UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geologic map of the northwestern three-forths of the Aeneas quadrangle, Okanogan and Ferry Counties, Washington

by

C. Dean Rinehart and Robert C. Greene [1]

Open-File Report 88-281

Prepared in cooperation with the
Washington State Department of Natural Resources,
Division of Geology and Earth Resources

[1] Menlo Park, California

1988

DESCRIPTION OF MAP UNITS

Valley Fill

Qya **Younger alluvium (Holocene)**-The unit includes stream deposits of gravel, sand, and silt; confined mainly to modern flood plains.

Qoa **Older alluvium (Holocene)**--This unit is similar to younger alluvium but has terraces 10-30m above modern flood plains developed on it.

Qdc **Glacial drift and colluvium (Holocene and Pleistocene)**--Generally, this unit is thicker in stream valleys, but blankets large areas of irregular topography. It consists of gravel, sand, and silt making up deposits of slope wash and slightly to moderately reworked drift. A somewhat dissected landslide (**Qls**), more than a mile long, north of the main road near Aeneas is also included in this unit.

Volcanic Rocks

Klondike Mountain Formation (Eocene)--The formation is composed chiefly of lava of intermediate composition (**Tkv**) exposed in three main areas: the largest mass occupies almost 25 mi^2 in the northern part of the map area; the smallest exposure occupies about half a square mile in the headwaters of Cobey Creek about midway between Highway 20 and Aeneas; the third area of exposure is bisected by the western part of West Fork Sanpoil River and is composed of several discrete smaller areas of exposure extending from Lost Creek northward to a little more than 2 mi northeast of Aeneas. Included with the formation are sedimentary rocks (**Tks**) that underlie the volcanic rocks at two localities: southeast of Wauconda Summit, and northwest of Aeneas.

Tkv The large northern mass is the southern end of an even larger area of volcanic rocks mapped by Pearson (1967) as Klondike Mountain Formation in the adjoining Bodie Mountain quadrangle. The rocks in both quadrangles consist of an unknown thickness of variegated lithoidal, but locally vitric, flow-banded, dacite to quartz latite flows and flow breccias that are exposed over a vertical distance of about 2,000 ft from an altitude of 3,500 ft near Sweat Creek on Highway 20, to 5,482 ft atop Clackamas Mountain. In that area the formation overlies: (1) Flows of the Sanpoil Volcanics and Paleozoic metamorphic rocks on the west; (2) granodiorite and granite on the south and east; and (3) a small metamorphic roof pendant at the north edge of the quadrangle.

The major rock types are flow-banded, phenocryst-poor lithoidal flows and flow breccia and their vitric equivalents. The latter are conspicuously exposed west of Sweat Creek in steep southwest-facing bluffs north of Highway 20, and on the steep western and southern flanks of Fir Mountain. Except locally, phenocryst content is less than 15 percent, plagioclase being most common, followed by hornblende, biotite, augite, and quartz, in order of decreasing abundance. The matrix is typically microlitic and is generally weakly to

moderately devitrified, the devitrification process apparently taking place from random close-spaced centers, giving the rock a mottled appearance microscopically. The microlites commonly show alinement that defines, or is parallel to, flow banding.

To the south, the volcanic rocks overlie granitic and metamorphic rocks and, except for the two easternmost bodies, do not differ from those to the north in any significant way. As in the north, thickness of the volcanic rocks in the south part of the quadrangle can only be estimated from the local relief, and is probably no greater than about 700 ft. Phenocryst type and abundance, the apparent compositional range, and the occurrence of a distinctive vitrophyre breccia in the southern part of the body north of Aeneas, all support the correlation of these rocks with the Klondike Mountain Formation.

The two easternmost bodies, in the south part of the quadrangle, are composed of flows consistently lighter colored than the average of the other volcanic bodies, although the composition of these flows doubtlessly falls within the compositional range of the more voluminous flows to the north. Minerals that constitute the phenocrysts are similar to those in rocks of the other bodies but the abundance of phenocrysts (40-50 percent) is markedly higher. Hence, it can be expected that further work may well show these lighter-colored rocks to have somewhat different affinities than those, for convenience, shown here.

Tks Southeast of Wauconda Summit along the southwest margin of the large area of **Tkv**, a section of fairly coarse epiclastic and volcaniclastic rocks having a maximum exposed thickness of about 1,500 ft underlies the volcanic rocks. These sedimentary rocks abruptly terminate near Sweat Creek, but extend northwestward 3 mi to Wauconda Summit where they gradually wedge out. From the stratigraphically lowest point along State Highway 20, the section grades upward from monolithologic boulder conglomerate and breccia composed of the distinctive rocks of the Wauconda Summit pluton (**Kgq**), through conglomerate having an upward-increasing diversity in clast composition and concomitant decrease in clast size; the conglomerate grades into sandstone and siltstone in the uppermost part. Bedding is well developed only locally, and the volcaniclastic proportion is greatest in the middle and upper parts. This informal member is probably correlative, in part, with Pearson's (1967) **Tkb** member.

Sedimentary rocks also occur at the base of the large volcanic body north of Aeneas. Best exposures are along the road that climbs the gully carved by Frosty Creek, part of which is in the adjoining Aeneas Valley quadrangle. The rocks there consist of light-brown thin-bedded sandstone, and olive to dark-gray, thin-bedded to laminated siltstone and shale. The sandstone consists mainly of plagioclase grains and volcanic rock fragments in a matrix of clay and sparry calcite. Interlayered siltstone is commonly dark gray because of abundant carbonaceous material, including small fragments of plant fossils. Bold outcrops a little more than a mile east of Aeneas expose conglomerate consisting of angular material a few millimeters to 10cm in maximum dimension which are mainly an exotic granitoid rock that contains as much as 20 percent hornblende. The pebbles and cobbles also include some locally

derived metamorphic and volcanic rocks but surprisingly, biotite-bearing granite and granodiorite are absent

Tsv **Sanpoil Volcanics (Eocene)**--A narrow, north-trending wedge of chiefly dacitic flows and minor pyroclastics widens northward from a vertex a mile and a half south of Wauconda Summit, to a mile wide at the northern border of the map area, and occupies an area of a little less than 2 square miles. The unit overlies metamorphic rocks unconformably but the contact is exposed only discontinuously. It is overlain unconformably by flows and flow breccias of the Klondike Mountain Formation except along its southern part where it is overlain by a wedge several hundred feet thick of coarse sedimentary rocks of the same formation.

