POTENTIAL FOR COBALT IN SKARN OCCURRENCES AT VICTORIA MOUNTAIN, CIRCLE QUADRANGLE, ALASKA

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Critical and Strategic Minerals in Alaska -

Livengood Project

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James G. Watt, Secretary

BUREAU OF MINES

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POTENTIAL FOR COBALT IN SKARN OCCURRENCES AT VICTORIA MOUNTAIN, CIRCLE QUADRANGLE, ALASKA

By James C. Barker[1]

ARSTRACT

The Victoria Mountain pluton is a biotite quartz monzonite stock surrounded by a sequence of thermally metamorphosed black carbonaceous shales. Regional stream sediment sampling has indicated possible anomalous levels of copper, zinc and cobalt from areas of the intrusive contact. Because of the indications of cobalt, an examination of the area was made by the U. S. Bureau of Mines as part of the "strategic and critical metals program".

Skarn-type quartz-pyroxene-sulfide bodies were found to outcrop in the vicinity of upper Sand Creek. The skarns occur as multiple parallel lenses hosted by hornfels facies black shales. The principal sulfides are pyrrhotite and pyrite with traces of chalcopyrite and sphalerite. Trace gold values were consistently detected, while cobalt content is near normal bedrock background.

Sampling and geologic observations indicate skarn occurrences are the apparent source of the anomalous metal values encountered in stream sediment sampling. While only insignificant metal values were found in outcrop samples, it is possible that higher grade zinc, copper and gold may occur in the vicinity. Cobalt, however does not appear to be present at appreciable levels.

[1] Mining Engineer, Alaska Field Operations Center, Fairbanks, Alaska

INTRODUCTION

Mineral investigations in the Victoria Mountain vicinity were originally conducted by the Bureau's Alaska Field Operation Center in 1977, when a brief regional reconnaissance of portions of the Tanana-Yukon Uplands included that area.[2] Anomalous levels of zinc, copper and cobalt were detected in the 1977 stream sediment samples from the area. No follow-up investigation of the anomalous values was made until 1982. The more recent work was undertaken as part of an Alaska-wide assessment of "critical and strategic" minerals. Consequently the objective of the 1982 work was particularly oriented toward cobalt and the potential for economic concentrations of cobalt in the Victoria Mountain area.

[2] Barker, J. C. Mineral Deposits of the Tanana-Yukon Uplands: A Summary Report. U.S. BuMines OFR 88-78, 1978, 33 pp.

There is no record of prospecting or mining claim activity near Victoria Mountain and no mineralization has previously been reported. At this time there is no reconnaissance level (1:250,000) scale geologic mapping available, although the U.S. Geological Survey is currently conducting an "Alaska Mineral Resource Appraisal Program" (AMRAP) study of the quadrangle. The AMRAP study will eventually result in a 1:250,000 geologic map.[3]

[3] USGS Alaska Mineral Resource Assessment Program (AMRAP), Circle Quadrangle in progress. H. Foster principal investigator.

The following manuscript is a summary of both the 1977 and 1982 USBM field work during which approximately 10 man-days of effort was expended.

ACKNOWLEDGEMENTS

The field investigations were assisted by K. H. Clautice, Geologist formerly with the Bureau of Mines, and by D. E. Alliger and G. S. Will, geological field assistants also formerly with the Bureau.

PHYSIOGRAPHY AND CLIMATE

The report area lies within a region of semi-mountainous topography and steep relief. The floors of the valleys are at elevations of approximatley 1000 ft, while the highest point on Victoria Mountain has an elevation of 4588 ft. Victoria Mountain is, in a sense, a northwest extension of the highland region known informally as the White Mountains.

The higher elevations exhibit some evidence of past cirque and valley type of glaciation. Above tree line (approx. 2500 ft) ground cover is rock skree and tundra with very limited outcrop. The lowland is generally boggy muskeg and woodland with continuous vegetation ground cover, while underlain by permafrost.

