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GEOLOGIC REPORT NO. 12

Geology of the Bear Creek Area

Seward Peninsula, Candle Quadrangle, Alaska

By

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ABSTRACT

The association of major structures and igneous rocks along the eastern margin of the Seward Peninsula has made that belt favorable for ore deposits. The map area is largely underlain by andesitic greenstone intruded by various acidic rocks. Olivine basalt overlies the greenstone. Dikes and small intrusives appear to be more abundant near a large fault which lies along Bear Creek, but they do not follow it. Gold, lead, and zinc deposits are associated with mafic syenite dikes and possibly with altered diorite.

Gold placers exist in the belt, one of which is closely associated with a lead-zinc-gold deposit on Bear Creek. Other similar associations are likely. Geochemical sampling indicates an extension of the Bear Creek prospect.

Mafic syenite, diorite, and probably jasper and hematite creek float are considered favorable indications of lode possibilities throughout the greenstone region. Stream sediment geochemical sampling should be effective if sampling is done at intervals of not greater than one mile in all drainages.

INTRODUCTION

The eastern boundary of the Seward Peninsula is a major tectonic junction between the Seward Peninsula tectonic block and the Koyukuk geosyncline. The Bear Creek area described in this report has the greatest topographic relief and the best bedrock exposures along this zone, has produced placer gold, and contains a number of small to moderate sized intrusive bodies. Nineteen days were spent in the area during August 1964 by the author and Michael Mitchell, field assistant. We are much indebted to Beltram E. "Chubby" Douglass and Albert Milligrock, both of Nome, for their hospitality at Bear Creek and for much useful information concerning the geology and ore deposits in the area.

Bear Creek is 145 miles east-northeast of Nome, the supply point most convenient to the area. A landing strip suitable for light aircraft is located on Bear Creek above the mouth of Bob Creek. The nearest permanent inhabitants are at the White Alice microwave relay site just south of the map area on Granite Mountain. The hills in the map area are tundra-covered and bare of brush and trees, but in the stream valleys, willow and alder are dense enough to impede walking in some areas. There is no spruce. Bedrock rubble is exposed in much of the upland area, but bedrock in place is limited to scattered scarps and stream cuts.

PREVIOUS INVESTIGATIONS

The area has been the subject of several reports by the U.S. Geological Survey. In 1905, Moffit enumerated the placer deposits that had been found and mentioned that the bedrock was volcanic. Smith and Eakin (1911) show a geologic map with a very general outline of the Granite Mountain intrusive and locate the placer deposits on Bear, Sheridan, and Cub Creeks. They show the bedrock on Bear Creek as undifferentiated nonmetamorphic intrusives and effusives of pre-Cretaceous age. Gault and others (1953) describe the heavy minerals-trace element surveys made by the U.S. Geological Survey for the AEC between 1945 and 1951 in the eastern Seward Peninsula. During the course of this work a deposit containing copper, lead, zinc, thorium, and uranium minerals was found near the head of the Peace River drainage. The geologic map of West and Matzko (Plate 3) in Gault and others (1953) shows the Granite Mountain intrusive essentially as drawn in the present report. They map the bedrock along Bear Creek as undifferentiated basic rocks. The latest report is a photo-geologic map by Cass (1959). This shows an outline of the Granite Mountain body resembling that of the early reports and groups all the rocks along Bear Creek as volcanic rocks.

PRESENT INVESTIGATION

The distribution of rocks was mapped and geochemical samples were taken throughout the mapped area. A small galena showing near the landing strip on Bear Creek was examined. Moderate geochemical anomalies were found to be associated with this showing and with the previously reported deposit at the head of Peace River. Several small areas of syenite, trachyte porphyry, rhyolite porphyry, and altered diorite were mapped.

GEOLOGIC SETTING

The Bear Creek area lies along a north-trending belt of pre-Cretaceous greenstone which is 20 miles wide and 55 miles long. This belt is cut by granitic to gabbroic intrusives and acid dike rocks. Flat-lying fresh basalt flows of Cenozoic age overlie the greenstone in places. This igneous province is flanked on the east by the Cretaceous sediments of the Koyukuk geosyncline and on the west by the marble and schist of the Seward Peninsula. The long-continued magmatism along the zone is evidence for movements at great depth along the boundary between the two radically different tectonic regions. Igneous-tectonic zones such as this are thought to have a considerably better-than-average potential for ore deposits. Placer gold deposits present in several areas along this zone are evidence of mineral deposits.

