GEOLOGIC MAP GM-10

STATE OF WASHINGTON
DEPARTMENT OF NATURAL RESOURCES

BERT L. COLE, Commissioner of Public Lands
DON LEE FRASER, Supervisor

DIVISION OF GEOLOGY AND EARTH RESOURCES

VAUGHN E. LIVINGSTON, JR., State Geologist

Geologic Map GM-10

PRELIMINARY GEOLOGIC MAP OF THE NEWPORT NUMBER 4 QUADRANGLE, SPOKANE AND PEND OREILLE COUNTIES, WASHINGTON, AND BONNER COUNTY, IDAHO

By

FRED K. MILLER
U.S. GEOLOGICAL SURVEY

Prepared cooperatively by the U.S. Geological Survey

1974

STATE OF WASHINGTON
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND EARTH RESOURCES

TO ACCOMPANY PRELIMINARY
GEOLOGIC MAP GM—10

PRELIMINARY GEOLOGIC MAP OF THE NEWPORT NUMBER 4 QUADRANGLE, SPOKANE AND PEND OREILLE COUNTIES, WASHINGTON, AND BONNER COUNTY, IDAHO

By

Fred K. Miller

INTRODUCTION

The Newport Number 4 quadrangle lies about 25 miles northeast of Spokane, Wash., and includes parts of Spokane and Pend Oreille Counties, Wash., and part of Bonner County, Idaho. It covers much of the hills and low mountains south of the Pend Oreille River and north of Mount Spokane. The quadrangle is a composite of four 7.5-minute quadrangles prepared by the U.S. Geological Survey: Newport, northeast quarter; Diamond Lake, northwest quarter; Camden, southwest quarter; and Tweedie, southeast quarter. In the initial stages of preparing modern topographic maps of the Newport 30-minute quadrangle, the U.S. Geological Survey divided the area into four 15-minute quadrangles and sixteen 7.5-minute quadrangles. No 15-minute quadrangles of the area were published, so the temporary name for the 15-minute quadrangle, Newport Number 4, is used for the area of this report.

Geologic mapping of the quadrangle was begun by the author in 1969 under a cooperative arrangement between the Division of Mines and Geology*of the Washington State Department of Natural Resources, and the U.S. Geological Survey. Able field assistance was provided by J. S. Tinker in 1969, P. N. Castle in 1970, and P. R. Margolin in 1971.

Plutonic rocks of Mesozoic and Tertiary age and finely to coarsely crystalline gneiss and schist derived from rocks probably of Precambrian age are exposed in much of the area. These rocks are separated from relatively unmetamorphosed rocks of the Belt Supergroup by the Newport fault zone, which roughly parallels the Pend Oreille River on its south side.

Although about half of the quadrangle is covered by glacial and alluvial deposits, areas of bedrock exposure are relatively good in the remainder of the quadrangle. Only south of Scotia Road in the southwest quarter of the quadrangle are good exposures scarce owing to deep weathering and extensive forest cover.

STRATIGRAPHY

PRECAMBRIAN ROCKS

BELT SUPERGROUP

Prichard Formation

About 9,000 feet of argillite, siltite, and quartzite assigned to the Prichard Formation underlies about 20 square miles in the northeasternmost part of the quadrangle. The stratigraphically lowest part of the formation in the northeast corner of the quadrangle consists of several thousand feet of thick- to thin-bedded siltite, argillite, and lesser amounts of quartzite. These rocks are overlain by about 2,000 to 3,000 feet of thick-bedded, light-gray to tan quartzite and siltite interbedded with subordinate amounts of argillite. Rocks of this interval characteristically weather to a lighter color than the fresh rock. Overlying this quartzite- and siltite-rich interval is several thousand feet of medium- to dark-gray well-laminated argillite. The quartzitic uppermost part of the formation that is well developed in the quadrangle to the north is not exposed in the Newport Number 4 quadrangle.

Almost all of the argillite throughout the formation contains the small amounts of disseminated pyrite and (or) pyrrhotite that are so ubiquitous in the Prichard.In addition, the weathered surfaces of much of the formation are iron stained, as is characteristic of the Prichard at other localities.

At least nine sills of metadiorite with a total thickness of about 6,000 feet intrude the Prichard in this quadrangle. If these sills are included in the Prichard, the thickness of that part of the formation preserved in the quadrangle becomes 15,000 feet.

The Prichard is bounded by the Newport fault zone on the south but extends about 17 miles northward into the adjoining Newport Number 1 quadrangle. East of the quadrangle the Prichard is intruded by Mesozoic plutonic rocks, so that the base is not exposed. The upper contact is concealed beneath glacial material.

Revett Formation

Medium- to thick-bedded fine-grained quartzite is exposed on the three hills north of the Pend Oreille River near Furport. Although the quartzite is probably part of the Revett Formation, it is white, pink, and maroon, unlike the all-white quartzite that is characteristic of the Revett at other localities. About 3 miles due north, in the Newport Number 1 quadrangle, the rock is colored similar to that near Furport. In the Newport Number 1 quadrangle, however, gradational contacts into the St. Regis Formation above and the Burke Formation below are fairly well exposed and establish the assignment of these anomalously colored rocks to the Revett Formation. The rocks near Furport grade upward into the St. Regis Formation, but the lower part of the quartzite is faulted. Because of this faulting and the extensive glacial cover, the Burke Formation, which normally lies between the Revett and Prichard Formations, is not exposed in the quadrangle.

Vitreous quartzite and quartzitic siltite make up about 75 percent of the formation in the quadrangle, although

*Name changed to Division of Geology and Earth Resources (1973) argillite and siltite beds are conspicuous, especially in the upper part of the unit. The argillite most commonly occurs as bedding-plane partings between the thicker quartzite and siltite beds.

About 1,500 feet of the Revett Formation is exposed. Four miles north of the quadrangle, the Revett is about 2,300 to 2,600 feet thick. The 800- to 1,000-foot difference is probably due primarily to the faulting rather than to stratigraphic thinning.

St. Regis Formation

Thin-bedded siltite, argillite, and lesser amounts of quartzite crop out on the two small hills north of Furport. The rocks are lavender to hematite red in color except for irregularly shaped bleached areas which are pale green, light gray, or white. The bleached areas range in size from a few square inches to several hundred square feet, and in some places their shapes appear to be controlled by bedding.

