Base from U.S. Geological Survey, 1956

SCALE 1:250 000

5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

Geology generalized by D. J. Grybeck and S. W. Nelson, 1980. Detailed geologic map published as part of this folio, MF-1176-A

MAP A.–MINUS-80-MESH STREAM-SEDIMENT ANOMALOUS DRAINAGE AREAS.

Base from U.S. Geological Survey, 1956

SCALE 1:250 000

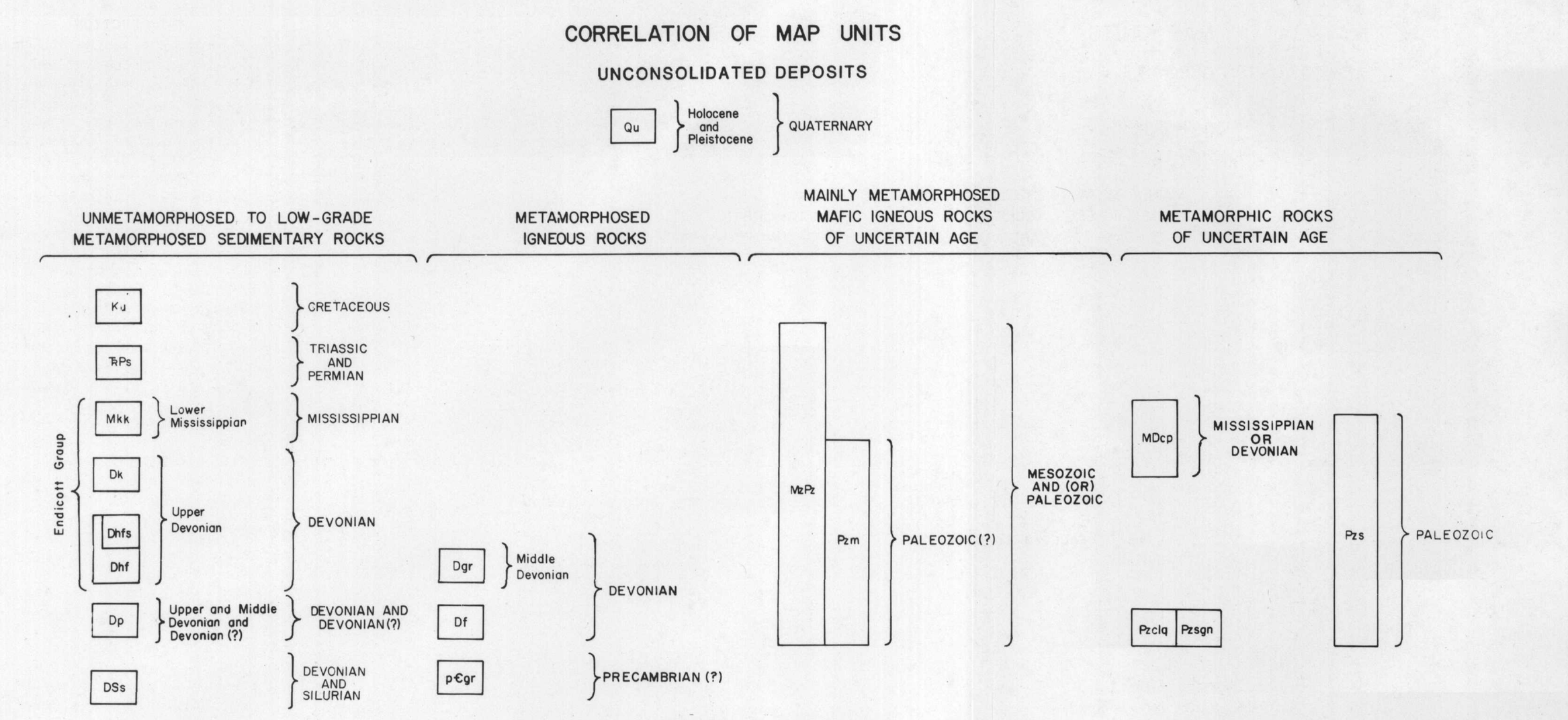
5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

Geology generalized by D. J. Grybeck and S. W. Nelson, 1980. Detailed geologic map published as part of this folio, MF-1176-A

MAP B.–NONMAGNETIC HEAVY-MINERAL-CONCENTRATE DRAINAGE AREAS.

