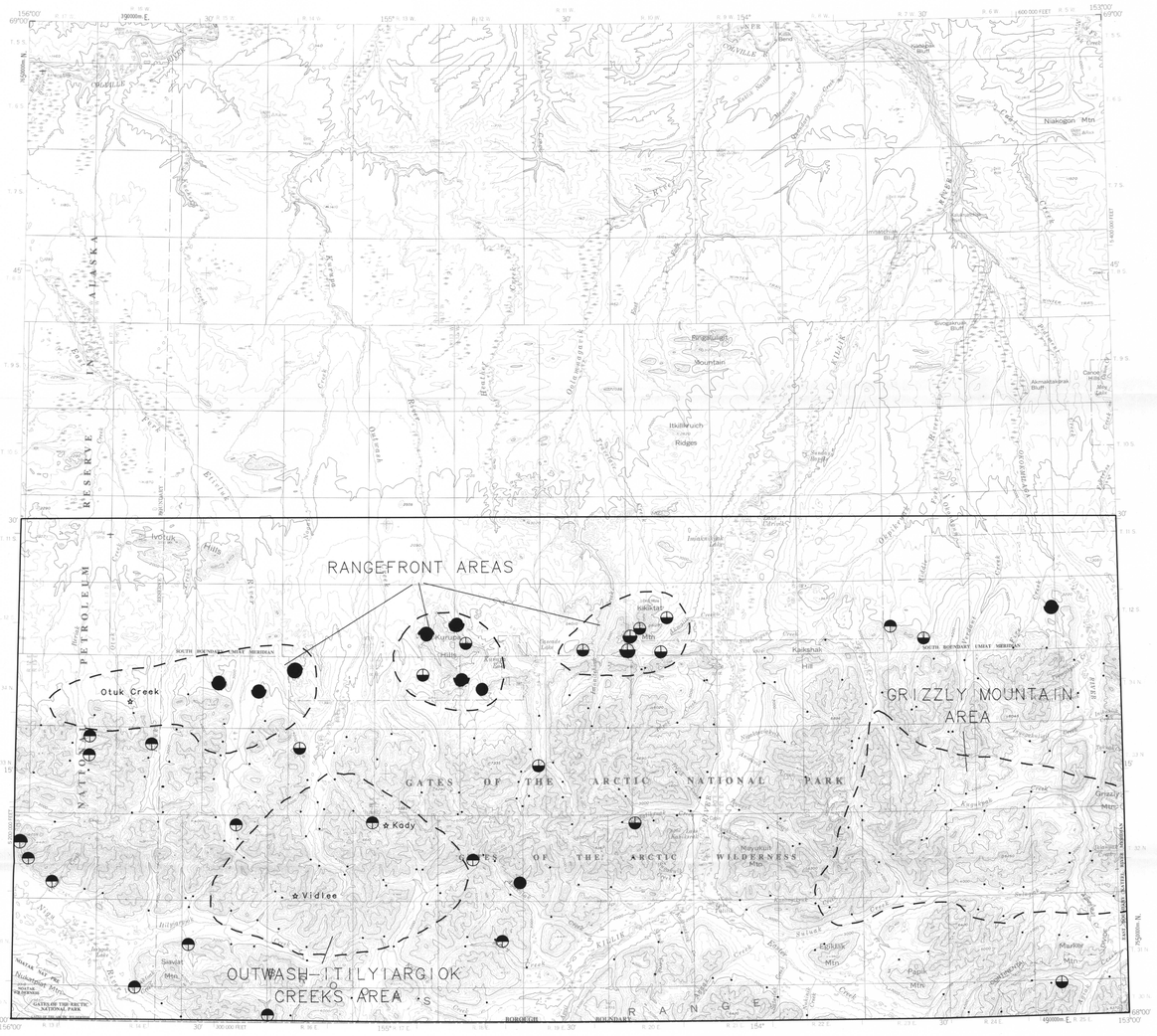


MAP D. DISTRIBUTION OF MINUS-30-MESH STREAM SEDIMENT SAMPLES CONTAINING ANOMALOUS CONCENTRATIONS OF Ba AND Mn

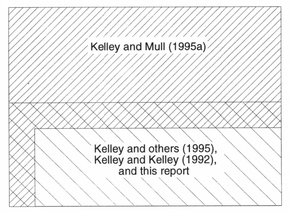


Figure 2. Killik River quadrangle showing areas covered by geochemical reports. Right ruled area, Kelley and Mull (1995a); left ruled area, Kelley and others (1995), Kelley and Kelley (1992), and this report.

