Preliminary geological and geochemical results from the Silver Creek and Yellow Ridge mineralized areas in the Washakie Wilderness, Wyoming

by

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

Introduction

Anomalous metal concentrations were discovered in the Washakie Wilderness by the U.S. Geological Survey during mineral-evaluation studies of the area. Cody, Wyo., the nearest town, is about 100 km northeast of the area. The Washakie Wilderness includes the former South Absaroka Wilderness Area, the former Stratified Primitive Area, and several adjoining wilderness study areas in the Shoshone National Forest. The two mineralized areas (fig. 1) described in this report, accessible only by foot or horseback, are as follows:

(1) The Silver Creek area--located on the Fall Creek 7 1/2-minute topographic quadrangle map, approximately 18 km from the road's end at the South Fork Ranger Station. It is accessible by a good horsetrail along the South Fork Shoshone River trail to the mouth of Silver Creek, across the river from the trail, and by foot up Silver Creek.

(2) The Yellow Ridge area--located on the Francs Peak 7 1/2-minute topographic quadrangle, approximately 35 km from the end of the Greybull River road. A good horsetrail follows the Greybull River and Yellow Creek to within 1 km of the mineralized area.

Rock samples from the two areas contain anomalous amounts of copper, lead, zinc, molybdenum, gold, and silver. The magnitude of the anomalies is similar to that of those anomalies described by Fisher (1972) in the Stinkingwater Mining Region and by Wilson (1975) in the Meadow Creek area and the Kirwin mineralized area (Wilson, 1964). The pattern and types of alteration associated with the metal anomalies in both areas are similar to those around porphyry copper deposits elsewhere in the Absaroka Mountains (Fisher, 1972; Wilson, 1964).

The Silver Creek area

Copper minerals and molybdenite are exposed in altered rocks of an intrusive complex in the Silver Creek area (fig. 2). Two types of intrusive rocks have been emplaced into Tertiary extrusive rocks of the Wapiti, Trout Peak Trachyandesite, and Wiggins Formations. The host rocks as well as the intrusives have been hydrothermally altered.

An exposed mineralized zone about 600 m by 300 m in the central part of the intrusive contains disseminated malachite, chalcopyrite, and bornite and small amounts of molybdenite. Chalcopyrite also occurs with pyrite in small veins. Pyrite is abundant in the central part of the mineralized zone, and it also occurs with sparsely distributed sulfides of zinc and lead in the outer part of the mineralized area.

Malachite is common along well-developed fractures that trend from N. 35° E. to N. 80° W. and dip vertical to 50° east and south. Analytical results of some rock samples indicate highly anomalous concentrations of copper (fig. 3); some of the rocks also contain smaller, but still anomalous, concentrations of lead, zinc, molybdenum, silver, and gold (table 1).

The intrusive complex consists of at least two kinds of rocks. The larger and more intensely mineralized stock is dacite-rhyodacite porphyry that contains phenocrysts of plagioclase (25-30%), quartz (10-15%), and biotite (5-10%). A smaller and less mineralized stock is dacite porphyry that is characterized by euhedral hornblende phenocrysts (10-15%); it also contains plagioclase phenocrysts (25-30%).

The intrusive rocks and the adjacent extrusive rocks are hydrothermally altered. Alteration in the outermost zone is predominantly propylitic (characterized by chlorite, calcite, and epidote). Alteration in the center of the complex is predominantly sericitic (characterized by quartz, sericite, and pyrite); the center contains small, irregular-shaped zones of potassically altered rocks characterized by small quartz-potassium feldspar veinlets and by secondary biotite and magnetite. Alteration boundaries are indistinct, and the zones commonly overlap. Hydrothermal alteration generally preceded mineralization. The sulfides of greatest economic interest (chalcopyrite, bornite, molybdenite) are contained within the sericitic and potassic zones. Pyrite is common throughout the central part of the complex but much less abundant in the propylitic zone.

The Yellow Ridge area

Copper minerals are exposed in highly altered intrusive rocks on the southeastern slope of Yellow Ridge (fig. 4). Plutons with a surface area of about 2.5 km^2 have been emplaced into extrusive flows and breccias of the Wiggins Formation of Tertiary age. Pervasive hydrothermal alteration has affected the host rocks as well as the intrusive rocks.

