COBALT INVESTIGATION OF THE MANLEY HOT SPRINGS DOME AREA

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Critical and Strategic Minerals in Alaska -

Livengood Project

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BUREAU OF MINES

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INTRODUCTION

A brief mineral investigation of a reported cobalt occurrence in the Manley Hot Springs Dome area (fig. 1) was made by the Alaska Field Operations Center, U. S. Bureau of Mines. The work was part of an Alaska-wide assessment of 'critical and strategic' minerals, and it follows up on the early brief reports of cobalt mineralization by the U. S. Geological Survey, local miners, and the U. S. Bureau of Mines. The following manuscript is a summary of field work in 1981 and will be updated if additional work is undertaken. Specific objectives of this investigation were to re-examine previous reports of mineralization and to evaluate the potential for economic cobalt mineralization in the area.

While cobalt mineralization has previously been noted in the Manley Hot Springs Dome area, and although claims on Manley Hot Springs Dome were once developed for copper, silver and lead, there has been no attempt in the past to specifically evaluate the cobalt potential of the area.

HISTORY AND PREVIOUS INVESTIGATION

The following summary of the history of the area is taken from Maloney (3)[1] and is updated where necessary.

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[1] Underlined numbers in parenthese refer to items listed in the references at the end of this report.

The exact date of the discovery of the metal-bearing lodes on Hot Springs Dome is not known but it may be assumed that the outcrops were found during the 1890's when the gold placer deposits

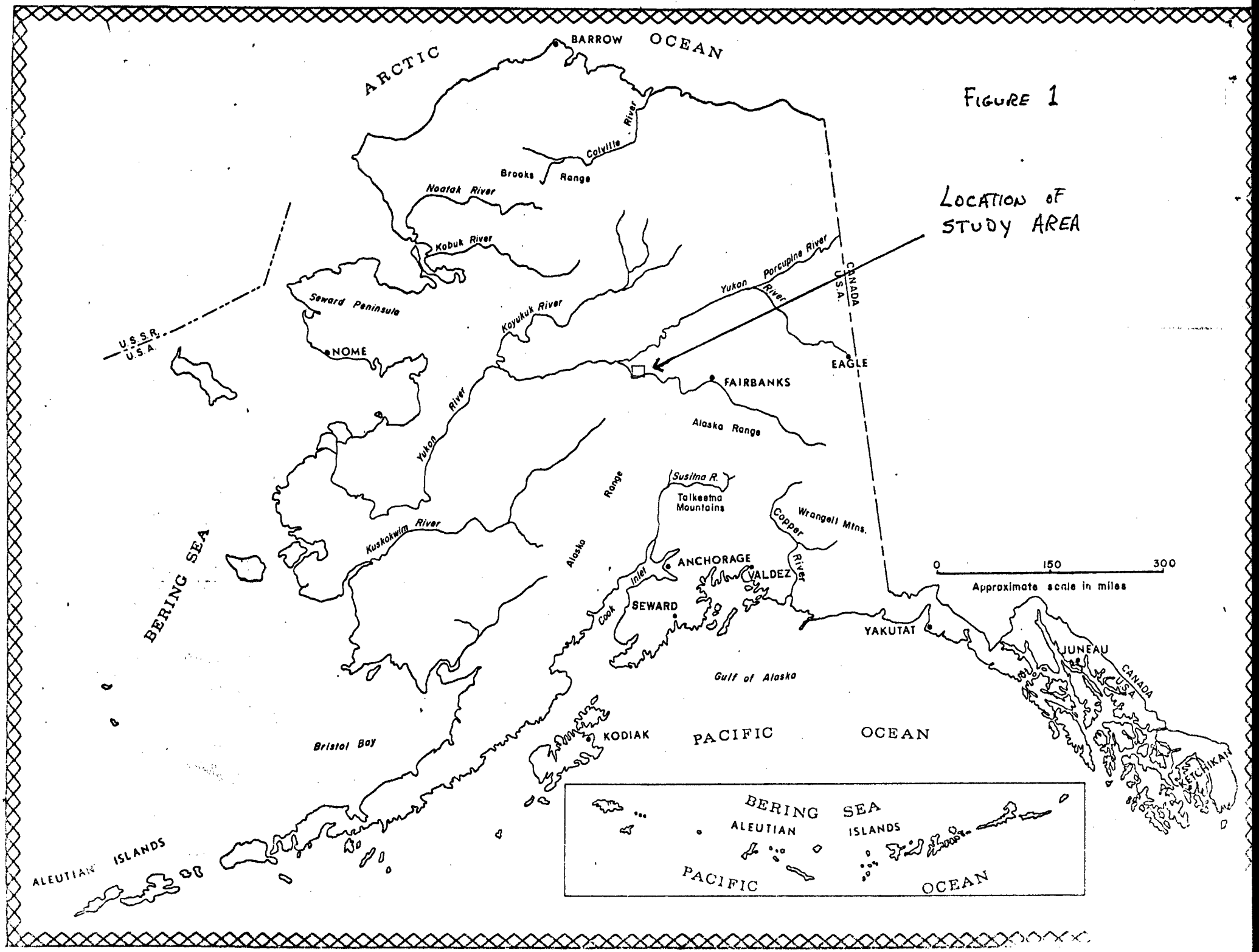
FIGURE 1
LOCATION OF STUDY AREA
ARCTIC OCEAN
BARROW
Colville River
Brooks Range
Noatak River
Kobuk River
Seward Peninsula
NOME
U.S.S.R.
U.S.A.
Kayukuk River
Yukon River
Porcupine River
CANADA
U.S.A.
EAGLE
FAIRBANKS
Alaska Range
Susitna R.
Talkeetna Mountains
Wrangell Mtns.
Copper River
Kuskokwim River
Alaska Range
ANCHORAGE
VALDEZ
Cook Inlet
SEWARD
YAKUTAT
JUNEAU
CANADA
U.S.A.
KETCHIKAN
Gulf of Alaska
BERING SEA
Bristol Bay
KODIAK
PACIFIC OCEAN
ALEUTIAN ISLANDS
0 150 300
Approximate scale in miles
BERING SEA
ALEUTIAN ISLANDS
PACIFIC OCEAN

