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RESULTS OF GEOCHEMICAL SAMPLING IN THE NORTHERN DARBY MOUNTAINS; SEWARD PENINSULA, ALASKA

By

Thomas P. Miller, Raymond L. Elliott, Donald H. Grybeck, and

Travis L. Hudson

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This report is preliminary
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INTRODUCTION

A program of regional geologic mapping and geochemical sampling was begun by the U.S. Geological Survey in 1968 in the Darby and eastern Bendeleben Mountains of the southeastern Seward Peninsula. This report gives the results of geochemical sampling in the area of the Windy Creek pluton about 90 miles ENE of Nome in the northern Darby Mountains. Anomalous amounts of molybdenum and, to a lesser degree, lead, zinc, and silver occur in the sediments in some of the streams which drain the pluton, and have also been found associated with fluorite in altered rocks of the pluton itself.

The area is located in the northern parts of the Bendeleben A-1 and A-2 quadrangles (fig. 1) and lies a few miles north of lead-silver deposits in the vicinity of Omilak Creek which have been discussed by Mulligan (1962) and Herreid (1965). The area is included in a report by Smith and Eakin (1911) on the general geology of the southeastern Seward Peninsula.

GEOLOGIC SETTING

An assortment of polymetamorphic rocks of probable Precambrian age form the host rock for the Windy Creek pluton (fig. 1). These rocks were first subjected to regional metamorphism and then thermally metamorphosed by the Windy Creek pluton and other nearby intrusives. Individual units are commonly separated by faults and their mutual relationships are difficult to determine. A quartz-plagioclase-biotite-garnet schist (pCsm) with intercalated calc-silicate rock and marble crops out on the east side of the pluton (fig. 1). This unit is

probably the oldest unit in the map area and on the basis of lithology is tentatively correlated with the Kigluaik Group of Precambrian age further west in the Bendeleben Mountains (Sainsbury and others, 1970).

A unit of metavolcanics and quartz-albite-mica schist (p€vs) underlies the area southwest of the pluton (fig. 1) and may be correlative, at least in part, with the Nome Group rocks further west on the Peninsula. Massive marble and calc-silicate rock (p€ls) crop out west of Windy Creek and are tentatively assigned a Precambrian age. A unit of metasedimentary rocks comprised chiefly of locally calcareous metagraywacke, black slate and metasiltstone, and intercalated recrystallized limestone (pOms) crops out along the south side of the map area. This section is similar in many respects to a thick sequence of black graphitic slates in the central and western Seward Peninsula which are believed to be pre-Ordovician in age, possibly even Late Precambrian (Sainsbury and others, 1969).

Country rock along the north side of the pluton is poorly exposed but appears to consist of a mixed assemblage of metamorphic rocks and various granitic and aphanitic intrusive rocks (mi). The metamorphics are chiefly metapelite, calc-silicate rock, and marble similar to the p€sm unit. The intrusives include biotite quartz monzonite, latite, and a greenish-colored quartz porphyry; the latter two intrusives were also observed cutting the Windy Creek pluton and are commonly pyritiferous. Biotite quartz monzonite (Kqm) of the Bendeleben pluton with screens of metamorphosed country rock underlies the northern part of the map area. The Bendeleben pluton is tentatively assigned a Late Cretaceous age based on a single K-Ar age date.

The Windy Creek pluton consists chiefly of quartz monzonite, monzonite, and syenite although boulders of melanite-bearing nepheline syenite occur in some of the stream gravels on the east side of the pluton. Screens and (or) small pendants of country rock occur in the west-central part of the pluton. The pluton has been mapped in reconnaissance only and individual facies within the pluton have not been delineated. Quartz is generally less than 15 percent; pyroxene and hornblende are the principal mafic minerals and melanite garnet occurs in some pyroxene syenites. The plutonic rocks are generally massive and non-foliated.

The west-central part of the pluton is considerably fractured and weathers to a rusty orange color. It is cut by thin quartz veins which locally contain small amounts of galena, sphalerite, and molybdenite. Purple fluorite occurs in fracture fillings and disseminated in the monzonite in this part of the pluton. Similar mineralization occurs locally along the east border of the pluton.