Siltite beds range in thickness from less than an inch to about one foot. Argillite occurs mainly as bedding-plane partings in the siltite and in beds less than 6 inches thick. The quartzite beds are found mainly in the lower 100 to 150 feet. Ripple marks, mudcracks, and mud-chip breccia are less abundant than at other localities. The bleaching in the rocks tends to make these structures less obvious.

Only about 650 to 700 feet of the lower part of the formation is preserved in the quadrangle, owing to faulting and extensive glacial cover. Approximately 4 miles north of the quadrangle, the formation is about 1,000 feet thick.

Metadiorite sills

Dark-gray to black metadiorite sills intrude the Prichard Formation in both the Newport 4 and Newport 1 quadrangle but are most numerous in the northeast corner of the former. The sills range in thickness from a few tens of feet to about 2,000 feet but average about 200 feet. The 2,000-foot sill may be faulted internally and may not be that thick. Most of the sills are composed of more than 50 percent green hornblende, a few percent quartz and opaque minerals, and the rest plagioclase. Biotite is present in some of the sills that have been contact metamorphosed, and augite is found in the easternmost sill in the quadrangle. Most of the larger sills are differentiated and have coarse-grained (in some places pegmatitic) interiors deficient in mafic minerals. A roadcut through the sill in the south part of sec. 35, T. 32 N., R. 45 E. exposes a coarse-grained interior with a color index of about 40 to 50 and a margin of medium-grained amphibolite with a color index of about 70 to 80. Small dikelets of the pegmatitic core cut the outer mafic margin.

Most of the sills appear to have undergone considerable recrystallization. The texture in some thin sections is slightly granoblastic or poikiloblastic; in these thin sections, the plagioclase is oligoclase, which is abnormally sodic for a rock of this composition. In addition, most of the diorite carries some free quartz. The chemical composition of the sills is that of a basalt or diabase, which is a further indication that they have been recrystallized because the mineralogy is not consistent with the chemical composition of a diabase or basalt.

ROCKS OF QUESTIONABLE RELATION TO THE BELT SUPERGROUP

Hauser Lake Gneiss

The Hauser Lake Gneiss is exposed over about 8 or 10 square miles in the southeast corner of the quadrangle. The formation is variable in texture and composition, but the bulk of it is rusty-weathering finely banded quartz-plagioclase-muscovite-biotite-sillimanite gneiss. Locally, kyanite is present in the rock in addition to the sillimanite. Garnet is actually more common than kyanite but is irregularly distributed. The most characteristic features of the rock are its fine banding and well-developed foliation. Some schist layers, made up predominantly of muscovite and biotite, are as much as a foot thick, and some quartz-feldspathic layers are several feet thick. Amphibolite layers as much as 100 feet thick are common but not abundant.

Small pods and injections of leucocratic igneous-looking rock are found throughout the gneiss and have varied textures that range from medium grained to pegmatitic and from foliated to massive.

Small-scale structural features in the rock are abundant. The most obvious is a prominent and ubiquitous lineation formed by the micaceous minerals and sillimanite streaked out along the plane of foliation. Small folds and crumpled layering are present but not abundant. It is not known if the gneissosity is parallel to bedding in the sedimentary rocks from which the gneiss was derived.

About 5,300 feet of gneiss is preserved in the quadrangle. The lower contact is not exposed, but the upper contact is gradational into the Newman Lake Gneiss over an interval of approximately 3,000 feet. Numerous bands and pods of rock similar to the Newman Lake Gneiss are present in the upper 1,000 to 2,000 feet.

The Hauser Lake Gneiss may have been derived from metamorphism of the Belt Supergroup. The general mineral assemblages and layering of the gneiss are compatible with the type of rock that would result from intense metamorphism of some parts of the Belt. The amphibolite layers in the gneiss make this hypothesis all the more attractive because of their similarity in composition and mode of occurrence to the metadiorite sills in the Belt. Because these sills are restricted entirely to the Prichard Formation in this region, the rock from which the gneiss was derived might be further restricted to the Prichard Formation. The presence of iron sulfide and rusty-weathering surfaces in both formations supports this suggestion.

The Hauser Lake Gneiss was named for its exposures in the Mt. Spokane quadrangle near Hauser Lake, 15 miles south of the Newport Number 4 quadrangle. It was first described by P. L. Weis (1968) in his report on the Greenacres quadrangle, where it also occurs. The gneiss forms a nearly continuous band from the Greenacres quadrangle to the Newport Number 4 quadrangle. It can also be recognized in the Spirit Lake quadrangle as far east as the town of Rathdrum.

Newman Lake Gneiss

The Newman Lake Gneiss in the Newport Number 4 quadrangle is a biotite-quartz-plagioclase-potassium feldspar gneiss with a fabric that ranges from well foliated to almost nonfoliated. It is medium to dark gray and fairly uniform in composition and appearance. In addition to the major minerals listed, the rock contains opaque minerals, allanite, zircon, and apatite as accessory minerals. Muscovite is present in small amounts but does not exceed 1 percent by volume.

Obvious effects of cataclasis can be seen in most thin sections, although the rock has been metamorphosed subsequent to the deformation, because most products of cataclasis show signs of recrystallization. The development of a pervasive lineation, as shown by streaked-out clots of biotite, may have accompanied the cataclasis. The lineation is best developed at the south end of the quadrangle and becomes rather indistinct north of Tweedie.

The gneiss is confined to an approximately north-south belt that averages 2 miles in width. The area shown on the map as leucocratic plutonic rock about 2 miles north of Tweedie partly resembles the Newman Lake Gneiss and may be a northward extension of the gneiss that has been intensely injected by leucocratic dikes and sills. Numerous pods of metasedimentary rock resembling the Hauser Lake Gneiss are found in the lower 1,000 to 2,000 feet. Muscovite-biotite quartz monzonite intrudes the Newman Lake Gneiss on the west.

Because the Newman Lake Gneiss is so uniform in composition and appearance, it is thought to be an orthogneiss. The wide contact zone with the Hauser Lake Gneiss may have been an intrusive contact zone that contained large numbers of dikes and sills that were subsequently streaked out during the deformation affecting both rocks. The Newman Lake Gneiss was named for the exposures of this rock around Newman Lake in the Mount Spokane quadrangle. It was first described by P. L. Weis (1968) in his report on the Greenacres quadrangle where the gneiss also occurs.

