UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of stream-sediment and panned-concentrate samples from the Killik River 1° x 3° quadrangle, Alaska

By

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STUDIES RELATED TO AMRAP

The U.S. Geological Survey, is required by the Alaskan National Interests Lands Conservation Act (ANILCA) (Public Law 96-487, 1980), to survey certain Federal lands to determine their mineral resource potential. Results from the Alaskan Mineral Resource Assessment Program (AMRAP) must be made available to the public and be submitted to the President and the Congress. This report presents analytical results of a geochemical survey of the Killik quadrangle, Alaska.

INTRODUCTION

In June and July, 1982, we conducted a geochemical survey of the Killik River 1° x 3° quadrangle, Alaska.

The Killik River quadrangle comprises about 3600 mi^2 in the north-central part of the Brooks Range, and lies about 250 mi northwest of Fairbanks (figure 1). Access to the vicinity of the study area is provided by charter plane from Bettles, Alaska.

The southern boundary of the quadrangle is approximately along the Brooks Range divide. The core of the Brooks Range consists mostly of metamorphic and igneous rocks. North of this core of metamorphic and igneous rocks is a belt of intensely thrust-faulted sedimentary and minor mafic igneous rocks of Late Devonian to Triassic age; it is mostly unmetamorphosed. This belt covers approximately the southern third of the quadrangle. North of the mountains, the foothills of the Brooks Range consist of Cretaceous to Tertiary age deltaic rocks that were derived from the Brooks Range and prograded northward and eastward. These clastic rocks are deformed into long east-west-trending anticlines and synclines and comprise the northern two-thirds of the quadrangle.

The topographic relief in the mountainous areas is about 4,000 feet with a maximum elevation of 7,420 ft. North of the mountains, the foothills are gently sloping plateaus with very little relief. The climate is arctic.

METHODS OF STUDY

Sample Collection

We collected samples at 69 sites (plate 1). At nearly all of those sites, we collected both a stream-sediment sample and a heavy-mineral concentrate. We analyzed 69 stream-sediment samples, and 66 panned-concentrate samples for a sampling density of about 1 sample per 2 mi^2 in the mountainous areas and about 1 sample per 5 mi^2 in the foothills.

Also included in this report are analytical results for 260 panned concentrates from stream-sediment samples and 267 stream-sediment samples collected in 1982 (Barton and others, 1982).

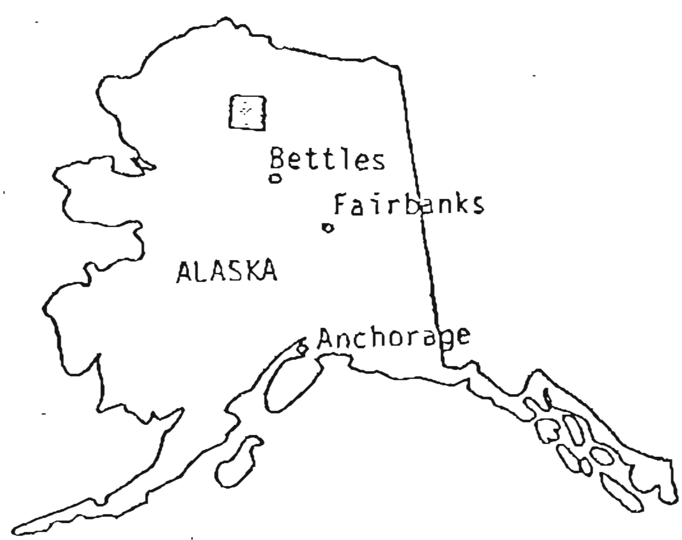

Figure 1. Index map of Alaska showing location of the Killik River quadrangle.

Stream-sediment samples

Analyses of the stream-sediment samples represent the chemistry of the rock material eroded from the drainage basin upstream from each sample site. Such information is useful in identifying those basins which contain concentrations of elements that may be related to mineral deposits.

The stream-sediment samples consisted of active alluvium collected primarily from first-order (unbranched) and second-order (below the junction of two first-order) streams as shown on USGS topographic maps (scale = 1:63,360). Each sample was composited from several localities within an area that may extend as much as 25 ft from the site plotted on the map.

Heavy-mineral-concentrate samples

We panned heavy-mineral-concentrate samples from the same active alluvium as the stream-sediment samples. Each bulk sample was passed through a 2.0-mm (10-mesh) screen to remove the coarse material. The sediment passing through the screen was panned until most of the quartz, feldspar, organic material, and clay-sized material was removed. The sample was oven dried at 110°C.

Sample Preparation

Only the stream-sediment samples required extensive preparation.

We sieved the stream-sediment at the collection site through a 10-mesh screen and the minus 10-mesh material was retained. The samples were air dried and sieved to 0.177 mm using stainless steel sieves. The portion of the sediment passing through the sieve was pulverized to minus 100-mesh and saved for analysis.

After panning the sediment, we used bromoform to separate and remove the remaining quartz and feldspar from the heavy-mineral concentrate. The heavy minerals (specific gravity >2.8) sample were separated into three fractions using a large electromagnet (in this case a modified Frantz Isodynamic Separator). The most magnetic material (largely magnetite) was discarded. The second fraction (largely ferromagnesian silicates and iron oxides) was saved for analysis/archival storage. The third fraction (the least magnetic material including the nonmagnetic ore minerals, zircon, sphene, etc.) was divided into two splits using a Jones splitter. One split was hand-ground for spectrographic analysis.

The magnetic separates discussed are the same separates that would be produced by removing the magnetite with a hand magnet and then using a Frantz Isodynamic Separator set at a slope of 15° and a tilt of 10° with a current of 0.1 ampere to remove the magnetite and ilmenite, and a current of 1.0 ampere to split the remainder of the sample into magnetic and nonmagnetic fractions.