between Rampart and Tofty were being prospected and developed. No serious attempt to explore the lodes was made, however, until 1914 when John J. Barrett, who had worked in Butte, Montana, noticed similarity between the manganese-stained gossans on Hot Springs Dome (fig. 2) and the outcrops of the lodes at Butte. Mr. Barrett staked the Iron Mask lode claim in 1914 and the adjoining Granite Quartz lode claim in 1924; both claims were patented in 1937.

Mr. Barrett sank three shafts and drove a short adit on the Iron Mask claim. The shafts, estimated to be about 20 ft deep, are partly caved now and are filled with water and ice to within 6 ft of the collars; the adit is about 20 ft long and was caved in when visited in 1981. Several trenches and a number of small prospect pits were observed on the claims and in the general vicinity of the claim. The positions of these various workings are shown on figure 2. The remains of a small cabin that has burned to the ground are about 3,000 ft south of the prospect workings.

Numerous examinations and reports have been made on these prominent gossans by government geologists. Mertie (5) discribed the geology of the Manley Hot Springs Dome area and reported on the mineralogy of the surface ore of the then (1934) already inactive prospect. In one open cut he reported erythrite, both in quartz stringers and in crevices in the schistose country rock. Wedow and others (8) again examined the mineralized shear zones in the schist unit. Moxham (4) visited the area during a reconnaissance of the Manley Hot Springs and Rampart Districts for radioactive materials. In 1971, Maloney (3) reported on earlier work (1953) by the U. S. Bureau of Mines, which included the sinking of eight diamond-drill holes through the gossans on Manley Hot Springs Dome