ROCK TYPES

Greenstone - The map area is underlain chiefly by greenstone except where this has been intruded by igenous rocks or capped by basalt flows. No sedimentary rocks were observed. The greenstone typically contains euhedral to anhedral feldspar and/or pyroxene phenocrysts in an aphanitic matrix which is generally dark green, but may be light colored. In some rocks phenocrysts are lacking. The texture and presence of well-formed pillowson Bear Creek, between Split and Polar Creeks, indicates a submarine lava flow origin. Both epidote and quartz veinlets are common. An estimated one to five percent of the greenstone in creek gravels contains quarts veinlets, whereas none of the other rock types have quartz veins. The greenstone is massive and unfoliated. The general lack of shearing of the rocks in the area is confirmed by thin section examination. The groundmass is generally composed of tiny actinolite shreds without preferred orientation. Locally (in the vicinity of site 55 on the geologic map) intrusion of the Granite Mountain syenite has produced a rude foliation in the adjacent greenstone. The syenite in this area is somewhat gneissic.

In thin section the pyroxene phenocrysts are colorless clinopyroxene, some with rims of actinolite and others completely altered to actinolite or actinolitic hornblende, with a light bluish-green pleochroism and Z/C=17°. Feldspar phenocrysts are saussuritized albite. Amygdules are present in some sections. They often are perfectly round and usually have clear quartz rims and cores of epidote or cholorite, occasionally with some magnetite. Evidently the greenstones were vesicular porphyritic andesites which have been transformed by thermal metamorphism to rocks of the albite-epidote hornfels facies.

Syenite - The Granite Mountain stock is a coarse-grained subhedral granular to gneissic syenite with mafic minerals making up between 10 and 40 percent of the rock. The syenite forms coarse frost-riven rubble on much of Granite Mountain. On the gentle, tundra-covered slopes to the south and east of the mountain the slopes have a conspicuously even grade where underlain by syenite. This is well shown by the map contours in the southern part of the map area.

Thin section examination, with visual estimation of mineral abundance of three widely spaced samples of syenite, taken near sites 71,55, and 68, shows the rock to be composed of 50-90% coarse perthitic orthoclase; 1-30% green hornblende, often with colorless clinopyroxene cores; and 1-5% sphene. A yellow-brown, zoned, isotropic garnet is present at site 71 and makes up 10% of the rock in close association with sphene (5%) at site 55. At sites 71 and 55, 1-3% biotite is present. Apatite is present in small amounts in all sections. The perthite grains contain numerous subhedral crystals of albite, both in the grains and along grain boundaries. The albite has evidently exsolved from the perthite.

The mafic syenite dikes at Bear Creek (sites 33 and 34) and north of Split Creek are extremely variable in composition, ranging from 20 to 95 percent mafic minerals. The dike at site 34 is closely associated with pyrite, galena, sphalerite, and gold. It is a coarse grained subhedral granular rock with black biotite plates up to five mm across and contains an estimated 45% clinopyroxene and about 25% each of biotite and orthoclase, plus minor amounts of apatite and pink garnet. The clinopyroxene grains (2V=56°) are euhedral and light green. The orthoclase is nonperthitic and mostly unaltered. Adjacent greenstone is spotted for 1-2 feet from the contact and has been largely altered to carbonate and apatite. On the ridge north of Split Creek syenite rubble is present which ranges in mafic content from 20 to 95 percent. One specimen contains 65% slightly perthitic orthoclase; 20% clinopyroxene; 10% green hornblende; 5% biotite; plus minor apatite and magnetite. The orthoclase is partly altered to clay minerals. These two bodies are probably related to the Granite Mountain syenite. Their high mafic content could be due to assimilation of greenstone.

