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UNITED STATES GEOLOGICAL SURVEY

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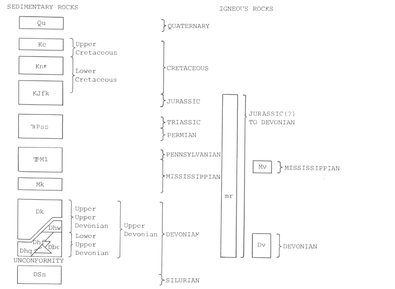
MISCELLANEOUS FIELD STUDIES
FOLIO OF THE PHILIP SMITH MOUNTAINS QUADRANGLE, ALASKA
MAP MF-879G
GEOCHEMICAL MAP, Cu

COPPER IN THE MINUS-80 MESH STREAM-SEDIMENT FRACTION AND ROCK

Base from U.S. Geological Survey, 1971

Geology generalized in 1977 by
W. P. Brosge, H. N. Reiser, J. T.
Dutro Jr., and R. L. Detterman

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SEDIMENTARY ROCKS

Qu SURFICIAL DEPOSITS, UNDIVIDED (QUATERNARY)

Kc COLVILLE GROUP (UPPER CRETACEOUS)--Tuff; tuffaceous clastic rocks

Knt NANUSHUK GROUP (UPPER AND LOWER CRETACEOUS) AND TOROK FORMATION (LOWER CRETACEOUS)--Nonmarine and marine; sandstone, shale, siltstone and conglomerate

KJfk FORTRESS MOUNTAIN, OKPIKRUAK AND KONGAKUT FORMATIONS (LOWER CRETACEOUS) AND KINGAK SHALE (JURASSIC)--Graywacke, dark-gray, partly manganiferous shale and siltstone, conglomerate

TRPss SHUBLIK FORMATION (TRIASSIC) AND SADLEROCHIT GROUP (TRIASSIC AND PERMIAN)--Phosphatic shale and limestone, partly calcareous siltstone and shale, sandstone, barite concretions

TPMl LISBURNE GROUP (PENNSYLVANIAN AND MISSISSIPPIAN)--Limestone and dolomite

Mk KAYAK SHALE (MISSISSIPPIAN)--Black shale, limestone, sandstone

Dk NANAVUT CONGLOMERATE (UPPER DEVONIAN)--Nonmarine quartzite, ferruginous conglomerate, red shale. Basal marine sandstone

Dhw HUNT FORK SHALE (UPPER DEVONIAN)
Wacke member--Manganiferous shale and siltstone, ferruginous subgraywacke

Dhf Shale--Dark-gray shale and slate; quartzite, limestone. Thin mafic flow and sills

Dhq Quartzite member

Dbc CALCAREOUS SANDSTONE MEMBER OF HUNT FORK SHALE AND UNNAMED BROWN CALCAREOUS CLASTIC ROCKS (UPPER DEVONIAN)--Includes some reef limestone and red and green shale

DSs SKALIT LIMESTONE (DEVONIAN AND SILURIAN)--Limestone, dolomite, marble. Few small mafic dikes

IGNEOUS ROCKS

Mv VOLCANIC ROCKS (MISSISSIPPIAN)--Diorite sill

Dv VOLCANIC ROCKS (DEVONIAN)--Pillow basalt flow

mr MAFIC ROCKS--Gabbro, diorite, and greenstone

GEOLOGIC CONTACT--Approximately located

FAULT--Dashed where approximately located

THRUST FAULT--Saw teeth on upper plate. Dotted where concealed

GEOCHEMICAL SYMBOLS

A COPPER VALUE DETERMINED AT SAMPLE SITE--Letters are defined on histograms (figs. 1 and 2)

4 ANOMALOUS COPPER VALUE--Number corresponds to the analytical results shown in table 1 and 3

1 ROCK SAMPLE SITE--Numbers correspond to the analytical results shown in table 2

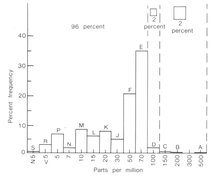


Figure 1.--Histogram for copper in 759 stream-sediment samples, Philip Smith Mountains quadrangle, Alaska, showing symbols, percentage of total samples, and letters corresponding to concentrations in parts per million. Statistics are based on all unqualified values within the sample population.