Metamorphic rocks, undivided

Highly recrystallized coarse-grained schist and quartzite are found south of Scotia Valley and north of Kent Meadows Lake. All of these rocks are highly injected by dikes and sills of the alaskite and pegmatite that make up the bulk of the unit grouped as leucocratic plutonic rocks. Quartz-plagioclase-muscovite-biotite is the most common assemblage found, but andalusite and sillimanite occur at a few places. Sills of amphibolite up to 300 feet thick, a few of which are shown on the geologic map, are fairly numerous. On the east and west flank of Lone Mountain, good representatives of these sills are well exposed. At both of these localities, the rock intruded by the sills is relatively unmetamorphosed compared to the bulk of the unit. Sedimentary features are well preserved, and the rock looks identical to the Prichard Formation.

Small folds with axes generally parallel to the strike of the foliation are common. If the small folds are indicative of larger folds or faults, neither of the latter were recognized. Pods of metamorphic rock up to a few hundred feet long are found in the leucocratic plutonic rocks as much as a mile from the main body of metamorphic rocks.

MESOZOIC ROCKS

CRETACEOUS SYSTEM

Fan Lake Granodiorite

The Fan Lake Granodiorite was named by Miller (1974) for the exposures around Fan Lake in the quadrangle west of the Newport Number 4 quadrangle. The rock is a medium- to coarse-grained, highly mafic, hornblende-biotite granodiorite (see modal diagram on map sheet). It is characterized by large hornblende crystals as much as a centimeter long. The texture is hypidiomorphic granular and porphyritic where large hornblende crystals are abundant.

Minerals identified in thin section include plagioclase, potassium feldspar (without microcline twinning), quartz, hornblende, biotite, sphene, allanite, zircon, apatite, and opaque minerals. The average composition of the moderately zoned plagioclase crystals is intermediate oligoclase. Potassium feldspar and quartz are interstitial to plagioclase and mafic minerals. Hornblende and biotite occur in nearly equal amounts. Most of the hornblende is the same size as other minerals in the rock, and, in places, very few of the large crystals can be found. Sphene is the only accessory mineral easily seen with the unaided eye, but it is only locally abundant.

The areal extent of the pluton is about 13 square miles in the Newport Number 4 quadrangle and about 22 square miles in the Newport Number 3 quadrangle, although much of these areas are covered by glacial and alluvial material. Excellent exposures of relatively unweathered rock crop out on both sides of Chain Lake and along most of Scotia Canyon.

Joan C. Engels, of the U.S. Geological Survey, obtained a potassium-argon age of 95.1 ± 4.0 m.y. on hornblende and 93.4 ± 2.6 m.y. on biotite (Cretaceous) from a specimen collected 0.25 mile southeast of Fan Lake.

Biotite quartz monzonite

Medium-grained biotite quartz monzonite forms very poor exposures in the low hills about 1 mile west of Chain Lake. These exposures are the easternmost part of a pluton that extends over about 5 or 6 square miles in the southeastern part of the Newport Number 3 quadrangle.

The rock consists principally of oligoclase, potassium feldspar, quartz, biotite, and locally small amounts of hornblende. The potassium feldspar shows no microcline twinning. Quartz is highly strained, forms interstitial grains, and in many thin sections shows sutured borders. Magnetite, zircon, and apatite are the most abundant accessory minerals.

Texturally, most of the rock is hypidiomorphic granular. Specimens in the western part of the body show obvious cataclasis and incipient metamorphism in thin section, but a mile to the east these features are not evident. The quartz monzonite is intrusive into the metamorphic rocks, but contacts with other plutons are not sufficiently well exposed to determine relative age relations. Except for the absence of hornblende, much of this rock is very similar to the Fan Lake pluton and may be genetically related to it. However, because of differences within the body, it is possible two or more similar-appearing plutons may have been included in this unit.

MESOZOIC OR CENOZOIC ROCKS

CRETACEOUS OR TERTIARY SYSTEMS

Muscovite-biotite quartz monzonite

Muscovite-biotite quartz monzonite is exposed over about 23 square miles in the south-central part of the quadrangle. Locally, the quartz monzonite contains phenocrysts of potassium feldspar as much as 1 inch in length. The pluton is distinguished however, by large phenocrysts of muscovite as much as 1 inch across, which occur in much of the southern two miles of that part of the pluton within the quadrangle.

The average plagioclase composition is oligoclase. Part of the potassium feldspar appears to be microcline, but most does not show grid twinning. Micas make up from 4 to 12 percent of the rock and occur in a muscovite to biotite ratio ranging from about 0.2 to 1. They are commonly wrapped around the quartz and feldspar.

The absence of foliation attitudes on the map in the north part of the pluton is due only in part to extremely poor exposure in that area, but more to the northward decrease in development of planar and linear structures. In the southern part of the quadrangle, the rock is not only obviously foliate, but it also has a well-developed lineation defined by micas streaked-out in the plane of foliation. In addition to the foliation and lineation, the rock in much of the southern part of the quadrangle shows abundant cataclasis in thin section. Most of the fine-grained products of the cataclasis are recrystallized, suggesting that the cataclasis occurred during the later stages of crystallization or that the rock was metamorphosed after the cataclasis.

The contact with the Newman Lake Gneiss is probably intrusive. Although both rocks have developed similar foliations, for about 1.5 miles the contact cuts across this foliation at an angle of about 40 degrees. No dikes of the muscovite-biotite quartz monzonite were seen cutting the gneiss, although consistently poor exposure precludes direct observation of the contact.

Granodiorite

A zone of granodiorite, ranging in width from about three-fourths of a mile to about 2 miles, separates the muscovite-biotite quartz monzonite from the Fan Lake Granodiorite and the undivided metamorphic rocks. This granodiorite is probably related to or is even a border phase of the muscovite-biotite quartz monzonite but has modal and some textural similarities to the Fan Lake pluton.