Altered diorite - This rock was only found in one area east of Sheridan Creek. It is a medium-grained intrusive of diabasic texture, composed in one specimen of saussuritized albite laths (70%) and intergranular pyroxene (30%). The latter is altered to actinolite and chlorite. Other alteration products are colorless epidote, carbonate, magnetite, and leucoxene. Another specimen has a similar texture and grain size but is composed of saussuritized albite laths with interstitial quartz (30%). The only mafic mineral is 1% hornblende which is clustered with magnetite grains and is somewhat chloritized. A little epidote is also present. No K-feldspar was identified in either rock. Analysis of the quartz-bearing rock by X-ray spectrograph indicates a K_2O content of 0.5%, an amount that could be present in the plagioclase. Alteration of this rock could have been deuteric or metamorphic, or both if this and other intrusives were responsible for the metamorphism of the region. Moffit (1905) reports that diorite is also present on the south side of the Granite Mountain stock.

Trachyte and Rhyolite Dikes - Red to tan trachyte porphyry dikes with euhedral phenocrysts of feldspar and/or mafic minerals in a fine-grained or aphanitic red to tan groundmass are common in the Bear Creek drainage. Similar looking dikes with quartz phenocrysts are of rhyolitic composition. Due to lack of exposures the two types have been combined on the map. Rubble exposures of the dikes up to 50 feet wide are present north and south of Eagle Creek. On the ridge north of Split Creek, and along Bear Creek near the landing strip, red porphyry dikes are associated with mafic syenite dikes. On the hills west of the landing strip scattered red porphyry rubble is present in predominantly greenstone areas.

A sample of red porphyry rubble from the ridge between Bob and Split Creeks, 2½ miles west-southwest of the Bear Creek airstrip, is a trachyte with euhedral phenocrysts of hornblende (5%), clinopyroxene (5%), orthoclase (<1%) and apatite (<1%). The groundmass contains tiny magnetite (?) grains in a fine-grained mass of subparallel sanidine laths which swirl about the phenocrysts. Another red porphyry from the ridge north of Split Creek has euhedral phenocrysts of microcline (5%) and hornblende (<1%) in the saussuritized felsic ground mass. A somewhat different rock type which may be a silicified dike is exposed along Bear Creek 1/8 mile down-stream from the mouth of Eagle Creek. It is a buff colored aphanitic rock with small black specks and is composed of quartz grains in a fine-grained felsic groundmass with scattered small magnetite (?) and leucoxene grains in the groundmass. Joints in the rock are heavily limonite-stained.

Carbonate Altered Zone - Conspicuous tan zones of alteration in the greenstone are present north of site 8, on the divide at the head of the south fork of Split Creek, and on the hillside south of site 67. These are zones composed almost entirely of calcite which has replaced the original greenstone. They are irregular isolated patches up to a few hundred feet across and are not visibly associated with faulting. No sulfide mineralization was seen around them. A moderate copper anomaly is associated with the zone near site 67. A specimen of altered greenstone taken one foot from the mafic syenite on Bear Creek (site 34) contains relict pyroxene from the greenstone and much added carbonate and apatite. There is a marked similarity of this rock with the more completely carbonatized rocks of the altered zones. These zones may mark the location of buried intrusives.

Olivine basalt - Most of the low hills in the area east of Bear Creek and downstream from Polar Creek are underlain by flat-lying basalt. This rock crops out prominantly on the steep left limit slopes of Bear Creek as rudely layered, fresh-appearing, dark, porphyritic rock which is locally vesicular. Apparently it was extruded as flows over the lowlands and into ancestral Bear Creek Valley. The higher greenstone hills were above the level of the flows. Bear Creek has since cut down through the basalt, leaving a terrace-like extension of basalt along the left limit slope north of Split Creek.

Typical vesicular basalt from the hill just east of site 18 is a porphyritic olivine basalt with phenocrysts of olivine (Fo-88), labradorite, and clinopyroxene ($2V_Z=52°$) up to 1-2 mm in diameter which grade down in size to a groundmass with intergranular texture composed of the same minerals plus a little carbonate. All minerals are fresh and unaltered. Nonvesicular porphyritic basalt from the same hill contains the same minerals with the addition of a little fine-grained magnetite in the groundmass. The feldspar laths in the groundmass have a trachytic texture that swirls around the phenocrysts. This rock is finer-grained than the vesicular basalt.