A narrow (60- to 100-m) zone of mineralized rocks is exposed in a northeasterly direction for about 750 m along the southeastern part of the intrusive complex. Malachite is the most common ore mineral in this zone; it occurs both as disseminated grains and as coatings on fracture surfaces. Pyrite and smaller amounts of chalcopyrite, bornite(?), and molybdenite(?) are the major sulfide minerals in the zone. Pyrite is also present with quartz in thin irregular veinlets. Analytical results taken from some rock samples indicate highly anomalous concentrations of copper (fig. 5). Some of the samples are also anomalous, but to a lesser extent, in their content of lead, zinc, molybdenum, silver, and gold (table 2).

At least three types of intrusive rocks are found in the area. The largest and probably oldest pluton is granodioritic to dioritic in composition and contains small (about 1 mm) subhedral to euhedral grains of plagioclase (labradorite - An_{50}) (60-70%), hornblende (15-20%), quartz (2-5%), and potassium feldspar (2-5%). The dioritic rocks have been intruded by an andesite porphyry characterized by large (5 mm to 2 cm) euhedral plagioclase (andesine - An_{48}) phenocrysts and smaller (1 to 2 mm) euhedral phenocrysts of biotite and hornblende. Plagioclase crystals constitute about 15 to 20% of of the andesite; of the biotite, about 5 to 10%; hornblende, 5 to 10%; small rounded quartz grains, about 2%; and matrix material, about 50%. A third type of intrusive rock in the Yellow Ridge area is a hornblende andesite that contains small (1-3 mm), euhedral phenocrysts of plagioclase (40 to 50%), hornblende (20 to 25%), and anhedral quartz (2 to 3%). The hornblende andesite may be simply a finer grained porphyritic phase of the dioritic intrusive body. Most of the mineralization appears to have been associated with the andesite porphyry characterized by the large plagioclase phenocrysts; however, in places the dioritic rocks and hornblende andesite have also been mineralized.

Almost all of the intrusive and extrusive rocks of the Yellow Ridge area have been hydrothermally altered. The outer zones of the intrusive bodies and surrounding extrusive rocks have been propylitically altered and are characterized by secondary chlorite, calcite, and eipdote. Hornblende crystals were apparently more susceptible to alteration, and commonly pseudomorphs of chlorite and eipdote after hornblende are present in the same rock with completely unaltered biotite. Nearer the central part of the intrusive complex, quartz, sericite, and some pyrite are more common; and in places the rocks have been completely altered to masses of these minerals. The rocks have been potassically altered in the southern and southeastern parts of the intrusive complex particularly within and immediately adjacent to the most heavily mineralized zone. In these rocks the alteration products are secondary biotite, disseminated magnetite, and veinlets of quartz-potassium feldspar and magnetite. Although quite extensively altered, the original texture of the potassically altered rocks is commonly well preserved.

References

Fisher, F. S., 1972, Tertiary mineralization and hydrothermal alteration in the Stinkingwater Mining Region, Park County, Wyoming: U.S. Geol. Survey Bull. 1332-C, 33 p.

Wilson, W. H., 1964, The Kirwin mineralized area, Park County, Wyoming: Wyoming Geol. Survey Prelim. Rept. 2, 12 p.

______ 1975, The copper-bearing Meadow Creek granodiorite, Upper Wood River area, Park County, Wyoming, in Wyoming Geol. Assoc. Guidebook 27th Ann. Field Conf., Bighorn Basin, 1975, p. 235-241.

Table 1. Analyses of rock samples from the Silver Creek mineralized area

[Analyses for copper, lead, zinc, and gold are by atomic absorption. Silver and molybdenum are by a six-step spectrochemical procedure by R. T. Hopkins, Jr. Numbers in parentheses beneath element symbols are the lowest abundance levels at which the elements can be satisfactorily determined by the analytical method used; L, detected, but in amount below satisfactory measurement level; N, not detected. Values in parts per million (ppm)]