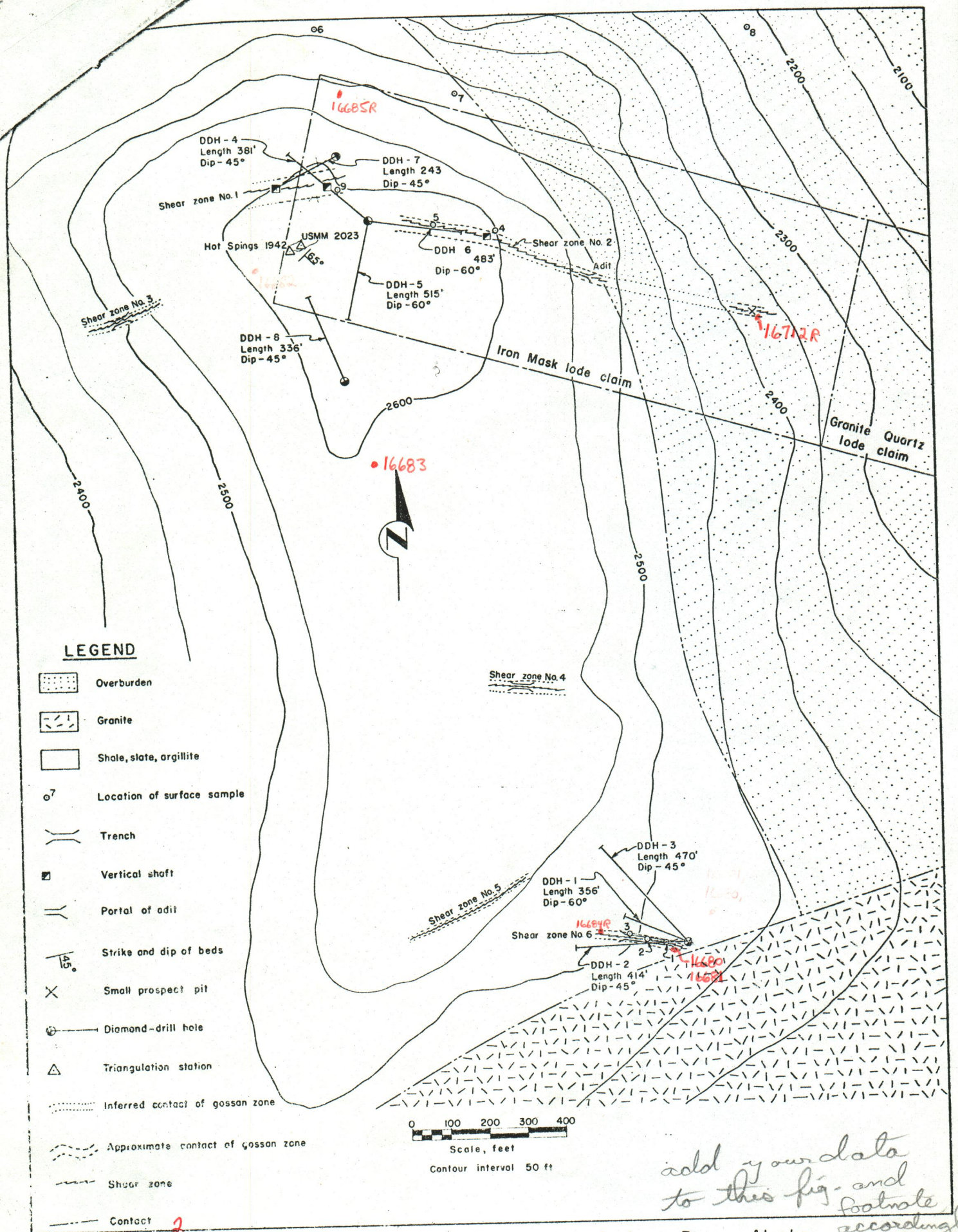

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FIGURE ~~4~~ 2 - Geologic and Topographic Map of Hot Springs Dome, Alaska.