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Unconsolidated Deposits

Qu SURFICIAL DEPOSITS, UNDIVIDED

Unmetamorphosed to Low-Grade Metamorphosed Sedimentary Rocks

Ku UNDIVIDED CONGLOMERATE--Quartz-pebble and igneous-pebble conglomerate; some interbedded volcanic sandstone

TRPs SHUBLIK AND SIKSIKPUK FORMATIONS (Triassic and Permian)--Pink-weathering limestone of Shublik Formation (Triassic) and black slate and chert of Siksikpuk Formation (Permian)

ENDICOTT GROUP (Mississippian and Devonian)--In map area includes:

Mkk KAYAK SHALE AND KEKIKTUK CONGLOMERATE (Lower Mississippian)--As mapped, unit includes related undifferentiated clastic rocks and a few outcrops of limestone in lower (?) part of Lisburne Group

Dk KANAYUT CONGLOMERATE (Upper Devonian)--Nonmarine rusty-weathering quartz sandstone, ferruginous mudstone, and black siltstone, and shale. Prominent, resistant layers of black-lichen-covered light-gray quartzite. Rare conglomerate

Dhf HUNT FORK SHALE (Upper Devonian)--Dark-gray phyllite with minor quartz mudstone and sandstone. Upper part includes:

Dhfs Wacke sandstone member--thick monotonous unit of interbedded rusty-weathering feldspathic sandstone and dark-gray mudstone and shale. Locally includes thin layers of reddish-gray fossiliferous limestone and calcareous sandstone

Dp GRAY PHYLLITE--Mainly gray, calcareous phyllite and muscovite schist; contains limestone beds up to 20 m thick. Locally consists of lenses of quartz-pebble conglomerate interbedded with orange-weathering, fossiliferous limestone, black siliceous phyllite, or micaceous schist

DSs SKAJIT LIMESTONE (Devonian and Silurian)--Massive white to light-gray granoblastic marble and orange-weathering dolomitic marble. Some interlayered chlorite schist

Metamorphosed Igneous Rocks

Dgr GNEISSIC GRANITE--Medium- to coarse-grained biotite-muscovite orthogneiss ranging in composition from granite to alkali-feldspar granite. Commonly well-developed augens; locally cataclastically deformed

Df METAFELSITE--Mainly quartz-albite-feldspar schist; locally porphyroblastic muscovite-biotite-quartz-albite-feldspar rocks that retain igneous textures

p€gr GRANITIC SCHIST--Medium-grained porphyroblastic gray biotite-quartz-feldspar schist

Mainly Metamorphosed Mafic Igneous Rocks of Uncertain Age

MzPz MAFIC VOLCANIC ROCKS, PHYLLITE, SANDSTONE, AND CHERT--Consists mainly of interbeds and fault slivers of Devonian(?) to Jurassic pillow basalt, greenstone, and diabase, gray phyllite, wacke sandstone, minor Triassic radiolarian chert, Mississippian radiolarian chert, and thin beds of Paleozoic limestone. Weakly metamorphosed to unmetamorphosed

Pzm MAFIC VOLCANIC AND INTRUSIVE ROCKS--Basalt, greenstone, and altered gabbro. Unmetamorphosed to slightly metamorphosed

Metamorphic Rocks of Uncertain Age

MDcp CALCAREOUS PHYLLITE--Black calcareous phyllite with thin dark-gray limestone lenses

Pzs LOW-GRADE SCHIST--Chlorotoid-bearing quartz-muscovite schist, calcareous quartz-albite-muscovite schist, quartzite, and rare thin limestone beds. Schist locally contains glaucophane

Pzclq CHLORITIC QUARTZITE--Chlorite quartzite and chloritic quartz schist

Pzsgn LOW- TO MEDIUM-GRADE SCHIST AND GNEISS--Interlayered quartz-muscovite schists and orange-weathering marble. Medium-grade schist and paragneiss with garnet, biotite, and amphibole near plutons

GEOLOGIC SYMBOLS

Contact--Dashed where approximately located; dotted where concealed

Fault--Dashed where approximately located or inferred; dotted where concealed; queried where uncertain

Thrust fault--Dashed where approximately located or inferred; dotted where concealed; queried where uncertain. Sawteeth on upper plate