Sample Analysis

Spectrographic method

We analyzed the stream-sediment, heavy-mineral-concentrate, and rock samples for 31 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The elements analyzed and their lower limits of determination are listed in Table 1. Spectrographic results were obtained by visual comparison of spectra derived from the sample against spectra obtained from standards made from pure oxides and carbonates. Standard concentrations are geometrically spaced over any given order of magnitude of concentration as follows: 100, 50, 20, 10, and so forth. Samples whose concentrations are estimated to fall between those values are assigned values of 70, 30, 15, and so forth. The precision of the analytical method is approximately plus or minus one reporting interval at the 83 percent confidence level and plus or minus two reporting intervals at the 96 percent confidence level (Motooka and Grimes, 1976). Values determined for the major elements (iron, magnesium, calcium, and titanium) are given in weight percent; all others are given in parts per million (micrograms/gram).

ROCK ANALYSIS STORAGE SYSTEM

Upon completion of all analytical work, the analytical results were entered into a computer-based file called RASS (Rock Analysis Storage System). This data base contains both descriptive geological information and analytical data. Any or all of this information may be retrieved and converted to a binary form (STATPAC) for computerized statistical analysis or publication (VanTrump and Miesch, 1976).

DESCRIPTION OF DATA TABLES

Tables 2 and 3 list the analyses for the samples of stream-sediment and panned-concentrate, respectively. For the two tables the data are arranged so that column 1 contains the USGS-assigned sample numbers. These numbers correspond to the numbers shown on the site location map (plate 1). Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses. In a similar manner, "aa" indicates atomic absorption analyses. A letter "N" in the tables indicates that a given element was looked for but not detected at the lower limit of determination shown for that element in table 1. If an element was observed but was below the lowest reporting value, then a "less than" symbol (<) was entered in the tables in front of the lower limit of determination. If an element was observed but was above the highest reporting value, then a "greater than" symbol (>) was entered in the tables in front of the upper limit of determination. If an element was not looked for in a sample, then two dashes (--) are entered in tables 2 and 3 in place of an analytical value. Because of the formatting used in the computer program that produced tables 2 and 3, some of the elements listed in these tables (Fe, Mg, Ca, Ti, Ag, and Be) carry one or more nonsignificant digits to the right of the significant digits. The analysts did not determine these elements to the accuracy suggested by the extra zeroes.

REFERENCES CITED

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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.

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TABLE 1.--Limits of determination for the spectrographic analysis of stream sediments, based on a 10-mg sample

[The spectrographic limits of determination for heavy-mineral-concentrate samples are based on a 5-mg sample, and are therefore two reporting intervals higher than the limits given for stream sediments]

Elements	Lower determination limit	Upper determination limit
	Percent	
Iron (Fe)	0.05	20
Magnesium (Mg)	.02	10
Calcium (Ca)	.05	20
Titanium (Ti)	.002	1
	Parts per million	
Manganese (Mn)	10	5,000
Silver (Ag)	0.5	5,000
Arsenic (As)	200	10,000
Gold (Au)	10	500
Boron (B)	10	2,000
Barium (Ba)	20	5,000
Beryllium (Be)	1	1,000
Bismuth (Bi)	10	1,000
Cadmium (Cd)	20	500
Cobalt (Co)	5	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Lanthanum (La)	20	1,000
Molybdenum (Mo)	5	2,000
Niobium (Nb)	20	2,000
Nickel (Ni)	5	5,000
Lead (Pb)	10	20,000
Antimony (Sb)	100	10,000
Scandium (Sc)	5	100
Tin (Sn)	10	1,000
Strontium (Sr)	100	5,000
Vanadium (V)	10	10,000
Tungsten (W)	50	10,000
Yttrium (Y)	10	2,000
Zinc (Zn)	200	10,000
Zirconium (Zr)	10	1,000
Thorium (Th)	100	2,000

Table 2. Spectrographic analysis of stream sediment samples from the Killik River quadrangle, Alaska.