Adapted FROM MAloney (1971)

to a depth of 446 ft below the surface. The work of these and other investigations has been summarized by Cobb (1).

Except for the Bureau of Mines project in 1953 (3), no development work has been done on the Hot Springs Dome deposits since Mr. Barrett's death in 1942.

OWNERSHIP

Both the Iron Mask lode claim and the Granite Quartz lode claim are patented and cover most of the mineralized shear zones on Manley Hot Springs Dome. Title to the claims is in the estate of J. J. Barrett, which, at least in 1957, was being administered by J. F. Emigh, Attorney-at-law, 47 North Main St., Butte, Montana.

PHYSIOGRAPHY

The report area (fig. 1) is concentrated on and around a small highland known as Bean Ridge, which lies within a region of generally low-lying topography and subdued relief. The floors of the surrounding valleys are at elevations of approximately 500 ft, while the highest point on Bean Ridge, Manley Hot Springs Dome, has an elevation of 2,650 ft. Roughtop Mountain, at elevation 3,150 ft, is the highest nearby feature and lies 11 mi to the north of Bean Ridge.

The valleys in the region have been glaciated and are now loess-filled. They are generally boggy, and much of the lowland is underlain by permafrost. The gravels beneath the loess, however, have proven to be gold-bearing in places, and much of the area continues to be actively mined. The region forms a part of the Tanana River drainage. Here the Tanana

is a typical meandering river with such characteristic features as sloughs, ox-bow lakes, cut-off channels, etc.

The climate is typically sub-Arctic, with long, cold winters and short but comparatively warm summers. Annual precipitation is approximately 10 to 12 in, which includes 50 in of snowfall. The snow-free period generally extends from May through September.

Vegetation consists of tundra, grasses and stunted black spruce in the boggy lowlands. Intermmediate elevations support thick growths of alder with some spruce and birch. The top of Bean Ridge is composed mainly of tundra growing through and over rubble crop.

ACCESS

Access to Hot Springs Dome was attempted on motor bikes over the trail to the summit which had been built by the Bureau of Mines in 1953 to haul in drilling equipment. The trail is now deeply rutted and overgrown and disappears into a boulder field approximately 2 1/2 mi from the town of Manley Hot Springs. Due to the distance from Hot Springs Dome to the town (approximately 4 mi), it is suggested that any future work in the area could be more easily done either from a spike camp on the site or by utilizing a helicopter. It is possible that a small airplane could land on the ridge, although this possibility was not explored with the local pilots.

REGIONAL GEOLOGY

The principle geologic units of the region are composed primarily of undifferentiated shale, quartzite and phyllite of Paleozoic through Cenozoic age, and of granitic rocks of Tertiary(?) age (2). Thin bedded

Cretaceous shales and phyllite near the intrusive bodies tend to show significant thermal metamorphism, while those that lie at some distance are relatively little metamorphosed (5).

The Tertiary(?) granitic rocks of the district are believed to have been the ultimate source of most of the economic mineralization of the region. This intrusive mass extends N. 65° E. for about 10 mi, and averages about 2 mi in width.

Tourmaline-bearing granitic dikes are associated with and cut the granite of Manley Hot Springs Dome. These dikes range from 3 in to 4 ft in thickness and are thought to represent a late stage of the Manley Hot Springs Dome intrusion (7).

WORK BY THE BUREAU OF MINES

FIELD WORK

A brief investigation of the Manley Hot Springs Dome area was made in late May, 1981. Work was conducted by a two-person team working from the roads near and around Hot Springs Dome, augmented by foot traverses. A total of two days were spent working in the area. This included geochemical sampling and examination of mineralized exposures and float. The summit of Manley Hot Springs Dome was investigated and sampled in the vicinity of the prospect trenches and drill hole sites.

In addition, 51 core samples from the 1953 Bureau of Mines drilling project on the dome were re-analyzed for cobalt, as well as, copper, lead, silver and zinc by quantitative procedures.