Cu, Pb, Zn / W, Sn, Sb — Anomalous drainage area--chemical symbol defines anomalous element or elements found within drainage area

Approximate southern boundary of the area from which heavy-mineral concentrates from stream-sediment samples were collected

INTRODUCTION

These two maps summarize the analytical results for copper, zinc, lead, barium, silver, tungsten, bismuth, antimony, arsenic, molybdenum, thorium, lanthanum, beryllium, boron, and tin found in 1,505 minus-80-mesh (-177 micrometers) stream-sediment samples and in the nonmagnetic fraction of 623 heavy-mineral (specific gravity >2.86) panned concentrates from stream-sediment samples collected in the Survey Pass quadrangle, Alaska, during the summers of 1977 and 1978. The work is part of the Survey Pass Alaska Mineral Resource Assessment Program (AMRAP). These maps are part of the series of maps called MF-1176, which collectively assess the mineral resources of the Survey Pass quadrangle. It should be emphasized that the stream-sediment survey made in the Survey Pass quadrangle was of a reconnaissance nature and is neither detailed nor exhaustive, particularly in respect to searching for mineralized rock.

The purpose of this reconnaissance geochemical investigation is:

(1) To furnish background trace-element data for the interpretation of analytical data from stream-sediment and related samples that may be collected in the future.
(2) To identify areas likely to have mineral-resource potential.
(3) To aid in the interpretation of the metallogeny of the quadrangle and of the Brooks Range.
(4) To establish geochemical associations of the known mineral occurrences and to suggest the possibilities for undiscovered types of mineral occurrences.

The elements plotted on these maps were judged to be the most informative and relevant to a regional mineral-resource appraisal of the Survey Pass quadrangle, and they adequately reflect the economic potential of the area within the limits of this reconnaissance evaluation.

A discussion on the techniques of sampling, sample preparation, analytical and statistical methods, analytical results, and sample locations used in the report is included in Cathrall, Cooley, O'Leary, Billings, and McDanal (1979), and Cathrall, Cooley, McDanal, and Billings (1979).

ANOMALOUS COMPOSITE DRAINAGE AREAS

Geochemical maps and data from Open-File Report 79-837 A-U series (Cathrall and others, 1979) were used to produce these composite maps of anomalous drainage areas. From each of the open-file series geochemical maps, the sample sites having an anomalous value were selected, and drainage basins contributing materials to these sample sites were outlined. A generalized outline was drawn to encompass the outer extremities of those anomalous drainage basins that overlap, join, or are close to one another. These outlined areas are referred to as composite anomalous drainage areas. Many of the composite areas were then partitioned and labeled to indicate which part of the overall area contained single or multielement anomalies.

THRESHOLD

The threshold values for the elements shown on these maps were selected by inspecting histograms shown in the Open-File Report 79-837 A-U series (Cathrall and others, 1979) and comparing these values with the median value and threshold values for the various geochemical rock units within the project area, as determined by Grybeck and others (1980). Table 1 lists threshold values and a summary of statistical data for the elements discussed in this report.

ANOMALOUS AREAS

Schist Belt

The minus-80-mesh stream-sediment anomalies from this study suggest that the known zone of copper- and zinc-bearing stratiform volcanogenic sulfide occurrences in the Ambler River quadrangle to the west (Grybeck and Nokleberg, 1978) extends eastward into the Survey Pass quadrangle. This volcanogenic sulfide mineralization has been found in the schist belt along the southern flank of the Brooks Range.

The schist belt, often referred to as the "copper belt," is composed primarily of low-grade metamorphic Devonian (possibly Precambrian?) schist containing outcrops of Devonian metafelsitic schist (Df) and Paleozoic mafic metavolcanic rocks (Pzm). West of Reed River, the Devonian metafelsitic schist (Df) and Paleozoic mafic metavolcanic (Pzm) rocks are more prevalent than they are east of Reed River. Geologic field mapping in the schist belt east of Reed River failed to find outcrops of the metafelsitic schist (Df) rocks.