Sample No.	Ag (0.5)	Cu (5)	Mo (5)	Pb (5)	Zn (5)	Au (0.05)
FA346R	N	70	N	30	N	N
FA347R	N	5	N	10	35	N
FA348R	N	10	N	20	60	N
FA349R	N	40	N	85	180	N
FA351R	2	170	N	130	2,000	N
FA352R	N	10	20	5	L	L
FA354R	N	530	10	5	35	N
FA356R	20	20,000	30	10	40	0.80
FA357R	N	260	150	10	20	L
FA360R	N	20	N	45	160	N
FA363R	N	40	N	10	160	N
FA366R	N	10	N	20	95	N
FA367R	N	10	N	10	40	N
FA369R	N	5,500	100	20	30	.20
FA371R	.5	1,500	20	10	20	.10
FA373R	.7	1,300	70	15	15	.20
FA375R	N	1,200	20	5	55	.10
FA377R	N	15	N	10	55	N
FA379R	N	95	N	25	25	N
FA380R	N	150	N	10	10	N
FA381R	N	45	N	10	10	N
FA385R	N	25	N	10	45	N
FA387R	N	10	N	10	55	N
FA389R	N	L	N	15	60	N
FA391R	N	25	5	40	45	N
FA394R	N	15	N	10	65	N
FA396R	1	2,000	100	40	20	.10
FA398R	L	1,800	5	10	30	L
FA1300R	N	L	N	20	40	N
FA1304R	1.5	140	N	70	160	N
FA1306R	1	380	10	20	180	N
FA1308R	N	5	N	50	120	N
FA1309R	N	320	N	50	60	N
FA1311R	N	260	N	15	20	N
FA1313R	N	25	N	15	60	N
FA1315R	N	110	N	15	40	N
FA402R	7	280	30	440	1,400	L
FA404R	.5	500	30	5	25	L
FA406R	N	250	N	5	10	N
FA407R	N	100	70	5	10	N
FA408R	3	L	N	10	50	N
FA17R	N	240	5	10	30	N

Table 2. Analyses of rock samples from the Yellow Ridge mineralized area
[Analyses for copper, lead, zinc, and gold are by atomic absorption. Silver and molybdenum are by a six-step spectrochemical procedure by R. T. Hopkins, Jr. Numbers in parentheses beneath element symbols are the lowest abundance levels at which the elements can be satisfactorily determined by the analytical method used; L, detected, but in amount below satisfactory measurement level; N, not detected. Values in parts per million (ppm)]

Sample No.	Ag (0.5)	Cu (5)	Mo (5)	Pb (5)	Zn (5)	Au (0.05)
FR1373R	N	20	N	20	35	N
FR1375R	N	15	N	15	70	N
FR1389R	N	30	N	50	80	N
FR1391R	N	15	N	5	40	N
FR1392R	N	10	N	20	40	N
FR1393R	N	30	N	10	65	N
FR1394R	N	10	L	20	80	N
FR1395R	N	10	7	5	L	N
FR1396R	N	45	N	50	50	N
FR1397R	N	5	N	30	130	N
FR1398R	N	10	L	100	130	N
FR1399R	N	20	N	20	20	N
FR2300R	N	55	N	35	35	N
FR2301R	N	10	L	10	10	N
FR2302R	N	35	N	10	35	N
FR2303R	N	5	7	5	L	N
FR2304R	N	30	N	10	35	N
FR2306R	N	25	10	15	55	N
FR2307R	N	5	N	25	60	N
FR2308R	N	40	N	15	60	N
FR2309R	N	25	N	20	40	N
FR2310R	N	5	N	5	50	N
FR2311R	N	10	N	10	75	N
FR2312R	N	20	N	15	50	N
FR2313R	2	80	N	500	340	N
FR2314R	N	25	N	55	130	N
FR2315R	N	30	L	60	15	N
FR2316R	1.5	280	50	20	20	N
FR2317R	N	3,400	N	10	70	0.05
FR2318R	10	3,600	7	20	35	.05
FR2319R	N	6,200	7	20	110	N
FR2320R	3	3,300	30	15	90	.25
FR2321R	3	8,100	10	65	180	L
FR2322R	3	280	100	240	5	.70
FR2323R	N	65	N	10	40	N
FR2324R	N	5	5	75	90	N
FR647R	N	5	N	25	85	N
FR648R	N	30	5	15	60	N
FR649R	N	25	N	30	60	N
FR650R	N	20	N	15	55	N
FR652R	N	10	N	75	170	N
FR653R	N	25	N	15	60	N
FR654R	N	30	N	20	70	N
FR655R	N	55	10	70	80	N
FR1065R	N	20	N	10	80	N
FR1066R	N	40	N	10	50	N
FR1067R	N	25	L	25	55	N
FR1070R	N	L	N	10	5	N
FR1071R	N	25	N	25	90	N
FR1072R	1.5	5	15	10	15	N
FR656R	N	10	5	15	15	N
FR657R	N	15	N	50	70	N
FR658R	N	35	N	20	40	N
FR659R	N	35	20	50	20	N
FR660R	0.7	950	100	75	120	0.10
FR661R	.5	920	30	250	100	.10
FR663R	N	2,800	N	20	90	L
FR665R	N	29,000	N	30	190	L
FR667R	N	130	10	40	90	N
FR669R	N	40	10	65	10	N
FR670R	N	15	7	25	85	N
FR671R	N	15	N	5	35	N
FR672R	N	35	N	10	50	N
FR673R	N	30	7	10	50	N
FR674R	N	L	N	25	65	N
FR675R	N	15	L	10	40	N
FR676R	N	10	N	10	40	N
FR677R	N	10	N	10	50	N
FR678R	N	10	N	10	110	N
FR679R	N	10	7	20	40	N
FR680R	N	15	L	20	40	N
FR681R	N	120	L	75	160	N
FR682R	N	10	7	20	60	N
FR683R	N	25	7	45	85	N
FR684R	N	5	N	5	5	N
FR685R	N	15	5	20	40	N
FR686R	N	45	N	10	40	N
FR687R	N	10	N	10	30	N
FR1404R	N	15	N	25	60	N
FR1407R	N	25	20	15	5	.05
FR1408R	N	35	N	20	40	N
FR1411R	N	10	N	20	25	N
FR1412R	N	75	N	20	30	N
FR1413R	N	25	N	15	40	N
FR1420R	N	30	N	15	50	N
FR1421R	N	15	N	30	55	N
FR1422R	N	35	N	25	40	N
FR1423R	N	80	N	15	100	L
FR1424R	1.5	30,000	N	300	210	.10
FR1425R	1	6,600	N	30	110	.05
FR1426R	N	25	10	55	L	N
FR1427R	N	20	20	10	L	N
FR1428R	N	30	N	10	90	N
FR1074R	N	10	N	10	40	N
FR1078R	1.5	20	N	270	320	N
FR1079R	N	5	N	10	45	N
FR1080R	1	130	10	20	10	N