The rocks are typically massive, locally flow banded medium to dark shades of gray and brown, and are conspicuously porphyritic with phenocrysts composing 20-60 percent of the rock. The average composition is probably dacite. The most common phenocrysts are intermediate to calcic plagioclase, biotite, hornblende, and lesser augite and quartz. The groundmass is moderately to weakly devitrified and locally microlitic, showing crude alinement of the feldspar laths. Alteration to clay and carbonate minerals is locally intense. Near the south end of the wedge, the base of the Sanpoil, is a coarse, well-indurated agglomerate or breccia.

Tsi Several dikes that are probably hypabyssal intrusive equivalents of the Sanpoil flows are mapped west of the outcrop of the Sanpoil. The dikes are all similar petrographically and are medium gray, and porphyritic. Phenocrysts are light-gray and white, equant plagioclase, and black biotite and hornblende, 1-5mm in maximum dimension; they compose about 30 percent of the rock. Quartz is generally present but not obvious. The dikes are strikingly similar to the Scatter Creek Rhyodacite described by Muessig (1967, p. 54-58) in the adjacent Republic quadrangle.

Granitoid Rocks

Tal **Mafic alkalic intrusive rocks (shonkinite?) (Eocene?)**--This rock is exposed only in the extreme northwest part of the map area, and is continuous to the north with an alkalic intrusive body mapped by Pearson (1967).

Kgc **Granite and granodiorite of Corner Butte (Cretaceous?)**--This unit underlies about 70 mi^2 in the central part of the map area; it also underlies many tens of square miles to the west, and at least several square miles to the east. Its constituent rocks are generally leucocratic, medium grained, sparsely porphyritic, and inequigranular (seriate rather that bimodal). Local variations include both fine and coarse grained rocks, and massive as well as strongly lineated and foliated rocks. Rocks in the northern half of the unit are more massive than those to the south, but close examination at almost all outcrops reveals subtle directional fabric which is commonly too poorly developed to measure. Composition and texture of the rocks in the northern half are more homogeneous than in the southern half although finer-grained rocks are somewhat more common in the northeastern extremity, especially east of

Gardner Creek and north of Golden Harvest Creek. The most extreme variation in both texture and composition occurs in a 2-square mile area, elongate northwest, east of the confluence of Lost Creek and West Fork Sanpoil River, where varied hybrid granitoid rocks abound concomitantly with an abundance of dikes and irregular intrusions of pegmatite, aplite, and alaskite. Numerous small and large, mapped and unmapped bodies of metamorphic rocks are also unusually abundant in that same area, indicated on the map there, and elsewhere, by a **diagonal line pattern**. Lineation--typically mineral streaking--is better developed than foliation throughout the unit.

Kgcc Several square miles centered roughly on Coco Mountain, is underlain by a coarse-grained variation of the granodiorite of Corner Butte. The rock is granite with exceptionally well-developed lineation, and is depicted separately on the map. A similar and perhaps correlative granite also occurs 6 miles northwest of Coco Mountain. This rock, however, may represent an older intrusion, because in the northeast corner of sec. 13, T. 35 N., R. 31 E., similar rock is enclosed in a host of more typical looking granodiorite of Corner Butte. Also, at one locality east of Coco Mountain, rocks typical of **Kgcc** are cut and intruded by a finer-grained but compositionally similar version of **Kgc**. Those relationships, together with the occurrence of somewhat finer-grained granite in the northeastern extremity of the unit, raise the possibility that **Kgc** and **Kgcc** are two separate plutons.

Microscopic examination shows that cataclastic textures, which record varied degrees of deformation, are ubiquitous. Even the most massive-appearing rock, megascopically, shows clear microscopic evidence of cataclastic deformation including: (1) xenomorphic-granular texture; (2) milled phenocrysts in porphyritic rocks; (3) much intergranular mortar; (4) recrystallized (probably redistributed) quartz showing marked fluxion structure and undulose character; (5) shredded, commonly alined biotite; (6) bent and broken twin lamellae in plagioclase; and (7) apatite locally entrained. Notwithstanding their cataclastic heritage, all the foregoing textures have been distinctly modified by recrystallization that has produced intricate intergrain boundaries in which the finest-grained part of the original mortar has been obliterated; recrystallization, however, has not proceeded far enough to diminish more than slightly the pronounced cataclastic character of the overall texture.

The average composition of the granite and granodiorite of Corner Butte, based on 61 modal analyses, is: 27 percent quartz, 45 percent andesine, 23 percent K-feldspar, and a color index of 4, the latter consisting of mainly biotite, some chlorite, and opaque minerals (Table 1, and figures). The 61 modes cluster at the boundary between the granite and granodiorite fields of Streckeisen (1976). Accessory minerals include apatite, zircon, and allanite, all of which are ubiquitous, and locally, muscovite.

Kgq **Granodiorite and quartz monzodiorite near Wauconda Summit (Cretaceous?)**--This pluton of medium- to coarse-grained, porphyritic hornblende-granodiorite and quartz monzodiorite probably underlies about 15 square miles, occurring in two masses separated by a prong of Klondike Mountain Formation. The unit extends southeastward for about 12 miles from

the northwest corner of the quadrangle, forming a crude arc open to the north. Much of the eastern mass is covered by Qdc, but small exposures suggest continuity in the subsurface. The pluton also extends an unknown distance northward under the Tertiary volcanic rocks.