The schist belt may be divided into three potential target areas for exploration for volcanogenic massive sulfide deposits. The criterion used to define this division is primarily the close spatial association of anomalous chalcophile base-metal stream-sediment anomalies with metafelsitic schist (Df), [illegible]

West of Reed River, to the western edge of the Survey Pass quadrangle, the so-called "copper belt" is defined very well by anomalous drainage areas containing anomalous copper, zinc, lead, silver, barium, antimony, molybdenum, tungsten, bismuth, and boron (Map A). Locally, however, the stream sediments are not anomalous at every sample site even where close to mineralized rock. The anomalous drainage areas correlate well with areas of mineral occurrences and areas of pervasive mineralization, and with the approximate location of lode claims described by Grybeck and Nelson (1980). All of these areas are primarily in metafelsitic schist (Df), which is associated with mafic metavolcanics (Pzm). The aeromagnetic data (Cady and Hackett, 1980) for this section of the schist belt show that all of the above-mentioned areas have a characteristic magnetic signature. The axes of aeromagnetic highs wrap around these areas, which in turn lie within aeromagnetic lows where magnetic anomalies approximately greater than -20 gammas are absent.

The anomalies close to a small gneissic granite pluton (Dgr) (T. 20 N., and R. 16 E.) may indicate polymetallic contact-metamorphic mineralization.

East of Reed River, a similar interrelationship of the geochemical, geological, and geophysical criteria used to target potential volcanogenic sulfide deposits west of Reed River occurs in an area just west of Walker Lake (T. 20 N., R. 20 E.). However, the metafelsitic schist (Df), which is often associated with mafic metavolcanic rocks (Pzm) west of Reed River, is not found in this segment of the copper belt.

Potential target areas for volcanogenic massive sulfide deposits found west of Walker Lake appear to be absent east of Walker Lake. However, the area of the first and second valleys east of Walker Lake shows some of the criteria used to define the volcanogenic massive sulfide potential target areas found to the west. The drainage areas contain anomalous concentrations of copper, zinc, lead, silver, antimony, and boron. Grybeck and others (1980) reported finding rock containing minerals having anomalous concentrations of copper, lead, silver, barium, and molybdenum. Although the suggestive volcanogenic massive sulfide host rock, metafelsitic schist (Df), does not crop out in this area, the mafic metavolcanic rocks (Pzm) often associated with it do. The metafelsitic schist may be concealed by the mapped east-west thrust fault. The axes of aeromagnetic highs appear to wrap around the anomalous drainage areas, areas of mineral occurrences, and the mafic metavolcanics (Pzm). Thus, these areas lie within aeromagnetic lows, as do the potential target areas to the west.

Anomalous values for cobalt, nickel, and chromium in stream sediments correlate well with other anomalous element values that occur in the copper belt (Cathrall, O'Leary, Billings and McDanal, 1979; Cathrall, Cooley, McDanal, and Billings, 1979).

Gneissic Granites

Approximately 900 km^2 of metamorphosed staniferous and beryllium-rich (Cathrall and others, 1979p, q, r, and s) gneissic granite (Dgr) is exposed in the Mount Igikpak and Arrigetch Peaks pluton and their satellitic stocks. The gneissic granite (Dgr) rocks give potassium-argon dates on biotite and muscovite of 86-92 m.y. and whole-rock rubidium-strontium ages of 373 $\pm$ 25 m.y. (Silberman and others, 1979). The contact of the plutonic rock with the surrounding country rock is complex, and in many areas the contact zone is an intricate mixture of metasedimentary and metaigneous rocks. Grybeck and Nelson (1980) reported that the attitudes of the contact indicate that the plutons are northward-dipping, slablike bodies, especially along their northern sides, and thus may extend beneath the Paleozoic rocks to the north.

The staniferous and beryllium-rich gneissic granite (Dgr) is mineralized, especially along its periphery. The mineralization within the plutons and around the peripheries of the plutons is indicated by the numerous minor occurrences of ore minerals described by Grybeck and others (1980) and the anomalous drainage areas shown on the accompanying maps. Geologic field mapping and stream traverses to further study some of the stream-sediment anomalies show that the mineralization at the periphery of the gneissic granite (Dgr) appears to be mainly as vein, skarn, and polymetallic contact-metamorphic occurrences. Various combinations of elements present in anomalous amounts, such as copper, lead, zinc, tungsten, molybdenum, bismuth, cadmium, silver, and tin found in stream sediments, heavy-mineral concentrates from stream sediments, and rocks help confirm these types of occurrences. The association of the molybdenum suite of tin, tungsten, and molybdenum with the gneissic granite (Dgr) plutons [illegible]

