Goat Rocks area (Swanson and Clayton, 1983).

Tdi *Diorite intrusions*--Sills and dikes; present in the Goat Rocks area (Clayton, 1980).

Tfi *Tieton volcano intrusions*--Dikes, plugs, and intrusions that are part of the Tieton cone; andesite and diorite; confined to the Tieton River area around Trout Lodge (Swanson, 1978).

Tid *Diorite intrusions*--Fine-grained diorite; domes, plugs and small plutons; present in the upper Rattlesnake Creek drainage (Simmons and Van Noy, 1984).

Tiblg *Stocks associated with Bumping Lake pluton*--Biotite-hornblende granodiorite; medium- to coarse-grained; stocks may intrude unit Tibl; present northwest of the Bumping Lake area (Simmons and Van Noy, 1984).

Tir *Rhyodacite intrusions*--Yellow to gray phyric rhyodacite and rhyolite; stocks, plugs, dikes, and sills; intrudes unit Tibl in the Bumping Lake area (Abbott, 1953).

Tibl *Bumping Lake pluton*--Quartz monzonite and granodiorite; green-gray and fine-grained; contains angular xenoliths; exposed in the Bumping Lake area; K-Ar eage estimate of 24.7 ± 0.6 Ma (Clayton, 1983).

Tit *Intrusions related to Tatoosh pluton*--Dikes, sills, and small intrusive bodies of diorite, granodiorite, and monzonite; fine- to medium-grained and phyric; present in the Chinook Pass area at the western margin of the mapped area; U-Pb age estimate of 25.8 Ma (Mattinson, 1972).

Ti *Intrusive rocks, undifferentiated*--Andesite, rhyolite, rhyodacite, dacite, and diorite; small plugs and intrusive bodies; widely distributed in the Naches Ranger District.

Tdg *Diabase and gabbro intrusions*--Black diabase and gabbro dikes and plugs; fine- to medium-grained; weather brown and red brown; present north of the Little Naches River drainage (Frizzell and others, 1984).

Jid *Indian Creek complex, weakly foliated plutonic rocks*--Weakly foliated diorite, gabbro, and quartz diorite intrusions; possible ophiolite complex; best exposures are in the South Fork Tieton area; fission-track age estimates of 132 ± 4 and 152.5 Ma (Clayton, 1983).

Jif *Indian Creek complex, well-foliated metaplutonic rocks*--Gneisses and amphibolites; several stages of gneissic intrusion; oldest rocks of the South Cascades; found at Clear Lake and in the upper Rattlesnake and Ahtanum Creek drainages; U-Pb age estimate of 155 Ma (Mattinson, 1972).

PTlq *Quartz Mountain stock*--Metatonalite and metagranodiorite; medium-grained, with hornblende and garnet; intrudes unit PTlm; Quartz Mountain area (Frizzell and others, 1984).

## Map Symbols

**Contact** between rock units--dotted where approximately located.

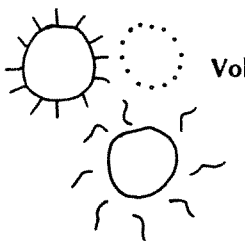
**High-angle fault**--Ball on down-thrown side; dashed where approximately located; dotted where concealed.

**Strike-slip fault**--Arrows indicate direction of movement.

**Anticline**--Showing trace of axis and direction of plunge; dashed where approximately located; dotted where concealed.

**Syncline**--Showing trace of trough and direction of plunge; dashed where approximately located; dotted where concealed

**Monocline**--Arrow on steep limb; dashed where approximately located; dotted where concealed.



**Volcanic centers**--Location of cones of Fifes Peak Formation volcanoes.

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