Vegetation in the low lying areas consists of tundra, grasses and a few stunted black spruce with stands of white spruce paralleling the larger water courses. Better drained slopes occasionaly support growths of alder, with some spruce and birch.

The climate is sub-arctic, with long, cold winters and short but comparatively warm summers. Annual precipitation is approximately 10 to 12 in. The snow-free period generally extends from May through mid-September with a somewhat shorter duration at the higher elevations.

Stream beds in the area are gravel bottomed. Beaver Creek is the principal drainage and is large enough to support light water craft.

LOCATION, ACCESS AND OWNERSHIP

Victoria Mountain is located at approximately 65° 45' north latitude and 147° west longitude (fig. 1). The mountain is 75 mi north by northeast of Fairbanks and is bordered to the east by Beaver Creek.

The area is most directly accessible by helicopter, although a gravel bar capable of landing small fixed wing aircraft on is located 9 mi east by northeast, on Beaver Creek. The 1977 field work was done via rubber raft transport and foot traverses from Beaver Creek.

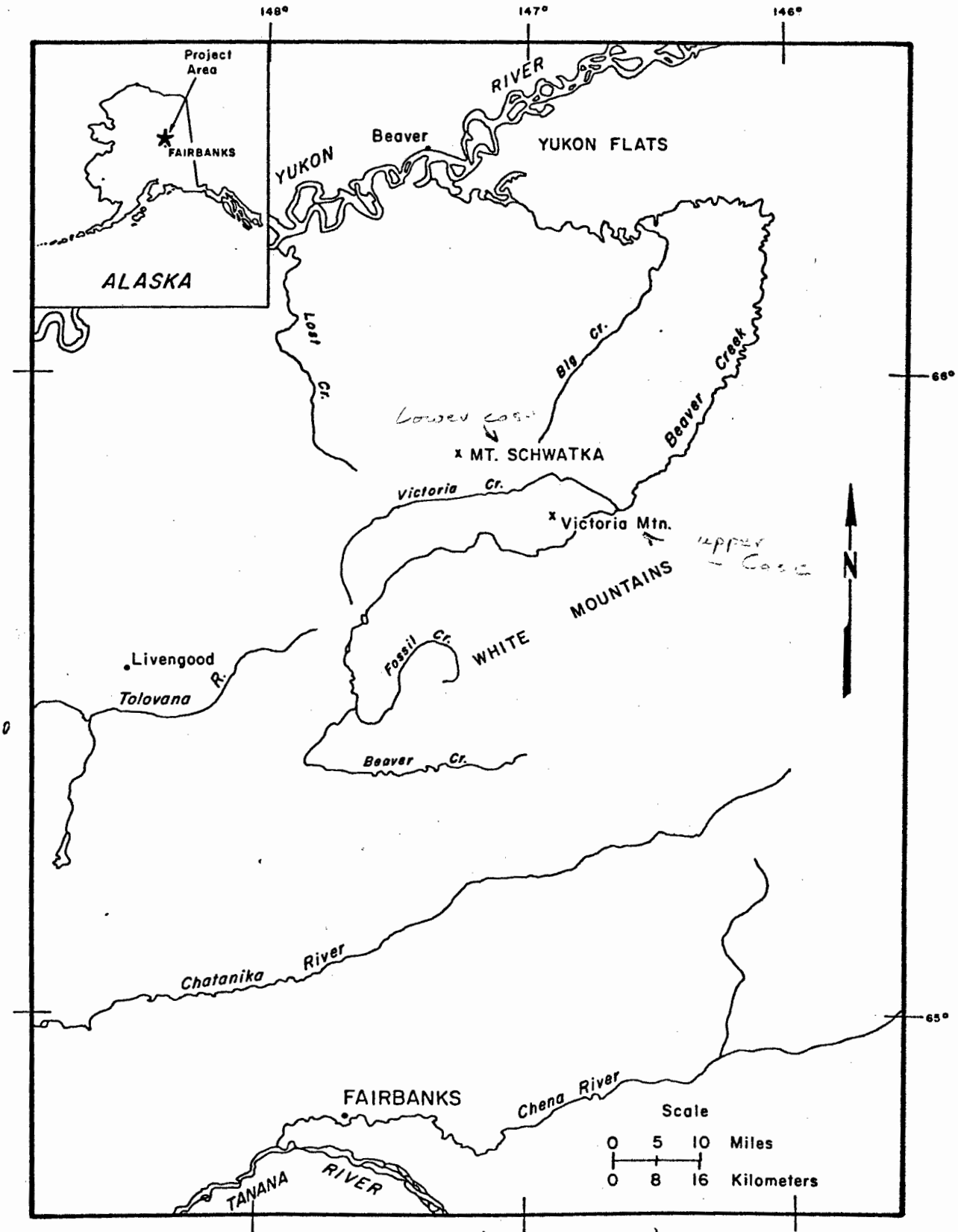
The area is included within the White Mountains National Recreational Area administered by the U. S. Bureau of Land Management. Beaver Creek is classified as a National Wild and Scenic River and this classification applies to an irregular corridor having a width up to 2 mi either side of the stream bed. The area is closed to claim location under the mining laws.