SAMPLING AND ANALYTICAL PROCEDURES

A few stream sediment samples were collected immediately down stream

from the prospect trenches, but most were collected away from the exposed contact between the phyllite and intrusive to see if there was any indication of further, unexposed mineralization. Stream sediment samples (table 1) were collected with a steel shovel from the finer sandy portion of the active channel or deepest most active part of a dry creek bed. Organic-rich material was avoided when possible. Samples were put in water-resistant paper sample bags and air-dried before screening at -80 mesh. Float-rock and stream characteristics were noted and recorded at each sample station.

Rock samples (table 1) 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 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 and is reported in table 2. Samples collected approximated 1-2 lb in weight.

A pulverized fraction of each crushed rock sample and a pulverized -80 mesh portion of each stream sediment sample collected was analyzed by standard atomic absorption methods for Cu, Pb, Zn, Ag, Mo, Sb, Co and Ni. These analyses were made by TSL Laboratories of Spokane, Washington.

Sample splits from 8 diamond drill cores from the 1953 USBM drilling project on Hot Springs Dome were reanalyzed in 1983 for Ag, Co, Cu, Pb, Zn (table 3). The analyses were by atomic absorption procedures and were performed by Bondar Clegg, of Lakewood, Colorado.

Mineralization

Previous workers have reported that the mineralization on Manley Hot

TABLE 1. - Geochemical analyses of Manley area stream sediment samples

Map No.	Field No.	Ag	Co	Cu	Pb	Zn
	Li16677S	56.5	12	14	7	54
	Li16678S	0.5	21	19	9	87
	Li16688S	2.5	8	15	8	66
	Li16689S	0.5	9	16	8	93
	Li16690S	2.0	9	17	7	68
	Li16691S	<0.1	9	10	7	68
	Li16705S	----	7	14	11	97
	Li16706S	----	9	16	11	93
	Li16707S	1.0	7	23	13	92
	Li16714S	6.4	8	12	7	61
	Li16715S	0.8	9	14	7	67
	Li16716S	1.5	7	16	7	59
	Li16719S	0.7	8	10	8	76

NOTE. - All values given in parts per million.

TABLE 2. - Geochemical analyses of Manley area rock samples

Map No.	Field No.	Ag	Co	Cu	Pb	Sb	Zn	Field Description
	Lil6679R	0.4	4	<1	5	NA	71	One foot wide quartz vein within biotite quartz monzonite.
	Lil6680R	0.7	30	99	9	NA	150	Pyrrhotite and trace of chalcopyrite.
	Lil6681R	43.4	49	5	9,250	NA	960	Heavy, limonite stained anglesite.
	Lil6682R	No sample collected.						
	Lil6683R	0.4	17	46	31	NA	85	Phyllite hornfels.
	Lil6684R	0.9	4	<1	22	NA	42	Fine-grained garnet-bearing, muscovite, tourmaline granite dike.
	Lil6685R	20.4	16	1,150	32,200	NA	185	Botryoidal anglesite surrounded by gossan.
	Lil6686R	0.5	7	3	590	NA	33	Typical granite of sample 16679.
	Lil6687R	2.1	225	40,500	320	NA	630	From prospect pit. Visible chalcopyrite and malchite.
	Lil6708R	0.3	10	<1	6	NA	32	Hematite-stained quartz rubble.
	Lil6709R	0.3	23	21	6	NA	65	Typical gray shale.
	Lil6710R	1.2	11	16	9	NA	120	Typical gray shale rubble, some iron staining.
	Lil6712R	0.4	29	32	20	NA	85	From small prospect trench on north side of dome.
	Lil6718R	0.5	38	35	16	NA	85	Red clay from near fault zone exposed in road cut.

NOTE. - All values given in parts per million.