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Latitude	Longitude	Fe-pct.	Mg-pct.	Ca-pct.	Ti-pct.	Mn-ppm	Ag-ppm	As-ppm	Au-ppm	B-ppm	Ba-ppm
			s	s	s	s	s	s	s	s	s	s
82KR500S	68 24 3	154 20 7	5.0	1.00	.20	.30	700	N	N	N	100	5,000
82KR501S	68 24 19	154 20 28	7.0	1.50	.20	.50	1,500	N	N	N	200	5,000
82KR502S	68 24 0	154 14 31	7.0	3.00	2.00	.50	1,500	N	N	N	70	5,000
82KR503S	68 24 18	154 14 21	7.0	2.00	1.00	.50	1,500	N	N	N	100	5,000
82KR504S	68 24 21	154 10 45	5.0	.50	.10	.30	1,000	N	N	N	50	3,000
82KR505S	68 22 9	154 10 44	5.0	2.00	3.00	.30	3,000	2.0	N	N	100	5,000
82KR506S	68 23 9	154 15 44	7.0	3.00	2.00	.30	1,500	.5	N	N	100	>5,000
82KR507S	68 7 25	155 16 31	7.0	.50	.15	.50	1,000	N	N	N	100	300
82KR508S	68 7 47	155 17 38	7.0	1.00	.10	.50	1,000	N	N	N	100	500
82KR509S	68 7 26	155 30 55	10.0	1.00	.10	.50	1,000	N	N	N	100	300
82KR510S	68 7 19	155 32 6	10.0	.50	.10	.50	1,500	N	N	N	100	300
82KR511S	68 27 45	155 24 27	5.0	3.00	3.00	.50	700	.5	N	N	200	>5,000
82KR512S	68 28 51	155 25 9	3.0	2.00	1.00	.20	3,000	.5	N	N	200	>5,000
82KR513S	68 28 9	155 26 37	5.0	2.00	1.00	.30	2,000	.5	N	N	150	>5,000
82KR514S	68 27 54	155 33 7	3.0	2.00	1.00	.30	2,000	.5	N	N	150	>5,000
82KR515S	68 27 19	155 29 11	3.0	2.00	5.00	.20	1,000	.5	N	N	150	>5,000
82KR516S	68 28 22	155 39 17	2.0	.50	.20	.20	700	1.0	N	N	100	>5,000
82KR517S	68 27 48	155 50 25	10.0	1.00	.20	.30	3,000	N	N	N	100	>5,000
82KR518S	68 20 53	155 49 48	10.0	.20	.07	.50	5,000	N	N	N	100	2,000
82KR519S	68 22 37	155 42 51	7.0	.15	.30	.50	5,000	N	N	N	150	>5,000
82KR520S	68 22 44	155 46 12	7.0	.30	.07	.50	5,000	N	N	N	100	1,000
82KR521S	68 26 9	155 39 48	7.0	.20	.20	.50	3,000	N	N	N	100	>5,000
82KR522S	68 24 4	155 33 29	7.0	.70	.10	.50	2,000	N	N	N	100	1,000
82KR523S	68 25 28	155 29 5	7.0	1.00	.10	.50	>5,000	N	N	N	100	>5,000
82KR524S	68 23 36	155 26 30	5.0	.70	.10	.50	>5,000	N	N	N	100	>5,000
82KR525S	68 35 24	154 15 1	7.0	1.00	.70	.50	3,000	N	N	N	50	1,000
82KR526S	68 36 19	154 10 48	7.0	.70	.10	.50	5,000	N	N	N	100	1,500
82KR527S	68 27 0	154 13 51	3.0	.30	.10	.30	5,000	N	N	N	50	300
82KR528S	68 28 12	154 15 31	7.0	.70	.20	.50	>5,000	N	N	N	100	2,000
82KR529S	68 30 1	154 15 53	7.0	--	.20	.50	3,000	N	N	N	70	500
82KR530S	68 30 5	154 20 55	7.0	1.00	.20	.50	3,000	N	N	N	300	>5,000
82KR531S	68 28 29	154 24 44	10.0	2.00	.30	.50	3,000	N	N	N	500	>5,000
82KR532S	68 27 13	154 25 6	7.0	.70	.10	.50	3,000	N	N	N	200	>5,000
82KR533S	68 27 3	154 28 5	7.0	1.00	.10	.50	5,000	N	N	N	200	>5,000
82KR534S	68 29 6	154 32 11	7.0	.30	.05	.30	3,000	N	N	N	100	700
82KR536S	68 25 25	154 39 19	7.0	.30	.10	.30	5,000	N	N	N	100	1,000
82KR537S	68 25 21	154 40 9	10.0	.50	.10	.50	3,000	N	N	N	100	700
82KR538S	68 25 35	154 48 36	3.0	.15	<.05	.15	1,000	N	N	N	50	300
82KR539S	68 28 18	154 52 33	2.0	.07	<.05	.10	1,000	N	N	N	20	150
82KR540S	68 24 22	154 55 10	3.0	.50	.10	.30	2,000	N	N	N	50	>5,000
82KR541S	68 24 39	154 59 54	3.0	.50	.05	.20	1,500	N	N	N	70	1,500
82KR542S	68 24 43	155 0 50	3.0	.70	.05	.30	1,000	<.5	N	N	100	5,000
82KR543S	68 22 53	155 3 51	3.0	.50	.05	.30	700	N	N	N	70	500
82KR544S	68 23 44	155 6 11	5.0	.30	<.05	.20	700	N	N	N	70	500
82KR545S	68 23 10	155 11 39	5.0	.70	.10	.30	5,000	N	N	N	100	>5,000

Table 2. Spectrographic analysis of stream sediment samples from the Killik River quadrangle, Alaska.

Sample	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s
82KRS00S	2.0	N	N	50	100	100	50	<5	20	100	30
82KRS01S	3.0	N	N	50	150	100	50	<5	20	100	50
82KRS02S	2.0	N	N	50	150	100	50	N	20	100	30
82KRS03S	2.0	N	N	50	150	150	50	N	20	100	30
82KRS04S	2.0	N	N	20	100	20	50	N	20	50	15
82KRS05S	1.0	N	N	20	50	100	50	<5	<20	150	15
82KRS06S	2.0	N	N	50	200	150	50	<5	<20	100	20
82KRS07S	2.0	N	N	30	150	70	50	N	20	100	100
82KRS08S	2.0	N	N	30	150	70	50	N	20	100	70
82KRS09S	2.0	N	N	30	150	70	50	N	20	100	50
82KRS10S	2.0	N	N	50	150	70	50	N	20	100	30
82KRS11S	2.0	N	N	20	150	100	50	20	20	100	30
82KRS12S	2.0	N	N	30	200	100	50	20	<20	100	30
82KRS13S	2.0	N	N	20	100	100	50	15	<20	100	20
82KRS14S	2.0	N	N	20	150	100	50	10	<20	100	20
82KRS15S	2.0	N	N	15	150	100	50	20	<20	70	30
82KRS16S	2.0	N	N	10	100	100	50	10	<20	70	20
82KRS17S	2.0	<10	N	50	100	100	50	N	<20	100	50
82KRS18S	2.0	<10	N	50	150	70	50	N	20	100	30
82KRS19S	2.0	<10	N	50	100	100	50	N	20	100	30
82KRS20S	2.0	<10	N	50	100	100	50	N	20	100	20
82KRS21S	2.0	<10	N	50	150	100	50	N	20	100	50
82KRS22S	2.0	N	N	50	100	70	50	N	20	70	20
82KRS23S	2.0	N	N	70	150	100	50	<5	20	150	50
82KRS24S	2.0	N	N	30	100	50	50	<5	20	100	20
82KRS25S	2.0	N	N	50	200	30	50	N	20	50	10
82KRS26S	2.0	N	N	70	300	100	50	N	20	100	10
82KRS27S	2.0	N	N	10	20	10	50	N	<20	50	10
82KRS28S	2.0	N	N	50	100	30	50	N	20	100	20
82KRS29S	2.0	N	N	30	100	30	50	N	20	50	20
82KRS30S	2.0	N	N	30	300	50	50	<5	20	70	30
82KRS31S	3.0	N	N	50	300	100	50	N	20	100	50
82KRS32S	2.0	N	N	50	150	100	50	N	20	100	30
82KRS33S	2.0	N	N	30	100	150	50	10	20	100	50
82KRS34S	2.0	N	N	30	70	50	50	N	20	70	20
82KRS36S	2.0	N	N	30	70	30	50	N	20	70	20
82KRS37S	2.0	N	N	50	150	50	50	N	20	70	50
82KRS38S	1.0	N	N	10	50	20	50	N	<20	20	<10
82KRS39S	1.0	N	N	5	20	10	50	N	<20	10	<10
82KRS40S	1.5	N	N	20	50	30	50	N	<20	50	<10
82KRS41S	1.5	N	N	30	150	30	50	5	N	70	30
82KRS42S	1.0	N	N	20	150	50	30	10	N	70	20
82KRS43S	1.0	N	N	30	100	50	<20	N	N	50	30
82KRS44S	1.0	N	N	30	70	20	50	N	N	50	20
82KRS45S	1.0	N	N	50	100	70	20	7	N	100	30