WORK BY THE BUREAU

SAMPLING AND ANALYTICAL PROCEDURES

Stream sediment samples were collected with a steel shovel from the finer, sandy portion of the active channels or deepest most active part of a dry creek bed. Organic rich material was avoided. Samples were put in water-resistant paper sample bags and air-dried before screening at -80 mesh. The undersize was then pulverized to -100 mesh. Float-rock and stream characteristics were noted and recorded at each sample station.

Rock samples were usually taken as random chip samples across a geologic unit of interest; for example, a suspected mineralized area or a zone of alteration. The outcrop characteristics of the area covered by



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VICTORIA MOUNTAIN

Figure 1 – ~~Mt. Schwatka~~ Project Location Map

the chip sample was recorded. If a sample consisted of an individual high-graded rock or float material of unknown origin, this was also noted. Samples collected were approximatley 1-2 lb in weight.

Pulverized fractions of each crushed rock sample and -80 mesh portion of each stream sediment sample collected were analyzed by standard atomic absorption methods for selected elements including Ag, Au, Co, Cu, Mo, Pb, and Zn. As indicated in the tables a few analyses were performed for W by colormetric techniques, and for Pd and Pt by fire assay-ICP procedures. The 1977 cobalt analyses, as indicated, were done by semi-quantitative emission spectrography.

The atomic absorption and colormetric analyses were made by TSL Laboratories of Spokane, Washington. The emission spectrograph analyses were performed by the University of Alaska, Mineral Industry Research Laboratory. The Pd and Pt analyses were done by the Bureau of Mines, Reno Research Center, Reno, Nevada.

GEOLOGY

The Victoria Mountain pluton (fig. 2) is a felsic intrusion composed primarily of biotite quartz monzonite. Biotite content averages approximately 3-5% but locally can approach as high as 20%. Other intrusive phases observed include rhyolite porphyry sills, aplitic dikes, and pegmatite dikes. Typically the phase variations increase near the outer periphery with the central core composed primarily of a coarse-grained to porphyritic quartz monzonite phase. The pluton outcrops over an area of approximately 6 to 10 sq mi. There is no known age for the intrusion but it is likely to be Cretaceous, based on the spatial relationship and compositional similarities to other interior Alaska intrusions.