The Windy Creek pluton resembles the Granite Mountain pluton and its satellitic Peace River stock which are located 40 miles to the east. The hornblende-pyroxene quartz monzonite and monzonite in each of the plutons are quite similar in composition and all the plutons contain nepheline syenite (Miller and Elliott, 1969). The satellitic stock on Peace River is altered locally and contains anomalous amounts of molybdenum, lead, silver, and bismuth. Fluorite is also common as fracture fillings and in thin veinlets. The Granite Mountain pluton has yielded a K-Ar age of 106±3.0 m.y. (Miller, 1971) and a Pb-α age of 90±10 m.y. (Patton, 1967). It has been assigned to a mid-Cretaceous

plutonic episode currently dated at 108 to 98 m.y. (Miller, 1970b). On the basis of the close similarity in lithology, the Windy Creek pluton is also assigned to this mid-Cretaceous plutonic suite. More specifically, it is considered to be part of a belt of alkaline subsilicic rocks that extends for about 180 miles in western Alaska (Miller, 1971).

Many strong lineaments which probably represent fault traces occur in the Windy Creek area; several of the more prominent ones are shown in figure 1. The east-west lineament north of the Windy Creek pluton may be a continuation of the prominent fault trace that occurs along the south flank of the Bendeleben Mountains.

SAMPLING AND ANALYTICAL PROCEDURES

Analytical data for 33 stream sediment samples and 14 altered rock samples are given in tables 1 and 2, respectively, and the location of the samples are shown in figure 1. Standard procedures were followed in the collection and preparation of the stream sediment samples. They were generally collected from the active stream channel; where this was not possible, the samples were collected from stream deposits adjacent to the active channel. The samples were dried, sieved, and the minus 80 mesh fraction were analyzed for 30[1/] elements by the six-step semiquantitative spectrographic method and for gold by the atomic absorption method. The spectrographic analyses were reported in percentage (pct) or parts per million (ppm) to the nearest number in the

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[1/] The spectrographic analyses for gold have been omitted from table 1.

series 1.0, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, etc. The precision of a reported value is approximately plus 100 percent or minus 50 percent. Minimum limits of detection for each element are given at the bottom of each page in table 1. The semiquantitative spectrographic analyses were done by K. J. Curry and the atomic absorption analyses were done by R. L. Miller.

RESULTS OF GEOCHEMICAL SAMPLING

Anomalous amounts of several metals occur in sediments of streams which drain the Windy Creek pluton. Samples from three streams (samples 16, 17, and 18) each about a mile apart on the west side of the pluton have 70, 50 and 30 ppm (parts per million) molybdenum (Mo) respectively. These three streams drain that part of the pluton that appears to be most fractured and altered and where fluorite and minor amounts of molybdenite, galena, and sphalerite have been found in the bedrock. Only 14 of 111 stream sediment samples collected from the eastern Bendeleben and Darby Mountains had 5 ppm or more Mo and 10 of these 14 samples are from the Windy Creek area.

Weakly anomalous amounts of lead, zinc, and silver occur in the sediments of several of the streams which drain the Windy Creek pluton. Lead occurs in amounts up to 150 ppm in 8 of the 33 samples; this is about twice the geometric mean of 72 ppm for the aforementioned 111 samples. Fourteen of the 111 samples from this region showed 200 ppm or more zinc and 5 of these are from the Windy Creek area. Silver in amounts of 0.5 ppm or more was found in only 6 of the 111 samples and 5 of these are in the Windy Creek area.

Semiquantitative spectrographic analyses of 11 grab samples (table 2) of altered samples from the pluton showed weakly to moderately anomalous amounts of Ag (0.5-2.0 ppm), Mo (5-700 ppm), Pb (70-3000 ppm), and Zn (200-700 ppm). Minor amounts of tin (up to 30 ppm) were found in five of the samples. Analyses of 3 grab samples of sulfide-bearing quartz veins showed, in addition to the expected high amounts of Pb, Zn, and Mo, tin values of 30, 150, and 500 ppm and La values of 150, 500, and more than 1000 ppm. None of the 14 analyzed samples contained detectable gold.