Table 2. Spectrographic analysis of stream sediment samples from the Killik River quadrangle, Alaska.

Sample	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s
82KR500S	N	15	N	<100	200	N	30	<200	100	N
82KR501S	N	20	N	100	300	N	70	200	200	N
82KR502S	N	20	N	100	300	N	50	<200	150	N
82KN503S	N	30	N	100	300	N	30	<200	200	N
82KR504S	N	15	N	N	150	N	20	<200	150	N
82KR505S	N	10	N	100	300	N	100	200	100	N
82KR506S	N	30	N	100	300	N	50	200	300	N
82KR507S	N	20	N	100	200	N	50	1,000	300	N
82KR508S	N	20	N	100	200	N	50	300	200	N
82KR509S	N	20	N	100	200	N	50	200	200	N
82KR510S	N	20	N	100	200	N	50	200	300	N
82KR511S	N	15	N	1,000	300	N	70	300	150	N
82KR512S	N	20	N	700	300	N	50	300	100	N
82KR513S	N	15	N	2,000	200	N	50	300	100	N
82KR514S	N	15	N	300	300	N	50	500	100	N
82KR515S	N	15	N	1,000	300	N	50	300	100	N
82KR516S	N	15	N	5,000	200	N	50	200	70	N
82KR517S	N	20	N	100	200	N	50	300	300	N
82KR518S	N	15	N	100	150	N	30	500	100	N
82KR519S	N	20	N	100	200	N	30	200	200	N
82KR520S	N	20	N	100	150	N	30	500	200	
82KR521S	N	20	N	200	200	N	50	200	200	
82KR522S	N	20	N	N	200	N	30	200	150	
82KR523S	N	20	N	<100	200	N	30	300	200	
82KR524S	N	15	N	<100	200	N	20	200	100	
82KR525S	N	20	N	100	200	N	20	<200	100	
82KR526S	N	20	N	N	200	N	20	200	100	
82KR527S	N	20	N	N	150	N	20	<200	100	
82KR528S	N	20	N	<100	200	N	30	300	150	
82KR529S	N	20	N	N	200	N	30	<200	150	
82KR530S	N	20	N	100	200	N	30	200	150	
82KR531S	N	30	N	<100	200	N	50	300	200	
82KR532S	N	20	N	N	200	N	30	200	150	
82KR533S	N	20	N	<100	200	N	30	300	150	
82KR534S	N	15	N	N	150	N	20	<200	100	
82KR536S	N	15	N	<100	200	N	50	<200	100	
82KR537S	N	20	N	N	200	N	30	<200	150	
82KR538S	N	5	N	N	70	N	10	<200	100	
82KR539S	N	5	N	N	50	N	N	<200	50	
82KR540S	N	10	N	<100	150	N	10	<200	100	
82KR541S	N	15	N	100	70	N	30	200	70	
82KR542S	N	15	N	150	100	N	30	N	70	
82KR543S	N	15	N	<100	70	N	30	<200	70	
82KR544S	N	15	N	<100	70	N	30	N	70	
82KR545S	N	10	N	100	100	N	20	200	70	

Table 2. Spectrographic analysis of stream sediment samples from the Killik River quadrangle, Alaska,--continued

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s
82KR546S	68 24 45	155 15 2	5.0	.50	.10	.20	2,000	N	N	N	100	>5,000
82KR560S	68 23 45	154 0 0	3.0	.50	.15	.20	500	N	N	N	70	1,000
82KR561S	68 27 38	153 42 19	2.0	.50	.05	.20	300	N	N	N	50	300
82KR562S	68 27 7	153 48 34	2.0	.30	.05	.20	700	N	N	N	50	200
82KR563S	68 25 48	153 36 53	5.0	.30	.07	.20	1,000	N	N	N	70	300
82KR564S	68 27 43	153 28 44	1.5	.30	.05	.20	500	N	N	N	50	300
82KR565S	68 27 54	153 25 23	2.0	.50	.05	.30	1,000	N	N	N	70	300
82KR566S	68 31 2	153 7 48	3.0	.50	.07	.20	1,500	N	N	N	70	300
82KR568S	68 34 23	153 23 36	3.0	.70	.15	.30	1,000	N	N	N	50	500
82KR569S	68 33 30	154 31 54	3.0	.70	.20	.30	3,000	.7	N	N	100	>5,000
82KR570S	68 22 15	154 27 4	3.0	.70	.07	.20	2,000	<.5	N	N	70	>5,000
82KR571S	68 35 59	154 21 56	2.0	.30	.05	.20	700	N	N	N	50	700
82KR572S	68 40 24	154 28 47	5.0	.70	.30	.30	1,000	<.5	N	N	50	700
82KR573S	68 47 35	154 16 32	3.0	1.50	.30	.30	500	N	N	N	50	500
82KR574S	68 49 7	154 20 58	3.0	1.00	.20	.30	500	N	N	N	50	500
82KR575S	68 49 59	154 17 34	2.0	.50	.10	.20	300	N	N	N	50	300
82KR576S	68 52 43	154 13 29	3.0	.50	.10	.20	700	N	N	N	30	500
82KR577S	68 55 45	154 11 11	5.0	.15	.05	.20	500	N	N	N	30	500
82KR578S	68 57 53	154 15 9	3.0	.50	.05	.20	500	<.5	N	N	30	500
82KR579S	68 59 45	154 25 18	3.0	.50	.05	.30	700	<.5	N	N	70	700
82KR580S	68 51 56	154 36 7	3.0	.20	<.05	.20	500	N	N	N	50	500
82KR581S	68 51 50	154 33 34	7.0	.50	.05	.30	1,000	N	N	N	30	500
82KR582S	68 50 58	154 35 4	2.0	.30	<.05	.20	700	N	N	N	50	300
82KR583S	68 30 11	154 42 15	3.0	.70	.15	.50	1,500	N	N	N	50	1,500