The distribution and apparent limit of geochemically anomalous drainage basins at the periphery of the main Arrigetch Peaks and Mount Igikpak plutons suggests that other favorable environments for mineralization may exist. These favorable environments may exist in the roof zones of country rock above the subsurface merging lobes of the Arrigetch Peaks and Mount Igikpak plutons, or where their nonmerging lobes are concealed, or where similar plutons are not exposed, or in all of these places. One area in particular is in Twelvemile and Lucky Six Creek drainage areas north of the Mount Igikpak pluton. Stream-sediment drainage anomalies (Map A), heavy-mineral-concentrate drainage anomalies (Map B), and mineral occurrences (Grybeck and others, 1980) indicate anomalous values for copper, lead, zinc, tungsten, bismuth, cadmium, silver, and tin in this area. The drainage anomalies from the nonmagnetic fraction of heavy-mineral concentrates suggest that areas similar to Twelvemile and Lucky Six Creek may exist north of the northeast lobe of the Mount Igikpak pluton and west and east of Arrigetch Creek north of Arrigetch Peak pluton. A stream-sediment anomalous drainage area in the Iyahuna Creek drainage, east of the Mount Igikpak pluton, suggests a subdued, yet similar, area.

Several anomalous areas occur along the west-central edge of the quadrangle. These anomalies may be related to the effects of the Shishakinovik pluton, in the Ambler River quadrangle, or to the effects of possible buried intrusives delineated by LANDSAT images (LeCompte, 1980) aeromagnetic highs (Cady and Hackett, 1980), or both.

Rocks in the Northern Third of the Quadrangle

LANDSAT imagery stream-sediment geochemical data, periphyton (assemblage of algae, fungi, and bacteria that are attached to or live on submerged objects in streams and lakes) data, and mineral occurrences delineate two potential areas for the occurrence of mineral deposits in the northern third of the quadrangle. Possible sources for the mineralization, suggested by LANDSAT data (LeCompte, 1980), are concealed intrusives. However, geologic mapping and geophysical data can neither verify nor negate the presence of these intrusives. An alternate hypothesis is that the allochthonous rock units in the area were mineralized over plutons to the south.

The potential target areas, which contain anomalous amounts of tin, tungsten, molybdenum, bismuth, silver, copper, lead, zinc, barium, lanthanum, thorium, and beryllium, are: (1) in and adjacent to the Coalit Creek drainage south of Plateau Mountain (T. 28 N., R. 24 E.); and (2) in and adjacent to the drainages encompassing the westernmost loop of the Continental Divide in the northwestern part of the quadrangle. The two areas occur in unmetamorphosed to low-grade metamorphosed sedimentary rock units (Mkk, Dk, Dhfs and Dhf of the Endicott Group, and calcareous phyllite, Dp).

LANDSAT imagery analyzed by LeCompte (1980) show a prominent circular feature in each of these areas. These circular features suggest the presence of concealed intrusives. Iron oxide color anomalies that appear on the analyzed LANDSAT imagery occur within and adjacent to these circular features. These iron oxide features appear much like those in other areas in Alaska, many of which have proved to be sites of hydrothermal alteration and mineralization (LeCompte, 1980).

Some parts of streams, as seen from the air, in the LANDSAT circular feature of Coalit Creek appear to be red. Ground examination revealed that the color was due to pigmentation associated with the profuse growth of periphyton. Periphyton collected and analyzed from one of the streams contained high concentrations of silver, copper, cadmium, arsenic, nickel, and zinc. It appears that the periphyton has utilized these elements, supplied to the streams, as micronutrients. As a result profuse growth and pigmentation of periphyton occurs within a section of the stream. Downstream, where there is no additional source of these micronutrients, the profuse growth diminishes.

The association of anomalous element values, especially tin, tungsten, molybdenum, thorium, and lanthanum, found in stream-sediment samples, suggests that mineralization in these areas was from a differentiated felsic source. Stream-creek traverses, which were made in the western area to study further some of the stream-sediment anomalies, located mineralized-quartz brecciated float and outcrops containing sphalerite, galena, and chalcopyrite.