Mapping in the Windy Creek area has been of reconnaissance nature and only 33 stream sediment samples were collected from an area of about 80 square miles. The geologic information presently available is therefore not sufficient to adequately evaluate the extent of mineralized rock in the Windy Creek area. The fractured nature of the pluton and the adjacent faults suggest mineralization may be related to faulting; Sainsbury and others (1969) report molybdenum anomalies in both rock and stream sediments further west in the Bendeleben A-6 quadrangle which may be related to numerous faults in the area. It is also of interest that two of the plutons in the southeastern Seward Peninsula that contain alkaline rocks show similar mineralization characterized by the presence of fluorite and anomalous amounts of molybdenum and, to a lesser degree, lead, zinc, silver, and (or) other elements. Other alkaline complexes occur in the general area (Miller, 1970a) and may warrant examination for similar mineralization.

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TITLE

TABLE 1. STREAM SED. SAMPLES*

SAMPLE NO.	FE PCT	MG PCT	CA PCT	TI PCT	MN PPM	AG PPM	AS PPM	B PPM	BA PPM	BE PPM
1	7.0000	1.5000	1.5000	0.5000	1500.0000	0.5000N	200.0000N	20.0000	700.0000	3.0000
2	7.0000	1.0000	1.0000	0.7000	2000.0000	0.5000N	200.0000N	20.0000	700.0000	3.0000
3	3.0000	0.7000	0.7000	0.3000	700.0000	0.5000N	200.0000N	15.0000	500.0000	3.0000
4	3.0000	0.7000	0.7000	0.3000	5000.0000G	0.5000L	200.0000N	20.0000	700.0000	3.0000
5	7.0000	0.7000	0.7000	0.7000	1000.0000	0.5000L	200.0000N	30.0000	700.0000	3.0000
6	3.0000	0.5000	0.5000	0.3000	700.0000	0.5000	200.0000N	15.0000	700.0000	3.0000
7	3.0000	0.5000	0.7000	0.3000	700.0000	0.5000L	200.0000N	15.0000	700.0000	3.0000
8	3.0000	0.7000	0.5000	0.3000	700.0000	0.5000L	200.0000N	15.0000	700.0000	2.0000
9	7.0000	0.7000	0.3000	0.3000	1500.0000	0.5000N	200.0000N	30.0000	500.0000	3.0000
10	3.0000	0.7000	0.5000	0.5000	700.0000	0.7000	200.0000N	20.0000	700.0000	3.0000