Most of the granodiorite is medium to coarse grained and nonfoliate or only slightly foliate. It contains biotite but only small amounts of muscovite. The biotite makes up less than 10 percent of the rock at most places. Plagioclase is oligoclase, and potassium feldspar shows no microcline twinning.

The contact with the muscovite-biotite quartz monzonite appears to be gradational, but exposures are very limited in this part of the quadrangle. On the west side of the body, however, excellent exposures near Lake of the Wood show dikes of the granodiorite cutting the Fan Lake Granodiorite. The age of the granodiorite is therefore less than 95 m.y.

Leucocratic plutonic rocks

A heterogeneous mixture of alaskite, pegmatite, aplite, and muscovite-biotite quartz monzonite intrudes and is intimately mixed with the metamorphic rocks south of Scotia Valley. All of the rock types regardless of grain size or texture are leucocratic and contain muscovite; most contain at least small amounts of biotite. Plagioclase is albite or oligoclase in all of the rock types, except in the quartz monzonite, which contains mainly oligoclase. Potassium feldspar is mostly microcline, but some orthoclase may be present.

The textures of the pegmatite and aplite are those typical of the general rock type; the alaskite and quartz monzonite are medium to coarse grained hypidiomorphic granular. All of the rock types are foliate at some localities and at many places are sheared and cataclasized.

Numerous pods of metmorphic rock are mixed with the leucocratic plutonic rocks, and many dikes of the leucocratic plutonic rocks intrude the undivided metamorphic rock unit. The contacts shown on the map are gradational over distances as great as several hundred feet, and their placement, therefore, is somewhat subjective.

The absolute age of any of the four rock types making up this unit is not known. Since at least four different lithologies are represented, the age of the unit could span a considerable length of time. Some of the quartz monzonite resembles the 100 m.y. Phillips Lake Granodiorite (Miller and Clark, 1974). The quartz monzonite is cut by dikes of the older three rock types making up this unit and so is clearly the oldest of the four.

CENOZOIC ROCKS

TERTIARY SYSTEM

Silver Point Quartz Monzonite

The Silver Point Quartz Monzonite is exposed over about 70 square miles in the Newport Number 4 quadrangle and about 47 square miles in the Newport Number 3 quadrangle. The rock was originally named by Miller (1969, p. 5) for Silver Point on the west shore of Loon Lake in the Loon Lake quadrangle. At the present level of erosion, the rocks assigned to the Silver Point Quartz Monzonite in the Newport Number 3 and 4 quadrangles are physically separated from the originally named pluton in the Loon Lake quadrangle by about 6 miles of older rocks. The quartz monzonite is so distinctive, however, that these two plutons are clearly part of the same genetic unit.

The pluton is a porphyritic hornblende-biotite quartz monzonite that is characterized by extremely uniform texture and composition. It has an unusual and distinctive tri-modal grain size. Potassium-feldspar phenocrysts as much as 1.5 inches long are the largest crystals in the rock. They occur with crystals of hornblende, biotite, plagioclase, and potassium feldspar, which make up about 30 percent of the rock and average 0.15 inch in length. Both phenocrysts and large crystals occur in a groundmass that averages about 0.04 inch in length and is composed of all mineral phases in the rock.

The mineralogy is quite common for a rock of this chemical composition. Plagioclase composition averages about An_{20}. Potassium feldspar is perthitic and shows no microcline twinning in thin section. Hornblende is slightly more abundant than biotite; the two together give the rock an average color index of about 15. Sphene, apatite, magnetite, zircon, and allanite are found in most rocks as accessories.

Almost all contacts with metamorphic rocks are sharp. Fine-grained border rocks, apparently resulting from chill effects, are found within 100 feet of the contact in the vicinity of Davis Lake just west of the quadrangle. In that area, the fine-grained rocks grade into the pluton to coarse-grained, highly mafic granodiorite. The mafic rock in turn grades into normal-looking quartz monzonite within about one mile of the border of the pluton.

Potassium-argon ages determined by Joan C. Engels, of the U.S. Geological Survey, on hornblende and biotite from two samples collected in the Newport Number 3 quadrangle were as follows:

	Sample 1	Sample 2
Hornblende	46.8±1.7 m.y.	51.0±5 m.y.
Biotite	46.7±1.3 m.y.	48.1±1 m.y.

Sample 1 collected 1.1 miles south of Davis Lake.
Sample 2 collected 1.6 miles southeast of Sacheen Lake in roadcut on State Highway 311.

The Silver Point Quartz Monzonite is considered Eocene in age and is the youngest plutonic rock in the Newport Number 4 quadrangle.

Cataclastic rock

The unit shown as cataclastic rock on the geologic map is composed of shattered, and in places mylonitized, plutonic rock associated with the Newport fault zone. The cataclastic rock is generally green or gray and ranges in grain size from medium grained to aphanitic. Mineralogically, the rock is generally the same regardless of the plutonic rock from which it was derived and contains quartz, albite, chlorite, carbonate, and opaque minerals. The physical character of the zone is described in the section on structure.

TERTIARY OR QUATERNARY SYSTEMS

Conglomerate and breccia

A thin veneer of conglomerate and sedimentary breccia overlies the Revett Formation on the small hill west of Furport Hill. The rock is composed of predominantly angular clasts ranging in length from less than an inch to about 1 foot. These clasts are derived from the immediately underlying rock and are loosely held together by a matrix of sand and silt that makes up only a small proportion of the rock.

The conglomerate and breccia may be part of the Tertiary Tiger Formation, which crops out only a few miles to the north. However, because the base of the conglomerate and breccia veneer conforms roughly to the present slope of the hill, it is thought that the unit is probably a semiconsolidated slope deposit and is probably younger than the Tiger Formation.

QUATERNARY SYSTEM

Glacial, alluvial, and talus deposits, undifferentiated

Glacial and alluvial sediments cover about half of the quadrangle. Most of the sediments are found in the broad lowlands, and the remainder are largely confined to floors and walls of valleys. Thin patches of glacial material mantle slopes at some of the higher elevations, but most are too small or too patchy to show on the geologic map. Clast size ranges from boulders to fine silt. Locally, the deposits are as much as 100 feet thick but may be much greater because the base is rarely exposed where the sediments are thickest. Talus is confined to the lower part of steeper slopes.