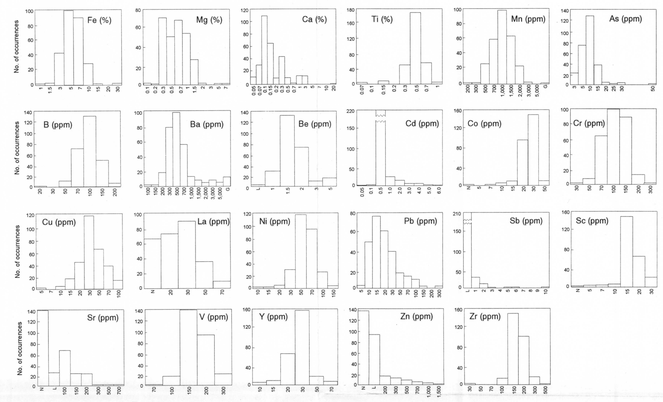


Figure 3. Frequency distribution diagrams for selected elements in minus-30-mesh stream-sediment samples from the southern part of the Killik River quadrangle (number of samples, 271; N, not detected at lower detection limit; L, less than lower detection limit; G, greater than upper detection limit).

EXPLANATION
MAP D

- Ba (5,000 to >5,000 ppm)
- Ba (1,000 to 5,000 ppm)
- Mn (3,000 to > 5,000 ppm)
- Mn (2,000 ppm)
- ☆ Kady — Sulfide mineral occurrence
- Area boundary delineated by minus-30-mesh stream-sediment samples containing anomalous concentrations of one or more elements
- Minus-30-mesh stream-sediment sample site

SCALE 1:250 000
5 0 5 10 15 MILES
5 0 5 10 15 KILOMETERS
CONTOUR INTERVAL 200 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Table 1. Analytical limits of detection for minus-30-mesh stream-sediment samples collected from the southern part of the Killik River quadrangle
[All values in parts per million unless otherwise noted; all analyses by semiquantitative emission spectrography unless otherwise noted; AA, analysis by atomic absorption spectrometry; NA, not applicable]

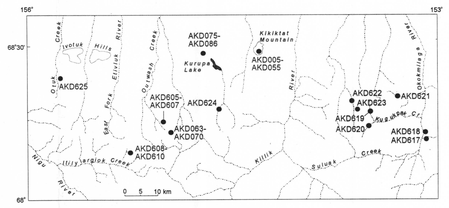
Element	Lower limit	Upper limit
Ca%	0.05	20
Fe%	0.05	20
Mg%	0.02	10
Ti%	0.002	1
Ag	0.5	5,000
Au[AA]	5	NA
As	200	10,000
Au[AA]	0.05	NA
Au	10	500
B	10	2,000
Ba	20	5,000
Be	1	1,000
Bi	10	1,000
Cd[AA]	0.05	NA
Cd	20	500
Co	5	2,000
Cr	10	5,000
Cu	5	20,000
La	20	1,000
Mn	10	5,000
Mo	5	2,000
Nb	20	2,000
Ni	5	5,000
Pb	10	20,000
Sb[AA]	1	NA
Sb	100	10,000
Sc	5	100
Sn	10	1,000
Sr	100	5,000
Th	100	2,000
V	10	10,000
W	50	10,000
Y	10	2,000
Zn[AA]	25	NA
Zn	200	10,000
Zr	10	1,000

Table 2. Statistical summary of selected elements from 271 minus-30-mesh stream-sediment samples from the Killik River quadrangle
[All concentrations in parts per million unless otherwise noted; UQV, number of samples with unqualified values; N, number of samples qualified with "N" (not detected at lower detection limit); L, number of samples qualified with "L" (less than lower detection limit); G, number of samples qualified with "G" (greater than upper detection limit); DR, detection ratio or the number of samples with unqualified values divided by the total number of samples; NI), not detected at lower limit of detection shown in parenthesis; ---, not calculated because DR is less than 0.3; *, geometric mean calculated using all data--values with "N" were set equal to 0.5 times the lower detection limit, values with "L" were set equal to 0.7 times the lower detection limit, and values with "G" were set equal to twice the upper detection limit; +, threshold values listed only for elements shown graphically on maps B through D].