11	7.0000	1.0000	0.7000	0.7000	700.0000	0.5000N	200.0000N	30.0000	700.0000	3.0000
12	10.0000	1.5000	1.5000	1.0000	1500.0000	0.5000N	200.0000N	30.0000	700.0000	2.0000
13	10.0000	1.0000	1.0000	1.0000	1500.0000	0.5000N	200.0000N	30.0000	700.0000	2.0000
14	3.0000	0.7000	0.7000	0.3000	700.0000	0.7000	200.0000N	30.0000	700.0000	2.0000
15	3.0000	0.7000	0.7000	0.3000	700.0000	0.5000L	200.0000N	20.0000	1000.0000	2.0000
16	15.0000	3.0000	1.5000	1.0000	2000.0000	0.7000	200.0000N	50.0000	1000.0000	2.0000
17	7.0000	1.5000	1.5000	1.0000	1500.0000	0.5000N	200.0000N	30.0000	700.0000	1.5000
18	15.0000	1.5000	1.0000	1.0000	1500.0000	0.5000	200.0000N	70.0000	700.0000	5.0000
19	10.0000	1.5000	1.5000	0.7000	1500.0000	0.5000L	200.0000N	70.0000	700.0000	5.0000
20	15.0000	5.0000	3.0000	1.0000G	2000.0000	0.5000N	200.0000N	200.0000	300.0000	2.0000
21	15.0000	5.0000	5.0000	1.0000G	2000.0000	0.5000N	200.0000N	150.0000	700.0000	1.5000
22	10.0000	3.0000	3.0000	1.0000	2000.0000	0.5000N	200.0000N	150.0000	700.0000	1.5000
23	10.0000	3.0000	3.0000	1.0000	1000.0000	0.5000L	200.0000N	70.0000	700.0000	3.0000
24	7.0000	2.0000	1.5000	1.0000	700.0000	0.5000N	200.0000N	70.0000	1000.0000	2.0000
25	10.0000	3.0000	2.0000	1.0000	700.0000	0.5000N	200.0000N	150.0000	700.0000	1.5000
26	10.0000	3.0000	1.5000	1.0000	700.0000	0.5000N	200.0000N	100.0000	700.0000	1.5000
27	7.0000	3.0000	3.0000	1.0000	700.0000	0.5000N	200.0000N	100.0000	1500.0000	1.5000
28	7.0000	2.0000	1.5000	1.0000	700.0000	0.5000L	200.0000N	150.0000	1500.0000	2.0000
29	10.0000	1.5000	1.5000	1.0000G	3000.0000	0.5000N	200.0000N	70.0000	300.0000	1.5000
30	7.0000	2.0000	1.5000	0.5000	1500.0000	0.5000N	200.0000N	100.0000	700.0000	1.5000
31	15.0000	3.0000	2.0000	1.0000	1000.0000	0.5000N	200.0000N	70.0000	700.0000	3.0000
32	7.0000	1.5000	2.0000	0.7000	2000.0000	0.5000N	200.0000N	30.0000	700.0000	3.0000
33	10.0000	1.5000	1.0000	0.7000	2000.0000	0.5000N	200.0000N	30.0000	700.0000	3.0000
LOWER LIMIT OF DETECTION	0.05	0.02	0.05	0.002	10.0	0.5	200.0	10.0	20.0	1.0