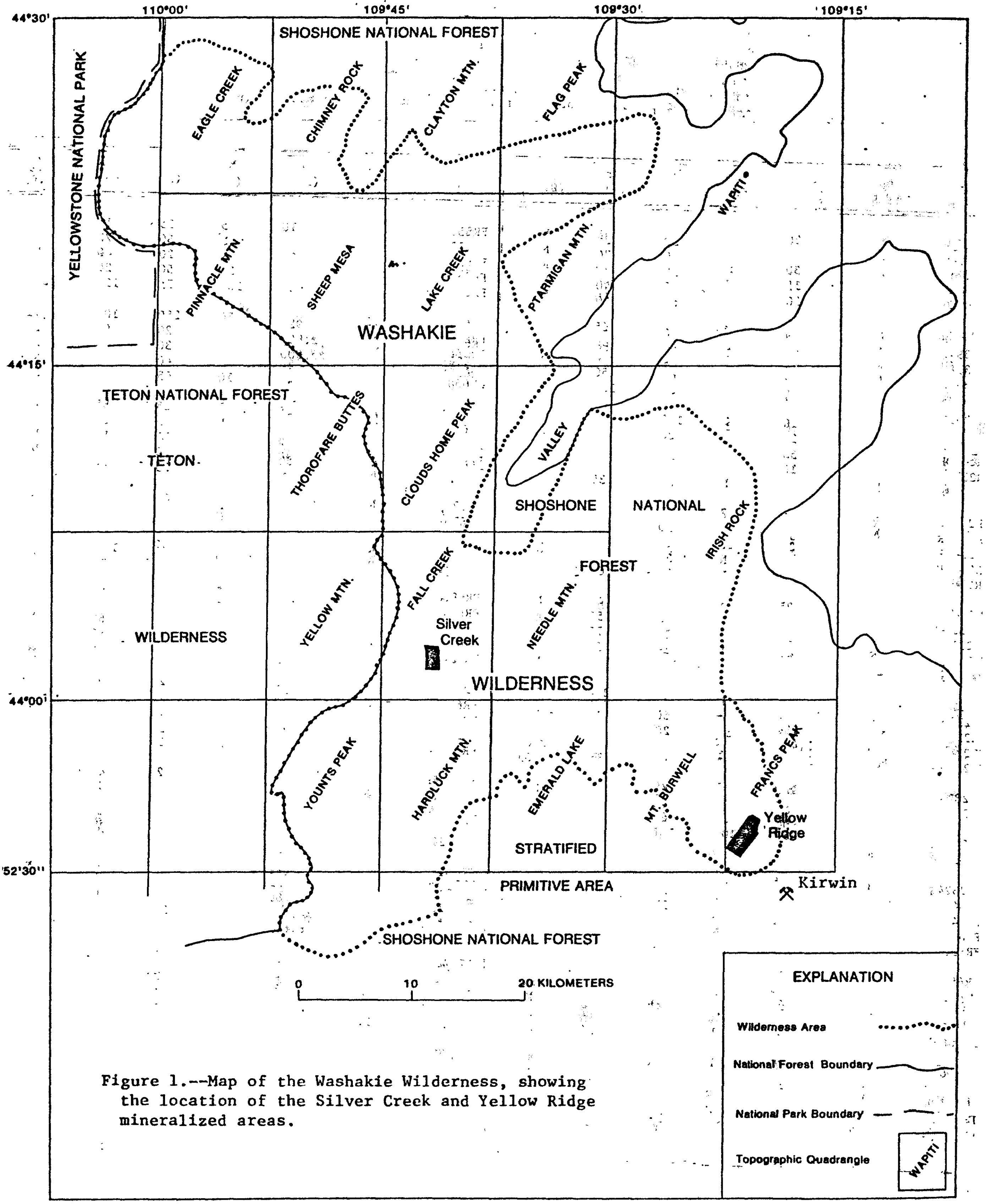

Figure 1.--Map of the Washakie Wilderness, showing the location of the Silver Creek and Yellow Ridge mineralized areas.