Rocks of the pluton are distinguished from those of the two adjacent plutons by coarser grain size, a higher color index, and the presence of hornblende. Though not everywhere porphyritic, the pluton locally is more coarsely porphyritic than its adjoining neighbors; subhedral K-feldspar megacrysts measuring 3 cm are fairly common, and in a few places they measure as much as 7 cm. Foliation occurs sporadically throughout the pluton, as can be inferred from the distribution of symbols on the map, and shows a tendency toward parallelism with the contact with the granite of Corner Butte. In the easternmost exposure, west of Mud Lake, foliation where present is swirled and is too irregular on a small scale to be mapped. The rocks ,there, show not only textural, but compositional variation, and commonly grade into hybrid rock types. Lineation is sparsely developed.

Examined microscopically, the rocks display cataclastic textures similar to those in the adjacent granites. These textures are ubiquitous, even in rocks that appear massive megascopically, and include: (1) xenomorphic-granular texture, (2) rounded K-feldspar phenocrysts with milled-off corners; (3) intergranular mortar (recrystallized); (4) locally entrained apatite; (5) bent, broken, and rehealed plagioclase showing distorted or offset twin lamellae; (6) undulose, flamboyantly recrystallized quartz, commonly showing implication texture. Recrystallization appears to have accompanied the cataclasis, and is best shown by mutual grain interpenetration along grain boundaries, and obliteration of the finest grain mortar texture. In thin section the ubiquitous occurrence of both sphene and the amphibole hastingsite, readily distinguishes rocks of this unit from the adjacent granites. The constituent minerals are otherwise similar: plagioclase--probably averaging near An-30--showing distinct polysynthetic twinning, weak or no zoning, and myrmekitic intergrowth with quartz; pale brown biotite commonly showing alteration to chlorite; K-feldspar phenocrysts with fine, zonally arranged inclusions of most other mineral constituents; accessory occurrence of apatite, epidote, allanite, zircon, monazite(?), and opaque minerals.

Unequivocal age relations with the granite and granodiorite of Corner Butte were not found, but felsic dikes similar to dikes associated with the Corner Butte unit cut the Wauconda Summit body in many places suggesting the latter is the older rock.

Ksk **Storm King Mountain pluton (Cretaceous?)**--Leucocratic medium-grained porphyritic granodiorite composes the Storm King Mountain pluton which underlies approximately 15 square miles in the northeastern part of the map area. Two main features of this unit serve to distinguish it from the biotite granite and granodiorite of Corner Butte: (1) It is typically porphyritic with anhedral--locally subhedral, rarely euhedral--K-feldspar phenocrysts 0.5-3.0cm across; (2) it is almost entirely massive (mappable directional structures were not found, but virtually all rock examined has sustained at least mild cataclasis, most obviously manifested by rounding of K-feldspar megacrysts).

A unique but more subtle feature of the Storm King is the common occurrence of quartz in sub-equant aggregates as large as, or only slightly smaller than, the K-feldspar megacrysts. Microscopically the rocks show xenomorphic-granular texture, presumably the result of mild cataclasis, at least in part. Evidence of deformation, however, is much subtler than in rocks of the other granitic units. Tan to brown biotite, locally showing alteration to chlorite, and opaque minerals constitute the mafic constituents. Minerals present in trace amounts are muscovite, apatite, locally allanite, and zircon.

Modes of rocks from the pluton fall completely within the field of modes for the Corner Butte unit, although the latter is nearly bisected by the granite-granodiorite field boundary, whereas modes of the Storm King unit lie almost exclusively in the granodiorite field. Color index is also similar.

Age relations with a darker hornblende-bearing granodiorite to the east, and the porphyritic hornblende granodiorite on the southeast and southwest, are wholly equivocal where seen, although contact exposures are extremely sparse. Where observed, contacts are either sharp and accompanied by no apparent textural or compositional change in either unit, or the contact zone is marked by abundance of hybrid granitoid rock, pegmatite and alaskite dikes, and irregular intrusive masses.

Kg **Granitoid rocks along North Fork Granite Creek (Cretaceous?)**--The granitoid rocks adjacent on the east to the Storm King Mountain pluton were mapped only a short distance east of the contact. These rocks are highly varied in both composition and texture, and contrast markedly with the Storm King rocks. They contain hornblende; are not porphyritic; have a wide compositional range that includes quartz monzodiorite, granodiorite, quartz monzonite, and granite; have an average color index of 18, but range as high as 28; show grain size variation from slightly greater than 1mm to nearly 5mm. Age relations with the Storm King are equivocal but felsic dikes resembling the Storm King cut the hornblendic rocks in several places near the contact. Age relations with the adjacent porphyritic rocks, correlated with the Wauconda Summit pluton, are unknown.

Metamorphic Rocks

Metamorphic rocks occur throughout the quadrangle as septa between, and pendants within, the plutonic rocks. In the southern half of the map area, metamorphic rocks show diversity of composition, occurring in discontinuous exposures over about 8 mi2 and doubtless occupy a few additional square miles in the subsurface. In the north half of the quadrangle, they occur in a zone surrounding the large area of **Tkv**. Except for rocks in the western part of the valley of West Fork Sanpoil River (**Pzms, Pza, Pzq, Pzpg**) and a band in the northwest corner of the quadrangle (**Pzg**), which are mainly greenschist grade, the rocks are of amphibolite grade containing sparse but widespread garnet, staurolite, and sillimanite, and are abundantly intruded by aplite and pegmatite. Although bedding is commonly well preserved, bedding-top directions were not seen, and evidence of tight and complex folding is everywhere. Because of this, neither stratigraphy nor structure has been

worked out in sufficient detail to accurately establish a stratigraphic column. Therefore, because the preponderance of attitudes strike northwest and dip northeast, the section is here treated as homoclinal; unit **Pzsg** near the southwestern corner of the map area is, for descriptive purposes, considered the oldest.