Table 2. Spectrographic analysis of stream sediment samples from the Killik River quadrangle, Alaska.--continued

Sample	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s
82KR546S	1.0	N	N	50	150	30	20	7	N	100	30
82KR560S	1.0	N	N	20	70	15	50	<5	N	30	15
82KR561S	1.0	N	N	15	70	10	30	N	N	30	10
82KR562S	<1.0	N	N	20	30	5	N	N	N	20	<10
82KR563S	1.0	N	N	30	50	20	50	N	N	50	20
82KR564S	<1.0	N	N	20	300	7	N	N	N	20	10
82KR565S	1.0	N	N	20	70	10	20	N	N	30	15
82KR566S	1.0	N	N	30	100	15	N	N	N	30	15
82KR568S	<1.0	N	N	20	200	10	N	N	N	20	10
82KR569S	1.0	N	<20	50	150	70	30	15	N	150	30
82KR570S	<1.0	N	N	30	70	30	N	<5	N	100	15
82KR571S	1.0	N	N	20	100	10	N	N	N	20	10
82KR572S	1.0	N	N	30	100	20	20	<5	N	30	30
82KR573S	1.0	N	N	30	1,000	20	N	N	N	150	15
82KR574S	1.0	N	N	30	700	10	N	N	N	150	<10
82KR575S	1.0	N	N	20	1,000	7	N	N	N	100	15
82KR576S	<1.0	N	N	20	1,000	15	N	N	N	150	10
82KR577S	1.0	N	N	20	150	10	N	N	N	50	15
82KR578S	1.0	N	N	20	150	7	N	N	N	70	20
82KR579S	1.0	N	N	30	100	30	N	N	N	100	30
82KR580S	1.0	N	N	20	200	10	N	N	N	50	20
82KR581S	1.0	N	N	30	300	10	20	N	N	150	10
82KR582S	<1.0	N	N	20	300	7	N	N	N	70	<10
82KR583S	1.0	N	N	20	150	10	N	N	N	50	20

Table 2. Spectrographic analysis of stream sediment samples from the Killik River quadrangle, Alaska.--continued

Sample	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s
82KR546S	N	10	N	150	100	N	30	<200	70	N
82KR560S	N	10	N	<100	70	N	30	N	70	N
82KR561S	N	7	N	N	70	N	15	N	70	N
82KR562S	N	7	N	N	50	N	15	N	100	N
82KR563S	N	10	N	<100	70	N	30	N	100	N
82KR564S	N	7	N	<100	70	N	15	N	70	N
82KR565S	N	7	N	<100	70	N	20	N	70	N
82KR566S	N	7	N	<100	70	N	20	N	50	N
82KR568S	N	7	N	<100	70	N	20	N	50	N
82KR569S	N	10	N	150	150	N	30	200	70	N
82KR570S	N	7	N	N	70	N	15	<200	100	N
82KR571S	N	10	N	N	50	N	20	N	100	N
82KR572S	N	15	N	100	100	N	30	<200	70	N
82KR573S	N	15	N	<100	70	N	30	N	70	N
82KR574S	N	15	N	<100	70	N	20	N	70	N
82KR575S	N	10	N	<100	50	N	20	N	70	N
82KR576S	N	7	N	N	70	N	20	N	70	N
82KR577S	N	10	N	N	50	N	20	N	70	N
82KR578S	N	10	N	N	50	N	20	N	100	N
82KR579S	N	15	N	<100	70	N	30	N	70	N
82KR580S	N	10	N	N	50	N	20	N	70	N
82KR581S	N	7	N	N	70	N	15	N	100	N
82KR582S	N	7	N	N	50	N	20	N	70	N
82KR583S	N	10	N	100	70	N	20	N	70	N

Table 3. Spectrographic analysis of heavy mineral concentrate samples from the Killik River quadrangle, Alaska.

