A COPPER-COBALT OCCURRENCE IN THE CAPE KRUSENSTERN AREA, NORTHWESTERN ALASKA

By James C. Barker and William S. Roberts

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William P. Clark, Secretary

EAU OF MINES

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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

ft	foot	oz	ounce
ft^3	cubic foot	pct	percent
g	gram	ppm	parts per million
in	inch		

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By James C. Barker[1] and William S. Roberts[2]

ABSTRACT

An occurrence of copper mineralization with minor cobalt, and traces of gold and silver was found in the Cape Krusenstern National Monument, northwest Alaska during critical and strategic mineral investigations by the Bureau of Mines in 1982. The occurrence consists of sub-angular sulfide-quartz boulders found in the drainage of Rabbit Creek and one similarly mineralized poorly exposed vein outcropping. The mineralized boulders range in width up to at least 3 ft. Chip and grab samples generally contained 0.5 to 6.7 pct copper with associated cobalt ranging from trace to 0.153 pct. The mineralization is suggestive of silicified shear zones in green to gray phyllites believed to be part of the Late Devonian to Early Mississippian Endicott Group. Further trenching and soil sampling necessary to assess this occurrence are not possible within the monument. This occurrence and reports of other mineralization in the area suggest a general favorabilitiy for mineralization in the Cape Krusenstern area.

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INTRODUCTION

The Bureau of Mines, Alaska Field Operations Center (AFOC) is engaged in a state-wide investigation of cobalt and other critical and strategic metals. Among the deposit types being investigated are vein-type occurrences. Cobalt often is found in association with silver, arsenic, gold, copper, and nickel. This report describes a vein-type occurrence of cobalt in northwestern Alaska (fig. 1) found by a Bureau field crew in 1982. The occurrence is in the Rabbit Creek drainage in the Mulgrave Hills near the Chukchi Sea coast (fig. 2) approximately 50 miles north of Kotzebue and 12 miles west of Noatak. Rabbit Creek drains from the Mulgrave Hills, an area of rolling low hills with nearly continuous tundra cover (fig. 3) underlain by continuous permafrost. There are no overland access routes or aircraft landing strips in the area. Access was by helicopter.

The Rabbit Creek area has been withdrawn from exploration since 1972 by the Public Land Order (PLO) 5184. In 1980, the Alaska Lands Act (PL-96-487) enlarged the withdrawl and included it within the Cape Krusenstern National Monument administered by the National Park Service from their field office in Kotzebue. Subsurface exploration is prohibited by Park Service regulations; therefore this report describes surface exposures only.