STRUCTURE

The major structure in the Newport Number 4 quadrangle is the Newport fault (Miller, 1971, p. D77), which divides relatively unmetamorphosed Belt Supergroup rocks on the north from plutonic and high-grade metamorphic rocks on the south. The fault zone averages about 1,000 feet in thickness and extends across the entire northern part of the quadrangle. West of Newport, the zone has an average strike of about N. 75° to 80° W. and dips 35° N. The zone gradually bends to an east-west strike where it touches the north end of Kelly Island in the Pend Oreille River near Newport.

About 5 miles west of the quadrangle, the fault zone bends to the north and maintains a general north-south strike for almost 20 miles. At the north edge of the Newport Number 2 quadrangle, the zone dips about 30° E. East of the Newport Number 4 quadrangle, the zone continues with a nearly east-west strike along the base of the mountains on the north side of the Pend Oreille River. There the dip of the fault cannot be measured directly, but its relation to the topography suggests that it is near zero. North of Priest River, the zone apparently bends north and continues beneath the Quaternary sediments up the Priest River valley and along the east side of Priest Lake. Along the east side of Priest Lake, the fault dips shallowly to the west. From the available data, the fault, within the quadrangle, appears to be a north- and east-dipping thrust fault along which local steepening has occurred.

That part of the Newport fault zone shown on the geologic map is only the zone of cataclastic rock and mylonite derived from crystalline rocks on the south side of the fault. The southern border of the cataclastic zone is gradational into normal plutonic rock. Intense brecciation in rocks on the north side of the fault is apparent for as much as several thousand feet away. The contact between the cataclastic rock and the brecciated rocks is relatively sharp at the few localities where it has been seen. Northward from the zone, brecciation in the upper plate rocks diminishes, but local breccia zones along faults possibly associated with the Newport fault zone are numerous.

The cataclastic rock or mylonite within the zone has very little fabric. Locally, poorly developed, wide-spaced fractures can be measured, and at some places the rock has a slight foliation. The rock has no well-developed planar structure, however, even where the mylonite is reduced to a pseudotachylyte. The lack of any foliation or pronounced recrystallization in the zone, in addition to the ubiquitous brecciation and crushing associated with the fault, suggests that the mylonite was not so deep seated a structure as some of the better known ones in the world. It may be that the mylonite and some of the cataclastic rock formed relatively deep, and that later movements along the zone broke them and brought them in contact with the nonmylonitized brecciated rock.

North of the Newport fault zone, the Belt Supergroup forms a west-dipping, relatively homoclinal section. A few faults cut the rocks, but most of them are concealed beneath surficial deposits. No large folds were found in these rocks.

South of the Newport fault zone a well-developed lineation is superimposed on the foliation of the Newman Lake and Hauser Lake Gneiss, and much of the muscovite-biotite quartz monzonite. The lineation, formed by streaked minerals primarily in the plane of foliation, consistently plunges at moderate or shallow angles to the southwest. The foliation varies little from a consistent north strike and moderate to shallow west dip.

Between Camden Gap and the Chicago, Milwaukee, St. Paul and Pacific Railroad tracks, the strike of the foliation in the undivided metamorphic rock conforms to the contact with the Silver Point Quartz Monzonite, which probably caused the conformity by its forceful intrusion.

Faults and possibly major folds probably exist in the crystalline rocks south of the Silver Point Quartz Monzonite but were not recognized owing to lack of marker units and to poor exposures. Minor folds present in the Hauser Lake Gneiss could not be related to any larger structures.

REFERENCES CITED

Becraft, G. E.; Weis, P. L., 1963, Geology and mineral deposits of the Turtle Lake quadrangle, Washington: U.S. Geol. Survey Bull. 1131, 73 p.

Becraft, G. E., 1966, Geologic map of the Wilmont Creek quadrangle, Ferry and Stevens Counties, Washington: U.S. Geol. Survey Geol. Quad. Map GQ-538, scale 1:62,500.

Bowman, E. C., 1950, Stratigraphy and structure of the Orient area, Washington: Harvard Univ. Ph. D. thesis, 149 p.

Campbell, A. B.; Raup, O. B., 1964, Preliminary geologic map of the Hunters quadrangle, Stevens and Ferry Counties, Washington: U.S. Geol. Survey Mineral Inv. Field Studies Map MF-276, scale 1:48,000.

Campbell, Ian; Loofbourow, J. S., Jr., 1962, Geology of the magnesite belt of Stevens County, Washington: U.S. Geol. Survey Bull. 1142-F, p. F1-F53.

Clark, L. D.; Miller, F. K., 1968, Geology of the Chewelah Mountain quadrangle, Stevens County, Washington: Washington Div. Mines and Geology Geol. Map GM-5, scale 1:62,500, 2 sheets accompanied by 6 pages of text.

Dings, M. G.; Whitebread, D. H., 1965, Geology and ore deposits of the Metaline zinc-lead district, Pend Oreille County, Washington: U.S. Geol. Survey Prof. Paper 489, 109 p.

Harrison, J. E.; Jobin, D. A., 1963, Geology of the Clark Fork quadrangle, Idaho-Montana: U.S. Geol. Survey Bull. 1141-K, p. K1-K38.

Harrison, J. E.; Jobin, D. A., 1965, Geologic map of the Packsaddle Mountain quadrangle, Idaho: U.S. Geol. Survey Geol. Quad. Map GQ-375, scale 1:62,500, accompanied by 4 pages of text.

Harrison, J. E., 1969, Geologic map of part of the Mount Pend Oreille quadrangle, Idaho-Montana: U.S. Geol. Survey open-file map, scale 1:48,000.

Harrison, J. E.; Schmidt, P. W., 1971, Geologic map of the Elmira quadrangle, Bonner County, Idaho: U.S. Geol. Survey Geol. Quad. Map GQ-953, scale 1:62,500.

Miller, F. K., 1969, Preliminary geologic map of the Loon Lake quadrangle, Stevens and Spokane Counties, Washington: Washington Div. Mines and Geology Geol. Map GM-6, scale 1:62,500, accompanied by 7 pages of text.

Miller, F. K., 1971, The Newport fault and associated mylonites, northeastern Washington: U.S. Geol. Survey Prof. Paper 750-D, p. D77-D79.

