MOLYBDENUM IN ROCK SAMPLES
(spectrographic determinations)

OPEN-FILE REPORT
81-728-G
sheet 1 of 2

Base from USGS 1:250,000 topo series: Bradfield Canal, 1955, ALASKA-CANADA.

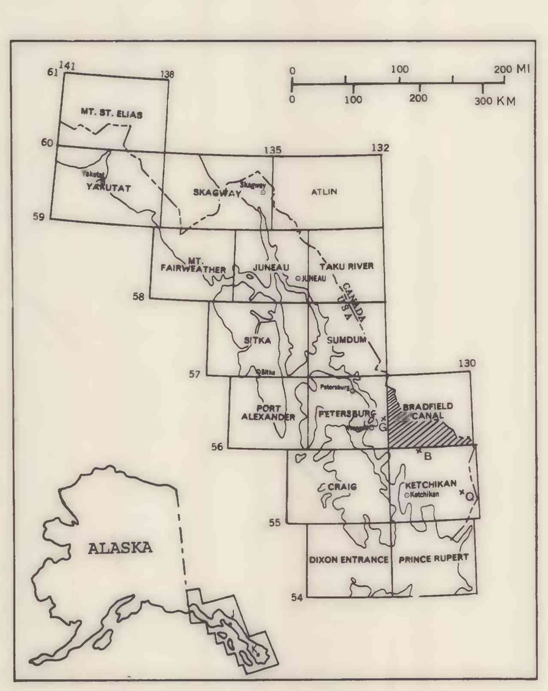
ROCK SAMPLES

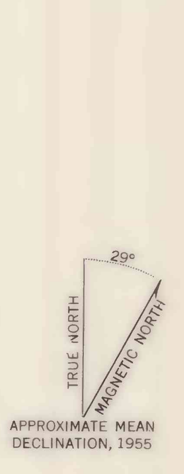
SCALE 1:250 000

5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL





APPROXIMATE MEAN DECLINATION, 1955

KEY TO LITHOLOGY GROUP SYMBOLS

A - ALKALI-FELDSPAR GRANITE - includes related dikes

B - BASALT and ANDESITE - includes dikes and flows, and lamprophyre dikes

C - CALCSILICATE and SKARN

D - DIORITE and GABBRO - includes minor metadiorite, hornblendite, and ultramafic rocks

F - FELSITE - some quartz-porphyritic. Includes dikes, flows(?), and breccias

G - GRANITIC ROCKS - mainly massive and foliated quartz monzonite, granodiorite, and quartz diorite, with lesser alaskite, aplite, and pegmatite

H - HORNBLENDE-RICH SCHIST and GNEISS - includes amphibolite, greenschist, and other mafic metamorphic rocks

M - MIGMATITE and ORTHOGNEISS - includes granitic gneiss (eg: granodiorite gneiss, quartz diorite gneiss, etc.)