Pza/Pzg **Metamorphic rocks (Paleozoic?)**--Near Old Wauconda, a belt of mostly metasedimentary and some metavolcanic rocks occupy about 4 mi^2 between granitic rocks on the west and volcanic rocks on the east. These rocks are divided into two units chiefly on the basis of metamorphic grade--greenschist facies on the east (**Pzg**) and amphibolite facies on the west (**Pza**); the two facies are separated along a north-trending line--probably a fault--that extends through the southern two-thirds of the belt.

Rocks east of the line are fine-grained, mostly greenish-gray, somewhat calcareous epiclastic and volcaniclastic rocks that are locally thin bedded, and in places are accompanied by laminated and thin-bedded limestone, greenstone and a little quartzite. At one locality about a mile and a half due south of Wauconda Summit near the center of section 18, an exposure of sharpstone conglomerate was found that, together with the other associated lithologies, makes this terrane strikingly similar to rocks of the Anarchist Group a few tens of miles to the west.

Rocks in the western part of the belt are generally similar in composition to those in the eastern part except for a greater proportion of pelitic rocks. They are mainly dark gray, with porphyroblasts of staurolite and/or garnet in otherwise fine-grained pelites, along almost the entire length of the belt. Those rocks are commonly interlayered with fine- and medium-grained amphibolite, and a little quartzite. Locally, both **Pza** and **Pzg** contain mapped and unmapped layers of fine- to medium- grained marble (**m**).

m Rocks similar to the above, except for an absence of marble, also form a discontinuous septum that separates the granite and granodiorite of Corner Butte from the granodiorite and quartz monzodiorite near Wauconda Summit. The continuity of the septum, perhaps exaggerated, is based mostly on scattered occurrences of metamorphic float in the higher parts of interfluves between rubbly outcrops on the ridges.

Foliation is pervasive but is better developed in the higher-grade rocks, and is generally parallel to bedding where both can be recognized. Lineation occurs locally, also in the higher-grade terrane, and is mainly defined by minor folds, kink bands, and fine corrugations that strike generally closer to east-west than to north-south.

Pzs The upper (presumed youngest) and most widespread metamorphic unit extends from near the latitude of Corner Butte south to the map boundary and consists of two assemblages: (1) quartz-mica schist, gneiss, and granulite, and (2) calc-silicate granulite, marble, amphibolite, and minor quartzite. The quartz-mica schist, gneiss, and granulite assemblage have a wide range in mica content (5-80 percent; both muscovite and biotite), typically contain abundant plagioclase (>20 percent), and little or no K-feldspar. Accessories include apatite, sphene,

zircon, tourmaline, and opaque minerals. Minor sillimanite, chlorite, and calcite occur locally, reflecting local variation in grade.

Calc-silicate granulites of the other assemblage are commonly greenish-gray, massive to laminated rocks scattered throughout the unit but predominating in a narrow belt extending southeastward from the hills west of Frosty Creek to the southeastern corner of the map area. Lenses of marble are also present in this belt. The calc-silicate granulites are primarily calcic plagioclase-quartz-diopside (and/or tremolite) rocks; locally, they contain substantial amounts of K-feldspar, biotite, epidote, and scapolite, the latter mineral occurring in rocks transitional to marble. Accessory minerals are chlorite, sphene, calcite, pyrite, apatite, and magnetite.

Amphibolite, like calc-silicate granulite, is scattered sparingly throughout the unit, but is somewhat more abundant in an ill-defined zone west of the northwest-trending belt of calc-silicate granulite. This zone may correlate at least in part with a thick greenstone unit to the south in the Bald Knob quadrangle (Staatz, 1964). Staatz suggests the protolith was an andesite flow and states that pillow structure is preserved locally. His greenstone unit is contiguous with part of the **Pzs** unit at the southern boundary of the Aeneas quadrangle. There, however, amphibolite is interlayed with quartz-mica schist, calc-silicate granulite and hornfels, and locally, marble.

The amphibolite bodies are generally greenish-black, locally black-and-white speckled, and massive to laminated. They are composed chiefly of plagioclase (andesine or labradorite) and hornblende, but commonly include varied amounts of quartz, epidote, and biotite. Accessory amounts of K-feldspar, chlorite, sphene, apatite, magnetite, pyrite, and zircon are locally present. The amphibolite is locally interlayed with calc-silicate rocks, suggesting that some amphibolite may have a sedimentary origin.

Pzqp This unit consists of irregularly interbedded phyllite and quartzite, the quartzite seemingly the most abundant, although the markedly less resistant phyllite may be nearly as abundant but crops out poorly. Most outcrops are quartzite with thin phyllite partings, but some less common phyllite-rich sequences several feet thick were also seen. Chlorite and muscovite compose the essential constituents of the phyllite, and the absence of biotite and the sparse and local presence of calcite indicate greenschist metamorphic grade. Unlike the **Pzs** unit to the east this unit is not intruded by pegmatite.

Pzq Consisting entirely of quartzite, mostly brecciated, rock of this distinctive unit is medium to light gray--locally with a slight bluish cast--and is massive. It is almost entirely a breccia whose constituent fragments measure no more than a few centimeters across, and which have been recemented by white vein quartz rendering the rock coherent and hard. Microscopically it is seen to consist of 98-100 percent quartz accompanied by minor opaque minerals, hence its metamorphic grade is indeterminate. The easternmost and southernmost parts of this unit are less distinctive, more mylonitic, and are associated with, and commonly grade into pegmatite.