Element	UQV	N	L	G	DR	Concentration Min	Concentration Max	Mean*	Percentile 50th	Percentile 80th	Percentile 90th	Threshold value+
Fe%	271	0	0	0	1.0	1%	30%	5.4%	5%	5%	7%	
Mg%	271	0	0	0	1.0	0.1%	7%	0.59%	0.3%	0.7%	1.5%	
Ca%	269	0	2	0	0.99	<0.05%	20%	0.14%	0.1%	0.1%	0.3%	
Ti%	271	0	0	0	1.0	0.07%	1%	0.37%	0.3%	0.3%	0.7%	
Mn	270	0	0	1	0.99	200	>5,000	1,002	700	1,000	1,500	2,000
Ag	6	265	1	0	0.02	N(0.5)	1	---	---	---	---	0.5
Au[AA]	248	0	23	0	0.92	<5	50	8.1	5	10	15	15
Au[AA]	2	269	0	0	0.007	N(0.05)	0.1	---	---	---	---	0.05
B	271	0	0	0	1.0	20	200	96	70	100	150	
Ba	265	0	0	6	0.98	100	>5,000	494	300	500	700	1,000
Be	270	0	1	0	0.99	<1	5	1.7	1.5	1.5	2	2
Cd[AA]	271	0	0	0	1.0	0.05	5.6	0.32	0.2	0.3	1.0	1.0
Co	270	1	0	0	0.99	N(5)	50	25	20	30	30	50
Cr	271	0	0	0	1.0	30	300	106	70	100	150	
Cu	271	0	0	0	1.0	5	100	35	30	30	70	70
Cu[AA]	271	0	0	0	1.0	5	100	38	30	40	55	
La	205	66	0	0	0.76	N(20)	70	23	20	20	50	
Mo	13	258	0	0	0.05	N(5)	15	---	---	---	---	
Nb	4	267	0	0	0.01	N(20)	20	---	---	---	---	
Ni	271	0	0	0	1.0	10	150	56	50	50	70	100
Pb	267	2	2	0	0.98	N(10)	300	20	15	20	50	50
Sb[AA]	62	0	209	0	0.23	<1	10	---	---	---	---	1.0
Sc	270	1	0	0	0.99	N(5)	30	16	15	15	20	
Sr	108	144	19	0	0.40	N(100)	700	74	50	50	150	
V	271	0	0	0	1.0	70	300	169	150	150	200	
Y	271	0	0	0	1.0	10	70	28	20	30	50	
Zn	45	138	88	0	0.17	N(200)	1,500	---	---	---	---	200
Zn[AA]	271	0	0	0	1.0	25	1,000	111	80	110	200	
Zr	271	0	0	0	1.0	30	500	168	150	150	200	

Table 3. Average worldwide abundances of selected trace elements in unaltered and unmineralized shale and chert
[All values in parts per million; nd, no data; (1), Levinson (1974); (2), Vine and Tourtelot (1970); (3), Maynard (1991); and (4), Adachi and others (1986)]