Miller, F. K., 1974, Preliminary geologic map of the Newport Number 3 quadrangle, Pend Oreille, Spokane, and Stevens Counties, Washington: Washington Div. of Geology and Earth Resources Geol. Map GM-9, scale 1:62,500, accompanied by 7 pages of text.

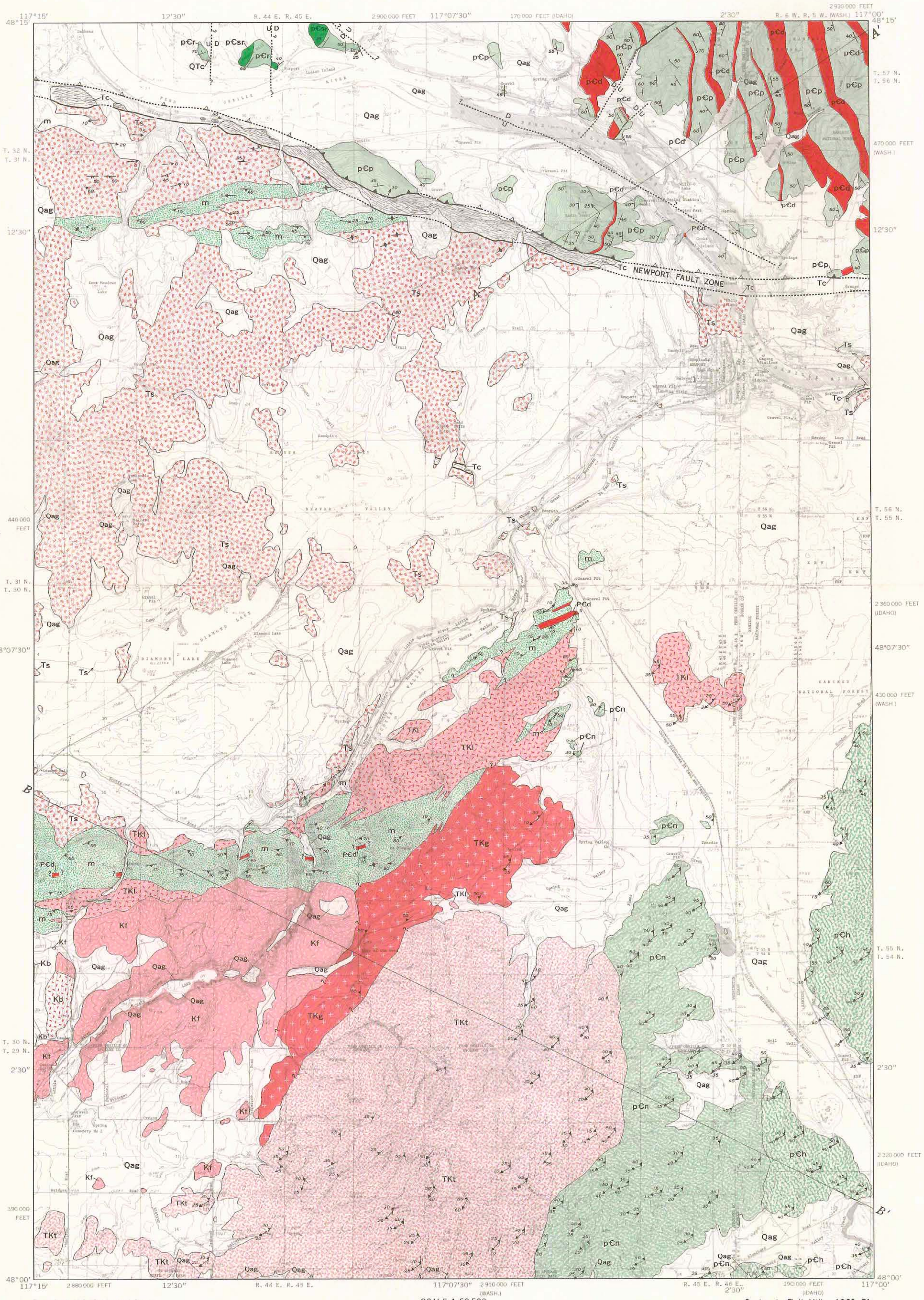
Miller, F. K.; Clark, L. D., 1974, Geology of the Chewelah-Loon Lake area, Stevens and Spokane Counties, Washington: U.S. Geol. Survey Prof. Paper 806, 74p. (In press)

Schroeder, M. C., 1952, Geology of the Bead Lake district, Pend Oreille County, Washington: Washington Div. Mines and Geology Bull. 40, 57 p.

Weis, P. L., 1968, Geologic map of the Greenacres quadrangle, Washington and Idaho: U.S. Geol. Survey Geol. Quad. Map GQ-734, scale 1:62,500, accompanied by 4 pages of text.

Yates, R. G., 1964, Geologic map and sections of the Deep Creek area, Stevens and Pend Oreille Counties, Washington: U.S. Geol. Survey Misc. Geol. Inv. Map I-412, scale 1:31,680.

Yates, R. G., 1971, Geologic map of the Northport quadrangle, Washington: U.S. Geol. Survey Misc. Geol. Inv. Map I-603, scale 1:31,680.



Base from U.S. Geological Survey advance sheets, scale 1:24,000: Tweedie, Newport, Diamond Lake, Camden, Washington-Idaho, 1968
10,000-foot grid based on Washington coordinate system, north zone, and Idaho coordinate system, west zone.