STRUCTURE

Due to the massive nature of the greenstone and the predominance of rubble exposures only two attitudes were measured. On a ridge in the upper drainage of Split Creek westerly dips are indicated by indistinct lines on the hillside and east-facing scarps on the ridge. The other attitude was on easterly-dipping greenstone pillows on Bear Creek, just north of Split Creek. These two attitudes seem to indicate anticlinal arching of the greenstone west of Bear Creek along a northwest axis.

Faulting is difficult to decipher. The straight course of Bear Creek, the differences in relief across it and the presence of flat-lying basalt only on its east side indicate that post-basalt faulting along the creek has uplifted the area to the west. It has been pointed out that basalt flows occupied ancestral Bear Creek valley. In all probability, the location of ancestral Bear Creek along the site of a later major fault was not fortuitous , but was due to earlier movement on the same fault. Traverses and visual observations west of Bear Creek indicate that the red porphyry and syenite are more abundant along Bear Creek than further west. These intrusives are probably localized along the fault zone.

Uplift of the Granite Mountain "block" along northerly trending faults along the east side of the mountain is probably responsible for the great relief there. No field evidence for such faults has been found, perhaps due to extensive cover and lack of detailed mapping in this area. Such faulting would most likely extend northward along the eastern edge of the Granite Mountain-Bear Creek highland to join the Bear Creek fault zone. All the known mineral deposits in the Bear Creek area and east of Granite Mountain are located along these zones.

GEOMORPHOLOGY

A conspicuous development of terraces and flat summits at various levels is present in the hills east and west of upper Bear Creek, north of Split Creek, and in the hills west of site 60, out of the map area. Similar features have been called altiplanation terraces by Eakin (1916, p. 78) who ascribed them to solifluction. The terraces seen in the map area lack obvious slump features such as a scooped-out area behind and lobate scarps at the face. Some of the terraces appear at a distance to have bedrock exposed along the scarp face. The accordant ridge levels along the interstream divides in the uplifted block west of Bear Creek probably represent an old erosion surface, and it seems possible that a number of stream terraces formed at different levels during the uplift and have been preserved.

GEOCHEMISTRY AND MINERAL DEPOSITS

The Bear Creek area is drained by an integrated network of small and medium sized streams with no large valleys deeply filled with alluvium that could geochemically mask ore deposits located in the valley bottoms. Geochemical sampling of stream sediments in this area, if properly done, should indicate the presence of any ore deposits even though the deposits are not actually found because of overburden or lack of detailed traversing. In order to find indications of hidden deposits of moderate size or larger it is necessary to sample at close intervals, analyze the samples accurately, determine the background of metal concentrations, and interpret any anomalies in terms of distance from, and size of, mineral deposits. Because of the many variables involved it is best to take samples from the creeks below known deposits to determine the extent and grade of anomalies associated with the deposits. This was done with the two deposits known in the map area.

Sampling was done mainly on stream sediments (see Table 1). Wherever possible, these samples were taken of fine-grained, nonorganic silt and mud from below the water level. In many places such samples were not obtainable, and samples with an appreciable organic content were taken at or above the water level. All samples were analyzed in the laboratory by the Division of Mines and Minerals or Rocky Mountain Geochemical Laboratories using extraction by bisulfate fusion or hot acid. These methods give total contents of each metal analyzed. A number of samples were run in the field by the University of Alaska method #1, a heavy metal test which utilizes sodium chloride, dithizone, and unleaded gasoline. This test gives the sum of the readily extractable copper, lead, zinc, and some other metals. A comparison between the heavy metal field tests and the results of the laboratory tests indicates that the field tests were not sufficiently accurate to locate anomalous areas with certainty. Duplicate analyses of samples and repeated analyses of portions of a single dummy sample inserted at random among the samples indicate that the laboratory results could be repeated within acceptable limits.

Graphs of frequency vs. concentration have been made for copper, lead, and zinc (Figure 1). The graph for each metal shows a single clearly defined peak (or mode) which indicates the concentration of that metal which occurs most frequently. Only a small percentage of the stream sediment samples have a metal concentration of more than twice the mode and most of these are spatially related to known metalliferous deposits. A figure equal to mode has therefore been selected as the threshold, and higher values are considered to be anomalous. As might be expected, the soil and other types of samples tend to have a greater geochemical relief than stream sediment samples. The relation of the metal content of stream sediments to the known deposits indicates that detectable metal anomalies in stream sediments extend at least one mile downstream below the showings on Bear Creek and the upper Peace River. Evidently a closer sample interval than was used will be necessary to prospect the area thoroughly for ore deposits of the apparently small size of those now known.

