GEOLOGIC MAP OF THE LEADPOINT QUADRANGLE STEVENS COUNTY, WASHINGTON

By
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The Leadpoint quadrangle, in Stevens County of northeastern Washington, is the northeastern of four 7½-minute quadrangles that are being mapped geologically to determine the stratigraphic and structural relations of the lead-zinc deposits in the Northport district. The accompanying geologic map, structure sections, and explanation of rock units is a preliminary presentation of data accumulated during the field seasons of 1954 and 1955 and, accordingly, is subject to revision upon completion of the mapping of the three remaining quadrangles. To make the map most usable and to give it an accuracy most consistent with the facts at hand, the quadrangle has been subdivided into three areas (see index map) and a separate explanation of rock units prepared for each.

Each of the three map areas has a stratigraphic and structural unity foreign to the other two. Stratigraphic and structural ties have been established for Areas I and II, and correlations between these areas are made. The geology of Area III is incompletely understood and its rock units cannot be correlated, with any certainty at this time, with those of either Area I or Area II. Area III is internally more complex than Areas I and II; therefore, it is divided into three subareas, each different from the other two in structure and rock assemblage. Some lithologically similar rocks appear in the different subareas, but it is not known whether or not they are stratigraphic equivalents.

Most rock units in Areas I and II are correlated with considerable confidence with established formations of the Metaline quadrangle (Park and Cannon, 1943), which adjoins the Leadpoint quadrangle on the east. Fossil evidence, lithologic similarities, and general stratigraphic relations establish the thick limestone and dolomite sequence as correlative with the Metaline limestone. The presence of Ordovician graptolites establishes certain black argillaceous rocks as equivalent to the Ledbetter slate. The stratigraphic position and general lithology of other units supports a correlation with the Maitlen phyllite.

Although these three formations are recognized in the Leadpoint quadrangle, they differ appreciably in lithology and thickness from the stratigraphic equivalents in the Metaline quadrangle. For example, the upper limestone unit of the Metaline formation is missing in Area I, although present in Area II; its stratigraphic position in Area I is occupied by an intraformational dolomite breccia containing Middle or Upper Cambrian fossils. As the map explanation indicates, similar contrasts occur between apparently contemporaneous rock units within the Leadpoint quadrangle.

Area I is essentially the western part of what Park and Cannon (1943, p. 28) referred to as the "Flume Creek-Russian Creek block", a structural unit that is "bounded on the north by the Russian Creek fault, on the east by the Flume Creek fault, on the south by the Kaniksu batholith, and on the west by the edge of the quadrangle (Metaline)." The Russian Creek fault extends into the Leadpoint quadrangle, but is not considered the northern boundary of Area I, because the upper unit of intraformational dolomite breccia of the Metaline formation and the Ledbetter slate, which are regarded as rocks diagnostic of Area I, appear north of the fault. Area I is separated from Areas II and III by a fault that extends N. 30° E. from the southwest corner of the quadrangle to the northeast corner.

The structure in the southern part of Area I is the nose of a southwestward-plunging anticline, whose axis crosses Gladstone Mountain (see sec. D-D'). At least three major and several minor faults cut the anticline. The southeastern flank of this anticline is broken by the Ridge fault (Park and Cannon, 1943, plate 1) of northeast trend. The northwestern flank of the anticline also is broken just north of Silver Creek by a fault trending N. 60° E. and just south of Hartbauer Creek by a fault trending N. 80° E. From the latter fault to the northeast corner of the quadrangle the predominant dip of beds is towards the southeast. This essentially homoclinal area is crossed near the Iroquois mine by the Russian Creek fault, which trends N. 60° E. and separates the lower member of the Metaline formation from the upper member. Rocks northwest of the Russian Creek fault are overturned, as are some of the beds immediately south of the fault.