Pzam Greenish-black and dark-and-light speckled, nearly massive amphibolite composes this unit, of unique composition in the western part of the valley of West Fork Sanpoil River. Somewhat similar-appearing amphibolite crops out in unit Pzs a mile and a half to the east, but in that rock, the plagioclase is labradorite, whereas in the present unit the plagioclase is albite; hence the rock represents greenschist grade. It consists chiefly of albite, hornblende, biotite, epidote, chlorite, and calcite; accessories are magnetite and sphene.

Pzms Generally gray, fine-grained schist and granulite of varied composition, probably representing metasiltstone, are locally mylonitized and typically consists of quartz and plagioclase with some combination of biotite, chlorite, muscovite, and locally epidote and hornblende. The rocks appear to be mainly representative of biotite metamorphic grade except where reduced to chlorite grade in the more mylonite zones.

Pzsg Dark hornblende-bearing schist, schist, and granulite occur in the southwestern part of the quadrangle. The rocks are generally well foliated with a poorly developed lineation, and are intruded with as much as 50 percent pegmatite. South of Lost Creek, the unit grades over nearly half a mile into granitic rocks through a mixed and hybrid zone where the metamorphic rocks are broken up and partly assimilated. North of the intervening drift-covered area, lighter-colored, non-hornblende-bearing schist and granulite are dominant. The principal rock types are quartz-plagioclase-biotite schist and granulite; garnet- and sillimanite-bearing layers occur locally, and nearly black, discontinuous amphibolite layers are sparsely scattered through this part of the unit. These rocks belong at least locally to the amphibolite metamorphic facies, based on the occurrence of sillimanite in the pelitic rocks and on the occurence of andesine in the amphibolite. The metamorphic grade appears to decrease progressively northward and the contact with unit **Pzms** probably reflects an isograd.