N, not detected at value shown; arithmetic mean, 44; standard deviation, 32; geometric mean, 33; and geometric deviation, 2.5.

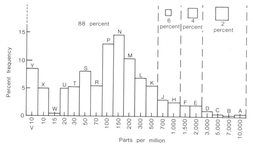


Figure 2.--Histogram for copper in 737 nonmagnetic heavy-mineral concentrates from stream-sediment samples, Philip Smith Mountains quadrangle, Alaska, showing symbol, percentage of total samples, and letters corresponding to concentrations in parts per million. Statistics are based on all unqualified values within the sample population.

Arithmetic mean, 366; standard deviation, 914; geometric mean, 130; and geometric deviation, 3.9.

COPPER IN THE NONMAGNETIC HEAVY-MINERAL CONCENTRATE FROM STREAM SEDIMENTS

Base from U.S. Geological Survey, 1971

Geology generalized in 1977 by
W. P. Brosge, H. N. Reiser, J. T.
Dutro Jr., and R. L. Detterman

Table 1.--*Lead, zinc, and silver associated with anomalous copper values in stream-sediment samples, Philip Smith Mountains quadrangle, Alaska*

[Values reported in parts per million (ppm). N, not detected; L, detected but below value shown; and *, anomalous value for Pb, Zn, or Ag. Lower limit of anomalous concentrations as follows in ppm: Cu, 100; Pb, 70; Zn (emission spectroscopy), 500; Zn (atomic absorption), 160; and Ag, 0.5. Analysts: E. F. Cooley and R. M. O'Leary]

Map No.	Field No.	Emission spectroscopy Cu	Pb	Zn	Ag	Atomic absorption Zn
1	76AP961	200	10	200N	0.5N	95
2	P8012	100	50	500*	0.5N	170*
3	P8059	100	50	500*	0.5N	180*
4	P8074	100	50	1,000*	2.0*	370*
5	P8091	100	30	200L	0.5N	85
6	P8134	100	70*	500*	0.5N	150
7	P8142	100	100*	500*	2.0*	220*
8	P8160	100	70*	500*	1.0*	230*
9	P8182	100	50	200	0.5N	120
10	P8190	500	70*	200L	0.5N	130
11	P8229	100	50	200	0.5N	120
12	P8266	100	30	200L	0.5N	110
13	P8324	100	70*	200	0.5N	120
14	P8326	100	50	200	0.5N	130
15	P8332	100	50	1,000*	0.5N	20
16	P8340	100	50	200	0.5N	130
17	P8341	100	70*	200	0.5N	140
18	P8385	150	30	200L	0.5N	100
19	P8398	150	30	200L	0.5N	100
20	P8415	100	50	200	0.5N	140
21	P8440	100	50	200L	0.5N	110
22	P8446	100	50	500*	0.5L*	250*
23	P8589	100	30	300	1.5*	240*
24	P8701	100	70*	1,000*	1.0*	530*
25	P8704	100	70*	1,500*	1.0*	790*
26	74AR895	100	30	200N	0.5N	150

TABLE 2.--*Copper, lead, zinc, silver, cadmium, molybdenum, and barium in total rock samples, Philip Smith Mountains quadrangle, Alaska*

[Values reported in parts per million (ppm). N, not detected at value shown; L, greater than value shown; N, not analyzed; L, detected but below value shown; *, small unmapped mafic rocks in unnamed brown calcareous clastic rocks and calcareous sandstone member of Hunt Fork Shale (Dbc); and **, unmapped sliver of Skalit Limestone (DSs) in Dbc. More than one rock sample was collected at sites 2, 7, 8, 9, 11, 24, 28, 33, 36, 38, 39, 45, 46, 47, 51, 52, 53, 55, 56, 57, 58, 59, 63 and 64. Analysts: E. F. Cooley and R. M. O'Leary]