The unusually anomalous sample 69 was taken from a frost boil in the tundra on a ridge. No explanation can be made as to the probable cause of the high concentration.

Gold claims were first staked on Bear Creek in August 1901 (Smith and Eakin, 1911), and by 1903, when Moffit (1905) visited the region, prospects were known on Sheridan Creek, Bear Creek, and Cub Creek. Most of the placer mining done to date has been on Bear Creek, above and below Split Creek. Mined areas with prominent tailings are shown on the geologic map. No lode mining has been done.

Table 1 - Analyses of Geochemical Samples
All samples are stream sediments unless otherwise noted

Sample No.	Copper (ppm)	Lead (ppm)	Zinc (ppm)	Moly. (ppm)	Remarks
1	45	20	145	2	
2	65	30	130	2	
3	90	20	135	3	
4	100	25	140	3	
5	65	15	170	2	
6	100	15	150	3	
7*	65	10	70		Gossan
8*	70	10	210		
9*	140	15	125		
10	150	90	750	5	Gossan
11	90	20	165	3	
12	85	20	135	3	
13	130	20	135	2	
14	140	15	125	3	
15*	60	10	90		
16*	40	5	80		
17	80	25	75	3	
18	40	40	90	3	
19*	50	40	110		
20*	100	250	90		Soil sample from ditch
21*	65	600	170		
22*	30	200	195		
23*	45	35	115		
24*	30	50	110		
25*	35	40	120		
26*	55	55	115		
27*	40	25	110		
28*	25	35	100		
29*	30	50	105		
30*	35	35	105		
31*	35	40	125		
32*	25	25	115		
33	105	30	60	2	350' above 340
34	185	140	330	3	
35	120	400	250	3	500' below 340
36	145	330	270	4	1000' below 340
37*	35	40	120		
38*	55	55	115		
39	110	40	115	3	
40	110	70	140	4	
41	65	30	130	3	
42	85	45	150	3	