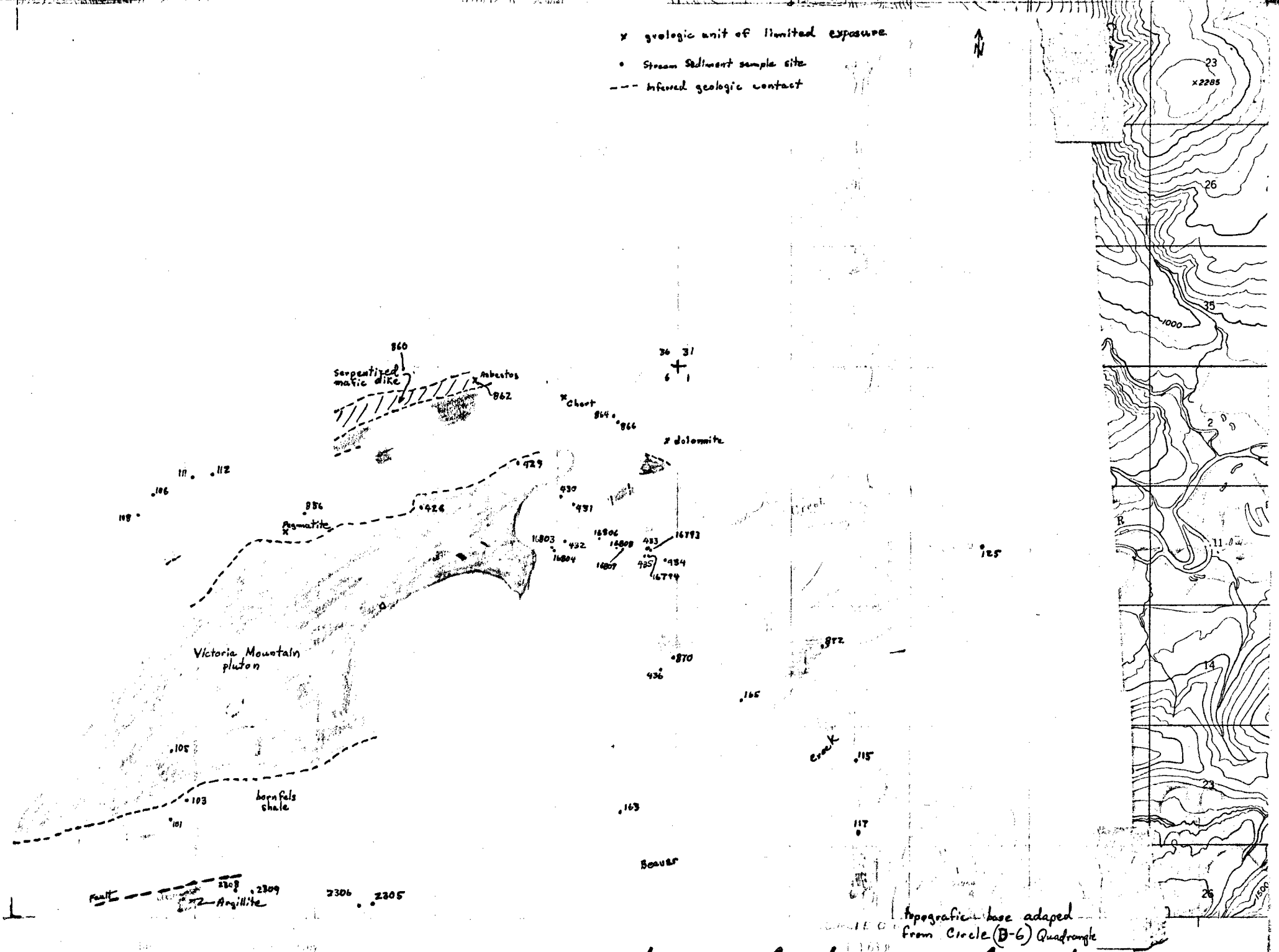


FIGURE 2 - Geology and stream sediment locations - Victoria Mountain

An aeromagnetic survey conducted over the Circle Quadrangle by the U. S. Geologic Survey[4] has indicated a strong magnetic anomaly over the pluton, apparently due to accessory iron minerals. Dipoles exist along the north and east sides of the anomaly. A east, northeast trending, more subtle postive anomaly suggest the pluton may continue at depth under Beaver Creek and beyond.

[4] U. S. Geological Survey. Aeromagnetic Map of the Circle Quadrangle, Northeastern Alaska. U.S. Geol. Survey OFR 74-101, 1974, 1 plate.