Area II is structurally simple; it has greater unity than Area I. Much of the area is an overturned isoclinal syncline, whose axis trends N. 70° E. (see sec. C-C'). In this fold the beds, as far south as the sill that crosses Sherlock Creek near its mouth, have a consistent dip of about 65° SE. South of the sill the beds dip towards the northwest, a relation that suggests that the sill is intruded along a fault. South of this inferred fault the rocks are complexly folded and faulted, the net effect of which has been to bring to the surface rocks that may be equivalent to the lower part of the Maitlen phyllite and upper part of the Gypsy quartzite. On the ridge north of O'Hara Creek the rocks are folded into a tight, asymmetric anticline.

Area II is bounded on the north by a fault that cuts off this anticline on both the north and east. The character of this fault is uncertain. Its trace makes a blocky map pattern, part of which may be the result of northeasterly trending faults offsetting a northwesterly trending fault. Rocks north and east of this fault appear to have moved upward in respect to those to the west and south.

Area III is subdivided into three smaller areas, each containing a distinctive rock assemblage. Area III-A is separated from Area III-B and Area III-C by a fault trending N. 20° E.; the relative movement along the fault appears to have been upwards on the west side. Area III-B is separated from Area III-C by a fault trending easterly between units bs and cp.

A large part of Area III-A is underlain by a sill-like sheet of albite granite (see sec. A-A'[1]) that is roughly accordant with the southwesterly plunging synclinal form of the intruded sedimentary rocks. A similarly plunging anticline involving both granite and sedimentary rocks may occur in the valley of Cedar Creek. It appears probable that the albite granite was intruded during folding, but it is conceivable that it was intruded into folded beds.

Area III-B is very irregular in shape and is perhaps the most structurally complex area in the quadrangle (see sec. B-B'[1]). Individual rocks have affinities with rocks in Area I and Area II, but the general assemblage is distinctly different. Quartzites in Area III-B may be equivalent to quartzites in Areas I and II that are considered as belonging to the lower part of the Maitlen phyllite or upper part of the Gypsy quartzite. The distinctive sequence of limestone and schist that conformably overlies quartzite in Area III-B was not identified in Areas I and II; however, there are limestones and schists in these areas that may be partly equivalent to the sequence in Area III-B.