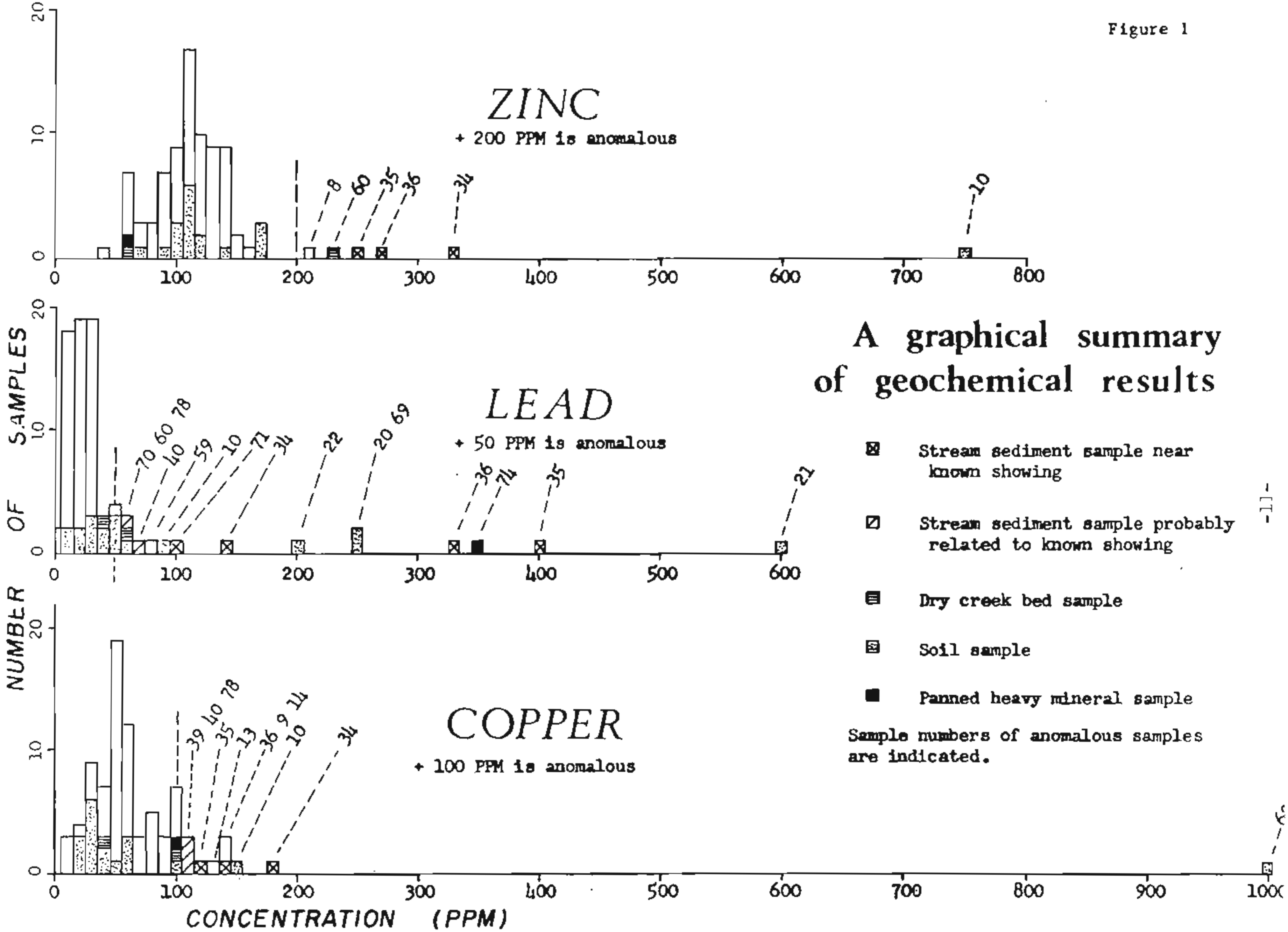
*Sample analyzed by Division of Mines and Minerals. All other samples run by Rocky Mountain Geochemical Laboratories.

Table 1 - Continued

Sample No.	Copper (ppm)	Lead (ppm)	Zinc (ppm)	Moly. (ppm)	Remarks
43	80	35	130	2	
44	45	25	115	2	
45	80	40	140	3	
46*	15	50	85		
47*	15	35	60		
48	65	40	135	2	
49	50	30	115	2	
50	55	25	80	1	
51	75	30	105	2	
52	75	30	70	1	
53	50	30	95	5	
54	65	25	110	2	
55	55	45	120	2	
56	65	35	145	2	
57	90	15	130	2	
58	50	35	125	2	
59	65	85	145	2	
60	100	60	235	3	Dry creek bed
61	60	30	115	2	
62	55	30	140	3	
63	50	20	110	2	
64	100	30	125	2	
65	65	30	110	3	
66	105	25	115	3	
67	130	20	145	2	
68	50	20	100	3	
69*	1000	250	175		Red Fe-rich frost boil
70*	20	60	110		Normal lt. brown frost boil
71	55	100	105	1	
72	40	45	60	4	Dry creek bed
73	35	20	40	2	
74*	100	350	60		Panned creek gravel concentrates
75*	55	20	60		
76*	30	25	65		
77	80	30	65	4	
78	110	60	75	16	6000' below AEC prospect

* Sample analyzed by Division of Mines and Minerals. All other samples run by Rocky Mountain Geochemical Laboratories.

Figure 1


ZINC
+ 200 PPM is anomalous
LEAD
+ 50 PPM is anomalous
COPPER
+ 100 PPM is anomalous
NUMBER OF SAMPLES
CONCENTRATION (PPM)
A graphical summary of geochemical results
Stream sediment sample near known showing
Stream sediment sample probably related to known showing
Dry creek bed sample
Soil sample
Panned heavy mineral sample
Sample numbers of anomalous samples are indicated.

At present the claims at the airstrip on Bear Creek are owned by Douglass and Edwards. They were prospected during the 1964 season by Douglass and Milligrock. The placer claims on Bear Creek below Bob Creek are held by Laura Wright. No work was in progress there at the time of the writer's visit.