The pluton intrudes an unmapped sequence of black carbonaceous slates and shales in which it has formed extensive hornfels. Hornfels are evident up to a mile away from the known contact. Locally the hornfels in hand samples was observed to contain pyroxene crystals to 1/2 in. in length.

North of the pluton is a sequence of red and green argillites and mafic sills. The sills are dioritic to gabbroic in texture and locally serpentinized. A locality of asbestos in serpentinite is noted on figure 2.

The argillite-mafic sequence appears to have no correlation to either the Victoria intrusion nor to the hosting shales and slates. Field observations suggest a possible fault may occur between the two geologic units.

MINERALIZATION

Skarn-type quartz-pyroxene-sulfide lenses were found to outcrop on a narrow ridge north of upper Sand Creek (figs. 3 and 4).

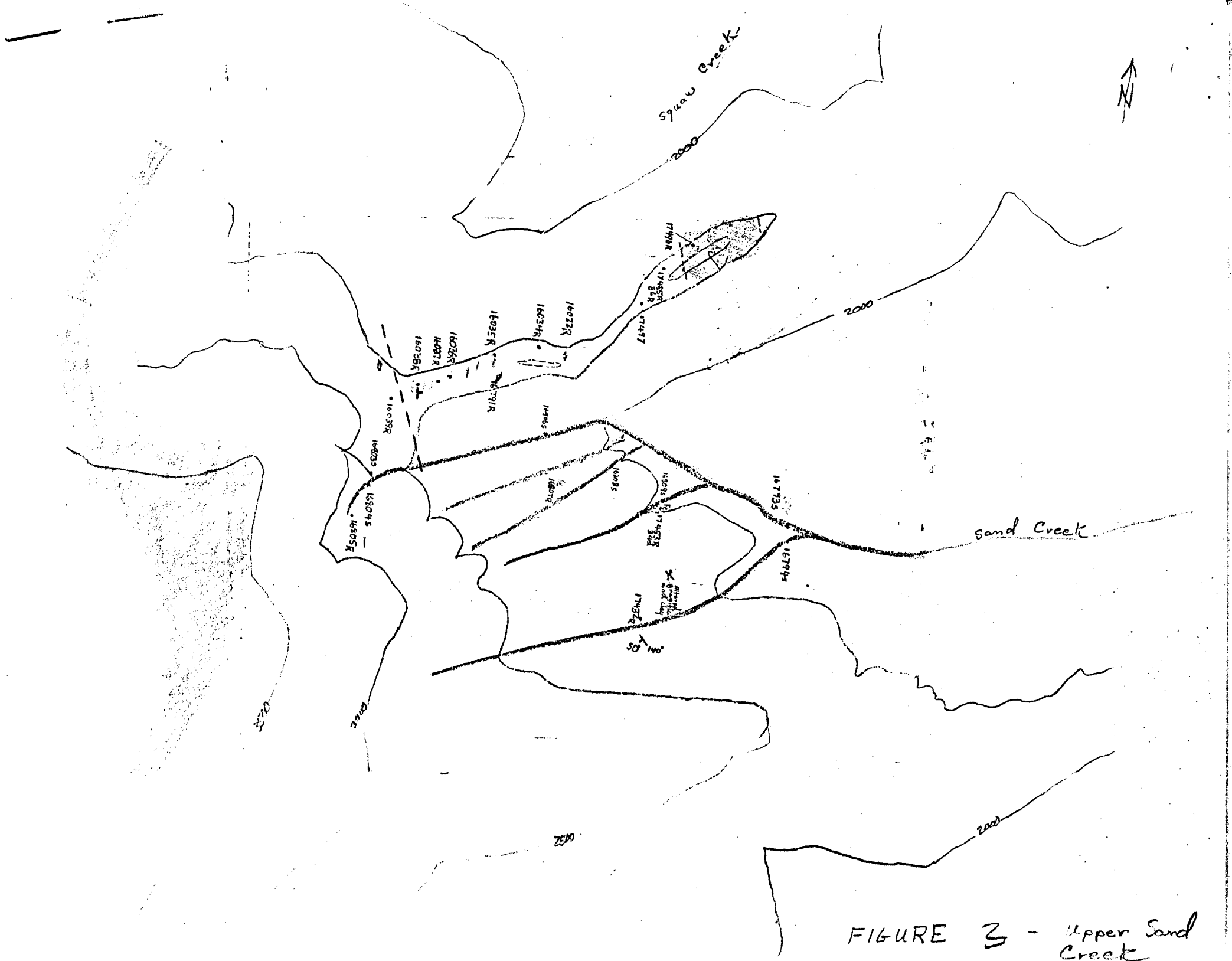
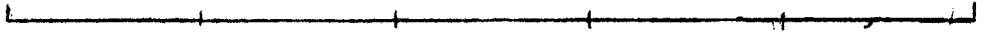