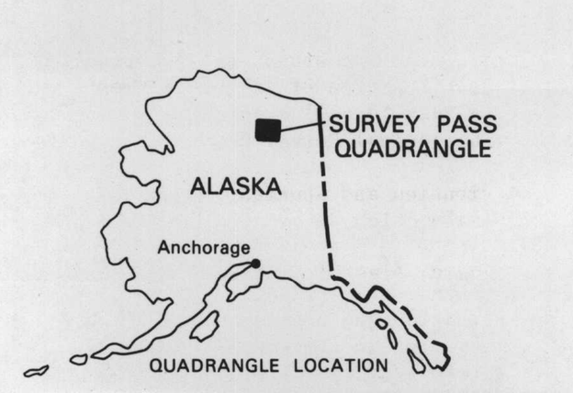
Table 1.--Threshold values and statistical summary of the analytical results for stream-sediments, heavy-mineral concentrates, and rock samples, Survey Pass quadrangle.

[Values are reported in parts per million. Leaders (--), no data or insufficient data. L, detected, but below value listed. Analysts: E. F. Cooley and R. M. O'Leary]

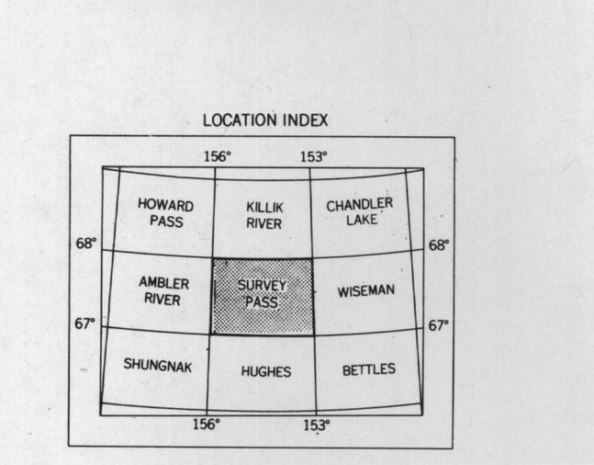
Element	Sample media	Threshold value	Number of values	Range of values		Geometric mean	Geometric deviation	Arithmetic mean	Standard deviation	Percentile distribution 25th	50th	75th	90th	95th	98th
Copper----	Stream-sediment.	150	1,492	<5-	1,500	35	2.2	58	395	22	39	52	86	109	150
	Concentrate----	700	623	<10-	10,000	104	2.8	212	564	45	102	203	400	613	1,117
	Rock-----------	200	1,434	<5-	20,000	32	3.3	145	990	--	--	--	106	170	350
Lead------	Stream-sediment.	70	1,470	<10-	500	27	1.7	33	29	20	24	38	52	72	107
	Concentrate----	300	621	<20-	7,000	66	2.4	120	322	38	51	100	201	506	665
	Rock-----------	150	1,386	<20-	20,000	28	2.5	103	798	--	--	--	72	115	243
Zinc------	Stream-sediment.	300	1,497	5-	1,500	81	1.7	96	75	57	84	111	154	196	302
	Concentrate----	500	171	<500-	5,000	729	1.8	962	1,039	--	--	--	--	--	850
	Rock-----------	200	1,552	<5-	130,000	45	3.4	506	5,223	--	--	--	118	170	449
Barium----	Stream-sediment.	1,500	1,477	20-	>5,000	513	1.9	613	444	394	491	753	1,063	1,180	1,785
	Concentrate----	3,000	601	<50-	<5,000	674	2.1	907	874	435	682	1,092	2,045	4,452	--
	Rock-----------	3,000	1,514	<20-	<5,000	364	2.9	612	737	--	--	--	1,393	2,123	3,647
Silver----	Stream-sediment.	.5L	33	<0.5-	10	1.3	2.4	1.9	2.2	--	--	--	--	--	--
	Concentrate----	1 L	39	<1-	20	3.2	2	4.3	3.8	--	--	--	--	--	3.7
	Rock-----------	.5	79	<0.5-	500	6.5	5.2	31	75	-	--	--	--	--	4.6
Tungsten--	Stream-sediment.	50	8	50-	100	64	1.4	69	26	--	--	--	--	--	--
	Concentrate----	<50	36	<50-	2,000	189	2.3	302	448	--	--	--	--	--	--
	Rock-----------	100	25	<50-	1,000	216	2	281	263	--	--	--	--	--	--
Bismuth---	Stream-sediment.	<50	5	<50-	50	--	--	50	--	--	--	--	--	--	--
	Concentrate----	<20	9	<20-	500	8.4	3	145	180	--	--	--	--	--	--
	Rock-----------	10	49	<10-	1,000	76	3.6	178	261	--	--	--	--	--	26
Antimony--	Stream-sediment.	100	103	100-	200	103	1.2	105	22	--	--	--	--	--	--
	Concentrate----	--	0	--	--	--	--	--	--	--	--	--	--	--	--
	Rock-----------	200	15	<100-	7,000	192	3.2	684	1,899	--	--	--	--	--	--
Arsenic---	Stream-sediment.	--	0	--	--	--	--	--	--	--	--	--	--	--	--
	Concentrate----	<500	9	<500-	1,500	773	1.4	825	333	--	--	--	--	--	--
	Rock-----------	200	10	<100-	<7,000	1,267	4.3	2,714	2,852	--	--	--	--	--	--