TABLE 3. - Analysis of drill core from Bureau of Mines Drilling Project, Manley Hot Springs Dome

Drill hole	Sample no.	Ag/Jl ppm	Co/Jl ppm	Cu/Jl ppm	Pb/Jl ppm	Zn/Jl ppm	Interval ft
2	6-112	1.6	15	55	1330	2700	260.5 - 261.5
2	6-113	1.7	10	60	255	2500	261.5 - 270.5
2	6-114	1.5	8	67	204	1790	270.5 - 278.6
2	6-116	7.8	14	45	>7500	5300	290.0 - 290.8
2	6-117	2.1	6	42	83	2470	298.2 - 310.9
3	6-119	0.3	18	34	40	1730	110.9 - 113.0
3	6-120	0.3	12	35	24	1370	118.0 - 120.0
3	6-122	2.8	5	28	285	1840	242.5 - 252.6
3	6-123	5.7	9	37	4300	5300	252.2 - 259.8
3	6-124	0.6	4	35	99	1780	259.8 - 276.5
3	6-125	0.3	10	117	10	107	360.9 - 362.4
3	6-126	0.3	17	166	3	44	390.0 - 391.5
4	6-127	5.7	104	495	136	3150	107.5 - 110.0
4	6-129	17.0	540	4950	83	210	169.8 - 174.0
4	6-130	0.6	14	207	8	41	158.8 - 160.4
4	6-131	1.9	54	2160	1360	830	217.8 - 219.2
5	6-132	0.5	11	121	52	1740	324.0 - 339.0
5	6-133	15.0	15	228	16	>20000	358.4 - 359.4
5	6-135	1.6	16	535	3670	1750	512.0 - 514.0
5	6-161	7.2	17	152	>7500	1730	428.0 - 445.0
6	6-136	3.7	31	205	75	585	183.7 - 186.1
6	6-137	1.6	32	48	54	690	175.5 - 179.5
6	6-138	1.6	24	70	12	203	214.4 - 221.0
6	6-139	3.6	22	114	23	306	221.0 - 233.8
6	6-140	8.7	21	145	74	303	233.8 - 256.4
6	6-141	1.2	8	273	20	288	266.0 - 271.4
6	6-142	1.1	7	154	10	323	292.0 - 297.5
6	6-143	0.8	6	93	18	237	301.4 - 311.4
6	6-144	0.3	28	238	6	1160	311.4 - 318.0
6	6-144A	4.4	14	505	26	262	187.4 - 194.8
6	6-145	0.2	22	114	30	565	318.0 - 322.3
6	6-146	0.2	12	110	176	415	322.3 - 336.0
6	6-147	0.4	18	97	17	212	336.0 - 340.3
6	6-148	0.4	9	110	18	136	340.0 - 349.7
6	6-149	0.3	24	230	56	1000	353.0 - 356.3
6	6-150	0.4	30	244	44	1310	356.3 - 364.2
6	6-151	0.4	22	53	13	625	387.5 - 390.0
6	6-152	0.4	22	16	15	985	390.0 - 391.5
6	6-156	0.7	14	77	9	386	414.0 - 423.0
7	6-153	5.4	38	1520	24	145	174.1 - 177.5
7	6-154	0.8	38	291	7	41	220.8 - 225.1
7	6-155	7.0	75	1280	24	156	233.1 - 243.0
8	6-157	0.3	4	87	<2	158	44.0 - 57.0
8	6-159	1.3	12	119	15	3300	256.0 - 265.1
8	6-160	013	18	153	2	213	305.8 - 316.4

Springs Dome occurs in at least 6 shear zones in metamorphosed sedimentary rocks close to and roughly parallel with the contact with a biotite-quartz monzonite intrusive body (3, 4, 5).

This investigation was oriented to examine: 1) evidence of cobalt associated with the mineralization in the above mentioned shear zones and 2) evidence of cobalt minerals in quartz veins in either the intrusive rocks or the phyllite.

