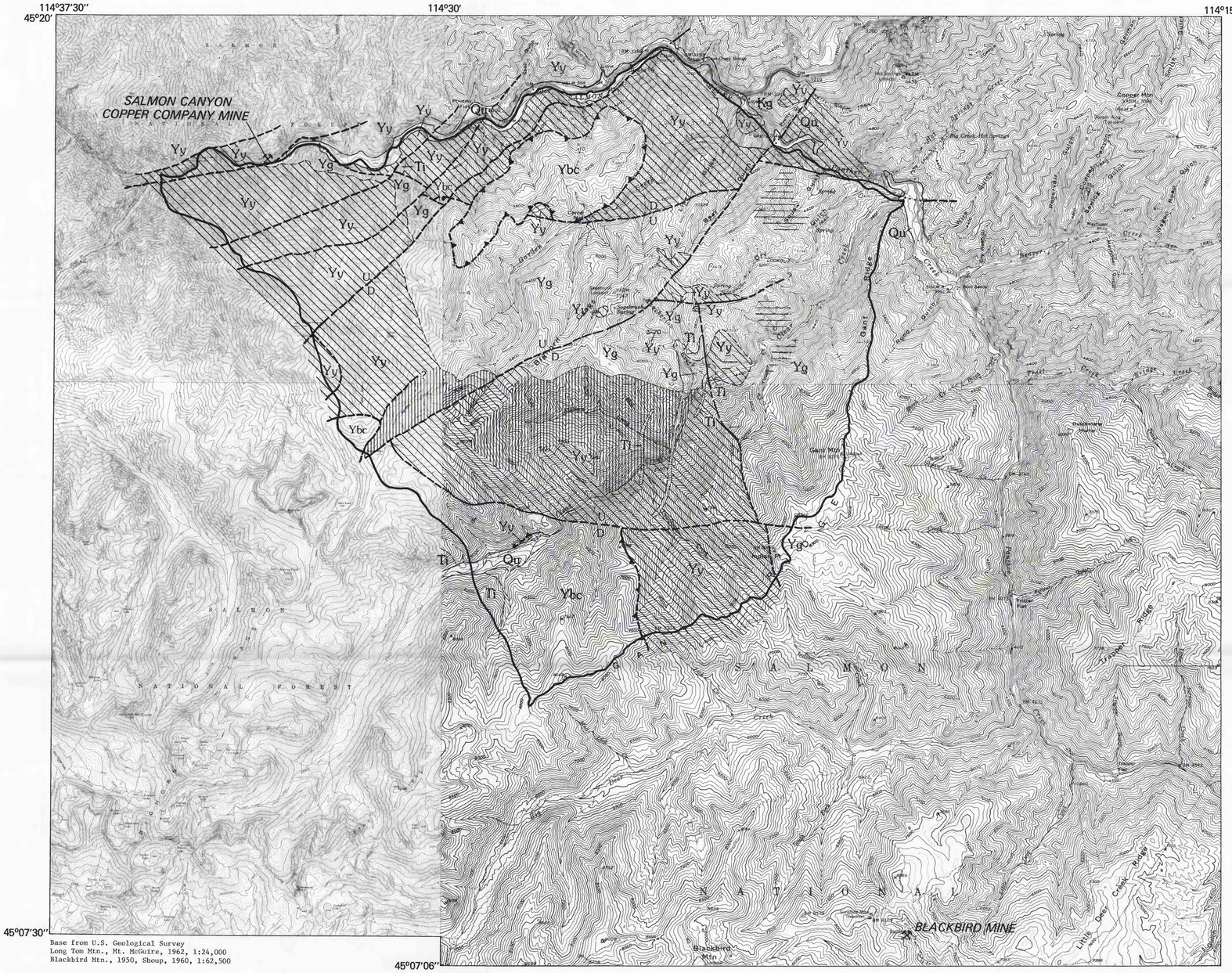
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1576-A
PAMPHLET ACCOMPANIES MAP



Base from U.S. Geological Survey
Long Tom Mtn., Mt. McGuire, 1962, 1:24,000
Blackbird Mtn., 1950, Shoup, 1960, 1:62,500