Table 1.--Threshold values and statistical summary of the analytical results for stream-sediments, heavy-mineral concentrates, and rock samples, Survey Pass quadrangle.--Continued

Element	Sample media	Threshold value	Number of values	Range of values		Geometric mean	Geometric deviation	Arithmetic mean	Standard deviation	Percentile distribution 25th	50th	75th	90th	95th	98th
Molybdenum	Stream-sediment.	15	715	<5-	70	7.8	1.6	9.5	8.2	--	--	--	10	12	23
	Concentrate----	10L	26	<10-	100	16	1.9	22	24	--	--	--	--	--	--
	Rock-----------	50	98	<5-	700	30	2.5	50	80	--	--	--	--	10.3	43
Tin-------	Stream-sediment.	10	222	<10-	200	28	1.9	34	23	--	--	--	20	41	51
	Concentrate----	50	89	<20-	1,000	76	2.7	138	188	--	--	--	39	82	234
	Rock-----------	20	96	<10-	1,000	67	4.1	198	314	--	--	--	--	14	126
Beryllium-	Stream-sediment.	--	1,358	<1-	200	1.5	1.6	1.7	1.3	--	--	2	2.5	3.9	5.1
	Concentrate----	5	621	<2-	200	2.3	1.5	3.3	109	1.7	2.1	2.4	3.5	4.6	5.5
	Rock-----------	100	1,404	<1-	1,000	1.9	2.3	7	55	--	--	--	3.2	4.9	12.6
Thorium---	Stream-sediment.	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Concentrate----	200L	17	<200-	1,000	304	1.8	371	298	--	--	--	--	--	--
	Rock-----------	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lanthanum-	Stream-sediment.	--	733	<20-	700	61	1.5	69	54	43	51	70	109	147	211
	Concentrate----	>1,000	623	<50-	>1,000	170	2.1	240	243	99	174	288	754	1,125	--
	Rock-----------	--	1,578	<20-	200	30	2.5	54	15	--	--	--	--	10.3	43
Boron-----	Stream-sediment.	300	1,387	<10-	2,000	64	2.2	87	90	28	53	94	197	247	326
	Concentrate----	--	623	<20-	500	104	1.9	131	98	60	94	195	271	345	--
	Rock-----------	--	1,497	<10-	2,000	44	3	85	133	--	--	--	210	274	410
Cobalt----	Stream-sediment.	100	1,479	<5-	300	32	1.9	39	27	20	38	49	61	86	111
	Concentrate----	--	623	>10-	150	22	1.7	27	20	14	20	30	51	67	94
	Rock-----------	--	1,406	<5-	700	28	2.1	38	40	--	--	--	57	88	112
Nickel----	Stream-sediment.	200	1,489	<5-	1,000	42	2.3	58	55	22	45	83	114	140	173
	Concentrate----	--	623	<10-	200	39	2	51	37	23	37	58	104	118	157
	Rock-----------	--	1,493	<5-	300	40	2.3	55	43	--	--	--	102	123	165
Chromium--	Stream-sediment.	300	1,473	<10-	500	10.3	2	126	73	82	109	186	234	253	316
	Concentrate----	--	623	<20-	700	165	1.8	200	138	109	163	239	402	501	--
	Rock-----------	--	1,334	<10-	2,000	104	2.3	145	147	--	--	--	234	295	442



QUADRANGLE LOCATION



REFERENCES

Cady, J. W., and Hackett, S. W., 1981, Aeromagnetic map and interpretation of the Survey Pass quadrangle, Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1176-G, in press.