Placer prospect cuts had been made on lower Cub Creek and claims were staked in the area during 1964 by Douglass, but no mining appears to have been done. Sheridan Creek shows signs of having been mined in the early days, but not of any recent work.

The Beltz copper prospect (Harrington, 1919, p. 339) on the ridge north of Split Creek at an elevation of 1300 feet was examined. It consists of a trench 80 feet long and 3-5 feet deep in greenstone country rock. A few pieces of quartz float plus one piece of malachite-stained greenstone one inch long are present alongside the trench. No other signs of mineralization were seen.

The only showing of minerals seen in place was on Bear Creek. This occurrence lies about 200 feet upstream from the north end of the airstrip. Here the greenstone is cut by an irregular northwest-trending mafic syenite dike which is exposed intermittently over a distance of about 200 feet and a width of 40 feet. Small amounts of ore minerals are present in the greenstone near the dike. These are: (1) quartz and pyrite veinlets up to 4 inches wide with disseminated pyrite-sphalerite-galena in the greenstone alongside the vein, (2) white calcite veinlets up to one inch wide with galena and pyrite disseminated in the walls, and (3) breccia zones as much as 2½ feet wide containing disseminated pyrite and galena occur in the greenstone 10-20 feet from the dike. Gold can be panned from the limonitized capping of these zones. These deposits do not approach ore grade or size, but do indicate the nature of deposits that are associated with the mafic syenite. The dike itself is unmineralized with the exception of a few thin stringers near the contact with the greenstone.

Heavy metals in the black sand concentrate from this area are zinc, arsenic, and lead, all less than 1%. In this area the only sulfide minerals associated with a buff colored feldspar porphyry dike 2½ feet wide are films of pyrite on joints in the greenstone wall rocks.

Stream sediment samples 34, 35, 36, and 40 show anomalous amounts of metals. The anomaly extends at least 4500 feet downstream from site 34. Further down Bear Creek, samples 42 and 43 are not anomalous.

Soil samples taken along the old water ditch (samples 20,21, and 22) give strong lead anomalies and are associated with mafic syenite float. A mineral deposit of the same type as that present at site 34 is evidently present along or above the ditch. These two occurrences are 1/8 mile apart and the area between them is covered to no great depth by vegetation, soil, and gravel.

About 800 feet upstream from the airstrip another area of mafic syenite bedrock, or large angular float nearly in place, crops out for 200 feet along the cutbank on the southwest side of Bear Creek. No ore minerals are exposed in place and only placer gold has been found. In some places here, 25-cent pans can be obtained on bedrock. The gold is "formation gold" according to Douglass. The close association of gold with mafic syenite suggests that the lode deposits here are similar to those already described and that the placer deposits have formed nearly in place.

No lode deposits are known in the placer area on Bear Creek just above Split Creek. Stream-cut exposures and bedrock cleaned off by mining just north of Split Creek show areas of crackled aphanitic greenstone with limonite-stained joints and, locally, with films and veinlets of quartz. No sulfides, limonite gossan, or quartz veins wider than two inches were seen. Possibly a lode deposit related to the mafic syenite on the hill slope 1/4 mile west of this placer area is the source of the gold in this area. The very low grade Beltz copper prospect west of the intrusive and a moderate copper anomaly in the stream sediments at site 14, below the intrusive, are indications of mineralization in the area.

Float from the tailing piles on Bear Creek just above Split Creek consists of 70% fine- and medium-grained greenstone, with 5% containing quartz veinlets; 5% syenite; 20% basalt; and 5% red dike rock. Jasper and hematite are restricted to greenstone. It is interesting to note that this placer locality has no higher percentage of quartz in the greenstone than does the greenstone on lower Eagle Creek, an area with no known placers.

The placer gold on Sheridan Creek probably indicates the presence of lode mineral deposits in that drainage. Both red porphyry and altered diorite are known to be present. The general lack of mineral showings or placers in association with the red porphyry in other areas suggests that any ore is most likely to be related to the altered diorite. The stream float near the mouth of Sheridan Creek consists of greenstone, basalt, red dike rocks, and diabasic diorite (or syenite). Quartz and hematite veinlets only occur in greenstone.