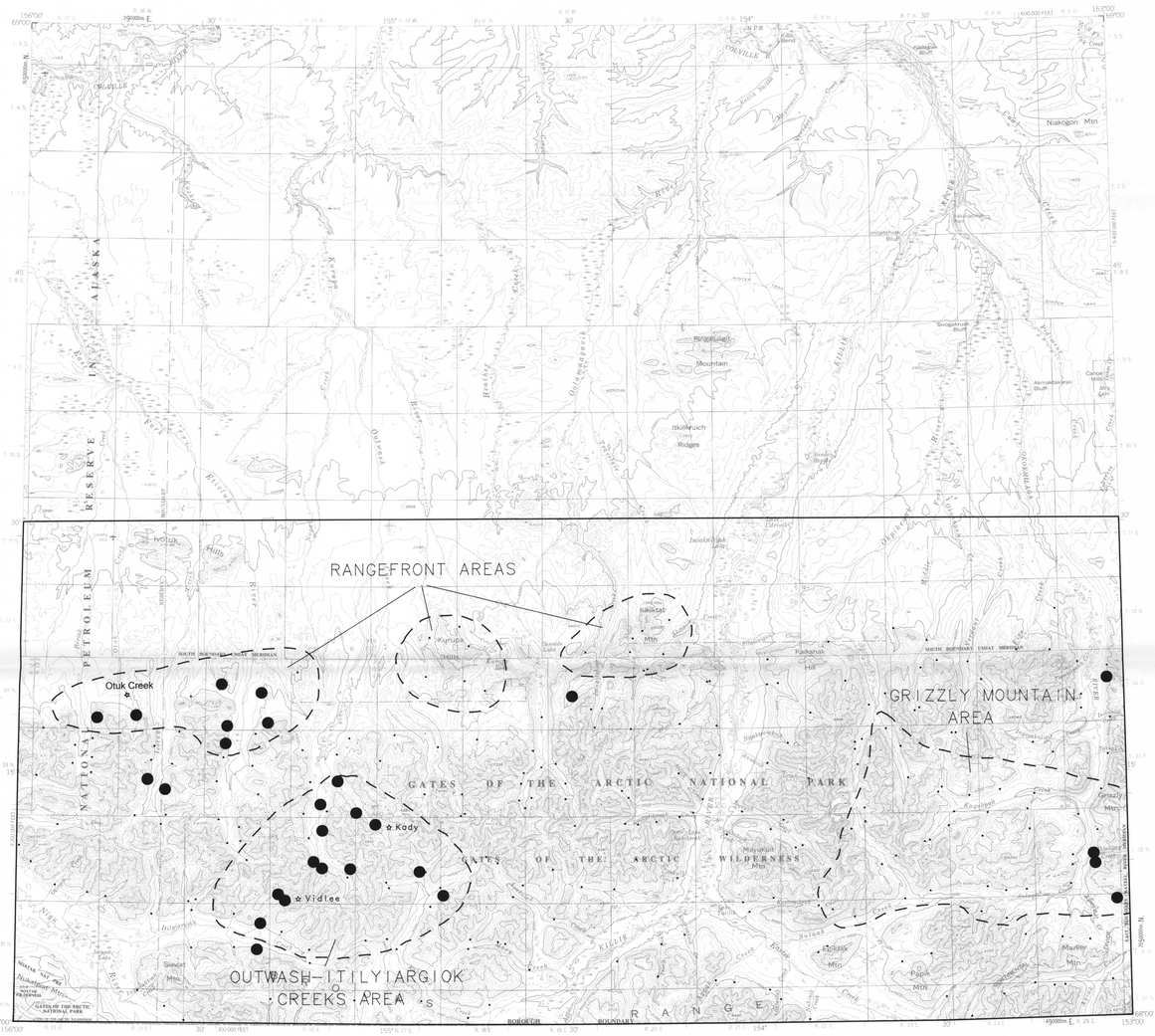
Rock type and reference	Ag	As	Ba	Cd	Co	Cr	Cu	Mn	Ni	Pb	Sb	Zn
Shale (1)	0.05	15	700	0.2	20	100	50	850	70	20	1	100
Black shale (2)	<1.0	nd	300	nd	10	100	70	150	50	20	nd	300
Host shale of Pb- and Zn-rich deposits (3)	nd	nd	6,550	nd	3	nd	28	330	40	24	nd	129
Host chert of Pb- and Zn-rich deposits (3)	nd	nd	5,047	nd	2	nd	18	123	16	13	nd	35
Oceanic chert (4)	nd	nd	450	nd	7	nd	130	2,700	26	12	nd	35
Continental chert (4)	nd	nd	140	nd	4	nd	59	253	14	8	nd	29



INDEX MAP SHOWING LOCALITIES OF ROCK SAMPLES LISTED IN TABLE 4

Table 4. Concentrations of selected elements in rock samples collected from the Killik River quadrangle
[locations of rock samples on index map; all values in parts per million except Fe, which is in percent; *, analyses by atomic absorption method; all other analyses by emission spectrography; N, not detected; NA, not analyzed]