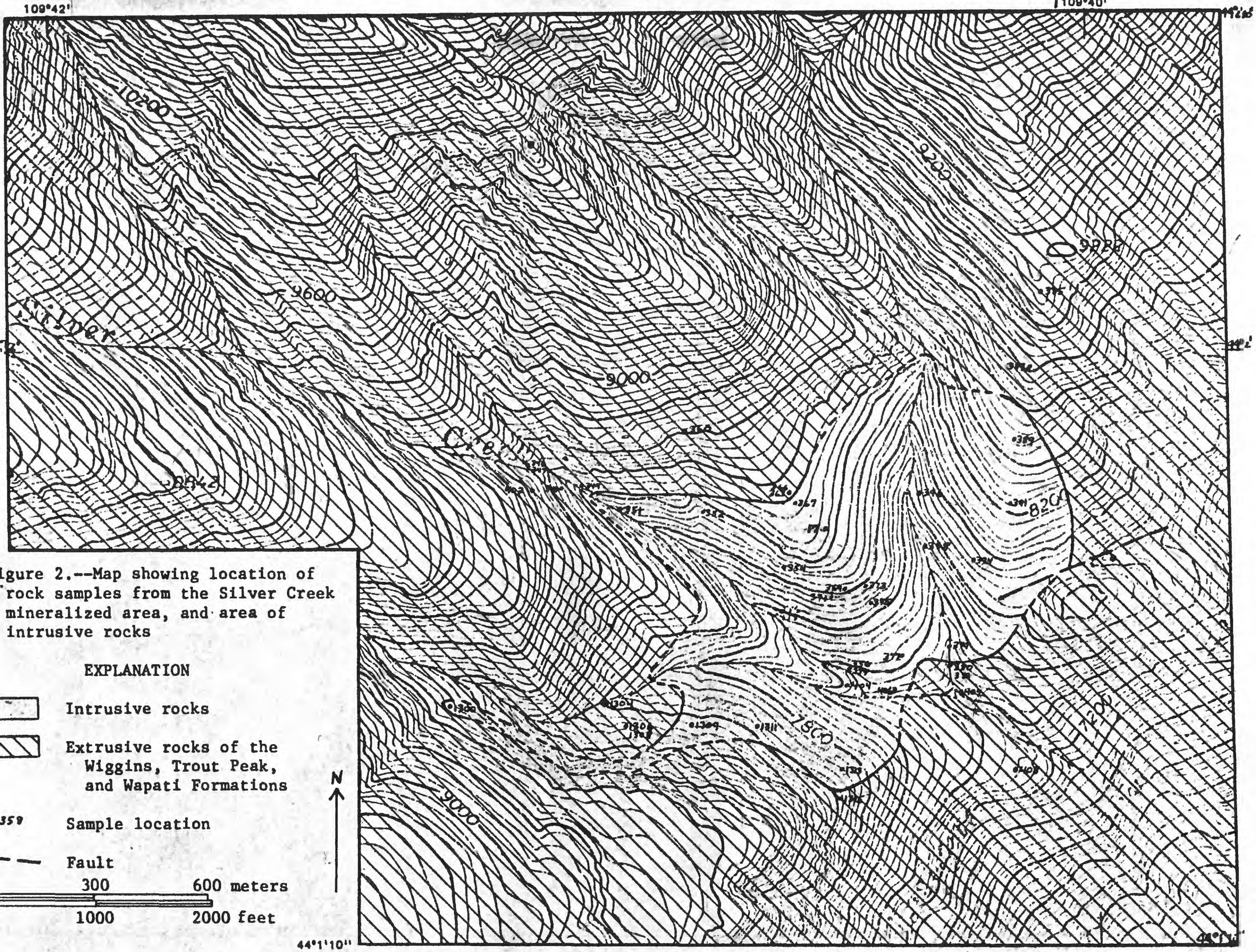

Figure 2.--Map showing location of rock samples from the Silver Creek mineralized area, and area of intrusive rocks