*N = NOT DETECTED, L = LESS THAN, G = GREATER THAN. ALSO NOTE THAT THE RIGHT-MOST ZERO DIGITS OF EACH DATA VALUE MAY OR MAY NOT BE SIGNIFICANT.

TITLE

TABLE 1. STREAM SED. SAMPLES

SAMPLE NO.	BI PPM	CD PPM	CO PPM	CR PPM	CU PPM	LA PPM	MO PPM	NB PPM	NI PPM	PB PPM
1	10.0000N	20.0000N	15.0000	50.0000	30.0000	100.0000	5.0000N	15.0000	30.0000	150.0000
2	10.0000N	20.0000N	20.0000	50.0000	30.0000	150.0000	5.0000L	15.0000	15.0000	150.0000
3	10.0000N	20.0000N	10.0000	15.0000	50.0000	30.0000	5.0000N	10.0000	15.0000	100.0000
4	10.0000N	20.0000N	15.0000	15.0000	70.0000	70.0000	5.0000L	15.0000	15.0000	150.0000
5	10.0000N	20.0000N	10.0000	50.0000	70.0000	200.0000	5.0000	15.0000	15.0000	100.0000
6	10.0000N	20.0000N	5.0000	10.0000L	70.0000	30.0000	5.0000L	10.0000	15.0000	150.0000
7	10.0000N	20.0000N	5.0000L	10.0000L	15.0000	70.0000	5.0000N	10.0000	7.0000	70.0000
8	10.0000N	20.0000N	5.0000	10.0000L	70.0000	100.0000	5.0000	10.0000	10.0000	150.0000
9	10.0000N	20.0000N	20.0000	50.0000	20.0000	50.0000	5.0000	10.0000	20.0000	70.0000
10	10.0000N	20.0000N	10.0000	30.0000	100.0000	300.0000	5.0000L	15.0000	15.0000	100.0000
11	10.0000N	20.0000N	15.0000	70.0000	70.0000	70.0000	5.0000N	10.0000	30.0000	70.0000
12	10.0000N	20.0000N	15.0000	70.0000	70.0000	200.0000	5.0000N	15.0000	20.0000	70.0000
13	10.0000N	20.0000N	20.0000	70.0000	100.0000	200.0000	5.0000L	20.0000	30.0000	100.0000
14	10.0000N	20.0000N	5.0000	30.0000	50.0000	70.0000	7.0000	10.0000	15.0000	70.0000
15	10.0000N	20.0000N	5.0000	20.0000	20.0000	50.0000	5.0000L	15.0000	15.0000	150.0000
16	10.0000N	20.0000N	30.0000	150.0000	70.0000	300.0000	70.0000	15.0000	70.0000	150.0000
17	10.0000N	20.0000N	15.0000	70.0000	70.0000	150.0000	50.0000	20.0000	50.0000	150.0000
18	10.0000N	20.0000N	20.0000	150.0000	70.0000	300.0000	30.0000	15.0000	70.0000	100.0000
19	10.0000N	20.0000N	15.0000	70.0000	70.0000	70.0000	5.0000	15.0000	70.0000	100.0000
20	10.0000N	20.0000N	30.0000	150.0000	70.0000	30.0000	5.0000L	15.0000	100.0000	50.0000
21	10.0000N	20.0000N	30.0000	150.0000	100.0000	20.0000L	5.0000L	20.0000	150.0000	70.0000
22	10.0000N	20.0000N	30.0000	150.0000	70.0000	20.0000L	5.0000L	15.0000	70.0000	70.0000
23	10.0000N	20.0000N	30.0000	100.0000	70.0000	150.0000	5.0000L	15.0000	100.0000	70.0000
24	10.0000N	20.0000N	30.0000	100.0000	50.0000	30.0000	5.0000L	10.0000	100.0000	30.0000
25	10.0000N	20.0000N	20.0000	150.0000	100.0000	20.0000L	5.0000L	20.0000	70.0000	30.0000
26	10.0000N	20.0000N	20.0000	150.0000	70.0000	20.0000	5.0000L	10.0000	100.0000	70.0000
27	10.0000N	20.0000N	15.0000	70.0000	70.0000	20.0000	5.0000L	10.0000	70.0000	30.0000
28	10.0000N	20.0000N	20.0000	70.0000	70.0000	20.0000L	5.0000	10.0000	70.0000	50.0000
29	10.0000N	20.0000N	15.0000	100.0000	100.0000	20.0000L	5.0000N	10.0000	70.0000	30.0000
30	10.0000N	20.0000N	20.0000	150.0000	100.0000	20.0000	5.0000N	10.0000	100.0000	70.0000
31	10.0000N	20.0000N	20.0000	150.0000	70.0000	100.0000	5.0000L	15.0000	100.0000	100.0000
32	10.0000N	20.0000N	15.0000	70.0000	70.0000	200.0000	5.0000L	15.0000	30.0000	100.0000
33	10.0000N	20.0000N	15.0000	70.0000	70.0000	200.0000	5.0000	15.0000	30.0000	100.0000
LOWER LIMIT OF DETECTION	10.0	20.0	5.0	5.0	5.0	20.0	5.0	10.0	5.0	10.0