Area	Sample no.	Latitude	Longitude	Fe	Ag	Ag*	As	As*	Au*	Ba	Cd*	Cd	Co	Cr	Cu	Mn	Ni	Pb	Zn*	Zn	Rock description (map-unit symbols from map A)
Otuk Creek	AKD625A	68 19 27	155 41 45	10	N	N	N	N	N	50	0.5	N	10	10	10	5,000	30	<10	120	200	vein in unit Mk
	AKD625B	68 19 27	155 41 45	20	N	2.3	N	N	N	>5,000	0.8	N	10	10	15	3,000	20	10	250	1,500	concretion in unit Mk; contains sphalerite
	AKD625C	68 19 27	155 41 45	20	N	0.8	N	N	N	300	0.8	N	10	<10	10	3,000	20	15	30	300	concretion in unit Mk; contains pyrite, calcite
	AKD625D	68 19 27	155 41 45	20	N	2.3	N	20	N	100	0.6	N	20	20	10	3,000	30	20	65	300	vein in chert; unit IPMK
	AKD625E	68 19 27	155 41 45	>20	N	0.05	N	30	N	500	0.5	N	20	50	10	3,000	30	50	100	500	vein in unit Mk
	AKD625F	68 19 27	155 41 45	1	3	N	N	10	N	700	1.5	N	<5	100	30	500	50	N	150	200	chert; unit IPMK
Kurupa Hills	AKD075	68 08 10	150 03 30	1	0.5	N	N	N	NA	1,000	NA	N	N	50	100	70	15	N	45	N	black chert
	AKD076	68 08 10	150 03 30	1	N	N	N	34	NA	5,000	NA	N	N	30	70	5,000	20	N	27	N	limestone
	AKD077	68 09 55	150 06 10	1	0.5	N	N	N	NA	1,000	NA	N	N	30	50	100	15	<10	39	N	black chert
	AKD079	68 09 55	150 06 10	1	1.5	1.1	N	N	NA	2,000	NA	N	10	70	70	100	500	<10	15	<200	pyritic chert
	AKD081	68 09 55	150 06 10	1	1.5	1.2	N	N	NA	1,500	NA	N	<5	100	70	50	30	<10	51	N	chert
	AKD082	68 09 55	150 06 10	1	1	0.94	N	11	NA	1,500	NA	N	<5	70	50	50	30	N	59	N	chert
	AKD084	68 09 55	150 06 10	1	0.7	0.73	N	14	NA	1,500	NA	N	<5	50	30	200	20	<10	52	N	chert
	AKD086	68 09 55	150 06 10	0.7	0.5	N	N	N	NA	1,500	NA	N	7	30	30	70	30	<10	98	N	chert
Kikiktat Mountain	AKD005	68 02 00	151 40 55	5	N	N	N	N	NA	200	NA	N	20	500	100	1,000	70	N	53	N	unit mi
	AKD009	68 05 00	151 39 20	3	N	N	N	N	NA	3,000	NA	N	50	70	50	1,500	70	15	160	200	shale
	AKD010	68 05 00	151 39 20	3	0.5	N	N	N	NA	500	NA	N	50	100	100	700	100	N	52	N	chert
	AKD018	68 05 00	151 39 20	5	<0.5	N	N	N	NA	200	NA	N	10	20	10	1,500	30	20	9	N	chert
	AKD023	68 05 00	151 39 20	1	7	N	N	N	NA	300	NA	N	15	10	100	500	100	15	140	N	unit mi; contains disseminated pyrite
	AKD029	68 04 31	151 39 20	1	N	N	N	N	NA	700	NA	N	10	<10	30	500	70	N	15	N	chert; contains disseminated pyrite
	AKD030	68 04 00	152 45 00	5	N	N	N	N	NA	500	NA	N	50	150	150	1,000	50	N	76	N	unit mi; contains pyrite
	AKD033	68 04 00	152 45 00	1	N	N	N	9.4	NA	500	NA	N	7	20	7	1,000	10	30	45	N	chert nodules
	AKD037	68 04 00	152 45 00	1.5	0.7	N	N	N	NA	700	NA	N	10	70	10	300	50	20	81	N	clastic rock
	AKD046	68 04 00	152 45 00	5	N	N	N	N	NA	500	NA	N	20	50	20	2,000	30	<10	96	N	unit mi
	AKD055	68 04 00	152 45 00	0.5	1	N	N	23	NA	1,000	NA	N	10	20	10	200	20	N	22	N	chert
Grizzly Mountain	AKD617	68 09 45	153 04 00	3	N	N	N	N	N	100	0.2	N	5	10	10	2,000	20	<10	35	<200	quartz vein
	AKD618	68 10 48	153 04 30	5	N	N	N	N	N	70	0.4	N	15	30	15	1,000	30	50	130	<200	quartz vein
	AKD619A	68 13 15	153 28 45	10	N	N	N	N	N	<20	0.3	N	10	<10	5	2,000	10	N	10	200	quartz vein; contains pyrite and sphalerite
	AKD619B	68 13 15	153 28 45	2	N	0.1	N	N	N	300	0.2	N	<5	20	5	50	10	<10	10	<200	unit MDk with disseminated oxidized pyrite
	AKD619C	68 13 15	153 28 45	5	N	N	N	N	N	50	0.3	N	10	10	15	1,000	30	20	60	<200	quartz vein; iron oxides
	AKD620	68 11 55	153 30 00	10	N	N	N	10	N	70	0.3	N	50	30	5	200	50	N	30	200	quartz vein; contains pyrite
	AKD621	68 16 45	153 17 00	10	N	0.5	N	N	N	100	0.5	N	20	50	20	1,500	50	<10	200	200	quartz vein