EXPLANATION

Intrusive rocks

Extrusive rocks of the Wiggins, Trout Peak, and Wapati Formations

• 359 Sample location

Fault

0 300 600 meters

0 1000 2000 feet

N

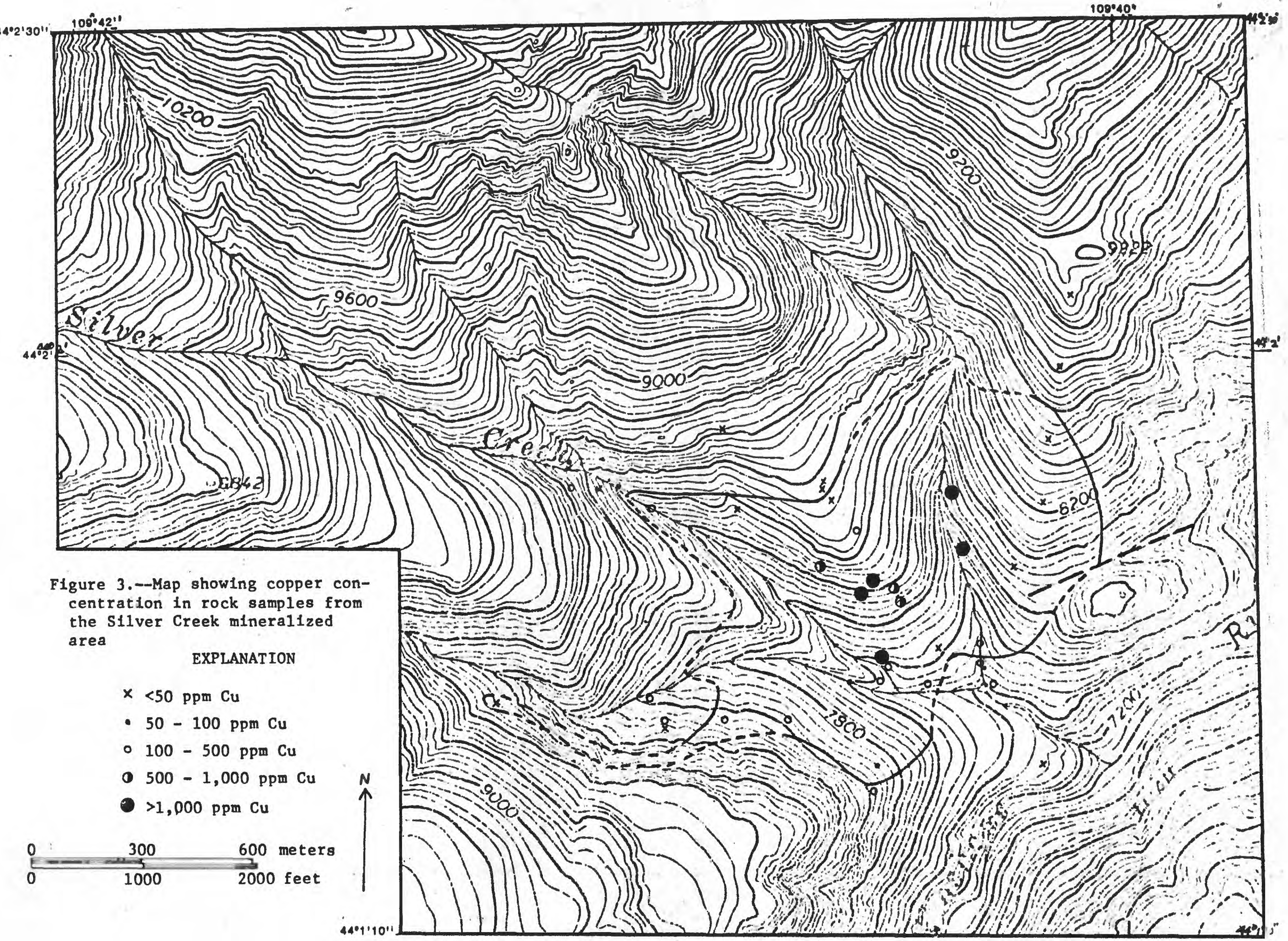

Figure 3.--Map showing copper concentration in rock samples from the Silver Creek mineralized area