Stratigraphic unit symbol of generalized map	Map No.	Field No.	Emission spectroscopy Cu	Pb	Zn	Ag	Cd	Mo	Ba	Sr	Atomic absorption Zn
Qu	1	T5B0112A	20	20	200	0.5N	20N	150	5N	0N	0L
Qbs	2	T5B0113A	70	700	1,000	1.0	20N	1,500	5N	0N	0L
	2	T5B0113B	7	100	200N	0.5N	20N	200	5N	0N	0L
	2	T5B0113C	20	100	1,000	0.5N	20N	1,000	5N	0N	0L
	2	T5B0113D	50	30	1,500	0.5N	20N	300	5N	0N	0L
	2	T5B0113E	300	100	1,000	0.5N	20N	500	5N	0N	0L
	2	T5B0113F	10	10	1,000	0.5N	20N	50	5N	0N	0L
	2	T5B0113T	5N	10	200N	0.5N	20N	20N	5N	0N	0L
Knf	3	T5B0118	50	70	200	0.5N	20N	500	5N	0N	0L
Qbs	4	T5B0120	20,000G	50	200N	7.0	20N	150	5N	0N	0L
Qbs	5	T5B0121	7,000	10	200N	1.0	20N	100	5N	0N	0L
Qbs	6	T5B0080	300	10	200N	0.5N	20N	200	5N	0N	0L
Dk	7	T5B0139A	5	20	200N	0.5N	20N	70	5N	0N	5N
	7	T5B0139B	50	50	200N	0.5N	20N	70	20	0N	5N
	7	T5B0139C	20	30	200N	0.5N	20N	70	5N	0N	40
	8	P8136A	7	20	200	0.5N	500G	500	5N	0N	100
	8	P8136B	10	100	200	0.5N	500G	200	5N	0N	250
Dk	9	P8232A	700	20,000G	10,000G	150.0	20N	20N	5N	0N	250,000
	9	P8232B	150	15,000G	10,000G	50.0	20N	20N	5N	0N	75,000
Dk	10	P8322A	15	50	200L	0.5N	20N	150	5N	0N	60
	11	P8330A	15	10L	200L	0.5N	20N	150	5N	0N	20
	11	P8330B	5L	10L	200L	0.5N	20N	100	5N	0N	10
	11	P8330C	5L	10L	200L	0.5N	20N	100	5N	0N	10
Mk	12	P8535	20	20	200	0.5N	20N	100	5N	0N	50
TRPss	13	P8239	5	10L	200L	0.5N	20N	50	5N	0N	40
Mk	14	P8563	15	20	1,000	0.5N	20N	500	5N	0N	120
TRPss	15	P8599	50	20	1,000	0.5N	20N	20L	5N	0N	200
TRPl	16	P8547	50	50	200L	0.5N	20N	1,000	5N	0N	80
Dhf	17	T6AR845	30	70	200	0.5N	20N	70	5N	0N	170
Dbc	18	T6AR847	1,000	20,000	10,000	30.0	70	5,000	5N	5,000	0L
Mv	19	T6AR848	150	100	200N	0.5N	20N	30	5N	0N	75
Dbc	20	T6B0412	30	30	200N	0.5N	20N	300	5N	0N	0L
Dhf	21	T6B4319B	300	30	500	2.0	20N	1,500	30	0N	320
	22	T6B4914	7	10N	3,000	0.5N	20N	150	5N	0N	1,700
	23	T6B4917X	30	100	200N	3.0	20N	150	5N	0N	150
Dhf	24	T6B4718	30	20	200N	0.5N	20N	150	5N	0N	260
	24	T6B4718	70	20	200N	0.5N	20N	300	5N	0N	130
Dk	25	T6B4745A	5	20	200N	0.5N	20N	300	5N	0N	20
Mv	26	T6B4871	150	10	200N	0.5N	20N	150	5N	0N	100
Mkls	27	T6AR846	0N	0N	0N	0.5N	0N	0N	0N	0N	340,000
KJfk	28	T5A1418A1	100	30	300	1.0	20N	5,000L	5N	0N	190
	28	T5A1418A2	70	30	500	3.0	20N	3,000	5N	0N	
	28	T5A1418B	150	20	200	0.5L	20N	5,000	5N	0N	140
TRPss	29	T5A1419B	30	30	200	0.5N	20N	2,000	5N	0N	160
KJfk	30	T5A8n- 4	150	50	200N	0.5N	20N	1,500	5N	0N	140
	30	T5A9A4L	150	30	200	0.5N	20N	2,000	5N	0N	150
TRPss	31	T5A9A15A	100	20	200	2.0	20N	2,000	5N	0N	180
	31	T5A9A15AL	100	20	200	2.0	20N	2,000	5N	0N	200
	31	T5A9A15B	100	20	200	2.0	20N	2,000	5N	0N	200
	31	T5A9A5C	200	50	500	2.0	20N	1,500	5N	0N	680
KJfk	35	T5A0c78-2	100	50	200N	0.5N	20N	500	5N	0N	190
	36	T5A0c39A	300	50	200N	0.5N	20N	2,000	5N	0N	190
	36	T5A8E39B1	200	50	200L	0.5N	20N	700	15N	0N	220