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s
82KR500C	68 24 3	154 20 7	.7	.20	1.00	.500	700	N	N	N	N	>10,000
82KR501C	68 24 19	154 20 28	1.5	.10	.15	.100	700	N	N	N	N	>10,000
82KR502C	68 24 0	154 14 31	1.5	.30	7.00	1.500	300	N	N	N	200	>10,000
82KR503C	68 24 18	154 14 21	2.0	.15	.70	.700	500	N	N	N	N	>10,000
82KR504C	68 24 21	154 10 45	3.0	.15	15.00	>2.000	700	5.0	N	N	<20	>10,000
82KR505C	68 22 9	154 10 44	2.0	.20	>50.00	.200	1,000	1.5	N	N	N	>10,000
82KR506C	68 23 9	154 15 44	3.0	.50	2.00	1.000	1,000	N	N	N	N	>10,000
82KR507C	68 7 25	155 16 31	1.5	.07	3.00	>2.000	300	300.0	N	N	70	10,000
82KR508C	68 7 47	155 17 38	1.5	.30	7.00	>2.000	500	150.0	N	N	30	>10,000
82KR509C	68 7 26	155 30 55	1.5	.50	15.00	>2.000	1,000	N	N	N	100	>10,000
82KR510C	68 7 19	155 32 6	1.5	.10	5.00	>2.000	500	N	N	N	50	7,000
82KR511C	68 27 45	155 24 27	.5	.07	.30	.070	50	<1.0	N	N	N	>10,000
82KR512C	68 28 51	155 25 9	<.1	<.05	<.10	.010	<20	N	N	N	N	>10,000
82KR513C	68 28 9	155 26 37	.5	.07	.20	.015	300	N	N	N	N	>10,000
82KR514C	68 27 54	155 33 7	1.0	.07	.20	.070	500	N	N	N	N	>10,000
82KR515C	68 27 19	155 29 11	.7	.07	.10	.030	100	N	N	N	N	>10,000
82KR516C	68 28 22	155 39 17	.5	<.05	<.10	.005	150	N	N	N	N	>10,000
82KR517C	68 27 48	155 50 25	.7	.15	.30	.200	2,000	N	N	N	N	>10,000
82KR518C	68 20 53	155 49 48	1.5	.07	.50	>2.000	700	N	N	N	50	>10,000
82KR519C	68 22 37	155 42 51	.3	.07	<.10	.500	1,500	N	N	N	N	>10,000
82KR520C	68 22 44	155 46 12	2.0	.07	.70	>2.000	700	N	N	N	50	>10,000
82KR521C	68 26 9	155 39 48	.7	.15	.50	.200	1,000	N	N	N	N	>10,000
82KR522C	68 24 4	155 33 29	1.5	.07	.50	1.500	700	N	N	N	N	>10,000
82KR523C	68 25 28	155 29 5	.7	.07	<.10	.300	1,500	N	N	N	N	>10,000
82KR524C	68 23 36	155 26 30	.5	.07	<.10	.030	2,000	N	N	N	N	>10,000
82KR526C	68 36 19	154 10 48	.1	.10	3.00	1.500	2,000	N	N	N	N	>10,000
82KR528C	68 28 12	154 15 31	1.0	.10	.50	1.000	3,000	N	N	N	<20	>10,000
82KR529C	68 30 1	154 15 53	2.0	.50	7.00	>2.000	1,500	N	N	N	<20	>10,000
82KR530C	68 30 5	154 20 55	1.0	.10	.20	.300	3,000	N	N	N	N	>10,000
82KR531C	68 26 29	154 24 44	1.5	.15	.15	.100	1,000	N	N	N	N	>10,000
82KR532C	68 27 13	154 25 6	2.0	.07	.15	.500	500	N	N	N	N	>10,000
82KR533C	68 27 3	154 28 5	1.5	.07	.15	.020	1,500	N	N	N	N	>10,000
82KR534C	68 29 6	154 32 11	1.0	.07	.20	1.500	1,000	N	N	N	N	>10,000
82KR538C	68 25 21	154 40 9	1.0	.05	.20	2.000	700	3.0	N	N	<20	>10,000
82KR539C	68 25 35	154 48 36	2.0	.20	1.00	>2.000	500	N	N	N	150	>10,000
82KR540C	68 28 18	154 52 33	.5	.15	.10	.300	3,000	N	N	N	N	>10,000
82KR541C	68 24 39	154 59 54	.5	.10	<.10	.050	1,000	N	N	N	N	>10,000
82KR542C	68 24 43	155 0 50	2.0	.30	.15	.100	2,000	N	N	N	N	>10,000
82KR543C	68 22 53	155 3 51	3.0	.05	.50	1.000	200	3.0	N	N	N	>10,000
82KR544C	68 23 44	155 6 11	.7	.05	.30	.700	200	N	N	N	N	>10,000
82KR545C	68 23 10	155 11 39	.7	.10	<.10	.050	3,000	N	N	N	N	>10,000
82KR546C	68 24 45	155 15 2	.5	.10	<.10	.050	1,500	N	N	N	N	>10,000
82KR560C	68 23 45	154 0 0	1.0	.10	30.00	1.000	500	<1.0	N	N	N	>10,000
82KR561C	68 27 38	153 42 19	1.5	.15	1.50	>2.000	700	N	N	N	70	>10,000
82KR562C	68 27 7	153 48 34	1.5	.70	3.00	>2.000	700	N	N	N	50	10,000

Table 3. Spectrographic analysis of heavy mineral concentrate samples from the Kilbuck River quadrangle, Alaska.