EXPLANATION

× <50 ppm Cu
• 50 - 100 ppm Cu
○ 100 - 500 ppm Cu
◑ 500 - 1,000 ppm Cu
● >1,000 ppm Cu

0 300 600 meters
0 1000 2000 feet

N

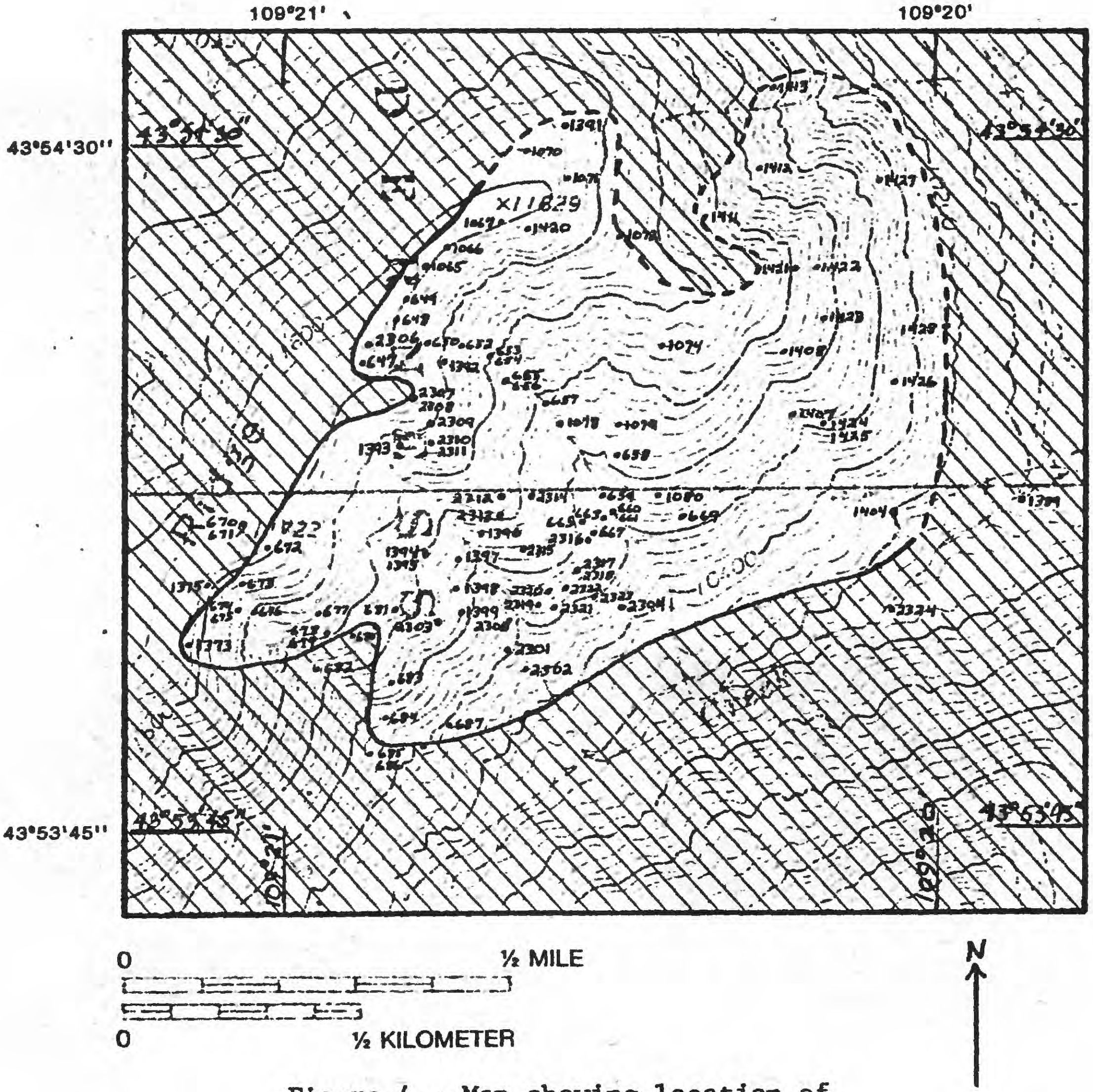

Figure 4.--Map showing location of rock samples from the Yellow Ridge mineralized area, and areas of intrusive rocks