TITLE

TABLE 1. STREAM SED. SAMPLES

SAMPLE NO.	SB PPM	SC PPM	SN PPM	SR PPM	V PPM	W PPM	Y PPM	ZN PPM	ZR PPM	AU PPM*
1	100.0000N	15.0000	10.0000N	700.0000	150.0000	50.0000N	30.0000	200.0000	300.0000	0.0200L
2	100.0000N	15.0000	10.0000N	700.0000	150.0000	50.0000N	50.0000	200.0000L	300.0000	0.0200L
3	100.0000N	5.0000	10.0000L	300.0000	70.0000	50.0000N	20.0000	200.0000L	150.0000	0.0200L
4	100.0000N	7.0000	10.0000N	700.0000	70.0000	50.0000N	20.0000	300.0000	300.0000	0.0200L
5	100.0000N	15.0000	10.0000L	700.0000	150.0000	50.0000N	50.0000	200.0000	300.0000	0.0200L
6	100.0000N	5.0000L	10.0000	700.0000	50.0000	50.0000N	15.0000	200.0000	100.0000	0.0200L
7	100.0000N	5.0000	10.0000	700.0000	30.0000	50.0000N	30.0000	200.0000L	150.0000	0.0200L
8	100.0000N	5.0000L	10.0000L	500.0000	70.0000	50.0000N	20.0000	300.0000	200.0000	0.0200L
9	100.0000N	10.0000	10.0000N	200.0000	100.0000	50.0000N	20.0000	200.0000N	150.0000	0.0200L
10	100.0000N	10.0000	10.0000	500.0000	70.0000	50.0000N	30.0000	200.0000N	200.0000	0.0200L
11	100.0000N	15.0000	10.0000N	300.0000	150.0000	50.0000N	20.0000	200.0000L	300.0000	0.0200L
12	100.0000N	20.0000	10.0000N	700.0000	200.0000	50.0000N	30.0000	200.0000N	500.0000	0.0200L
13	100.0000N	15.0000	10.0000N	700.0000	200.0000	50.0000N	50.0000	200.0000N	300.0000	0.0200L
14	100.0000N	10.0000	10.0000N	300.0000	100.0000	50.0000N	15.0000	200.0000N	150.0000	0.0200L
15	100.0000N	7.0000	10.0000N	700.0000	70.0000	50.0000N	10.0000	200.0000N	200.0000	0.1000L
16	100.0000N	30.0000	10.0000N	500.0000	300.0000	50.0000N	70.0000	200.0000N	300.0000	0.0200L
17	100.0000N	15.0000	10.0000N	500.0000	200.0000	50.0000N	30.0000	200.0000L	300.0000	0.1000L
18	100.0000N	30.0000	10.0000N	300.0000	300.0000	50.0000N	70.0000	200.0000N	300.0000	0.0200L
19	100.0000N	20.0000	10.0000N	700.0000	300.0000	50.0000N	30.0000	200.0000N	300.0000	0.0200L
20	100.0000N	30.0000	10.0000N	300.0000	300.0000	50.0000N	70.0000	200.0000N	300.0000	0.0200L
21	100.0000N	30.0000	10.0000N	300.0000	300.0000	50.0000N	50.0000	200.0000L	300.0000	0.0200L
22	100.0000N	20.0000	10.0000N	500.0000	300.0000	50.0000N	30.0000	200.0000N	300.0000	0.0200N
23	100.0000N	20.0000	10.0000N	300.0000	300.0000	50.0000N	50.0000	200.0000N	300.0000	0.0200L
24	100.0000N	20.0000	10.0000N	300.0000	300.0000	50.0000N	30.0000	200.0000N	300.0000	0.0200L
25	100.0000N	30.0000	10.0000N	300.0000	300.0000	50.0000N	50.0000	200.0000N	300.0000	0.0200L
26	100.0000N	20.0000	10.0000N	200.0000	300.0000	50.0000N	30.0000	200.0000N	300.0000	0.0200L
27	100.0000N	20.0000	10.0000N	300.0000	300.0000	50.0000N	30.0000	200.0000N	300.0000	0.0200L
28	100.0000N	20.0000	10.0000N	300.0000	300.0000	50.0000N	30.0000	200.0000N	300.0000	0.0200L
29	100.0000N	30.0000	10.0000N	150.0000	150.0000	50.0000N	70.0000	200.0000N	300.0000	0.0200L
30	100.0000N	30.0000	10.0000N	150.0000	300.0000	50.0000N	30.0000	200.0000N	200.0000	0.0200L
31	100.0000N	30.0000	10.0000N	300.0000	200.0000	50.0000N	70.0000	200.0000N	300.0000	0.0200L
32	100.0000N	15.0000	10.0000N	700.0000	150.0000	50.0000N	50.0000	200.0000L	200.0000	0.0200L
33	100.0000N	15.0000	10.0000N	700.0000	150.0000	50.0000N	50.0000	200.0000N	300.0000	0.0200L
LOWER LIMIT OF DETECTION	100.0	5.0	10.0	100.0	10.0	50.0	10.0	200.0	10.0	0.02

*GOLD ANALYSES ARE BY ATOMIC ABSORPTION TECHNIQUES.