Sample	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s
82KR500C	N	N	N	N	50	50	50	<10	N	N	20
82KR501C	N	N	N	15	<20	50	<50	N	N	30	<20
82KR502C	N	N	N	N	100	15	70	N	N	<10	50
82KR503C	N	N	N	15	50	50	50	15	N	50	30
82KR504C	N	N	N	10	200	20	500	10	50	30	3,000
82KR505C	N	N	N	<10	200	30	1,000	20	N	30	50
82KR506C	N	N	N	<10	70	50	50	N	<50	30	30
82KR507C	<2	N	<50	15	200	150	700	<10	50	70	>50,000
82KR508C	N	N	N	15	500	70	200	N	70	10	>50,000
82KR509C	N	N	N	15	1,000	70	1,000	<10	50	10	1,500
82KR510C	<2	N	N	15	200	100	1,000	N	100	10	70
82KR511C	N	N	N	N	N	15	N	N	N	20	<20
82KR512C	N	N	N	N	N	<10	N	N	N	10	<20
82KR513C	N	N	N	N	N	30	N	N	N	15	20
82KR514C	N	N	N	<10	N	50	N	N	N	70	70
82KR515C	N	N	N	N	N	10	N	N	N	<10	70
82KR516C	N	N	N	N	N	15	N	N	N	<10	30
82KR517C	N	N	N	N	N	20	<50	N	N	10	50
82KR518C	<2	N	N	10	200	20	700	N	70	15	500
82KR519C	N	N	N	N	<20	10	N	N	N	10	<20
82KR520C	2	N	N	15	200	20	1,500	N	50	10	150
82KR521C	N	N	N	<10	<20	30	50	N	N	15	20
82KR522C	N	N	N	<10	20	50	70	N	N	15	30
82KR523C	N	N	N	10	20	20	<50	N	N	30	20
82KR524C	N	N	N	N	<20	10	<50	N	N	15	20
82KR526C	N	N	N	N	150	<10	50	N	N	<10	50
82KR528C	N	N	N	15	300	20	70	N	N	15	50
82KR529C	N	N	N	20	10,000	<10	100	N	N	30	200
82KR530C	N	N	N	15	30	20	50	<10	50	20	20
82KR531C	N	N	N	10	100	30	<50	15	N	20	20
82KR532C	N	N	N	<10	<20	30	50	N	N	20	<20
82KR533C	N	N	N	<10	<20	30	<50	20	N	50	<20
82KR534C	N	N	N	N	70	15	100	N	N	<10	70
82KR538C	<2	N	N	<10	50	50	200	N	N	<10	70
82KR539C	N	N	N	10	200	30	2,000	N	<50	30	200
82KR540C	N	N	N	N	50	20	<50	<10	<50	<10	30
82KR541C	N	N	N	N	<20	20	<50	<10	N	10	20
82KR542C	N	N	N	N	70	30	<50	20	N	<10	50
82KR543C	N	N	N	<10	70	50	70	N	N	20	7,000
82KR544C	N	N	N	N	30	30	70	N	N	15	50
82KR545C	N	N	N	10	20	50	<50	N	N	30	30
82KR546C	N	N	N	10	20	20	<50	N	N	20	30
82KR560C	N	N	N	<10	100	30	70	<10	N	30	300
82KR561C	N	N	N	10	300	20	1,000	N	100	<10	100
82KR562C	N	N	N	10	1,000	15	1,000	N	70	<10	100

Table 3. Spectrographic analysis of heavy mineral concentrate samples from the Killik River quadrangle, Alaska.

Sample	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s
82KR500C	N	<10	N	10,000	70	N	30	N	1,500	N
82KR501C	N	<10	N	3,000	30	N	<20	1,500	150	N
82KR502C	N	10	N	7,000	70	N	70	N	700	N
82KR503C	N	<10	N	5,000	70	N	50	N	500	N
82KR504C	N	20	50	5,000	300	N	500	1,500	>2,000	N
82KR505C	N	<10	N	>10,000	500	N	700	N	200	N
82KR506C	N	10	N	10,000	150	N	70	N	1,500	N
82KR507C	2,000	20	50	700	300	N	200	20,000	>2,000	N
82KR508C	N	20	30	1,500	300	N	300	N	>2,000	N
82KR509C	N	50	70	3,000	300	N	500	N	>2,000	N
82KR510C	N	15	20	1,000	300	N	300	1,500	>2,000	N
82KR511C	N	N	N	3,000	20	N	<20	N	20	N
82KR512C	N	N	N	3,000	20	N	N	N	<20	N
82KR513C	N	N	N	10,000	30	N	<20	N	<20	N
82KR514C	N	N	N	7,000	30	N	<20	N	100	N
82KR515C	N	N	N	>10,000	30	N	N	N	30	N
82KR516C	N	N	N	10,000	20	N	N	N	<20	N
82KR517C	N	<10	N	10,000	50	N	<20	N	50	N
82KR518C	N	20	N	1,500	200	N	150	1,500	>2,000	N
82KR519C	N	<10	N	1,000	30	N	N	N	700	N
82KR520C	N	30	30	3,000	300	N	200	1,500	>2,000	N
82KR521C	N	<10	N	5,000	50	N	50	N	150	N
82KR522C	N	10	N	5,000	70	N	50	2,000	1,000	N
82KR523C	N	N	N	1,500	50	N	N	N	200	N
82KR524C	N	N	N	2,000	50	N	N	N	<20	N
82KR526C	N	10	N	>10,000	70	N	50	N	700	N
82KR528C	N	10	N	3,000	70	N	50	N	1,000	N
82KR529C	N	20	30	1,000	300	N	N	N	>2,000	N
82KR530C	N	<10	N	5,000	70	N	200	N	70	N
82KR531C	N	N	N	5,000	50	N	N	N	150	N
82KR532C	N	<10	N	2,000	50	N	<20	N	300	N
82KR533C	N	N	N	3,000	30	N	N	N	<20	N
82KR534C	N	10	N	10,000	70	N	50	N	1,000	N
82KR538C	N	<10	N	1,000	100	N	70	N	1,000	N
82KR539C	N	50	70	5,000	200	N	200	N	>2,000	N
82KR540C	N	<10	N	7,000	30	N	N	N	N	N
82KR541C	N	N	N	3,000	20	N	N	N	100	N
82KR542C	N	10	N	10,000	70	N	<20	N	50	N
82KR543C	N	<10	N	7,000	50	N	50	5,000	500	N
82KR544C	N	<10	N	3,000	70	N	70	N	500	N
82KR545C	N	<10	N	1,500	50	N	N	N	20	N
82KR546C	N	<10	N	2,000	30	N	N	N	20	N
82KR560C	N	10	N	7,000	200	N	300	N	1,500	N
82KR561C	N	30	150	2,000	300	N	200	N	>2,000	N
82KR562C	N	30	50	1,500	300	N	200	N	>2,000	N

Table 3. Spectrographic analysis of heavy mineral concentrate samples from the Killik River quadrangle, Alaska.--continued