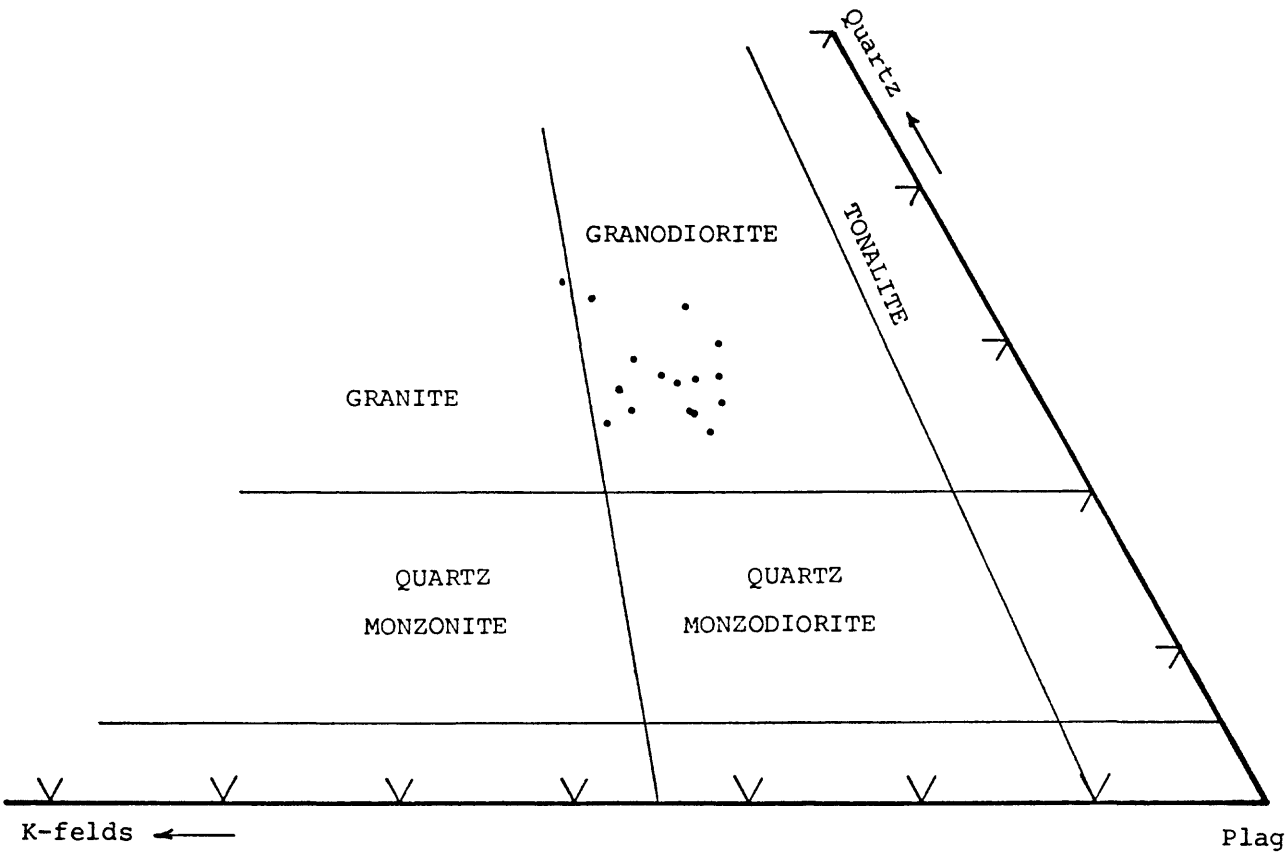
References

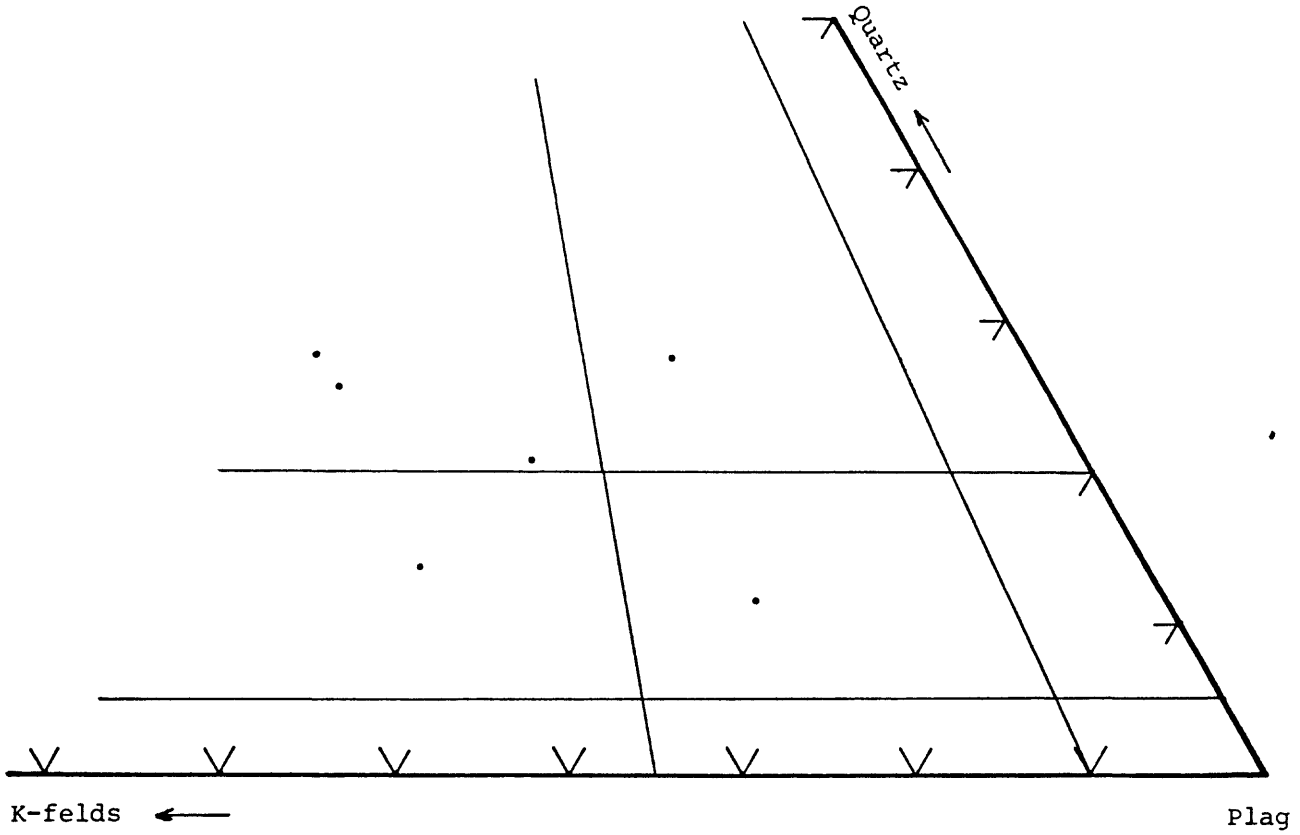
Muessig, Siegfried, 1967, Geology of the Republic quadrangle and a part of the Aeneas quadrangle, Ferry County, Washington: U.S. Geological Survey Bulletin 1216, 135 p.

Pearson, R.C., 1967, Geologic map of the Bodie Mountain quadrangle, Ferry and Okanogan Counties, Washington: U.S. Geological Survey Geologic Quadrangle Map GQ-636, scale 1:62,500.

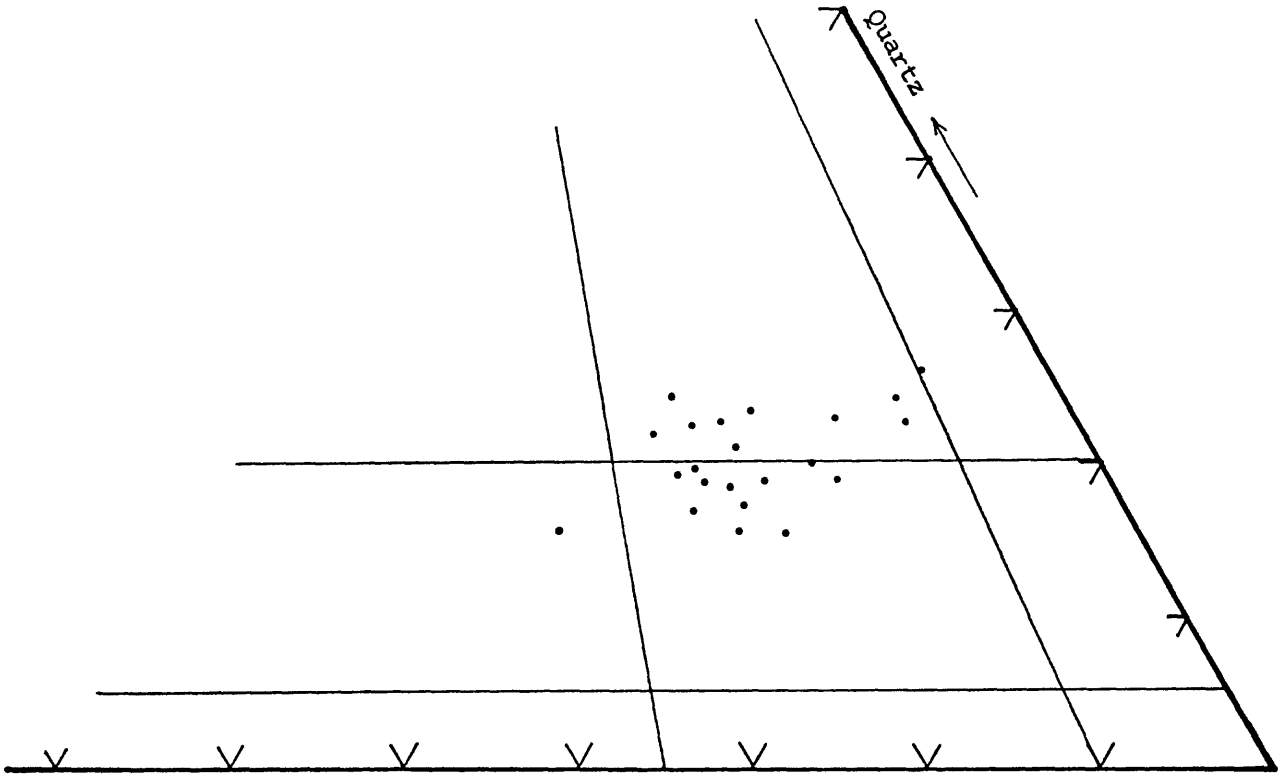
Staatz, M.H., 1964, Geology of the Bald Knob quadrangle, Ferry and Okanogan Counties, Washington: U.S. Geological Survey Bulletin 1161-F, 79 p.