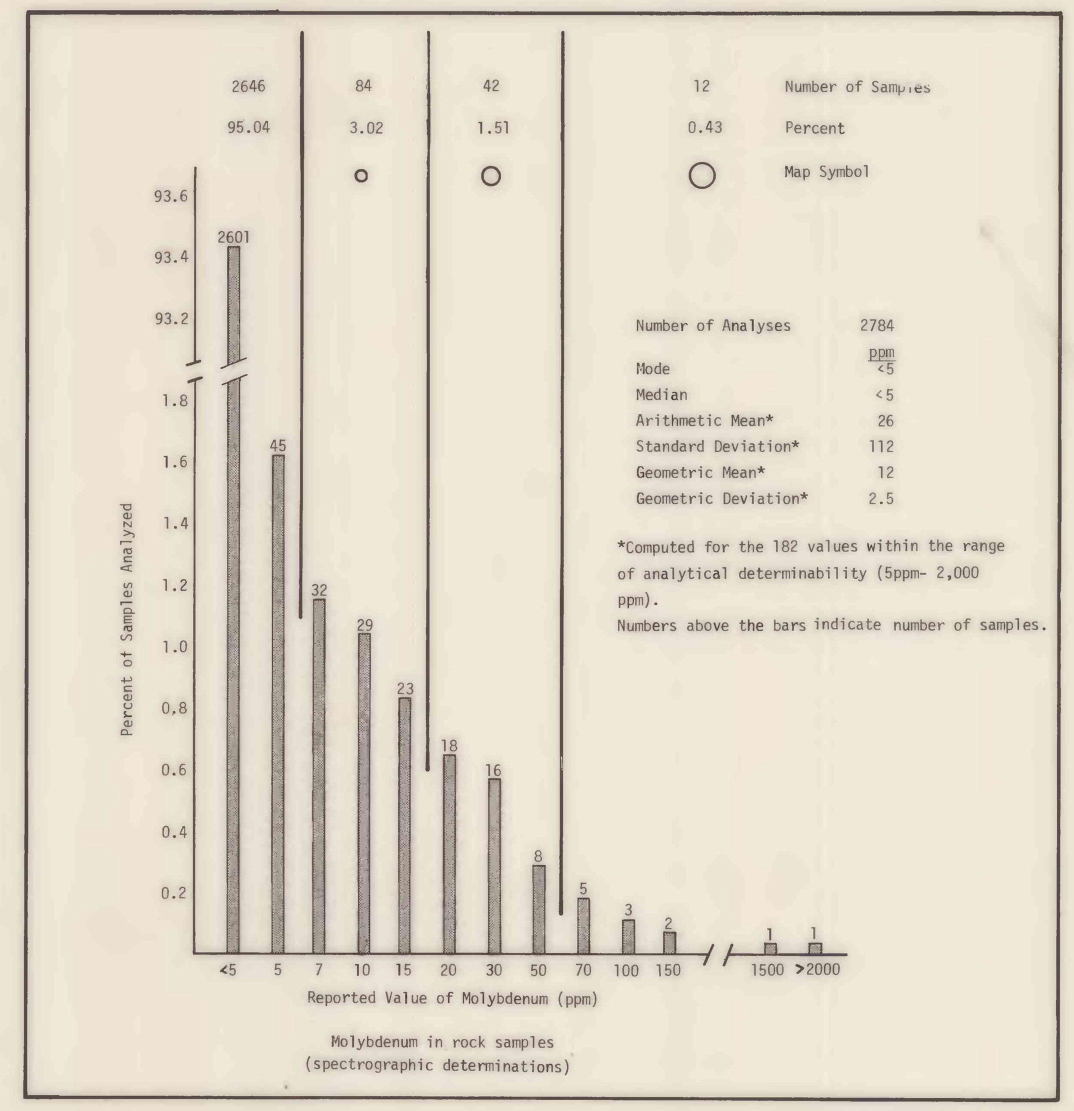
S - SCHIST and GNEISS - mainly pelitic and quartzofeldspathic schist and gneiss, and lesser non-schistose metasedimentary rocks

V - VEINS

Geology by H. C. Berg, D. A. Brew, A. L. Clark, W. H. Condon, J. E. Decker, M. F. Diggles, G. C. Dunne, R. L. Elliott, J. D. Gallinatti, M. H. Herdrick, S. M. Karl, R. D. Koch, M. L. Miller-Hoare, R. P. Morrell, J. G. Smith, and R. A. Sonnevil, 1968-1979.

Unit Descriptions

Qu	UNCONSOLIDATED DEPOSITS, UNDIVIDED (Quaternary)
QT_b	BASALT (Quaternary and Tertiary?)
Tgr	ALKALI-FELDSPAR GRANITE WITH ASSOCIATED QUARTZ-PORPHYRITIC RHYOLITE DIKES AND FLOWS(?) (Miocene?)
Tgb	BIOTITE-PYROXENE GABBRO, LOCALLY CONTAINS HORNBLENDE AND/OR OLIVINE (Miocene)
Telg	LEUCOCRATIC QUARTZ MONZONITE AND GRANODIORITE (Eocene)
Tegq	GRANODIORITE AND QUARTZ DIORITE (Eocene)
Tq	QUARTZ DIORITE (Eocene or Paleocene)
TKlg	LEUCOCRATIC QUARTZ MONZONITE AND GRANODIORITE (Tertiary and/or Cretaceous)
TKgq	GRANODIORITE AND QUARTZ DIORITE (Tertiary and/or Cretaceous)
Kgq	BIOTITE-HORNBLENDE QUARTZ DIORITE, PLAGIOCLASE-PORPHYRITIC BIOTITE GRANODIORITE/QUARTZ DIORITE, BOTH LOCALLY CONTAIN GARNET AND/OR EPIDOTE (Cretaceous)
℞t	TEXAS CREEK GRANODIORITE (Triassic)
MzPzmg	MIGMATITE AND ORTHOGNEISS, WITH LESSER PARAGNEISS (Mesozoic and/or Paleozoic)
MzPzpo	PARAGNEISS AND ORTHOGNEISS, WITH LESSER AMPHIBOLITE AND MARBLE (Mesozoic and/or Paleozoic)
MzPzsp	SCHIST AND PARAGNEISS, WITH LESSER AMPHIBOLITE AND MARBLE (Mesozoic and/or Paleozoic)
MzPzsv	METASEDIMENTARY AND LESSER METAVOLCANIC ROCKS, WITH LOCAL MARBLE (Mesozoic and/or Paleozoic)