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s
82KR563C	68 25 48	153 36 53	3.0	1.00	30.00	>2.000	1,500	N	N	N	30	>10,000
82KR564C	68 27 43	153 28 44	1.5	1.00	2.00	>2.000	500	N	N	N	70	>10,000
82KR565C	68 27 54	153 25 23	1.5	1.00	1.50	>2.000	500	N	N	N	<20	>10,000
82KR566C	68 31 2	153 7 48	1.5	1.00	7.00	2.000	700	N	N	N	500	>10,000
82KR567C	68 33 58	152 59 0	1.5	2.00	10.00	>2.000	500	N	N	N	100	>10,000
82KR568C	68 34 23	153 23 36	1.5	.50	.50	.100	1,500	N	N	N	N	>10,000
82KR569C	68 33 30	154 31 54	.2	.20	.10	.300	700	N	N	N	N	>10,000
82KR570C	68 22 15	154 27 4	.7	.30	2.00	1.500	300	N	N	N	<20	>10,000
82KR571C	68 35 59	154 21 56	2.0	.50	10.00	1.500	700	N	N	N	20	>10,000
82KR572C	68 40 24	154 28 47	7.0	3.00	1.50	.500	500	7.0	N	N	20	>10,000
82KR573C	68 47 35	154 16 32	3.0	5.00	3.00	2.000	500	N	N	N	50	>10,000
82KR574C	68 49 7	154 20 58	7.0	3.00	7.00	2.000	500	7.0	500	N	20	>10,000
82KR575C	68 49 59	154 17 34	7.0	1.50	2.00	2.000	200	3.0	1,000	N	20	>10,000
82KR576C	68 52 43	154 13 29	1.5	1.00	3.00	>2.000	200	N	N	N	50	>10,000
82KR577C	68 55 45	154 11 11	.7	.50	.70	>2.000	70	N	N	N	20	7,000
82KR578C	68 57 53	154 15 9	3.0	1.00	5.00	>2.000	200	N	N	N	50	>10,000
82KR579C	68 59 45	154 25 18	1.0	.30	.30	>2.000	300	N	N	N	<20	10,000
82KR580C	68 51 56	154 36 7	.7	.70	3.00	>2.000	200	N	N	N	50	5,000
82KR581C	68 51 50	154 33 54	1.5	1.00	5.00	>2.000	300	N	N	N	20	10,000
82KR582C	68 50 58	154 35 4	.7	.70	5.00	>2.000	100	N	N	N	<20	5,000
82KR583C	68 30 11	154 42 15	.5	.30	.30	.700	1,500	N	N	N	30	>10,000

Table 3. Spectrographic analysis of heavy mineral concentrate samples from the Killik River quadrangle, Alaska.--continued

Sample	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s
82KR563C	N	N	N	10	700	50	1,000	N	<50	15	100
82KR564C	N	N	N	15	2,000	50	1,000	10	100	N	70
82KR565C	N	N	N	15	200	15	500	N	70	10	70
82KR566C	N	N	N	10	700	20	70	<10	<50	10	50
82KR567C	N	N	N	15	1,000	20	500	10	70	<10	100
82KR568C	N	N	N	<10	<20	30	<50	N	N	50	20
82KR569C	N	N	N	N	<20	<10	N	N	N	N	<20
82KR570C	<2	N	N	N	70	20	70	N	<50	N	30
82KR571C	N	N	N	10	70	20	100	<10	<50	30	50
82KR572C	N	N	N	20	700	50	<50	N	N	300	150
82KR573C	N	N	N	20	5,000	2,000	70	N	50	200	200
82KR574C	N	N	N	20	5,000	70	70	N	<50	500	200
82KR575C	N	N	N	20	1,500	70	70	N	50	500	200
82KR576C	N	N	N	15	2,000	20	500	N	70	150	100
82KR577C	N	N	N	10	500	10	100	N	100	30	50
82KR578C	N	N	N	15	1,000	50	100	N	70	70	100
82KR579C	N	N	N	10	500	<10	50	N	50	10	50
82KR580C	N	N	N	10	2,000	15	700	<10	100	10	100
82KR581C	N	N	N	15	7,000	15	1,000	N	50	15	70
82KR582C	N	N	N	N	1,500	<10	500	N	70	20	50
82KR583C	N	N	N	10	70	15	50	N	N	<10	20

Table 3. Spectrographic analysis of heavy mineral concentrate samples from the Killik River quadrangle, Alaska.--continued

Sample	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s
82KR563C	N	50	30	3,000	200	N	500	N	>2,000	N
82KR564C	N	30	70	3,000	300	N	200	10,000	>2,000	N
82KR565C	N	30	<20	1,000	200	N	200	N	>2,000	N
82KR566C	N	30	N	2,000	300	N	100	N	>2,000	N
82KR567C	N	30	50	1,500	500	N	200	N	>2,000	N
82KR568C	N	<10	N	10,000	100	N	20	N	700	N
82KR569C	N	N	N	2,000	20	N	N	N	500	N
82KR570C	N	N	N	700	70	N	100	N	2,000	N
82KR571C	N	<10	N	3,000	150	N	150	N	2,000	N
82KR572C	N	N	N	N	70	N	30	N	>2,000	N
82KR573C	N	30	50	N	300	N	150	N	>2,000	N
82KR574C	N	30	<20	500	150	N	70	3,000	2,000	N
82KR575C	N	15	<20	N	100	N	70	2,000	2,000	N
82KR576C	N	20	50	700	300	N	300	N	>2,000	N
82KR577C	N	<10	20	300	200	N	70	N	1,500	N
82KR578C	N	30	30	700	200	N	150	10,000	>2,000	N
82KR579C	N	<10	N	N	200	N	30	N	1,500	N
82KR580C	N	30	70	700	300	N	300	N	>2,000	N
82KR581C	N	30	50	1,000	300	N	300	N	>2,000	N
82KR582C	N	20	20	500	500	N	200	N	>2,000	N
82KR583C	N	<10	N	1,500	50	N	50	N	300	N