Cathrall, J. B., Billings, T. M., and Cooley, E. F., 1979a, Distribution and abundance of copper in the minus-80-mesh fraction of stream-sediment samples for the Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-C.

______1979b, Distribution and abundance of copper in the nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-D.

______1979c, Distribution and abundance of lead in the minus-80-mesh fraction of stream-sediment samples, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-E.

______1979d, Distribution and abundance of lead in the nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-F.

______1979e, Distribution and abundance of zinc (determined by spectrographic analysis) in the minus-80-mesh fraction of stream sediment samples, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-H.

______1979f, Distribution and abundance of zinc in the nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-I.

______1979g, Distribution and abundance of barium in the minus-80-mesh fraction of stream-sediment samples, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-J.

______1979h, Distribution and abundance of barium in the nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-K.

______1979i, Distribution and abundance of silver, bismuth, and tungsten in the minus-80-mesh fraction of stream-sediment samples, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-L.

______1979j, Distribution and abundance of silver, arsenic, bismuth, tungsten, and thorium in the nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-M.

______1979k, Distribution and abundance of molybdenum in the minus-80-mesh fraction of stream-sediment samples, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-N.

______1979l, Distribution and abundance of molybdenum in the nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-O.

______1979m, Distribution and abundance of tin in the minus-80-mesh fraction of stream-sediment samples, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-P.

______1979n, Distribution and abundance of beryllium in the minus-80-mesh fraction of stream-sediment samples, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-R.

______1979o, Distribution and abundance of beryllium in the nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-873-S.

______1979p, Distribution and abundance of antimony in the minus-80-mesh fraction of stream-sediment samples, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-T.

______1979q, Distribution and abundance of lanthanum in the nonmagnetic fraction of heavy-mineral concentrates from stream sediments, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-873-U.

Cathrall, J. B., Billings, T. M., and O'Leary, R. M., 1979, Distribution and abundance of zinc (determined by atomic-absorption analysis) in the minus-80-mesh fraction of stream-sediment samples, Survey Pass 1° x 3° quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-G.

Cathrall, J. B., Cooley, E. F., McDanal, S. K., and Billings, T. M., 1979, A listing and statistical summary of spectrographic analysis of heavy-mineral concentrates from stream-sediment samples for the Survey Pass quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-B, 52 p., 1 pl., 3 tables.

Cathrall, J. B., Cooley, E. F., O'Leary, R. M., Billings, T. M., and McDanal, S. K., 1979, A listing and statistical summary of spectrographic and chemical analysis of stream-sediment samples from the Survey Pass quadrangle, Alaska: U.S. Geological Survey Open-File Report 79-837-A, 54 p., 1 pl., 3 tables.

Grybeck, Donald, McDanal, S. K., Cooley, E. F., and O'Leary, R. M., 1980, Map showing anomalous elements in rock samples, Survey Pass quadrangle, Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1176-E, in press.

Grybeck, Donald, and Nelson, S. W., 1980, Mineral deposits map of the Survey Pass quadrangle, Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1176-F, in press.

Grybeck, Donald, and Nokleberg, W. J., 1978, Metallogeny of the Brooks Range, Alaska, in Johnson, K. M., and William, J. R., eds., The United States Geological Survey in Alaska--accomplishments during 1978: U.S. Geological Survey Circular 804-B, p. B18-B19.

Lecompte, J. R., 1980, Map showing interpretation of Landsat imagery of the Survey Pass quadrangle, Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1176-H, in press.

Silberman, M. L., Brookins, D. G., Nelson, S. W., and Grybeck, Donald, 1979, Rubidium-strontium and potassium-argon dating of emplacement and metamorphism of the Arrigetch Peaks and Mount Igikpak plutons, Survey Pass quadrangle, Alaska, in Johnson, K. M., and Williams, J. R., eds., The United States Geological Survey in Alaska--Accomplishments during 1978: U.S. Geological Survey Circular 804-B, p. B18-B19.

MAPS SHOWING ANOMALOUS DRAINAGE AREAS OF SELECTED ELEMENTS IN THE SURVEY PASS QUADRANGLE, BROOKS RANGE, ALASKA

By
J. B. Cathrall, T. M. Billings, E. F. Cooley, and R. M. O'Leary

1981

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1981

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225