TRPss	37	T5A8E0L	100	20	200N	0.5N	20N	50	5N	0N	160
KJfk	38	T5A0c26B	200	30	200N	0.5N	20N	1,500	5N	0N	120
	38	T5A0c26E	100	30	200L	0.5N	20N	1,500	5N	0N	140
	39	T5A0c29C	100	30	200L	0.5N	20N	1,500	5N	0N	120
	40	T5A0c39C1	150	30	200L	0.5N	20N	2,000	5N	0N	220
	41	T5A0c72	150	30	200L	0.5N	20N	5,000	5N	0N	140
	42	T5A0c71	20	10	200	0.5N	20N	500	5N	0N	40
	43	T5A0c98-1	150	30	200N	0.5N	20N	2,000	5N	0N	120
	43	T5A0c98-1	200	1,000	200N	0.5N	20N	3,000	5N	0N	140
TRPss	44	T5A0c10	150	20	200L	0.5N	20N	5,000	5N	0N	140
KJfk	45	T5A0E2	20	30	200N	2.0	20N	200	5N	0N	20
	46	T5A0E2-1f	150	20	200L	0.5N	20N	2,000	5N	0N	120
	47	T5A0E2-2A	150	50	200L	0.5N	20N	1,500	5N	0N	140
	47	T5A0E2-2B	150	50	200L	0.5N	20N	2,000	5N	0N	180
	47	T5A0E3A	150	50	200L	0.5N	20N	2,000	5N	0N	160
	47	T5A0E3B	100	50	200L	0.5N	20N	1,500	5N	0N	120
	47	T5A0E3B1	70	50	200L	2.0	20N	700	5N	0N	120
	48	T5A0E3C	150	50	200L	0.5N	20N	2,000	5N	0N	120
	49	T5A0E3D	150	50	200N	0.5N	20N	2,000	5N	0N	140
Knt	50	T5A0E10	100	50	200L	0.5N	20N	1,000	5N	0N	120
KJfk	51	T5A0E42A	100	30	200N	0.5N	20N	2,000	5N	0N	80
	51	T5A0E42A1	70	30	200L	0.5N	20N	700	5N	0N	80
TRPss	52	T5A0E22A	70	20	200L	0.5N	20N	1,000	5N	0N	100
	52	T5A0E22A1	10	30	200	0.5N	20N	2,000	5N	0N	120
	52	T5A0E22B	20	20	200N	0.5N	20N	1,500	5N	0N	75
	52	T5A0E22C1	30	20	200L	0.5N	20N	1,500	5N	0N	75
	52	T5A0E22C2	30	20	200N	0.5N	20N	1,000	5N	0N	80
	52	T5A0E22C3	30	20	200N	0.5N	20N	1,000	5N	0N	80
	52	T5A0E22ef	150	30	200L	0.5N	20N	700	5N	0N	120
	53	T5A0E24	150	50	300	0.5N	20N	1,500	5N	0N	120
	53	T5A0E24A	150	50	200L	0.5N	20N	1,500	5N	0N	120
	53	T5A0E24A1	70	150	500	0.5N	20N	700	5N	0N	120
Knt	54	T5A0E29A	100	70	200N	0.5N	20N	1,500	5N	0N	140
KJfk	55	T5A0E52	100	50	200N	0.5N	20N	1,500	5N	0N	110
	55	T5A0E52A	70	30	200	0.5N	20N	1,000	5N	0N	120
	56	T5A0E61	150	50	200L	0.5N	20N	3,000	5N	0N	140
	57	T5A0E62A	150	50	200	0.5N	20N	1,500	5N	0N	120
	57	T5A0E62	50	50	200	0.5N	20N	500	5N	0N	80
	58	T5A0E68	100	30	200N	0.5N	20N	1,000	5N	0N	80
	58	T5A0E68A	100	30	200	0.5N	20N	700	5N	0N	140
Knt	59	T5A0E83	100	20	200L	0.5N	20N	1,500	5N	0N	140
KJfk	60	T5A0E45	100	30	200N	0.5N	20N	1,000	5N	0N	150
Kc	61	T5A0E32A	100	70	200N	0.5N	20N	1,000	5N	0N	140
KJfk	62	T5A0e31A	100	30	200L	0.5N	20N	1,500	5N	0N	140
TRPss	63	T5A0E79	10	20	200	0.5N	20N	1,500	5N	0N	70
KJfk	64	T5A0E48B	100	20	200L	1.5	20N	3,000	5N	0N	110
TRPss	65	T5A0E51-1	50	10L	200N	0.5N	20N	1,000	5N	0N	60
	65	T5A0E51-2	50	10	200N	0.5N	20N	1,000	5N	0N	60
	66	T5A0E58A	30	50	200N	0.5N	20N	500	5N	0N	60
	67	T5A0E58A	30	20	200N	0.5N	20N	1,000	5N	0N	50
	68	T5A0E58C	30	20	200N	0.5N	20N	500	5N	0N	50
	68	T5A0E58C1	30	20	200N	0.5N	20N	500	5N	0N	40
	69	T5A0E58D	30	20	200N	0.5N	20N	500	5N	0N	40
	70	T5A0E58E	20	20	200N	0.5N	20N	500	5N	0N	70