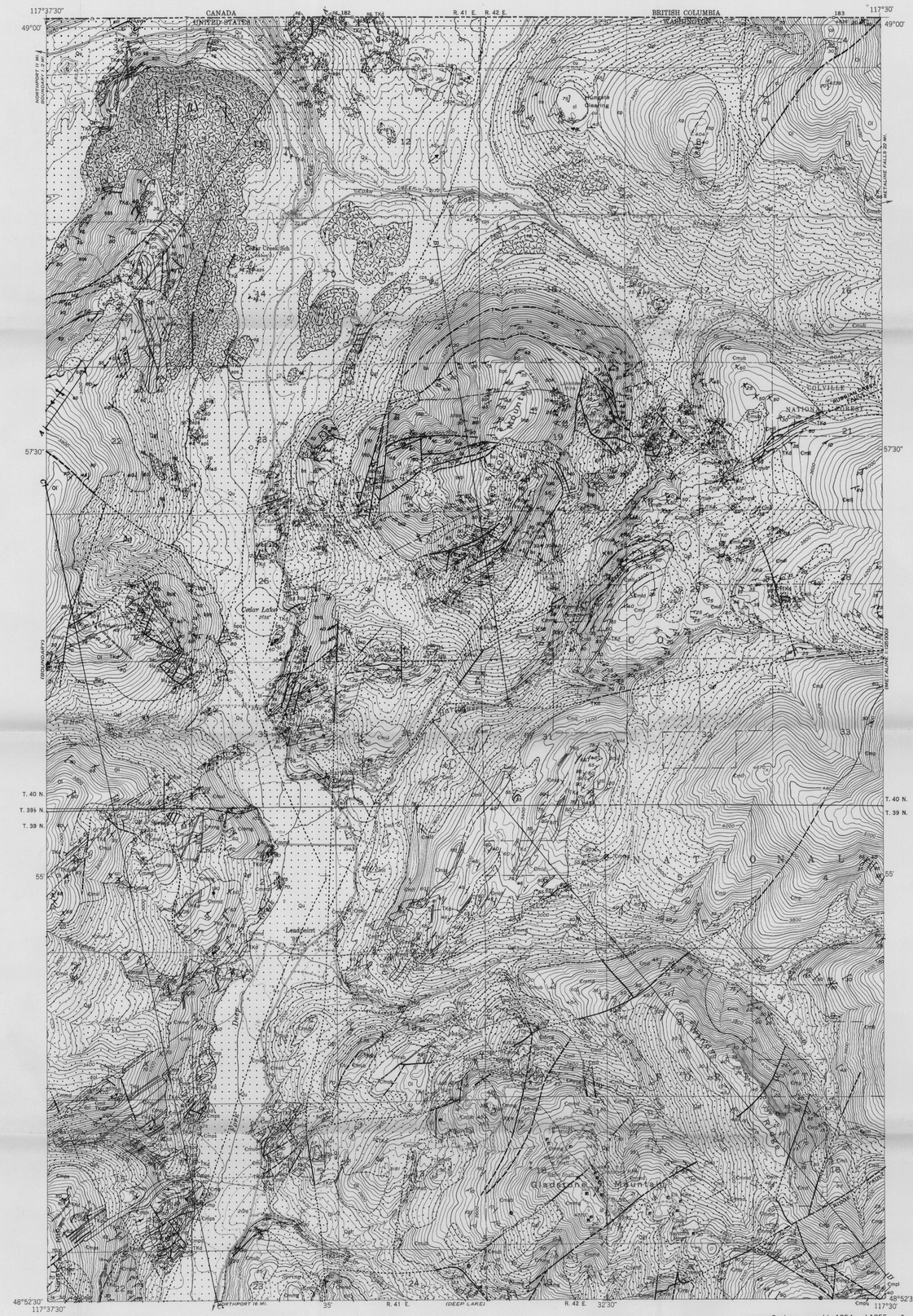
One rock unit, the black siliceous phyllite, bsp, found on Red Top Mountain in Area III-B has no lithologic equivalent in the Cambrian sequence of adjoining areas; accordingly, its presence introduces the problem of whether its position is the result of structure, or of a combination of stratigraphy and structure. Solely on the basis of comparative lithologies, this rock can be correlated with the graptolite-bearing rocks mapped as Ledbetter slate in Area II. To consider unit bsp as the Ledbetter slate, its position on Red Top Mountain must be interpreted as the result of thrust faulting. Considered solely on the basis of rocks with which it is associated, unit bsp can be construed as belonging to the Maitlen phyllite, although it is totally different from any rocks that elsewhere have been assigned to the Maitlen. The dissimilarity of unit bsp to any unit of the Maitlen phyllite observed in the Leadpoint quadrangle or described in the Metaline quadrangle, and the apparent lack of any rocks that might be regarded as transitional to bsp, suggests that if bsp is a facies of the Maitlen phyllite, it most likely owes its position in Area III-B to fault movements.

Regardless of the age of unit bsp, Area III-B can be regarded as an open, southwestward-plunging syncline that is broken near Cedar Lake by several steep north-trending faults, the aggregate movements of which have brought older rocks to the surface.

Area III-C is much less understood than the other areas, mainly because it is heavily covered by forest growth and glaciofluvial deposits and not necessarily because it is an area of complex structure.

REFERENCE

Park, C. F., Jr., and Cannon, R. S., Jr., 1943, Geology and ore deposits of the Metaline quadrangle, Wash.: U. S. Geol. Survey Prof. Paper 202.



Base map by Topographic Division
U. S. Geological Survey 1952

Geology mapped in 1954 and 1955

EXPLANATION

Contact, showing dip
Dashed where approximately located, dotted where concealed.