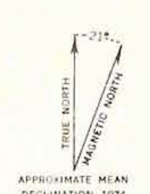
SCALE 1:62 500

5 MILES

7 KILOMETERS

CONTOUR INTERVAL 40 FEET
DASHED LINES REPRESENT 20-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

Geology by F. K. Miller, 1969–71; assisted by J. S. Tinker, 1969; P. N. Castle, 1970; and P. R. Margolin, 1971



QUADRANGLE LOCATION

EXPLANATION

Qag

Glacial, alluvial, and talus deposits, undifferentiated

Chiefly unconsolidated gravel, sand, and clay

QUATERNARY

UNCONFORMITY

QTc

Conglomerate and breccia

Poorly consolidated conglomerate and breccia composed of clasts derived from rocks immediately underlying it

TERTIARY OR QUATERNARY

UNCONFORMITY

Tc

Cataclastic rock

Mylonite and cataclastic rock within the Newport fault zone. Ranges from highly sheared and broken plutonic rock to pseudotachylyte

Ts

Silver Point Quartz Monzonite

Hornblende-biotite quartz monzonite. Porphyritic with groundmass of bimodal grain size. Northern border is foliated in places, and contains a higher proportion of mafic minerals than the bulk of the pluton

Eocene

TERTIARY

CENOZOIC

TKg

Granodiorite

Biotite granodiorite, with minor amounts of muscovite. Probably related to the muscovite-biotite quartz monzonite

TKt

Muscovite-biotite quartz monzonite

Porphyritic in part; contains phenocrysts of muscovite up to 1 inch in length. Eastern and southern parts of pluton are foliate

TKl

Leucocratic plutonic rocks

Alaskite, pegmatite, and muscovite-biotite quartz monzonite. Intimately mixed with undivided metamorphic rocks

CRETACEOUS OR TERTIARY

MESOZOIC OR CENOZOIC

Kf

Fan Lake Granodiorite

Hornblende-biotite granodiorite, medium- to coarse-grained, highly mafic. Contains sparse hornblende phenocrysts

Kb

Biotite quartz monzonite

Contains abundant biotite, sparse hornblende, and numerous inclusions. May be a variant of the Fan Lake Granodiorite

CRETACEOUS

MESOZOIC

Belt Supergroup

p€sr

St. Regis Formation

Argillite, siltite, and quartzite. Lavender and maroon, medium- to thin-bedded

p€d

Metadiorite sills

Mafic-rich diorite recrystallized to amphibolite in most places. Restricted to the Prichard Formation

p€r

Revett Formation

Quartzite, white, fine-grained, well-bedded; siltitic especially near middle. Locally maroon to lavender

p€p

Prichard Formation

Argillite, siltite, and quartzite; thin-bedded; commonly iron-stained weathered surfaces

Rocks of questionable relation to Belt Supergroup

p€n

Newman Lake Gneiss

Medium- to coarse-grained, highly foliate and lineate biotite granite gneiss. Locally porphyroblastic. Shows granulation in thin section

p€h

Hauser Lake Gneiss

Interlayered mica schist, quartzite, and alaskite. Most layers less than 2 inches thick. Contains amphibolite layers. Commonly has iron-stained weathered surfaces. Probably derived from Belt Supergroup, especially Prichard Formation

m

Metamorphic rocks, undivided

Schist, quartzite, gneiss, and amphibolite. Probably derived from Prichard Formation

PRECAMBRIAN

Contact, approximately located

Queried where uncertain

U
D

Fault

Dashed where approximately located; dotted where concealed; queried where uncertain. U, relatively upthrown side; D, relatively downthrown side

30

Thrust fault, showing dip

Dashed where approximately located; dotted where concealed. Sawteeth on upper plate