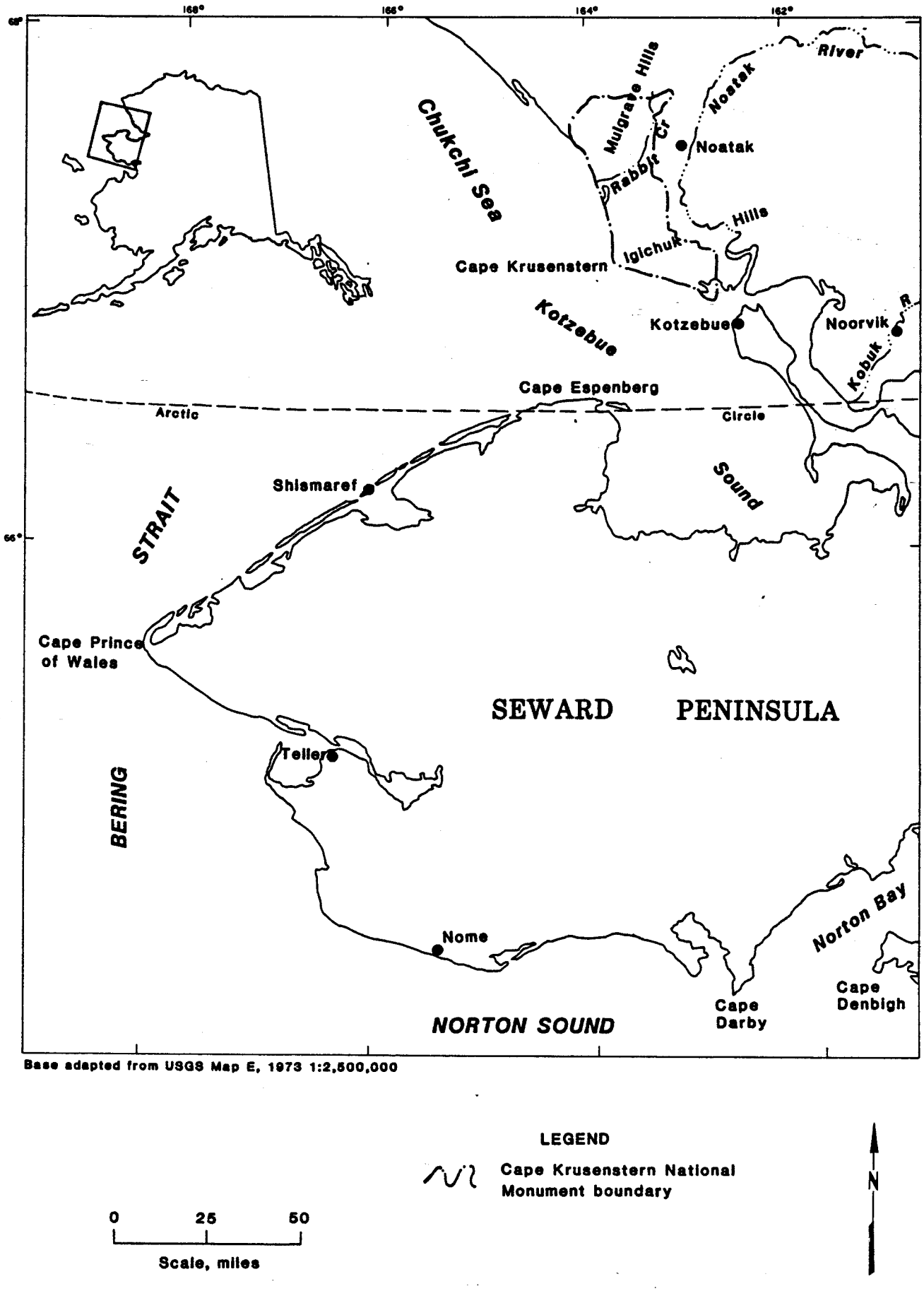

FIGURE 1. - Location map of northwestern Alaska.