Table 3.--*Lead, zinc, and silver associated with anomalous copper values in nonmagnetic heavy-mineral concentrates from stream-sediment samples, Philip Smith Mountains quadrangle, Alaska*

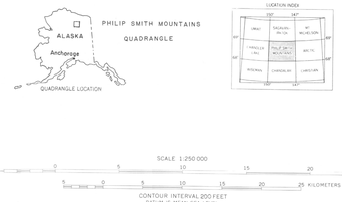
[Values reported in parts per million (ppm). N, not detected; L, detected but below value shown; G, greater than value shown; *, anomalous values for Pb, Zn, or Ag. Lower limit of anomalous concentrations as follow in ppm: Cu, 700; Pb, 1,500; Zn, 3,000; and Ag, 3. Analyst: E. F. Cooley]

Map No.	Field No. PS	Emission spectroscopy Cu	Pb	Zn	Ag	Map No.	Field No. PS	Emission spectroscopy Cu	Pb	Zn	Ag
1	01AC1	700	200	500L	1N	46	305C3	2,000	200	500	1N
2	07AC3	2,000	700	2,000	20*	47	308C3	1,000	500	500N	1N
3	08AC3	1,000	500	700	20*	48	312C3	700	2,000*	1,000	1N*
4	14AC3	3,000	10,000*	10,000*	5*	49	314C3	1,000	700	500	1N
5	15C3	700	200	1,000	2	50	315C3	700	700	500L	1L
6	16C3	700	1,500*	2,000	3*	51	317C3	3,000	3,000	500L	7*
7	17C3	1,500	1,500*	2,000	3*	52	318C3	700	500	1,000	1N
8	18C3	3,000	50	500N	1N	53	320C3	1,500	700	1,000	1N
9	17C3	1,000	100	10,000*	1N	54	330C3	700	700	1,000	1L
10	17AC3	1,000	1,000	2,000	1L	55	332C3	700	700	500N	1N
11	17BC3	2,000	100	700	1N	56	337C3	700	150	500N	1N
12	17BC3	700	500	2,000	1N	57	339C3	1,000	1,000	2,000	1
13	18AC3	1,000	100	500L	1N	58	340C3	1,500	700	3,000*	3L*
14	18BC3	5,000	50	500L	1N	59	342C3	700	1,000*	7,000*	1N
15	18AC3	10,000	1,500*	500	1L	60	348C3	2,000	700	1,000	1N
16	19AC3	700	500	2,000	1N	61	349C3	1,000	1,000*	500L	1L
17	19BC3	2,000	1,000	500	1N	62	350C3	1,000	3,000*	10,000*	1N
18	20BC3	2,000	700	5,000*	1N	63	357C3	5,000	1,000*	1,000	1N
19	20CC3	1,500	100	500N	1N	64	357C3	700	1,500*	2,000	2
20	20BC3	2,000	100	1,500	1N	65	361C3	1,000	1,000	2,000	1N
21	20PC3	2,000	100	700	1N	66	363C3	700	2,000*	7,000*	1N
22	21AC3	1,500	100	500N	1N	67	366C3	1,000	700	5,000*	3*
23	21BC3	700	100	500N	1N	68	368C3	700	150	7,000*	1N
24	21BC3	700	150	500L	1N	69	373C3	700	5,000*	10,000*	2
25	22AC3	1,500	100	500L	1N	70	382C3	1,000	7,000*	10,000*	3N*
26	22BC3	1,000	100	500L	1N	71	388C3	2,000	3,000*	7,000*	2
27	22BC3	1,000	3,000*	10,000*	1N*	72	389C3	1,500	2,000*	5,000*	1