EXPLANATION

Intrusive rocks

Extrusive rocks of the Wiggins Formation

•2300 Sample location

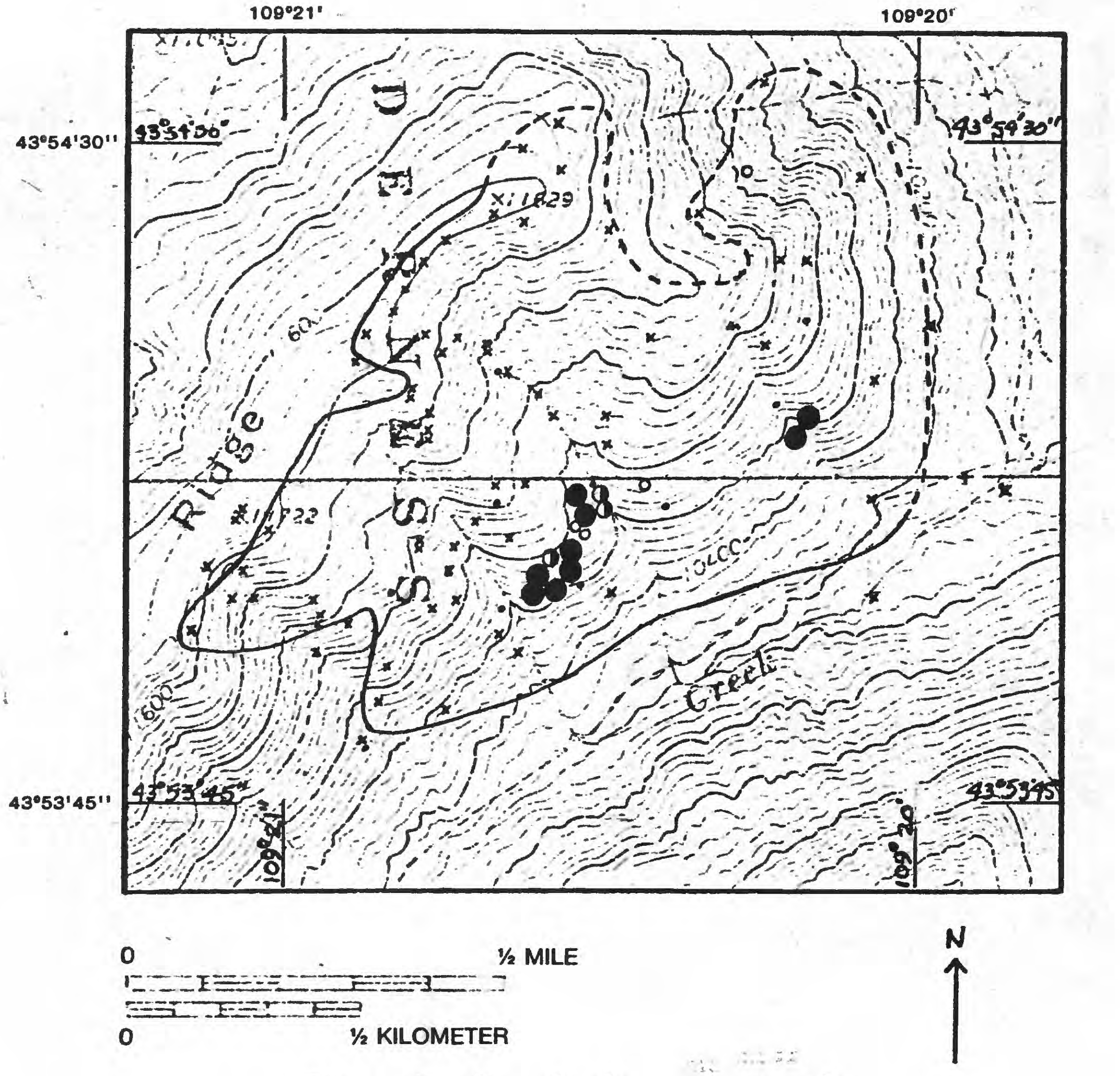

Figure 5.--Map showing concentration of copper in rock samples from the Yellow Ridge mineralized area

EXPLANATION

× <50 ppm Cu

• 50 - 100 ppm Cu

o 100 - 500 ppm Cu

0 500 - 1,000 ppm Cu

● >1,000 ppm Cu