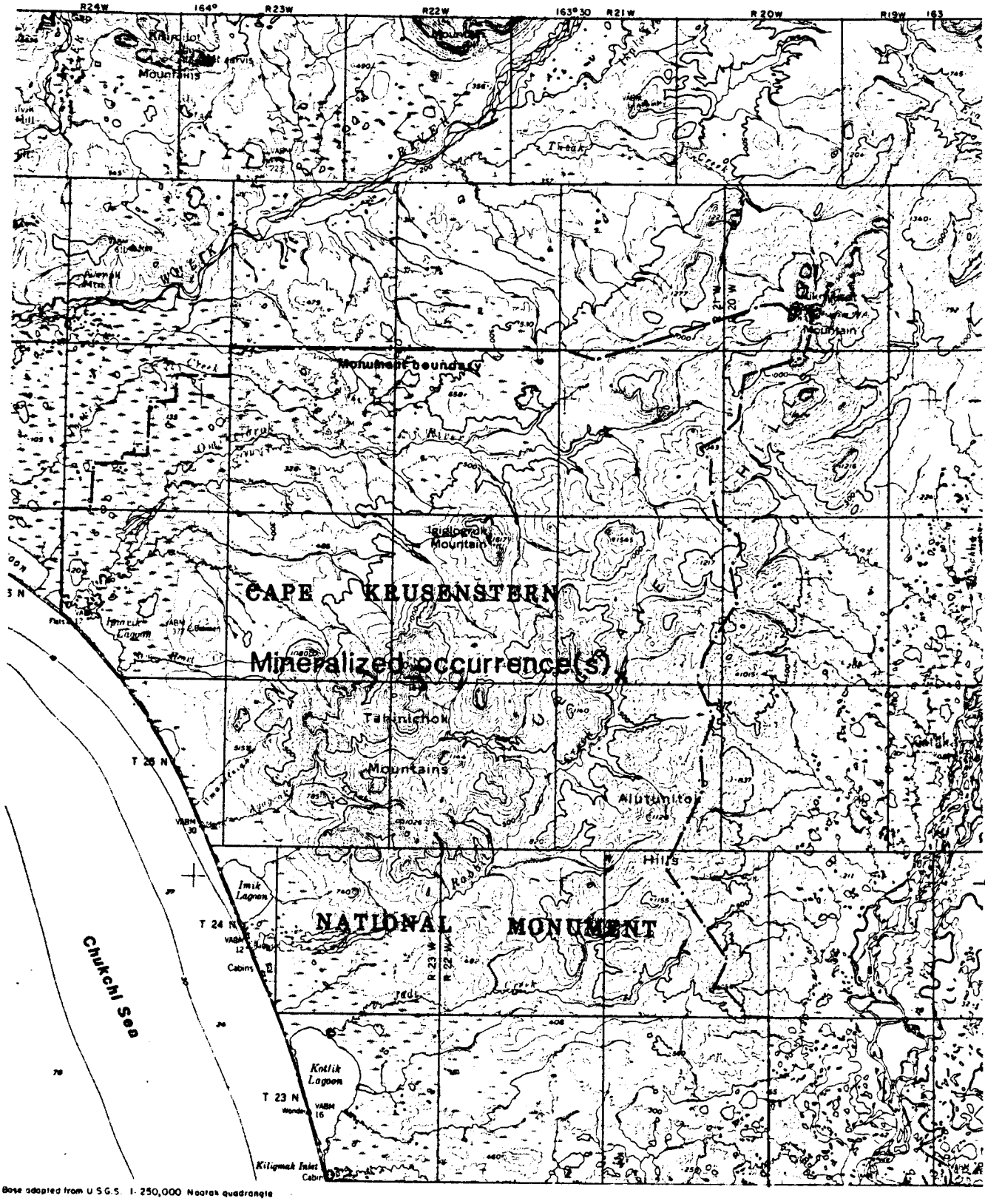

FIGURE 2. - Location of mineralized occurrence.

FIGURE 3. - View of rolling terrain of the Rabbit Creek valley and surrounding area.

ACKNOWLEDGEMENTS

The authors acknowledge the help of D. E. Alliger, geologic field assistant, who participated in this investigation, and who first identified an outcropping of mineralization.

HISTORY

A preliminary geologic map of the Western Brooks Range compiled by the Geological Survey at 1:1,000,000 scale (2)[3] includes the study area. There are, however, no detailed descriptions in the published literature of either the geology or the mineralization within the study area.

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

Little is known about the history of prospecting and mining in the Rabbit Creek vicinity. There has apparently been little or no evalua-

tion using modern exploration techniques. A 1946 report (1) that consists of a tabulation of prospectors' verbal reports of mineral occurrences in Alaska refers to metallic mineral deposits in or near the study area. The locations of reported occurrences are not given in sufficient detail to map. Within the Cape Krusenstern vicinity, there were references to a "ledge" of galena said to contain $35.00 per ton in gold (at $35.00 per ounce) and silver, a lead-silver vein, and both vein and placer gold deposits.

In 1974, a mineral exploration firm working for the NANA Native Corporation, Inc., undertook a regional mineral reconnaissance in northwestern Alaska that included evaluation of some lands adjoining the Cape Krusenstern land withdrawal. A base metal sulfide mineral occurrence was reportedly discovered near the headwaters of Rabbit Creek (3) approximately 4 miles north of the present study area. The sulfides were reported to occur as stratiform mineralization in light gray and tan-weathering phyllite of the Devonian-Mississippian Endicott Group. A sample from a mineralized zone is reported to have assayed 2.5 pct Pb, 0.85 pct Zn, and 4.5 oz/ton Ag (3). The average grade, thickness, linear extent, and attitude of this deposit are not known. The Alaska Lands Act of 1980 enlarged the withdrawl area. The Cape Krusenstern National Monument presently includes this discovery.