Molybdenum in rock samples
(spectrographic determinations)

Average abundance[1/] of molybdenum (in ppm) in the Earth's crust and various crustal components. (From Levinson, 1974)

	Earth's crust	Ultramafic	Basalt	Granodiorite	Granite	Shale	Limestone	Soil
Mo	1.5	0.3	1	1	2	3	1	2

1/ Note: Because the analyses on which these averages are based may not be directly comparable to the analyses used for this report, these figures serve only as a general guide.

SELECTED REFERENCES

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Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for the semiquantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.

Hudson, Travis, Smith, J. G., and Elliott, R. L., 1979, Petrology, composition, and age of intrusive rocks associated with the Quartz Hill Molybdenite Deposit, southeastern Alaska: Canadian Journal of Earth Sciences, v 16, p. 1805-1822.

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_____, 1980b, Trace element data for stream-sediment samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 80-910B, 172 p.

_____, 1980c, Trace element data for stream-sediment heavy-mineral concentrate samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 80-910C, 68 p.

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FOLIO OF THE BRADFIELD CANAL QUADRANGLE ALASKA

KOCH AND ELLIOTT-GEOCHEMISTRY-Mo

Discussion

During U.S. Geological Survey investigations in the Bradfield Canal quadrangle between 1968 and 1979, 2784 rock geochemical samples, 1295 stream-sediment samples, and 219 stream-sediment heavy-mineral concentrate samples were collected. The samples were analyzed for up to 31 elements by a 6-step, semi-quantitative emission spectrographic method (Grimes and Marranzino, 1968) and for up to 5 elements by atomic-absorbtion techniques (Ward and others, 1969). Complete analytical data for all samples, plus location maps, station coordinates, and a discussion of sampling and analytical procedures are available in 3 reports (Koch and others, 1980a, b, c). These data are also available on magnetic computer tape (Koch, O'Leary, and Risoli, 1980).

Maps on this and the accompanying sheet show the amounts of molybdenum (Mo) detected in all geochemical samples collected in the Bradfield Canal quadrangle. All molybdenum analyses were by the 6-step spectrographic method. Average geochemical abundances vary for different lithologies and in different areas. The degree of chemical weathering also affects the elemental abundances, although probably with minor effect in this recently glaciated terrain. Variations in sampling practice and analytical variance limit the repeatability of these results. Complex interactions between these sources of variation make it impossible to select a single threshold value which will discriminate between areas which are barren and areas with potentially valuable mineral concentrations.

In order to estimate which analytical values are sufficiently above general background levels to warrant further interest, the following procedure was followed for each sample type. Histograms of the data were examined for apparent breaks (discontinuities or abrupt changes in level) in the distribution. A cutoff value was selected at an arbitrarily chosen level near the 95th percentile or at a break close to that level when one was present. The geographic distribution of the samples above the cutoff level was examined for clumping and scatter. The cutoff level was adjusted up or down to minimize apparent geographic scatter ("noise").

Samples in which the Mo Content was above the cutoff level are marked by circles; with each size of circle representing a range of values. Samples in which the Mo content was below the cutoff level are indicated on the map by dots. The range of values, and number and percentage of values associated with each map symbol are indicated on the corresponding histogram. Higher values may indicate a greater likelihood of bedrock mineralization but confidence levels are low for values near analytical limits of determinability, for single-element anomalies, and for results not supported by high values in nearby samples.