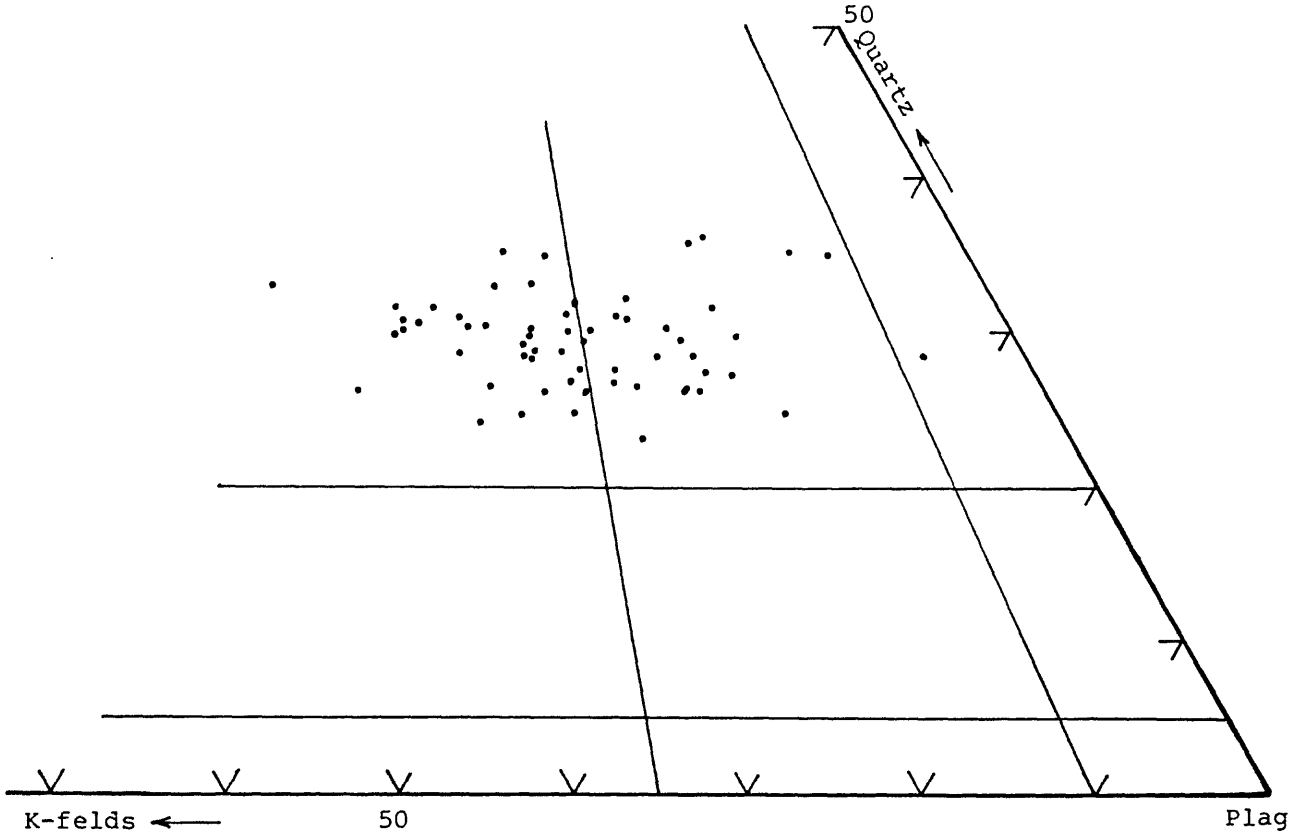
Streckeisen, A., 1976, To each plutonic rock its proper name: Earth Sceince Reviews, v. 12, p. 133.





Modal plots, on K-feldspar-plagioclase-quartz diagrams, of the Storm King Mountain pluton (above), and granitoid rocks along North Fork Granite Creek (below). Classification after Streckeisen (1976).





Modal plots, on K-feldspar-plagioclase-quartz diagrams, of the granodiorite and quartz monzodiorite near Wauconda Summit (above), and the granite and granodiorite of Corner Butte (below).

Table 1: Mode, in volume percent, of granitoid rocks. [Determined by superimposing dot grid over sawed and selectively stained slab, 4-12 in in area and recording mineral beneatl each of about 1,000 dots. Asterisk (*) indicates mode determined by point-counting selectively stained standard-siz thin sections; minimum of 1,000 points counted in each sectic Color index is percent of dark minerals, mainly biotite and hornblende.]