In 1980, a Bureau report described mineral occurrences near and within the Cape Krusenstern area. That report included multi-element data from 77 stream sediment samples. Among the results were indications of anomalous manganese and zinc in the headwaters of Rabbit Creek near the NANA lead-zinc-silver prospect (3, pp. 11). Regional geochemical data is also included in several reports by the Department of

Energy (National Uranium Resource Evaluation program--HSSR reports, 4).

MINERAL INVESTIGATIONS

Geology

The Rabbit Creek vicinity is underlain by clastic rocks of the Late Devonian to Early Mississippian Endicott Group (2). No further differentiation of the stratigraphy was possible during this investigation due to the nearly complete tundra cover exhibited in figure 3. Outcrop mapping depicted in figure 4 delineates two generalized metamorphic grades of the clastic rocks.

Terraces of unconsolidated gravels of probable glaciofluvial origin mantle the hillsides up to elevations of at least 950 ft. A common constituent of these gravels is massive and layered mafic-ultramafic rock. No local origin for the igneous rocks was found and the source is suspected to be mafic complexes tens of miles to the north or east.

Sampling

Stream sediment samples listed in table 1 and shown in figure 5, indicate no substantially anomalous trends for the elements silver, arsenic, cobalt, copper, nickel, lead, and zinc. Vein-type deposits are typically difficult to detect with widely spaced geochemical samples. Except for a slight zinc anomaly (280 ppm at sample 6), the reported NANA lead-zinc-silver prospect near the headwaters of Rabbit Creek was also not reflected in the sediment data.

Secondary stream drainages where samples were collected, generally gravel-bottomed, often appeared to be underlain by frozen silt and organic muck. At least some, and probably most, aggregate was derived from the high level glaciofluvial gravels. Therefore, influence of bedrock on metal content of the stream sediments is likely to be minimal.