FIGURE 3 - Upper Sand Creek

Rhyolite porphyry and aplite grading to hypabyssal quartz monzonite

Hornfels black carbonaceous shale, locally thin pebble horizons.



Approx. Scale = 5000
1" ~ 1000'

Biotite quartz monzonite of the Victoria Mtn. pluton

Quartz, pyrrarene, sulfide skarn

Topographic base from Cerro (D-6) Quadrangle

FIGURE 4. - Ridge hosting quartz-pyroxene-sulfide skarns. Note upper Sand Creek in foregound.

Sulfides were predominently pyrrhotite and pyrite with traces of chalcopyrite and sphalerite. No sample assays (table 1) exceeded 0.06% Cu, or 0.05% Zn. Cobalt values ranged from typical background levels to 0.008%. Traces of gold were detected in most skarn samples. These skarn lenses generally were only 1 to 2 ft thick but occurred frequently along the ridge and particularly across a stratigraphic width of approximatley 100-150 ft. Skarn material was found to be weakly magnetic.

Samples of hornfels after shales commonly contained very finely disseminated pyrrhotite but analyses indicate no significant Cu or Zn values. Outcrops are iron-stained. A particularly iron-stained, decomposed outcrop of pyrrhotite-hornfels (LI17483) contained slightly anomalous Cu and Zn. A soil sample (LI17484) on the slope below there contained 0.14% Zn, 0.09% Cu, 0.04 oz/ton Au with slightly anomalous Co and Ag. Sediment from the local drainage (LI16809, see table 2) was also anomalous. The local area was almost totally vegetated and further investigation of potential sulfide zones will have to rely on soil sampling.

TABLE 1. - Analyses and descriptions of rock and soil samples, Victoria Mountain

Map no.	Sample no.	Ag	Au	Co	Cu	Pd	Pt	W	Zn	Sample type	Sample description
	LI16033	1.3	0.002	20	306	<0.0003	<0.0003		206	Rock	Rubble from narrow sulfide-bearing skarn zones in hornfels of shale.
	LI16034	1.2	<0.0002	21	353	<0.0003	<0.0003		550	Rock	Do
	LI16035	0.3	0.007	15	49				132	Rock	Hornfels of black shale with finely disseminated sulfides.
	LI16036	0.8	0.002	78	571	<0.0003	<0.0003	20	91	Rock	Chips from one of numerous pyroxene-sulfide skarn lenses in hillside. Zones are 1 to 2 ft thick, occurring 5 to 10 ft apart, and are slightly magnetic.
	LI16037	0.6	0.001	37	316	<0.0003	<0.0003	15	351	Rock	Do
	LI16038	2.2	0.004	8	324	<0.0003	<0.0003		415	Rock	Do
	LI16039	0.2		9	49				1120 ~~93~~	Rock	Hornfels of shale with finely disseminated sulfides.
	LI16791	0.2	<0.0002	19	270	<0.0003	<0.0003		152	Rock	Chip samples across 6 ft wide sulfide zone striking approximately N.60°E.
	LI16805	0.2	<0.0002	18	99	<0.0003	<0.0003		201	Rock	Random chips from iron-stained outcrop of hornfels with finely disseminated sulfides.
	LI16807	1.2	<0.0002	15	430	<0.0003	<0.0003	30	387	Rock	Rubble occurrence of sulfide-bearing pyroxene, non-magnetic skarn.
	LI17482	0.2	<0.0002	11	183	<0.0003	<0.0003		43	Rock	Black hornfels with disseminated pyrrhotite.
	LI17483	0.2	0.005	10	206	<0.0003	<0.0003		105	Rock	Five foot zone of hornfels with locally abundant pyrrhotite, quartz lenses and boxworks.
	LI17484	6.0	0.04	59	935				1440	Soil	Soil from downslope of pyrrhotite-quartz gossan in hornfels shale (see LI17483).
	LI17485	1.8	<0.0002	45	47	0.001	<0.0003		940 ~~101~~	Rock	Quartz veining over undetermined width with pyrrhotite and boxwork.
	LI17497	0.2	<0.0002	22	2	<0.0003	<0.0003		~~212~~ 6900	Rock	Iron-stained silicious rock with relic quartz and feldspar phenocrysts.