The gossans on Hot Springs Dome occur in a dark gray phyllite within 500 yd of a granitic contact (see fig. 2 and 3). The phyllite is commonly crenulated and in places small (<6") isoclinal folds occur in a "cascade and run" pattern. Quartz veining follows and also cuts this folding. Adjacent to the contact, the phyllite has been altered to a spotted hornfels (#16683, table 2, fig. 2) which is not mineralized. Close to the granitic contact in the vicinity of "shear zone #6", a dark gray, chalcopyrite-bearing quartzite (#16680) was sampled but proved to contain only copper and zinc values of 99 ppm Cu and 150 ppm Zn.

The granitic rocks are a porphyritic medium-to coarse-grained, biotite-quartz-bearing monzonite which contains feldspar megacrysts up to two inches in length. One sample of this rock (#16686) contained 590 ppm lead. This sample shows evidence of substantial weathering, with moderate clay alteration of the feldspars. Quartz veining in the stock is common. A sample (#16679) of a notably large (one-foot wide) quartz vein contained terminated quartz crystals, limonite, siderite and tourmaline contained no anomalous metal values.

Float rock of a fine grained garnet-bearing tourmaline-muscovite quartz-bearing monzonite (#16684) occurs within the phyllite in the

vicinity of prospect trenches on the south side of the summit ("shear zone #6", fig. 2) and probably represents a late-stage dike.

The gossans which occur in the phyllite are well-developed and composed mainly of iron (hematite, limonite, goethite, siderite[?]) and manganese (pyrolusite[?], psilomelane[?]) minerals. Of the grab samples of this material that were analyzed, maximum values were 4.05 percent copper, 3.22 percent lead, 0.096 percent zinc, 0.004 percent silver, and 0.02 percent cobalt (table 2).

Analyses of splits of drill core from the 1953 project revealed cobalt values of up to 0.02 percent, along with 3.7 percent lead and 1.2 percent copper. At that time, only a few select samples were analyzed for cobalt, which was done by optical emission spectrographic procedures. The highest cobalt value obtained (540 ppm) was from diamond drill hole (DDH) #4 at the 169.8174 ft depth interval. Only 2 other intervals (DDH #4, 107.5-110 and DDH #7, 233.1-243) were anomalous in Co, containing 104 ppm and 75 ppm respectively. A visual scan of the analytical results suggests a correlation between the higher Co values and high Cu values. It should be noted that these values are not all from one sample. All were collected from or near prospect trenches, hence they are, in a sense, highgraded samples.

From the brief time spent at the prospect, it appears that Maloney's map (fig. 2) is an accurate representation of the geologic contacts and of the prospect trenches. Several more recent shallow trenches also were observed several hundred feet down slope on the north and northeast sides of the summit, but they exposed no gossan or mineralized material.

Although some slickensides were noted in the mineralized areas, the distinct shear zones as mapped by Maloney (fig. 2) were not observed.

SUMMARY AND RECOMMENDATIONS

Examination of the claims on Manley Hot Springs Dome has indicated the occurrence of copper and lead, with minor zinc and silver mineralization. Cobalt is occasionally present in weakly anomalous concentrations. No cobalt bloom (erythrite) as reported by Mertie, was observed during the 1981 visit.

The 1981 surficial studies and the 1953 drilling project by the USBM indicate that although this occurrence may be of moderate to fairly high grade for polymetallic mineralization, the apparent hydrothermal, vein-controlled nature of this deposit implies low overall tonnages.

Stream sediment analyses have not indicated that the mineralization extends outward from the summit of Manley Hot Springs Dome, however most of these were taken at considerable distance from the stock, and more closely-spaced sampling is probably necessary to adequately appraise the results of sediment sampling.

It is concluded that due to the low tonnage implied by a hydrothermal vein-type occurrence, this area would be economic only for a small-tonnage operation recovering a precious metal/base metal product. Since cobalt values are low and sporadic in the mineralized zones, potential production of cobalt is probably very small to nil.

If it is decided to further pursue this deposit as a resource for cobalt however, a soil grid over the dome and adjacent portions of Bean Ridge could help delineate the areal extent of mineralization.

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