Indefinite or inferred contact

Fault, showing dip
Dashed where approximately located, dotted where concealed.

Vertical fault

Doubtful or probable fault

Fault breccia

Anticline, showing trace of axial plane and bearing and direction of plunge of axis
Dashed where approximately located, dotted where concealed.

Syncline, showing trace of axial plane and bearing and direction of plunge of axis
Dashed where approximately located, dotted where concealed.

Overturned syncline
Showing trace of axial plane and direction of dip of limbs.

Overturned anticline
Showing strike and dip of axial plane and direction of dip of limbs. Dashed where approximately located, dotted where concealed.

Plunge of minor anticline

Plunge of minor syncline

Plunge of fold axis

Strike of vertical axial plane showing plunge of fold axis

Axial plane of minor folds where plunge is unknown

Strike and dip of beds

Strike and dip of overturned beds

Strike of vertical beds

Horizontal beds

Strike and dip of foliation showing plunge of lineation
Lineation may be any of types shown below.

Strike of vertical foliation

Strike and dip of cleavage

Strike and dip of cleavage showing plunge of lineation
Lineation may be any of types shown below.

Strike of vertical cleavage

Plunge of pencil cleavage

Plunge of lineation of mineral streaking

Plunge of plications of cleavage planes

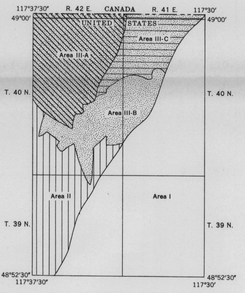
Strike and dip of jointing

Strike of vertical joints

Vertical shaft

Portal of tunnel or adit

Small prospect pit or open cut



MAP SHOWING AREAS OF ROCK UNITS

EXPLANATION OF ROCK UNITS

ROCK UNITS COMMON TO ENTIRE MAP AREA

QUATERNARY

Recent

Alluvium and terrace deposits
Includes both granite and sands of Columbia and Pend Oreille Rivers forming valley fills and alluvial fans of Recent age and high terrace gravels and sands of probable Wisconsin age. Age of terrace granite indicated by unfilled kettles on upper surface of terrace at northwest corner of area.

Pleistocene

Glaciofluvial deposits
Unsorted, waterworn gravel and sand of glaciofluvial origin covering much of area. Pebbles, cobbles, and boulders of mainly granitic rocks derived from areas to north during one or more stages of Pleistocene continental glaciation. Thickness highly irregular; ranges from a few feet to probably several hundred feet. In part redistributed since the Pleistocene.

CRETACEOUS(?) OR TERTIARY(?)

Andesitic and lamprophyric dikes
Dikes and sills of light-gray to black, medium-grained, porphyritic rocks. Andesitic and lamprophyric types not differentiated on map. Commonly less than 20 feet thick, but a few sills are over 100 feet thick. Intruded after folding and after intrusion of albite granite; may be of Late Cretaceous or Tertiary age.

MESOZOIC(?)

Albite granite and quartz monzonite
Light-colored, medium-grained albite granite, ag, irregularly mylonitized and crushed, and composed of orthoclase, albite, quartz, and small amounts of amphibole. Small masses of a medium-gray, medium-grained quartz monzonite rock, qz, containing 15 percent biotite. Age unknown, probably Mesozoic.

ROCK UNITS FOUND WITHIN AREA I

ORDOVICIAN

Ledbetter slate
Predominantly dark-gray to black slate and phyllitic slate. Beds thin and indistinct and show prominent cleavage and hackly fracture. Locally limy and in places, particularly near the base, contains thin beds of fine-grained limestone. Poorly preserved graptolites in slate indicate Ordovician age. Complete section not exposed; probably more than 1,000 feet thick.

CAMBRIAN(?)

Shale, limestone, and dolomite
Thin-bedded gray shale, limy shale, and limestone and, near structural top of unit, medium-bedded black fine-grained shale. Shale characterized by paper-thin partings. Minimum thickness 500 feet; stratigraphic position indefinite. Present only south of Silver Creek.