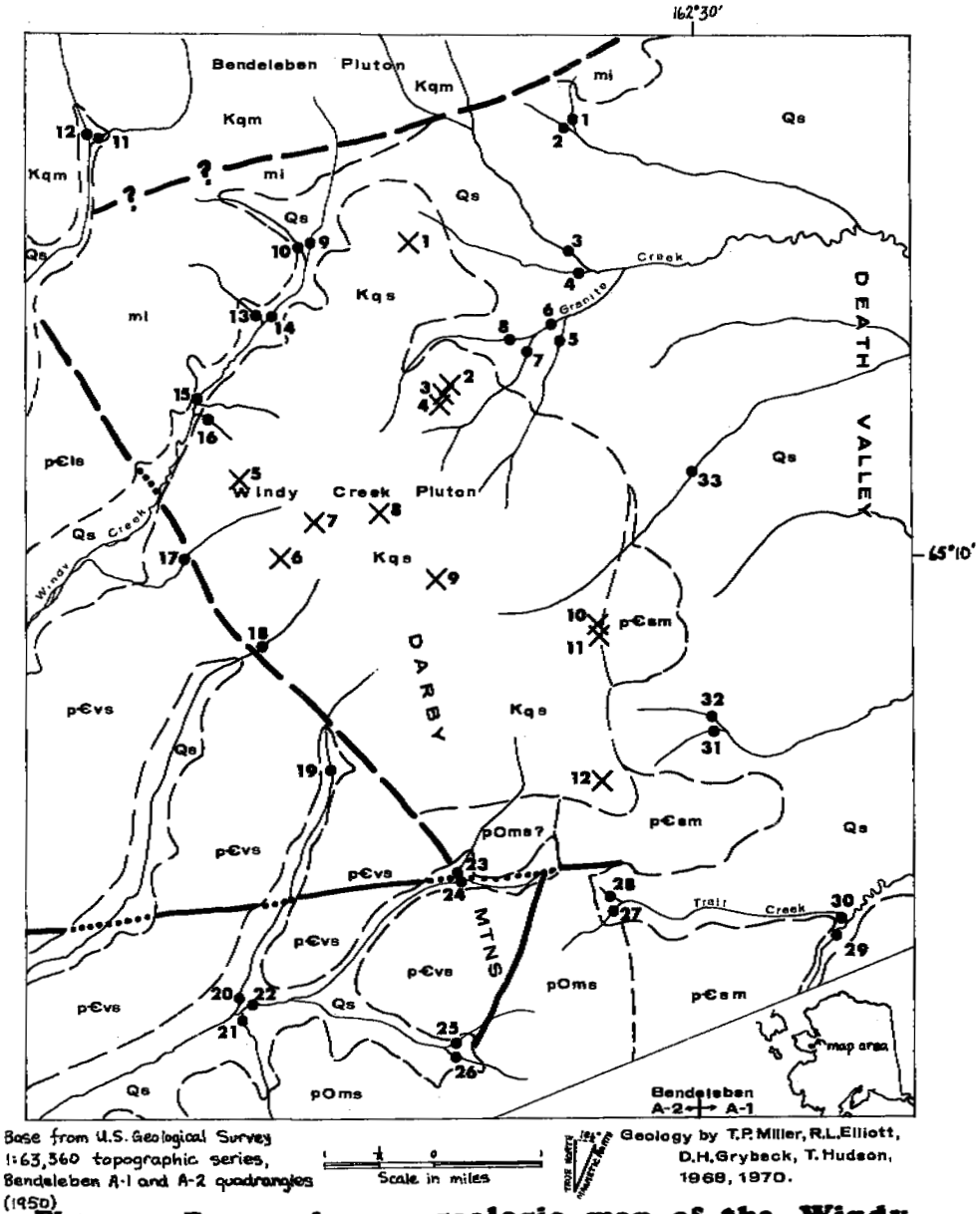
TABLE 2.* ANALYSES OF ALTERED ROCK SAMPLES FROM THE WINDY CREEK PLUTON; Au analyses by atomic absorption, all other elements by semiquantitative spectrographic analyses.