	AKD622	68 16 30	153 37 58	3	N	1.9	N	20	N	100	0.2	N	<5	10	5	50	10	10	<5	<200	unit MDk; contains disseminated pyrite
	AKD623	68 15 30	153 35 00	3	N	1.0	N	20	N	200	0.3	N	<5	20	10	100	10	<10	<5	<200	unit MDk; contains disseminated pyrite
Southern Kurupa Lake	AKD624A	68 13 28	154 38 58	10	N	1.7	200	220	N	70	0.2	N	50	15	200	200	50	N	N	<200	quartz vein
	AKD624B	68 13 28	154 38 58	10	N	0.15	N	N	N	100	0.9	N	50	100	50	2,000	50	<10	N	<200	iron oxides
Outwash Creek (Kady occurrence)	AKD605C	68 12 00	155 02 00	0.5	3	6.0	N	80	<0.05	50	480	100	50	<10	1,000	30	20	30	28,000	>10,000	breccia; contains pyrite, galena
	AKD605D	68 12 00	155 01 25	0.2	0.7	1.9	N	30	N	50	0.3	N	10	<10	500	N	15	500	35	<200	quartz vein; contains pyrite, galena
	AKD605E	68 12 00	155 01 25	5	5	7.9	700	240	0.15	<20	1,900	500	200	<10	2,000	15	150	50	210,000	>10,000	vein-breccia; contains sphalerite, pyrite
	AKD605F	68 12 00	155 01 25	0.5	2	3.7	N	20	N	N	780	150	20	N	1,000	<10	10	N	120,000	>10,000	vein; contains sphalerite
	AKD606A	68 11 57	155 00 30	1	1.5	2.4	N	30	N	50	>100	100	7	<10	70	20	5	15	>2,000	10,000	quartz boxwork; contains sphalerite
	AKD606B	68 11 57	155 00 30	N	N	N	N	N	N	<20	0.5	N	<5	<10	<5	<10	<5	N	105	<200	quartz vein; barren
	AKD606C	68 11 57	155 00 30	1.5	1.5	2.6	N	400	<0.05	<20	1,200	>500	50	N	1,000	10	20	20	150,000	>10,000	vein-breccia; contains sphalerite
	AKD606D	68 11 57	155 00 30	1	7	13	N	N	0.20	<20	1,200	N	70	N	200	10	<5	50	170,000	<200	quartz vein
	AKD607A	68 11 30	155 00 00	0.5	N	10	N	10	0.05	<20	1.8	N	<5	<10	1,500	15	<5	N	130	1,000	vein; contains pyrite, chalcopyrite
	AKD607C	68 11 30	155 00 00	15	150	72	500	110	0.10	50	1.1	N	30	<10	>20,000	10	100	100	40	<200	vein; contains pyrite, chalcopyrite
	AKD607D	68 11 30	155 00 00	2	10	>100	N	10	0.05	50	0.5	N	15	<10	7,000	30	20	10	25	<200	disseminated pyrite, chalcopyrite
	AKD063	68 09 11	155 00 36	0.7	N	N	N	10	NA	100	NA	N	7	70	7	500	N	N	8	N	sandstone
	AKD064	68 09 14	155 00 43	0.7	0.5	N	N	41	NA	700	NA	N	30	150	30	150	70	30	97	N	shale
	AKD065	68 09 14	155 00 43	3	N	NA	N	NA	NA	200	NA	N	20	70	7	1,000	20	30	NA	N	siltstone
	AKD070A	68 07 08	155 00 00	2	N	NA	N	NA	NA	200	NA	N	10	70	7	500	20	N	NA	N	sandstone
	AKD070C	68 07 08	155 00 00	20	10	NA	1,000	NA	NA	150	NA	N	1,000	20	200	20	1,000	700	NA	300	pyrite nodule in sandstone
Itilyiargiok Creek (Vidlee occurrence)	AKD608	68 07 45	155 18 00	0.7	20	32	1,000	6,400	0.75	50	120	150	500	<10	1,500	50	50	20,000	140,000	>10,000	disseminated pyrite, arsenopyrite
	AKD609A	68 07 30	155 17 00	7	7	14	200	240	0.05	50	2.6	N	50	50	10,000	200	20	150	120	500	vein; contains pyrite
	AKD609B	68 07 30	155 17 00	5	2	2.4	200	220	0.15	50	16	<20	50	20	50	20	10	70	1,600	2,000	disseminated pyrite
	AKD609C	68 07 30	155 17 00	3	20	17	N	30	0.05	30	990	>500	50	20	500	150	10	2,000	220,000	>10,000	quartz vein; contains sphalerite
	AKD609D	68 07 30	155 17 00	10	50	39	N	20	0.10	20	2,500	>500	50	<10	500	70	7	1,000	250,000	>10,000	quartz vein; contains sphalerite
	AKD610A	68 07 35	155 16 45	7	20	28	<200	140	0.05	50	9	20	70	<10	1,000	20	20	2,000	1,200	3,000	quartz vein; contains pyrite
	AKD610B	68 07 35	155 16 45	5	300	21	200	160	0.15	50	>100	>500	70	50	7,000	50	20	>20,000	4,000	10,000	quartz vein; contains galena
	AKD610C	68 07 35	155 16 45	10	150	100	N	N	0.05	<20	2,800	>500	50	<10	300	150	5	15,000	27,000	10,000	massive sphalerite