Metaline formation

Upper member
Dark- to light-gray, medium- to fine-grained, thin-bedded dolomite alternating with and grading laterally into intraformational dolomite breccia, fragments of which have same character as the bedded dolomite. Bedded dolomite and dolomite breccia occur in a ratio of roughly 3:1. Gross sorting is overall parallel, but in detail the contacts between breccia and bedded dolomite are highly irregular, and a few beds are locally contorted and disconnected. Breccia fragments are mostly thin slabs broken parallel to bedding; they range from less than ¼ inch to 3 feet in length. Most are angular to subangular, and occur unsorted in a matrix of fine-grained darker dolomite. At some places fragments are oriented in plane of bedding, more commonly rotated. Recrystallization has, in places, destroyed or obscured evidence of breccia fragments; at most such places the rock forms banded tan to irregular mottled gray and white coarser dolomite, forms banded to irregular mottled gray and white fine-grained quartz, which also occurs as irregular nodules, lenses, and sheets in the bedded dolomite. Maximum exposed thickness of member about 1,500 feet. Contains a few phosphatic brachiopods tentatively assigned to Middle and Late Cambrian age. Basal contact with underlying middle dolomite member appears to be gradational; upper contact with Ledbetter slate generally obscured by faulting but appears to be sharp and conformable where exposed.

Middle member
Medium- to fine-grained banded dolomite, Cmmd, consisting of medium- to dark-gray layers alternating with light-gray to white layers; color banding locally absent or indistinct and rock either uniformly light gray or dark to medium gray. Color bands, generally ¼ to 1½ inches thick, represent beds whose outlines are locally discontinuous and irregular as a result of migration of carbonaceous material during recrystallization. Many dark gray bands contain thin streaks and small lenticular lobes of light-gray to white dolomite. Maximum exposed thickness about 1,000 feet.
Unit Cmmg includes light-gray to white, massive, medium- to coarse-grained dolomite of Gladstone Mountain, and creamy-white medium-grained bedded dolomite of approximately equivalent stratigraphic position north of Hartbauer Creek. Light-colored dolomite that appears to be dolomitized Cmi and recrystallized Cmmd also included. Maximum exposed thickness less than 1,000 feet, but highly variable. Probably has no significance as a stratigraphic unit.

Lower member
Medium- to dark-gray, fine-grained, thick-bedded limestone, and finely mottled gray- and buff-weathering limestone, Cmll, with intercalated thin beds of gray, limy to argillaceous phyllite and minor amounts of micaceous schist. Buff-weathering mottles slightly more carbonaceous or dolomitic and limonitic than gray parts. Bedding indistinct and discontinuous. Included in upper part of member are dark-gray crystalline dolomite beds, Cmid, a few feet to 200 feet thick, and a few beds of platy argillaceous limestone containing middle Middle Cambrian Bathyuriscus-Elrathina fauna. Algal and oolitic limestone beds at several localities; limy phyllite and mica schist more abundant near the base. Contact with underlying Maitlen phyllite gradational in places; most of upper contact is faulted or not exposed. Thickness unknown; section exposed on Windy Ridge is 1,700 feet thick, probably reduced by faulting; section north of Silver Creek exceeds 10,000 feet but may be duplicated in part.

Metaline phyllite

Phyllite
Mainly greenish-gray to gray phyllite with minor amount of sericite schist. Thin quartzite beds near base and limestone beds near top; large cubes of pyrite common in phyllite. Total thickness probably at least 3,000 feet.

Quartzite
Fine-grained, thin-bedded, gray quartzite with interbeds and partings of phyllite and quartz-sericite schist. Exposed thickness about 1,000 feet.

Limestone
Thin-bedded limestone that weathers brown, and fine-grained, sugary, gray limestone. Total thickness probably less than 800 feet.