Sample	Ag	As	Au	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	W	Zn
1	N	N	N	1000	3	5	L	70	70	N	L	5	70	L	N	700	30	N	L
2	2	N	N	1000	3	5	10	15	20	N	10	7	150	5	20	700	30	N	L
3	1	N	N	700	5	5	10	150	50	L	10	7	700	L	15	500	50	N	700
4	L	N	N	1500	3	10	L	50	20	N	10	7	150	L	N	L	30	N	L
5a	.5	N	N	300	2	L	L	50	500	N	15	5	150	N	N	300	30	N	N
5b	1.5	L	N	50	2	10	L	150	150	50	30	20	70	L	30	L	50	50	N
6	7	L	N	700	3	L	L	7	500	N	30	7	15000	N	150	700	30	L	300
7	1.5	L	N	G(5000)	3	15	20	70	150	700	15	10	3000	7	30	1500	150	50	300
8	3	N	N	200	30	7	20	50	G(1000)	1500	30	5	3000	30	500	200	1500	L	1500
9	L	N	N	700	5	5	10	15	200	L	30	7	70	5	L	700	100	N	N
10	N	N	N	700	3	5	70	70	70	L	20	15	100	15	L	700	200	N	N
11a	L	N	N	1000	1	L	L	70	20	N	10	10	150	N	10	500	100	N	N
11b	L	N	N	700	2	5	10	7	70	N	L	5	70	N	N	300	30	N	N
12	1	L	N	300	1.5	N	L	20	L	5	10	L	300	N	30	300	20	N	L

Description of samples (all grab samples)

1 Pyritiferous quartz monzonite.
2 Oxidized quartz monzonite.
3 Pyritiferous aphanitic dike.
4 Pyritiferous quartz monzonite.
5a Fractured quartz monzonite; fluorite in fracture fillings.
5b Pyrite-bearing quartz.
6 Quartz vein containing galena and pyrite.
7 Fractured monzonite; fluorite, quartz, molybdenite, galena filling fractures.
8 Oxidized quartz vein.
9 Oxidized aphanitic intrusive.
10 Altered metamorphic rock.
11a Fractured syenite; fluorite in fractures.
11b Oxidized syenite.
12 Oxidized quartz monzonite.

* N = not detected, L = less than lower limit of detection, G = greater than value shown; lower limits of detection are the same as in table 1.



Base from U.S. Geological Survey 1:63,360 topographic series, Bendeleben A-1 and A-2 quadrangles (1950)

Scale in miles

Geology by T.P. Miller, R.L. Elliott, D.H. Grybeck, T. Hudson, 1968, 1970.

Figure 1. Reconnaissance geologic map of the Windy Creek pluton and adjacent areas showing location of analyzed stream sediment and rock samples.

Open-file map

EXPLANATION

QUATERNARY

Qs — Surficial deposits; colluvium and alluvium

CRETACEOUS

Kqm — Quartz monzonite; screens of metamorphic rock near contact

Kqs — Chiefly quartz monzonite, monzonite, and syenite; minor nepheline syenite; local screens of metamorphic rocks

PRECAMBRIAN (?)

pOms — Metasedimentary rocks, chiefly metagraywacke, black slate, limestone. Tentatively correlated with pre-Ordovician rocks further west

p€vs — Chiefly metavolcanic rocks and quartz-albite-mica schist; includes some marble

p€sm — Chiefly quartz-plagioclase-biotite-garnet schist; intercalated marble and calc-silicate rock

mi — Mixed zone of Precambrian(?) metamorphic rocks cut by Cretaceous granitic and aphanitic intrusives

p€ls — Marble and calc-silicate rock

Approximate contacts

Fault — Approximately located or inferred; queried where uncertain; dotted where concealed

● 23 — Location of analyzed stream sediment sample; number refers to table 1.

× 5 — Location of analyzed rock sample; number refers to table 2.

This map is preliminary and has not been edited or reviewed for conformity with U.S. Geological Survey standards and nomenclature.