28	22PC3	700	700	500N	1N	73	390C3	1,000	3,000*	5,000*	1
29	23AC3	3,000	3,000*	1,000	1N*	74	392C3	1,000	2,000*	2,000	1
30	23BC3	2,000	500	3,000*	1N	75	392C3	1,500	1,000	1,000	1L
31	24DC3	700	70	500N	1N	76	393C3	1,500	300	1,000	1L
32	24AC3	1,000	100	500	1N	77	408C3	1,000	10,000*	10,000*	7*
33	24AC3	2,000	1,000	2,000	1N	78	410C3	2,000	300	10,000*	3*
34	24BC3	5,000	1,000	2,000	1N	79	412C3	1,000	1,000	2,000	1
35	24DC3	7,000	200	1,000	1N	80	415C3	1,500	2,000*	10,000*	2
36	24GC3	10,000	2,000*	500	1L	81	432C3	1,000	2,000*	500N	1N
37	28BC3	1,500	700	3,000*	1N	82	434C3	1,000	1,500*	500N	3*
38	28PC3	2,000	700	1,000*	1N	83	467C3	1,000	500	500	5N*
39	25DC3	700	1,000	1,000	1L	84	584C3	1,000	20L	500L	1N
40	29CC3	3,000	3,000*	2,000	2	85	612C3	5,000	20L	500L	1N
41	25CC3	10,000	7,000*	10,000*	15*						
42	25BC3	700	1,000*	7,000*	1						
43	29AC3	2,000	5,000*	2,000	5*						
44	30DC3	1,500	70	500N	1N						
45	301C3	1,000	1,500*	500N	1*						

Table 4.--*Comparison of anomalous copper values to anomalous lead, zinc, and silver values within the same sample population of heavy-mineral concentrates from stream-sediment samples and minus-80 mesh stream-sediment fraction, Philip Smith Mountains quadrangle, Alaska*

[Range of values reported in parts per million. Total number of samples: 737 heavy-mineral concentrates and 759 stream sediments. N.A., not analyzed]

	Element	No. anomalous samples	Range of anomalous values Upper	Lower	No. anomalous samples associated with anomalous Cu
Nonmagnetic heavy-mineral concentrate samples from stream sediments					
Emission spectrography	Cu	85	10,000	700	85
	Pb	64	>20,000	1,500	30
	Zn	87	>5,000	3,000	23
	Ag	46	100	3	18
Atomic absorption	Zn	N.A.	N.A.	N.A.	N.A.
Stream-sediment samples					
Emission spectrography	Cu	26	500	100	26
	Pb	68	500	70	8
	Zn	49	2,000	500	10
	Ag	31	30	<0.5	7
Atomic absorption	Zn	86	2,000	160	9



GEOCHEMICAL MAPS SHOWING THE DISTRIBUTION AND ABUNDANCE OF COPPER IN THE PHILIP SMITH MOUNTAINS QUADRANGLE, ALASKA

By
J. B. Cathrall, D. E. Detra and E. F. Cooley

1978

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