Schist
Quartz-chlorite-sericite schist containing a few thin quartzite and limestone beds. Probably stratigraphically beneath rocks mapped as Cmp. Exposed thickness not in excess of 500 feet.

ROCK UNITS FOUND WITHIN AREA II

ORDOVICIAN

Ledbetter slate
Thin-bedded, dark-gray to black, siliceous, phyllitic argillites composed of fine-grained quartz and muscovite; locally limy. No subunits recognized. Contains Ordovician graptolites near base. Upper contact not established; thickness in area about 3,000 feet.

Metaline formation

Upper member
Coarse-grained, white to light-gray limestone, blotched and streaked with dark-gray limestone and wisps of muscovite schist. Bedding fairly well developed. Appears to grade downward into Cmmg. Maximum thickness 1,500 feet.

Middle member
Two units—upper, light-gray to white, medium- to coarse-grained, massive dolomite, Cmmg, and lower, medium-grained, interlayered, light- and dark-gray dolomite, Cmmd. Combined thickness about 3,000 feet. Relationship between two units and overlying limestone, Cmu, not well established. Cmmg may have little or no stratigraphic significance, possibly in part hydrothermally dolomitized Cmui and in part recrystallized Cmmd. Cmmd contains thin beds of gray limestone, ls, near base.

Lower member
Dark-gray, fine-grained, thick- to thin-bedded and platy limestone with minor amounts of mottled, gray- and buff-weathering limestone, and thin interbeds of gray, limy to argillaceous phyllite and mica schist. Contains a few thin lenses of gray dolomite, do, near top. At base grades into dark-gray Maitlen phyllite. Thickness about 900 feet, with no apparent loss of section by faulting.

Metaline phyllite

Phyllite
In canyon of Sherlock Creek and on ridge to northeast dominantly dark-gray phyllite and limy phyllite with interlayered schist and minor amount of limestone. Thickness 650 to 850 feet. Included under Cmp are rocks found south of Sherlock Creek that are lithologically similar but stratigraphically lower in the section. There, limy phyllite, dominantly light gray to brown, silty to quartzite, is interlayered and gradational with massive- to thick-bedded light-gray limestone, ls, and minor amount of schist. Section is incomplete, but estimated minimum thickness is 1,000 feet.

Schist
Medium to light greenish-gray, fine-grained, quartz-chlorite-muscovite schist, generally banded, with layers ranging from green chlorite schist to highly quartzitic muscovite schist. Contains thin, gray to buff limestone and gray phyllite layers. Foliation commonly parallel or nearly parallel to bedding; foliation crinkled, and crinkle-cleavage well developed at high angles to foliation. Exposed section 3,300 feet thick, in part cut out by faults.

Quartzite
Light-gray to pale-reddish and medium olive-gray, medium- to fine-grained, thick- to thin-bedded, generally impure quartzite. Contains thin interbeds of olive-gray phyllite and schist, and a 50-foot magnetite-rich quartzite layer. Total thickness in area 600 feet, but top is faulted out and base not exposed. Map be equivalent, in part, to Gypsy quartzite of Cambrian age in Metaline quadrangle, which is more than 5,000 feet thick.

ROCK UNITS FOUND WITHIN AREA III

Stratigraphic relations unknown or uncertain. Probably rocks of Paleozoic and Mesozoic age are represented, but correlations with rocks outside Area III are uncertain or unknown. Correlations among rocks of subareas A, B, and C are unknown, except as stated in the captions below.

SUBAREA A

Rocks arranged in stratigraphic sequence, but because they may be overturned, the relative ages are unknown.

Lava and argillite
Greenish-gray to black mafic lava and associated limy black argillite. Thickness unknown.

Phyllite
Contorted and sheared silery-gray phyllite, locally limy, mostly highly crenulated. Contains a few thin fine-grained gray limestone lenses. Thickness unknown.