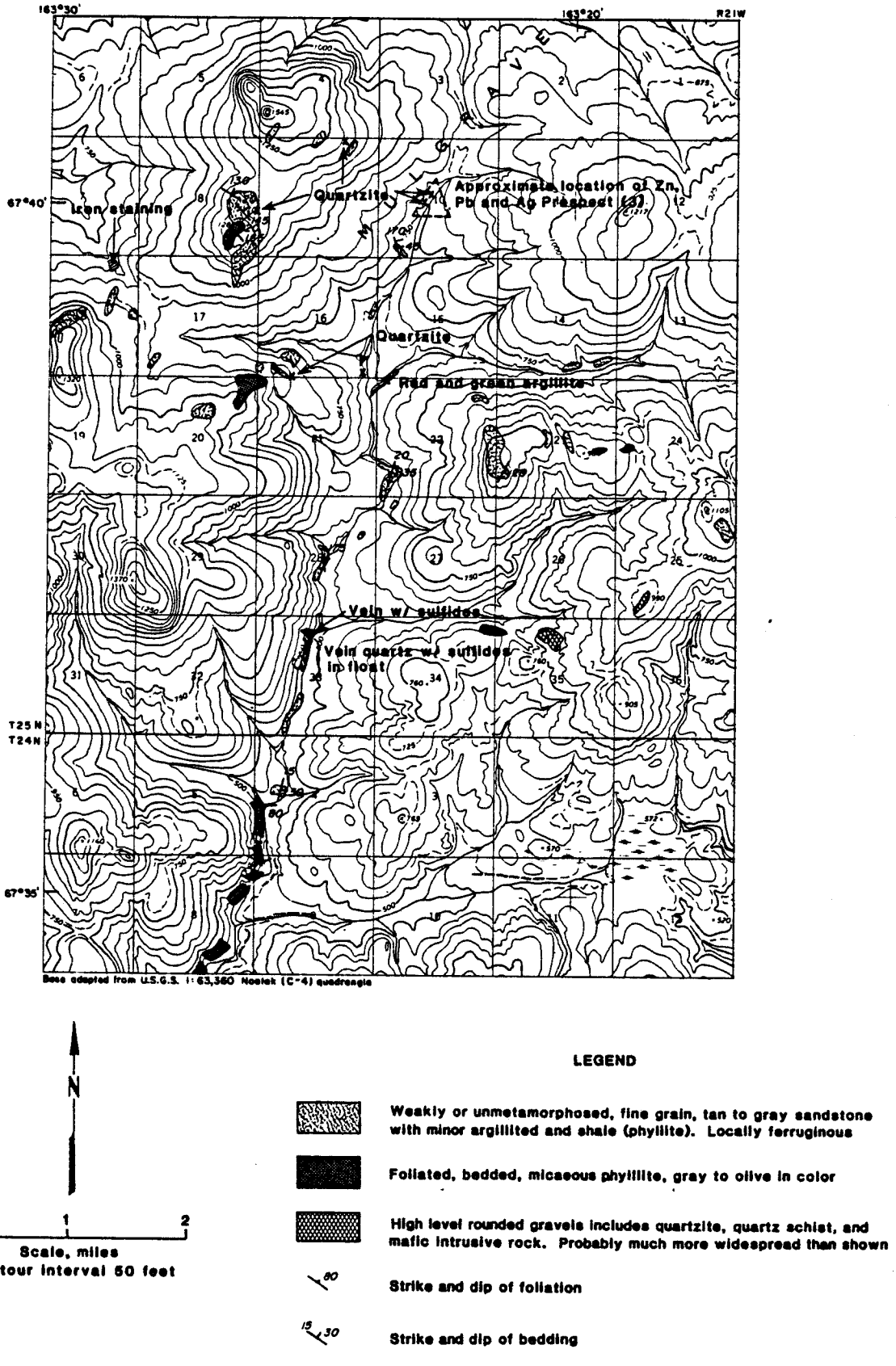

FIGURE 4. - Local outcrop of upper Rabbit Creek.