The uranium-thorium base metal locality found by the U.S. Geological Survey on the headwaters of the Peace River (Gault and others, 1955, p. 28-31) was visited briefly. The mineralized area was originally located by tracing anomalies in heavy mineral stream sediment samples up to the divide at the head of a minor tributary. The area is covered by tundra except along the larger streams and no deposit is exposed. The area lies on or near the greenstone-syenite contact. Some pits and trenches are present, but no ore minerals are exposed in them. A panned sample (71) from one of the pits in creek alluvium contains 350 ppm lead. Samples 72 and 73, taken along the swampy minor tributary creek on which the deposit is supposed to lie, were not anomalous. However, sample 78, taken more than a mile downstream, is anomalous in copper, lead, and molybdenum. The creek gravel is heavily hematite-stained for about ½ mile up stream from site 78 and for an unknown distance downstream. No explanation can be given for the high concentration of metals in the unusually anomalous sample 69. It was taken of red material in a frost boil on a ridge.

Moffit (1905) reported that in the Bear Creek area, "a considerable quantity of a heavy red cherty rock remains in the boxes with the gold and is a source of annoyance to the miner." Many heavy red pebbles and irregular masses of this material in greenstone float were seen in the creek gravels. Some of this material has an iron content of about 50%, and gives a red streak when scratched with a knife, indicating hematite. Other red cherty rocks have an iron content of about 5% and are harder than the knife blade, indicating jasper. This material is restricted to the greenstone, where it occurs as crosscutting veins and masses with sharp contacts. It is thought to have formed at depth rather than as a surface alteration product and could have been associated with mineralization of the greenstone. Semi-quantitative analyses by X-ray spectrograph of 3 pieces of hematite and jasper float from Bear Creek are as follows.

	Fe	Mn	Cu	Pb	Zn	Ni	As
Hematite float	50%	<.1	Nil	<.1	<.05	<.05	<.1
Hematite float	50%	<.1	Tr	<.1	<.05	<.05	<.1
Jasper float	5%	.5	Tr	.05	Tr	.05	Tr

SUMMARY AND SUGGESTIONS FOR PROSPECTING

The igneous rocks along the eastern margin of the Seward Peninsula between Dime Landing and Buckland mark a marginal belt of major structure at the junction of the Seward Peninsula tectonic block and the Koyukuk geosyncline. The association of major structure and igneous rocks makes this belt one of more-than-average favorability for ore deposits.

The map area is in this marginal igneous belt. It is largely underlain by andesitic greenstone of pre-Cretaceous age. This rock is porphyritic andesite which as been transformed by thermal metamorphism to a non-schistose greenstone of the albite-epidote hornfels facies. The greenstone is intruded by the Granite Mountain syenite, mafic syenite dikes, altered diorite, and acidic porphyry dikes. Olivine basalt of Cenozoic age overlies the greenstone and also is presumably younger than the intrusives. A major northwesterly trending fault is present along Bear Creek and may join with faults on the east side of Granite Mountain. Uplift of the block west of Bear Creek has been along these faults. Dikes and small intrusives in the Bear Creek drainage appear to be more abundant near the Bear Creek fault than at a distance, but do not follow it. Gold, lead, and zinc deposits in the Bear Creek drainage are associated with mafic syenite dikes and possibly with altered diorite. The uranium-thorium-base metal deposit east of Granite Mountain may be localized along the fault zone there.

A number of placer deposits are present along the marginal belt. One of these placers, on Bear Creek, is closely associated with a lead-zinc deposit and appears to have formed nearly in place. It is likely that other base metal deposits are closely associated with the gold placers in the region.

Geochemical sampling indicates that the small lead-zinc-gold showing on Bear Creek probably extends westward at least 1/8 mile. Detectable geochemical anomalies extend for about one mile downstream from the known mineral deposits in the area. Analysis of samples by simple field methods that give the readily extractable heavy metal content may require a spacing of samples closer than one mile.

In most of the region there is little possibility of finding lode deposits exposed at the surface because of the moderate relief and extensive cover of tundra and colluvium. Mafic syenite, diorite, and probably jasper and hematite creek float are considered favorable indications of lode possibilities throughout the greenstone region. Stream sediment geochemical sampling should be effective if sampling is done at intervals of not greater than one mile on all drainages.

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Vicinity Map