Quartzite, chert, schist, greenstone and limestone
Sheared and recrystallized quartzite in thin lenses, white to light-gray, fine- to medium-grained, with indistinct bedding. Gray, greenish-gray, and pinkish-gray to buff, thin-bedded chert with phyllitic partings. Dark greenish-gray greenstone, and greenish-gray quartz-sericite-chlorite schist, probably derived in part from mafic volcanic rocks. Limestone, medium- to dark-gray, fine to medium grained, and thin to medium bedded. Limestone beds separated as ss. Total thickness of unit about 1,000 feet.

Phyllite, argillite, and limestone
Black, siliceous phyllite and argillite interlayered with dense black limestone. Characterized by interlayering of argillite and limestone; individual layers from 1 to ½ inches thick. Thickness of unit probably between 1,000 and 3,000 feet.

Limestone
Light-gray to white, medium-grained limestone, locally mottled gray and white. Bedding not determinable. Probably not more than 100 feet thick.

SUBAREA B

Stratigraphic sequence not established, arrangement without significance except as stated in captions.

Quartzite, limestone, and schist
A distinctive sequence of quartzite, limestone, and chlorite-sericite-schist on east side of Red Top Mtn. and east and west of Cedar Lake. Basal unit interbedded quartzite and phyllite, bq2, overlain in supposed ascending order by limestone unit, bl1, schist unit, bs1, limestone unit, bl2 schist unit, bs2 and limestone unit, bl3. Contacts between units moderately sharp with enough gradational change to indicate depositional relations. Quartzite, bq2, massive, grades into overlying limestone. Limestone units grayish-white to creamy-white with moderately well developed bedding represented by layers and streaks of limestone containing fine muscovite. Chlorite schist grayish-green with well-developed cleavage, no determinable bedding. Assemblage at least 3,650 feet thick, upper and lower limits unknown. Estimated thickness of individual units: bq2 1,800+ feet; bl3 50-100 feet; bs3 100 feet; bl2 100-150 feet; bs2 800 feet; and bl1 1,800+ feet. Relations of this assemblage to units in other areas are uncertain. Quartzite may be equivalent to upper part of Gypsy quartzite of Metaline quadrangle (Reno formation in British Columbia), and limestone may be equivalent to ore-bearing limestone at Reeves-McDonald mine in British Columbia.

Schist
Greenish-gray quartz-sericite-chlorite schist, commonly layered as result of variations in quartz content. Contains at least one layer of greenstone. Rocks mapped as bs may include two distinct units, as suggested by two limestone layers in schist on east side of Red Top Mtn. and absence of these limestones in schist on north slope of mountain. Minimum thickness estimated as in excess of 1,500 feet.

Limestone
Thin- to massive-bedded, light-gray to creamy-white, medium- to coarse-grained limestone. Possibly two separate stratigraphic units included; some exposures labeled bl may be bl2. Includes two types of limestone: thinly laminated gray and white limestone and more obscurely and thicker bedded creamy-white coarsely crystalline limestone containing flakes and shreds of muscovite. Thickness not measurable; probably between 500 and 1,000 feet.

Quartzite
Gray to white, thick-bedded, medium-grained quartzite. Has a few thin interbeds of greenish-gray phyllite. Thickness unknown, but at least 800 feet exposed. May be equivalent to Gypsy quartzite of Metaline quadrangle.

Phyllite and slate
Black, thin-bedded, fine-grained phyllite and phyllitic slate. Composed mainly of fine-grained quartz, sericite, and carbonaceous matter. Unit contains a few thin layers of black fine-grained limestone and a 10-foot layer of gray limy quartzite. Closely resembles rocks mapped as Ledbetter slate in Area II. Exposed thickness about 2,000 feet.

Phyllite
Sheared and contorted dark-gray phyllite; may be a highly deformed phase of bsp.

SUBAREA C

Stratigraphic sequence not established, arrangement without significance except as stated in captions.