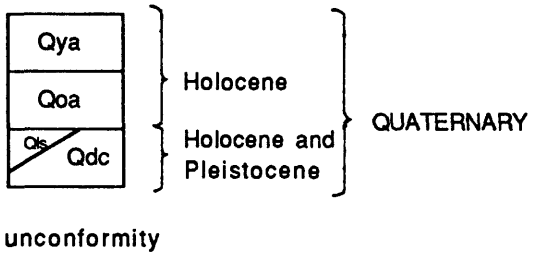
Granite and granodiorite of Corner Butte

Map no.	Plagioclase	K-feldspar	Quartz	color index
38A	55	20	22	3 (dike)
38B	48	15	29	8
39	48	22	25	5
40	55	15	23	7
41	43	23	29	5
42	37	31	27	5
43	36	29	28	7
44	45	20	29	6
45	42	27	28	3
46	38	27	21	14
47	45	23	25	7
48	41	27	26	6
49	41	27	29	3
50A	44	24	26	6
50B	45	26	26	3
51	43	24	27	6
52	40	26	32	2
53	46	23	25	6
54*	43	24	29	4
55	48	20	25	7
56	42	23	28	7
57*	38	25	33	4
58*	39	28	28	5
59*	38	26	31	5
70*	47	14	33	6
71	44	26	23	7
72	43	25	27	5
73	51	19	24	6
74	49	15	30	6
75*	39	23	32	6
76*	34	38	25	3
77*	51	7	30	12
78*	27	41	28	4
79*	45	20	28	7
81*	37	30	30	3
82*	63	5	26	6
83*	51	9	32	8

84*	45	20	30	5
85*	33	33	28	6
86	49	18	28	5
87*	33	33	29	5
88*	42	30	25	3
89*	43	25	27	5
90*	43	26	24	7
91*	51	19	25	5
92*	51	23	22	4
93*	50	18	28	4
94*	25	39	31	5
95*	51	14	27	8
96*	42	23	30	5
97	52	16	25	7
98	49	19	24	8
99	47	16	26	11
100*	42	31	23	4
101*	42	27	27	4
102*	47	25	25	3
103*	53	18	23	6
104	33	33	29	5
106	40	26	26	8
107	35	33	29	3
108	35	31	30	4
Granodiorite and quartz monzodiorite near Wauconda Summit				
1	47	30	14	9
2	57	15	17	11
3	59	7	23	11
4	63	10	21	6
5	49	21	23	7
6	57	13	21	9
7	57	15	17	11
8	55	18	22	5
9	57	15	18	10
10	55	19	14	12
11	54	21	22	3
12	51	22	14	13
13	53	20	13	14
14	60	13	17	10
15	57	14	17	12
16	51	21	17	11
17	56	18	17	9
18	54	19	19	8
19	50	23	20	7
20	53	22	19	6
21	53	23	18	6
Storm King Mountain pluton				
22	47	24	24	5
23	51	19	26	4

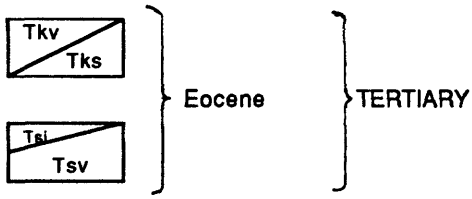
24	52	17	26	5
25	52	21	23	4
26	48	16	31	5
27	53	17	24	6
28	47	23	26	4
29	49	23	24	4
30	40	22	32	6
31	54	18	24	4
32	46	20	27	7
33	42	21	31	6
34	52	19	24	5
35	51	16	29	4
36	48	19	26	7
37	51	18	26	5
	Granitoid rocks along North Fork Granite Creek			
109	34	32	11	23
110	30	37	26	7
111	40	27	18	15
112	45	17	23	15
113	47	17	8	28
114	28	34	21	17

CORRELATION OF MAP UNITS



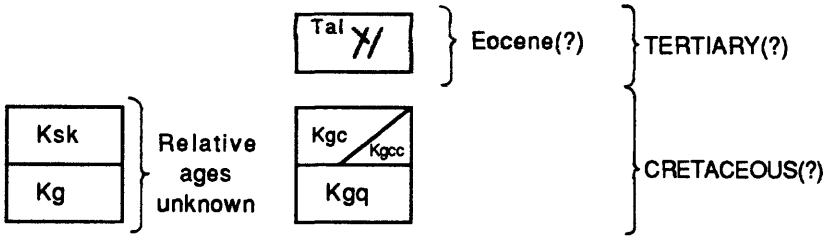
unconformity

VOLCANIC ROCKS

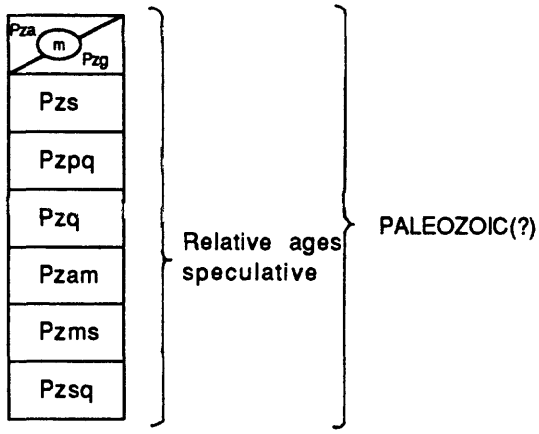


unconformity

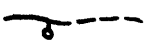
GRANITOID ROCKS



METAMORPHIC ROCKS



Contact, approximately located, dotted where concealed



Fault, dashed where approximately located; bar and ball indicate downthrown side of normal fault

Fold axis, minor, horizontal

Strike and dip of beds; may be combined with foliation and lineation where observed together

Inclined

Vertical

Strike and dip of foliation; mainly secondary structure in both igneous and metamorphic rocks; wavy tails indicate attitude is varied

Inclined

Vertical

Horizontal

Lineation, showing plunge, generally expressed by mineral streaking on foliation plane; combined with foliation where observed together

Inclined

Horizontal

Strike and dip of joints

Inclined

Horizontal

Strike and dip of flow layering in volcanic rocks

Inclined

Vertical

Subhorizontal

Locality of modally analyzed sample; numbers and analyses listed on Table 1

× 83 **Slab mode**

o 57 **Thin-section mode**; double underline where locality coincides with structure symbol