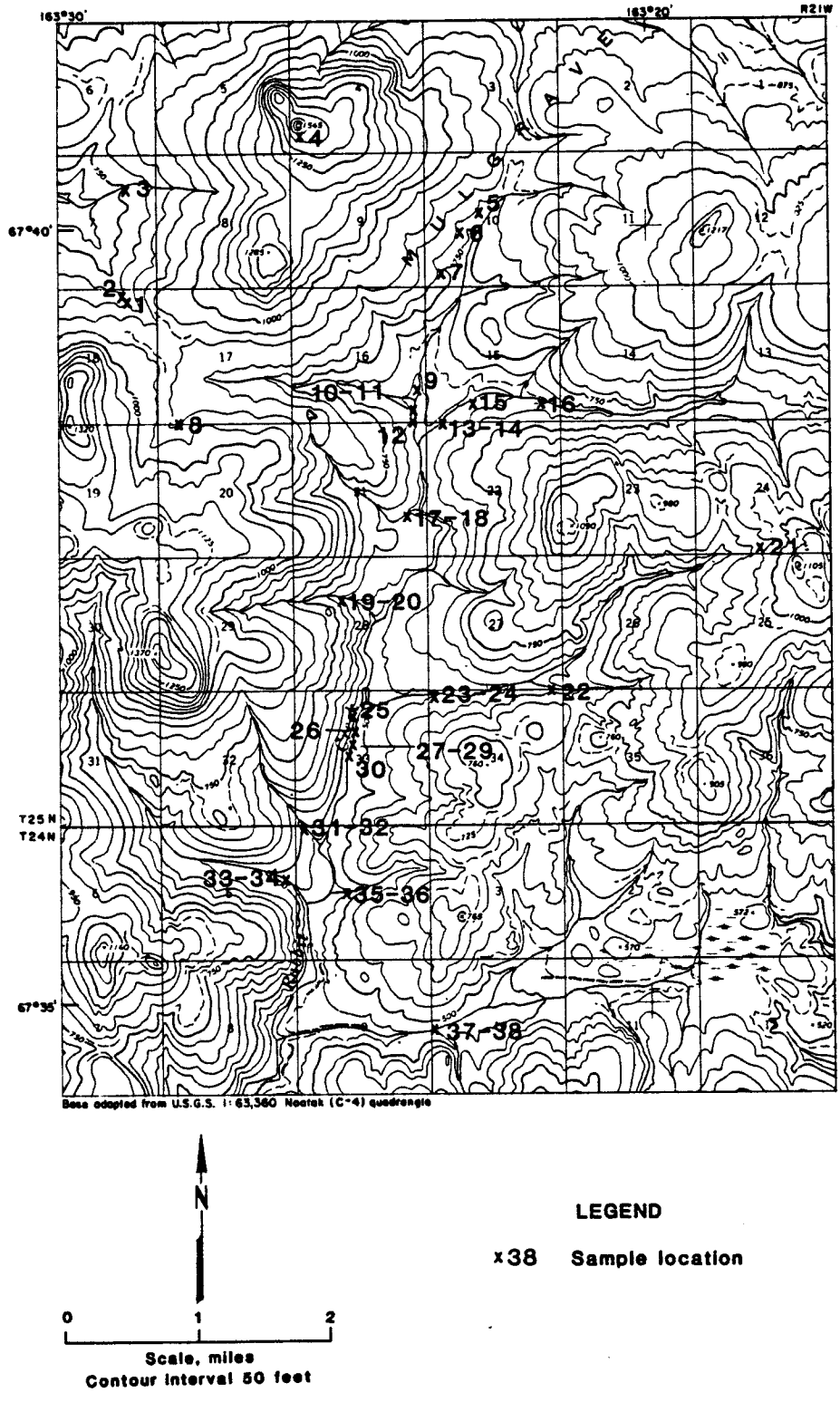

FIGURE 5. - Sample locations of upper Rabbit Creek area.

TABLE 1. - Rabbit Creek stream sediment samples

(All values in parts per million)

Map no.	Sample no.	Ag	As	Co	Cu	Ni	Pb	Zn
1....	WB20424...	0.2	NA	NA	30	63	13	117
2....	WB20425...	.2	NA	NA	22	64	12	106
3....	WB20426...	.2	NA	NA	19	47	18	112
5....	WB16661...	.2	8	26	18	93	NA	161
6....	WB16660...	.2	8	19	16	61	NA	280
8....	WB20423...	.2	NA	23	19	64	14	99
11...	WB20824...	NA	7	19	23	60	14	91
14...	WB20822...	NA	6	20	25	68	11	88
16...	WB16664...	.2	6	24	23	78	NA	120
18...	WB20820...	NA	11	17	24	68	17	84
20...	WB20818...	NA	12	18	30	63	14	95
21...	WB16665...	.2	7	21	18	56	NA	116
22...	WB16666...	.2	7	16	17	59	NA	81
24...	WB20807...	NA	14	22	28	69	17	93
32...	WB20816...	NA	12	18	26	76	17	94
34...	WB20814...	NA	10	18	28	77	13	100
36...	WB20810...	NA	6	22	24	68	11	103
38...	WB20812...	NA	9	16	26	57	12	81

NA Not analyzed.

NOTE.--Analyses by atomic absorption procedures, Bondar-Clegg Inc., Denver, CO.

Samples comprise the minus 80 mesh fraction of silty gravel from active stream beds. The minus fraction was pulverized prior to analysis.