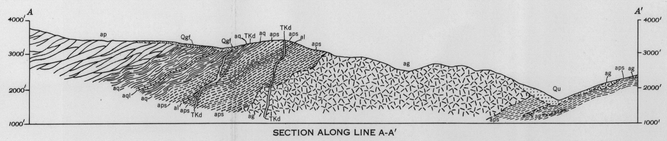
Phyllite
Dark-gray to black, fine-grained, thinly bedded siliceous, graphitic phyllite, containing sparsely scattered pyrite crystals less than 1 mm across. Bedding mostly obscured by cleavage. Lithologically similar to Ledbetter slate, O, west of Cedar Lake and to unit bsp on Red Top Mtn. Thickness and age unknown.

Phyllite and slate
Dark-gray to silver-gray carbonaceous phyllite and phyllitic slate; locally contains thin beds of medium- to light-gray fine- to medium-grained limestone and quartzite. Cleavage well developed, but bedding either obscured or poorly formed. Unit is mostly soft rock, poorly exposed, but a few weathered layers are silty and fairly well exposed. Thickness and age unknown; relative position with respect to adjacent rock units obscure.

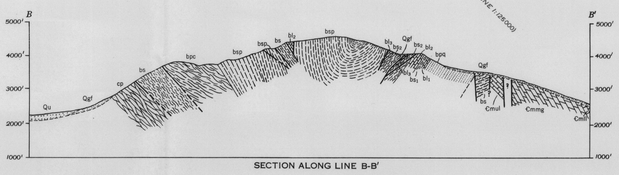
Limestone
Includes at least two distinct stratigraphic units and several thin lenses, all of unknown stratigraphic position. Exposure near Hungry Clearing is medium-grained light-gray limestone, irregularly streaked with darker gray. Exposure in northeast corner of quadrangle consists of a gray to black limestone, thin-bedded and interlayered with structurally underlying phyllite.

Phyllite, schist, and greenstone
Undifferentiated phyllite, schist, and greenstone, characterized by lack of distinct units and predominant greenish-gray color. Could be stratigraphically equivalent to as of subarea III-A.

Phyllite, argillite, and limestone
Black siliceous phyllite and argillite, interlayered with dense black limestone. Characterized by interlayering of argillite and limestone; individual layers from 1 to ½ inches thick. Not completely exposed but probably equivalent to sas of subarea III-A.



SECTION ALONG LINE A-A'



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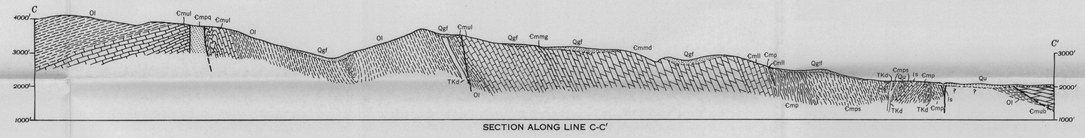

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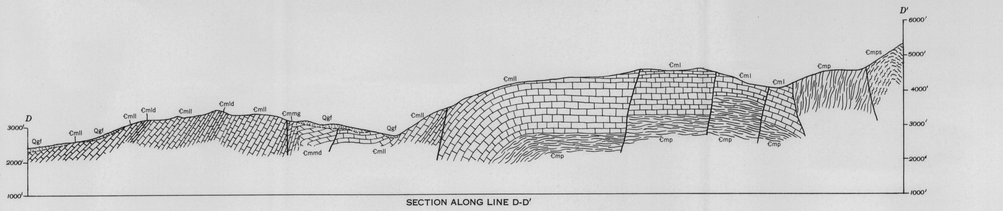

SECTION ALONG LINE D-D'

PRELIMINARY GEOLOGIC MAP OF THE LEADPOINT QUADRANGLE, STEVENS COUNTY, WASHINGTON

By
R. G. Yates and J. F. Robertson

Scale 1:24 000

1 ½ 0 1 Mile

Contour interval 40 feet
Dotted lines represent half-interval contours
Datum is mean sea level

1958

TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1957

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.— M R-1311

For sale by U. S. Geological Survey, price 50 cents