TABLE 2. - Analyses of stream sediment samples, Victoria Mountain*

Map no.	Sample no.	Ag	Co	Cu	Mo	Pb	Zn
	BE 101	1	<20	35	5	16	120
	BE 103	2		46	7	29	180
	BE 105	1		23	7	13	84
	BE 106	1	20	65	8	25	180
	BE 108	2	70	77	8	24	290
	BE 111	1	50	62	7	28	200
	BE 112	1		46	7	20	180
	BE 115	1		61	8	12	130
	BE 117	1		61	8	12	120
	BE 125	0		27	5	9	260
	BE 163	1		63	8	35	490
	BE 165	0		36	3	9	210
	BE 426	1		49	6	32	230
	BE 429	0	20	33	6	21	440
	BE 430	1		200	10	100	1200
	BE 431	1	30	84	7	170	360
	BE 432	1		92	11	260	760
	BE 433	2	50	130	2	92	1600
	BE 434	1	20	44	5	41	1000
	BE 435	2	30	130	16	160	1900
	BE 436	1	30	62	6	23	360
	BE 856	0		39	5	20	130
	BE 860	0		47	5	23	170
	BE 862	0		24	5	23	240
	BE 864	0	30	39	6	21	220
	BE 866	2	30	65	10	54	680
	BE 870	2		41	7	21	160
	BE 872	1	20	22	5	18	85
	BE 2305	1	30	70	19	24	1200
	BE 2306	1	50	31	16	16	480
	BE 2308	0	150	<80	0	0	610
	BE 2309	0	100	70	19	29	1500
	LI16793	1.1	62	139			2020
	LI16794	1.3	35	123			1850
	LI16803		72	193			1980
	LI16804		18	126			1010
	LI16806	0.7	17	65			640
	LI16808		16	31			312
1	LI16809		90	369			3500

[1] Creek is eroding iron-stained decomposed hornfels and clay. There is a slight limonite seating on creek bed

Note. - Co in samples 101 to 2309 was analyzed by semi-quantatative emission spectrographic procedures. All other analyses by atomic absorption.

* All values in parts per million.

DISSCUSSION AND CONCLUSION

Quartz-pyroxene-sulfide skarn mineralization occurs in hornfels of shales and slates on or near the contact of the Victoria Mountain intrusion. Outcrops examined contained insignificant grades of Cu, Zn, and Co.

Stream sediment sampling and the soil sample at LI17484 suggest higher grade Zn and Cu mineralization may occur in similar skarns elsewhere in the area but these were not found during this investigation, and will require a detailed soil sampling grid to further explore.

While slightly elevated Co values were noted in both rock and stream sediment samples there was no evidence to suggest that Co may be found at grades that would warrant further investigation as part of the present "critical and strategic" metals program.