TABLE 2. - Rabbit Creek panned concentrate samples

(All values in oz/ton)

Map no.	Sample no.	Au	Pd	Pt	Weight of recovered black sand (g)	Volume of original sample (ft^3)
10...	WB20823...	0.0022	<0.0010	<0.0010	44.4	0.5
13...	WB20821...	<.0002	<.0003	<.0003	14.7	.5
17...	WB20819...	<.0002	<.0003	<.0003	10.9	.5
19...	WB20817...	<.0002	<.0003	<.0003	11.3	.5
23...	WB20808...	<.0002	<.0003	<.0003	12.6	.5
31...	WB20815...	<.0002	<.0003	<.0003	13.6	.5
33...	WB20813...	<.0002	<.0003	<.0003	17.1	.5
35...	WB20809...	<.0002	<.0003	<.0003	6.9	.5
37...	WB20811...	<.0002	.0010	.0020	22.0	.5

NOTE.--Samples were collected from active channel with a steel shovel and reduced to near black sand by hand panning. The entire heavy mineral fraction was used for analysis.

Analyses were by fire-assay ICP procedures, Bureau of Mines Reno (NV) Research Center.

Panned concentrates collected at some sediment sample stations (fig. 5) gave no indication of appreciable placer gold, platinum, or palladium associated either with the mafic-ultramafic float found in the area or with any other possible sources (table 2).

Mineralization

Boulders of limonite- and hematite-stained quartz with copper and iron sulfides occur in Rabbit Creek near sample locations 26 to 30 (fig. 5). Nearly a dozen boulders of massive quartz up to 2.5 ft across and 4 ft long contain pods, wisps and bands of hematite and sulfides (fig. 6). Sulfide minerals including pyrite, chalcopyrite, and minor bornite were identified in hand specimens. Samples tested with a hand magnet were nonmagnetic. Observations of float material indicated that the occurrence(s) range in width from 1/4 in to at least 3 ft and are apparently associated with veins or pods in shear zones. Some boulders were attached to pieces of sheared or foliated country rock (fig. 6). The boulders are subrounded to subangular and are aligned along the right limit of the stream. It was apparent that they had not been transported very far.

Four thin sections were observed with reflective microscopy (samples 25, 26, 27, and 30). The major sulfide present was chalcopyrite with minor pyrite. Small fractures within the chalcopyrite were replaced with covellite, which was also found at some grain boundaries between the two major sulfide phases. Pyrite appeared to be locally oxidized with iron oxides present within fractures and pits on the reflective surface. Two other opaque phases were not identified because of their minor occurrence and small dimensions. One unidentified sulfide phase that appeared white in color was found to occur in contact with chalco-

FIGURE 6. - Photograph of sheared and mineralized quartz and country rock from Rabbit Creek. Note the angular form of the boulder indicating very little alluvial transport.

pyrite and in discreet grains. Large irregular quartz grains indicate strong alignment of which the significance is not clear.

Grab samples contained up to 6.7 pct Cu and 0.153 pct Co. The samples averaged 3.13 pct Cu and 0.034 pct Co (table 3). Traces of gold and silver are also present.

Although the general area has almost continuous tundra cover, one poorly-exposed outcrop in a small gully along the right limit of Rabbit Creek is cut by a 0.3-ft-thick sulfide-bearing quartz vein stained by iron and minor malachite. The wall rock is a green to gray, crenulated phyllite. Orientation of the vein structures(s) is unclear. Elsewhere along the west side of Rabbit Creek the outcrops of phyllite are eroded by fluvial processes. Exposures of the phyllite commonly contain barren quartz stringers and pods. No quartz veins large enough to host the sulfide-bearing quartz boulders in Rabbit Creek were found.

SUMMARY AND CONCLUSION

Mineralized boulders up to 3-ft-thick found in Rabbit Creek contain appreciable copper with minor values of cobalt, and traces of gold and silver. Nearby outcropping of a vein with similar mineralization indicates that the mineralization is hosted by a gray-green phyllite. The boulders and outcrop may indicate similar vein-type copper-cobalt mineralization in the vicinity. Further evaluation will require trenching and the digging of test pits, neither of which is presently permitted in the Cape Krusenstern National Monument.

This occurrence, plus the previously reported silver, gold, lead, and zinc prospects said to occur in the Cape Krusenstern area, suggest a general favorability for mineralization in the vicinity.