MAP E. DISTRIBUTION OF MINUS-30-MESH STREAM SEDIMENT SAMPLES CONTAINING ANOMALOUS FACTOR 4 SCORES (As-Cu-Mn-Pb-Zn)

Table 5. Factor loadings for the five-factor model for 271 minus-30-mesh stream-sediment samples. Total variance explained by the five factors equals 68 percent. To simplify, all loadings less than 0.35 have been omitted

Element	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Fe	0.55	---	---	---	0.36
Mg	---	0.84	---	---	---
Ca	---	0.46	0.67	---	---
Ti	0.86	---	---	---	---
Mn	0.38	-0.54	0.35	0.38	---
As	---	---	---	0.66	---
B	0.56	---	---	---	0.42
Ba	---	---	0.75	---	---
Co	0.35	---	---	---	0.72
Cr	0.50	---	---	---	0.51
Cu	0.66	---	---	0.35	---
La	---	0.58	---	---	0.40
Ni	---	---	---	---	0.77
Pb	---	---	---	0.66	0.45
S	---	---	---	---	0.79
Sr	---	---	0.60	---	0.54
V	0.38	---	---	---	0.69
Y	---	---	---	---	0.73
Zn	---	---	---	0.80	---
Zr	0.53	---	---	---	---
Percent of total data variance explained by factor	37.0	12.0	7.0	7.0	5.0

EXPLANATION
MAP E

- Sample yielding anomalous factor 4 scores (As-Cu-Mn-Pb-Zn)
- ☆ Kady — Sulfide mineral occurrence
- Area boundary delineated by minus-30-mesh stream-sediment samples containing anomalous concentrations of one or more elements
- Minus-30-mesh stream-sediment-sample site

SCALE 1:250 000
5 0 5 10 15 MILES
5 0 5 10 15 KILOMETERS
CONTOUR INTERVAL 200 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

MAPS SHOWING DISTRIBUTION OF SELECTED ELEMENTS IN MINUS-30-MESH STREAM SEDIMENT SAMPLES FROM THE SOUTHERN PART OF THE KILLIK RIVER 1° × 3° QUADRANGLE, ALASKA

By

Karen D. Kelley, Charles G. Mull, and Harlan N. Barton

1995