Each rock sample was assigned to one of ten broad lithologic groups of similar rock types on the basis of the rock name given to the sample at the time that it was collected. The types of rock included in each of the groups are summarized in the table labelled "Key to Lithology Group Symbols". Circles representing rock samples with Mo content above the cutoff value are labelled with the letter indicating the lithology group for that sample.

In southern southeastern Alaska, molybdenum is detectable in significant amounts at several locations in and near the Coast Plutonic Complex. The two most notable occurences in this area are stockwork molybdenum deposits in granite-quartz monzonite stocks (Hudson and others, 1979). These are located in the Ketchikan quadrangle, on the north shore of Burroughs Bay and at "Quartz Hill" between Wilson Arm and Boca de Quadra (see points labelled "B" and "Q" on index map). Associated with these stockwork deposits are swarms of felsite and quartz-porphyritic felsite dikes which often contain detectable Mo. Similar dikes outcrop in small numbers here and there throughout this region of the Coast Range. The area around Groundhog Basin ("G" on the index map), just west of the study area, contains a large swarm of felsic dikes with some associated Mo; though many of these dikes are conspicuously less porphyritic than those seen elsewhere.

The lithologies of rock samples collected in the Bradfield Canal quadrangle with detectable Mo in excess of the cutoff level of 7 ppm are summarized below.

Percent	Rock type	Maximum value (ppm)
49	Metamorphic (mainly schist, lesser gneiss)	100
17	Granitic (mainly granodiorite, lesser quartz diorite)	150, with one 1500
12	Felsite and alkali-feldspar granite	70
6.5	Vein (mainly in Hyder-Texas Creek area)	150
.5	Skarn	2000
15	Other (orthogneiss, migmatite, mafic rocks)	50

The seven highest values of Mo in rock samples (all values 70 ppm) are listed below. With the possible exception of sample 68DN039 (a site not visited during the current study) none of these sites appears likely to contain a deposit of appreciable size. These sample sites are labelled on the map with numbers 1 through 6.

Map number	Mo (ppm)	Sample	Rocks
1	2000	79SK762A	Skarn pods within amphibolite, visible molybdenite.
2	1500	79MH089B	Quartz-rich granitic aplite float, visible molybdenite.
3	150	68DN039	Vein from line of prospect pits.
4	150	79RS325Y	Diorite associated with Fe skarn deposit.
4	100	79RS325X	Diorite associated with Fe skarn deposit.
5	100	79GJ130B	Gneiss layer associated with marble, extreme Fe-stain.
6	100	72B623R	Fe-stained aplite dike.

Among the metamorphic rock samples with Mo values above the 7 ppm cutoff level, most came from unit MzPzsp with schist samples far outnumbering those of gneiss and other lithologies. Fewer samples with Mo above the cutoff level were from unit MzPzpo (schist samples more common than skarn, mafic and granitic rocks, and gneiss) and from MzPzsv (mostly schist, skarn and vein samples). There is a strong correlation between elevated Mo values and the alkali-feldspar granite and associated felsite dikes in the area around Cone Mountain.

Some stream-sediment samples with Mo contents above the cutoff value of 7 ppm are scattered within several granitic units such as Kgq where there is no other known evidence for Mo enrichment. The high values near Burroughs Bay, including one value of 70 and one of 100 ppm, have no known source. Elevated values in alkali-granite and associated felsite dikes account for the high values in stream-sediment, including one of 70 and one of 100 ppm, near Cone Mountain. The cluster along the Salmon River at the eastern edge of the quadrangle (Berg and others, 1977, Smith, 1977) is probably related to the many small sulfide-bearing veins in this heavily prospected area. Values above the cutoff level are somewhat concentrated in unit MzPzsp, possibly the result of high background levels in schist and paragneiss.

Detectable Mo occurred in a lower percentage of stream-sediment heavy-mineral concentrate samples (4 percent) than in rock or stream-sediment samples. Because of this, all heavy-mineral concentrate samples with detectable Mo are represented on the map by circles. High values in the Cone Mountain area are related to the alkali-feldspar granite and associated felsite dikes. High values in the area of unit TKgq are unsupported by rock or normal stream-sediment samples and their source is unknown.

MAPS SHOWING DISTRIBUTION AND ABUNDANCE OF MOLYBDENUM IN GEOCHEMICAL SAMPLES FROM THE BRADFIELD CANAL QUADRANGLE, SOUTHEASTERN ALASKA

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1981