TABLE 3. - Rabbit Creek rock samples

Map no.	Sample no.	Ag	As	Co	Cu	Ni	Zn	Au	Pd	Pt
		(Values in ppm)						(Values in oz/ton)		
4.....	WB16662....	NA	NA	NA	NA	NA	NA	<0.0002	<0.001	<0.001
7.....	WB16659....	0.2	4	11	141	51	143	NA	NA	NA
9.....	WB16658....	.2	3	62	22	248	54	<.0002	<.001	<.001
12....	WB20433....	NA	NA	NA	NA	NA	NA	.001	<.0003	<.0003
15....	WB16663....	.2	3	87	79	580	64	<.0002	<.001	<.001
25A...	WB16672A...	.8	45	21	5,250	53	5	NA	NA	NA
25B...	WB16672B...	NA	NA	17	4,500	49	NA	NA	NA	NA
26A...	WB16667A...	7.8	59	154	51,400	377	16	<.0002	<.0003	<.0003
26B...	WB16667B...	NA	NA	100	54,000	263	NA	NA	NA	NA
27A...	WB16669A...	5.3	24	1,530	45,700	3430	9	NA	NA	NA
27B...	WB16669B...	NA	NA	1,350	47,500	2950	NA	NA	NA	NA
28A...	WB16670A...	11.0	92	170	50,000	385	57	NA	<.0003	<.0003
28B...	WB16670B...	NA	NA	101	67,000	257	NA	NA	NA	NA
29A...	WB16671A...	.2	140	138	775	267	14	.0005	<.001	<.001
29B...	WB16671B...	NA	NA	89	740	184	NA	NA	NA	NA
30A...	WB20422A...	NA	NA	259	23,400	306	NA	<.0004	NA	NA
30B...	WB20422B...	NA	NA	150	25,400	306	NA	NA	NA	NA

		Description
4.....	WB16662....	Random chips of gray quartzite with numerous segregations of barren milky quartz.
7.....	WB16659....	Random chips of gray to black fissile shale with sulfide nodules (including minor chalcopyrite).
9.....	WB16658....	Coarse grain gabbro grab sample with accessory iron sulfide and magnetite.
12....	WB20433....	Gabbro grab sample with minor accessory sulfides from creek rubble.
15....	WB16663....	Limonite-stained pyroxenite found as creek float.
25....	WB16672....	Chips from 0.3-ft-wide quartz sulfide vein found cutting green crenulated phyllite in outcrop.
26....	WB16667....	Grab sample of hematite-stained quartz with pyrite, chalcopyrite and minor bornite(?) occurring as a 2-ft-wide boulder in creek bed.
27....	WB16669....	Grab sample of sulfide-bearing quartz vein in boulder of green to gray phyllite-schist.
28....	WB16670....	Similar boulder to above.
29....	WB16671....	Do.
30....	WB20422....	Chips taken at random from all sides of several mineralized quartz boulders.

NA Not analyzed.

NOTE.--Analyses of Ag, As, Co, Cu, Ni, Zn by atomic absorption procedures, Bondar-Clegg, Inc., Denver, CO. Cu concentrations greater than 20,000 ppm were redetermined by wet chemistry. Analyses for Au, Pd, Pt by fire assay ICP procedure, Bureau of Mines Reno (NV) Research Center.

REFERENCES

1. Anderson, E. Information Gathered Mainly from Verbal Statements of Prospectors: Territory of Alaska, Department of Mines, 1946, 29 pp.

2. Grybeck, D., H. M. Beikman, W. W. Brosge', I. L. Tailleur, and C. G. Mull. Geologic Map of the Brooks Range. U.S. Geol. Surv. Open File Map 77-166B, 1977.

3. U. S. Bureau of Mines. Mineral Deposits of the Cape Krusenstern Area, Alaska: A Preliminary Comment. BuMines OFR 42-80, 1980, 22 pp.

4. U.S. Department of Energy. Hydrologic Stream Sediment Reconnaissance. Data available in compilations GJBX 63(77); 87(78); and 26(79), Noatak Quadrangle, Alaska.