60 35

Inclined Overturned

Strike and dip of beds

50

Inclined Vertical

Strike and dip of foliation

35

Strike and dip of cleavage

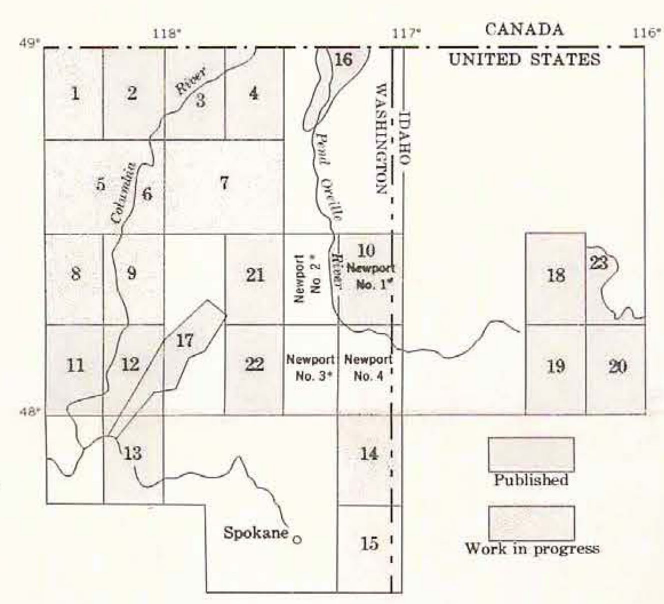
80

Strike and dip of flattened inclusions in Silver Point Quartz Monzonite

50 25

Minor fold axes Mineral lineations

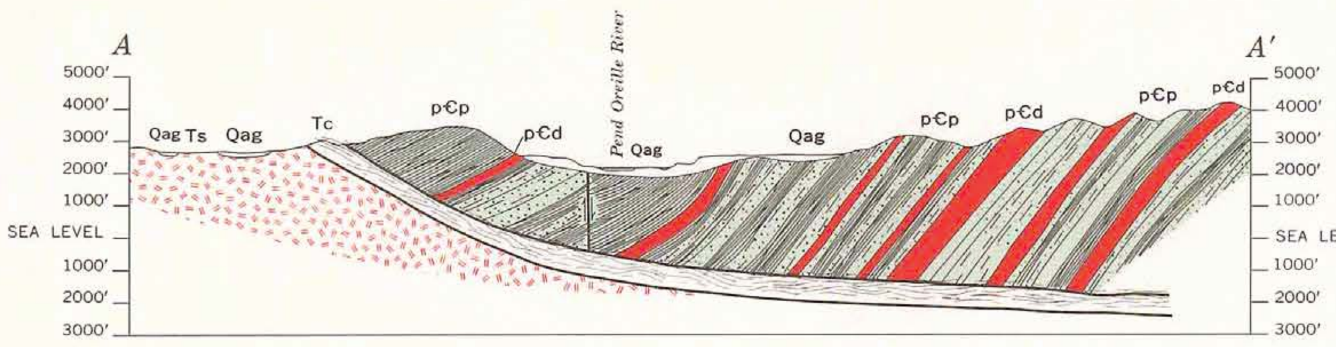
Bearing and plunge of lineations

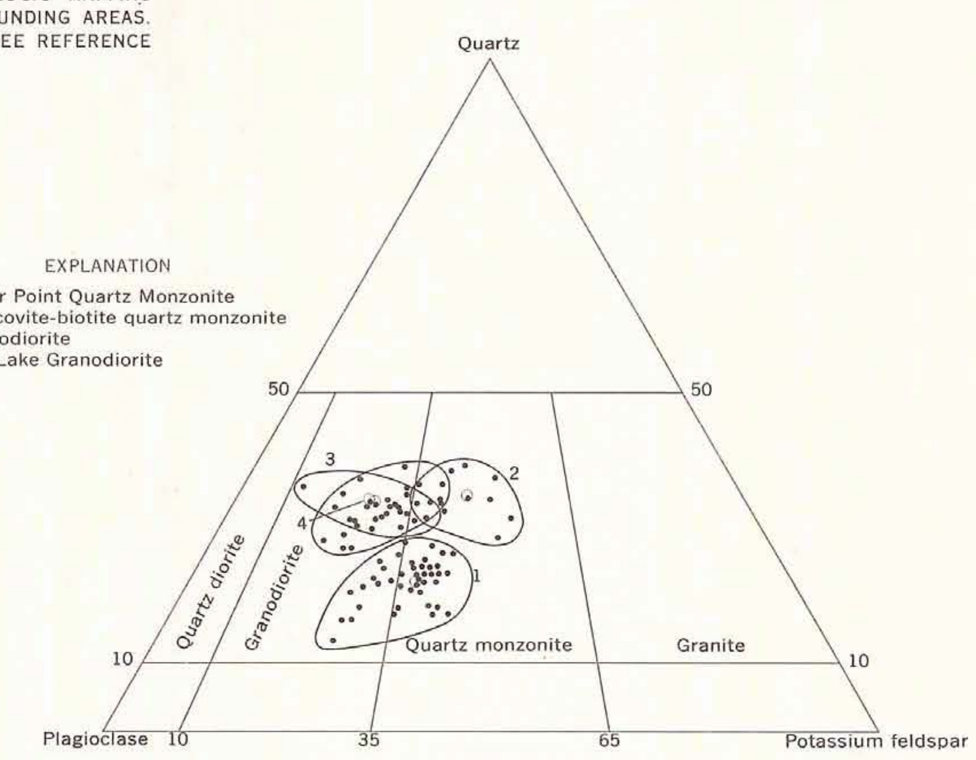


INDEX MAP SHOWING LOCATION OF THE NEWPORT NUMBER 4 QUADRANGLE AND STATUS OF GEOLOGIC MAPPING (1:62,500 SCALE OR LARGER) IN SURROUNDING AREAS. DATES INDICATE PUBLISHED REPORTS (SEE REFERENCE LIST IN PAMPHLET)

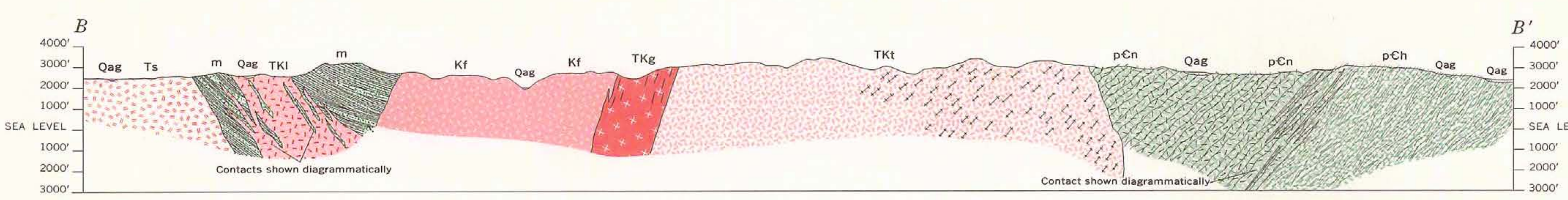
1. Togo Mountain quadrangle.—R. C. Pearson
2. Orient area.—E. C. Bowman (1950)
3. Northport area.—R. G. Yates (1971)
4. Deep Creek area.—R. G. Yates (1964)
5. Kettle Falls area (west of river).—C. D. Campbell
6. Kettle Falls area (east of river).—J. W. Mills
7. Colville area.—W. A. G. Bennett
8. Twin Lakes quadrangle.—G. E. Becraft
9. Inchelium quadrangle.—A. G. Campbell
10. Bead Lake area.—M. C. Schroeder (1952)
11. Wilmont Creek quadrangle.—G. E. Becraft (1966)
12. Hunters quadrangle.—A. B. Campbell and O. B. Raup (1964)
13. Turtle Lake quadrangle.—G. E. Becraft and P. L. Weis (1963)
14. Mt. Spokane quadrangle.—A. E. Weissenborn
15. Greenacres quadrangle.—P. L. Weis (1968)
16. Metaline area.—M. Dings and D. Whitebread (1965)
17. Magnesite belt.—I. Campbell and J. Loofbourow (1962)
18. Elmira quadrangle.—J. E. Harrison and P. W. Schmidt (1971)
19. Packsaddle Mountain quadrangle.—J. E. Harrison and D. A. Jobin (1965)
20. Clark Fork quadrangle.—J. E. Harrison and D. A. Jobin (1963)
21. Chewelah Mountain quadrangle.—L. D. Clark and F. K. Miller (1968)
22. Loon Lake quadrangle.—F. K. Miller (1969)
23. Part of the Mt. Pend Oreille quadrangle.—J. E. Harrison (1969)

* Newport number 1, 2, and 3 quadrangles.—F. K. Miller (1974)





MODAL DIAGRAM SHOWING VARIATION IN COMPOSITION OF SOME OF THE PLUTONIC ROCKS IN THE NEWPORT NUMBER 4 QUADRANGLE. CIRCLED POINT IS THE AVERAGE FOR EACH PLUTON. SOME MODES ARE ON SPECIMENS COLLECTED OUTSIDE THE QUADRANGLE



PRELIMINARY GEOLOGIC MAP OF THE NEWPORT NUMBER 4 QUADRANGLE, SPOKANE AND PEND OREILLE COUNTIES, WASHINGTON, AND BONNER COUNTY, IDAHO

By
Fred K. Miller
U.S. Geological Survey

1974

For sale by Department of Natural Resources, Olympia, Washington
Price $1.00