Geology mapped by Karen Lund and K. V. Evans, 1981-82

SCALE 1:50 000
1 ½ 0 1 2 3 MILES
1 .5 0 1 2 3 KILOMETERS
CONTOUR INTERVAL 40 AND 100 FEET

MINERAL RESOURCE POTENTIAL MAP OF THE SPECIAL MINING MANAGEMENT ZONE-CLEAR CREEK, LEMHI COUNTY, IDAHO

By

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1983

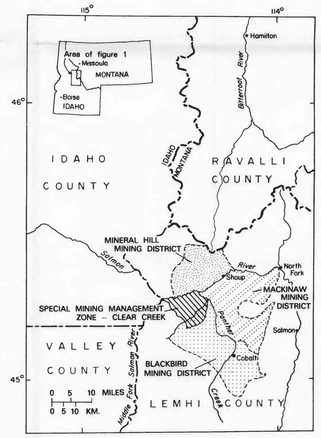

Figure 1.-Index showing location of the Special Mining Management Zone-Clear Creek, Lemhi County, Idaho

CORRELATION OF MAP UNITS

Qu	Relative age unknown	QUATERNARY
Ti		TERTIARY
Kg		CRETACEOUS
Ybc		PROTEROZOIC Y
Yg		
Yy		

DESCRIPTION OF MAP UNITS

Qu UNCONSOLIDATED SEDIMENTS (QUATERNARY)--Includes alluvial, colluvial, and morainal deposits

Ti INTRUSIVE ROCKS (TERTIARY)--Related to the Eocene Bighorn Crags pluton; medium-grained granite, porphyritic rhyolite, and porphyritic dacite

Kg TWO-MICA GRANITE (CRETACEOUS)--Medium-grained, slightly foliated; related to the main phase of the Idaho batholith

Ybc METAQUARTZITE (PROTEROZOIC Y)--White; correlated with Big Creek Formation

Yg GRANITE (PROTEROZOIC Y)--Porphyritic or nonporphyritic, gray or pink, strongly foliated

Yy METAGRAYWACKE AND SCHIST (PROTEROZOIC Y)--Weakly to strongly metamorphosed, biotitic; correlated with Yellowjacket Formation

CONTACT--Dashed where approximately located or inferred; dotted where concealed

NORMAL FAULT--Dashed where approximately located; dotted where concealed; queried where uncertain; U, upthrown side, D, downthrown side

THRUST FAULT--Dashed where approximately located; sawteeth on upper plate

APPROXIMATE BOUNDARY OF MANAGEMENT ZONE

AREAS WITH HIGH COBALT-COPPER POTENTIAL

AREAS WITH MODERATE COBALT-COPPER POTENTIAL

AREAS WITH LOW COPPER-MOLYBDENUM POTENTIAL

STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of the Special Mining Management Zone--Clear Creek in the Salmon National Forest, Lemhi County, Idaho. The area was included in the River of No Return Wilderness by Public Law (96-312, July 23, 1980). It was originally part of the West Panther Creek Roadless Area (W4-504), Salmon National Forest, Lemhi County, Idaho, which was classified as a proposed wilderness during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

MINERAL RESOURCE POTENTIAL SUMMARY STATEMENT

A high potential for the occurrence of cobalt-copper-gold-silver deposits similar to those of the Blackbird mine near Cobalt, Idaho, exists in the Elkhorn and upper Garden Creek areas of the Special Mining Management Zone--Clear Creek, Lemhi County, Idaho. The combination of rocks correlative with the Yellowjacket Formation lithologies hosting stratabound cobalt-copper-gold-silver at the Blackbird mine, anomalously high cobalt-copper values in rocks and stream sediments, tourmaline breccia, and cobalt and copper oxides in outcrop in these drainages, supports this conclusion. All other areas underlain by Yellowjacket-equivalent rocks have moderate potential based on stratigraphy and scattered occurrences of the features mentioned above.

A low potential for porphyry-type copper-molybdenum deposits exists along Clear Creek and upper Squaw Gulch within the study area. This is suggested by extensive fracturing and alteration of the nonporphyritic granite, magnetite mineralization, and the close proximity of a known Tertiary pluton. Such geologic features are commonly associated with porphyry systems in Idaho and southwestern Montana.

INTRODUCTION

The Special Mining Management Zone--Clear Creek, Lemhi County, Idaho, covers 39,000 acres located in the Salmon River Mountains 24 mi west of Salmon, Idaho (see index map). It presently forms the northeast portion of the River of No Return Wilderness Area but was initially included as part of the West Panther Creek Roadless Area (RARE II). The study area is about 6 mi north of the Blackbird cobalt mine, the largest mine in the United States worked primarily for cobalt.

The study area is underlain by Proterozoic metasedimentary rocks, most of which correlate with the Yellowjacket Formation and form part of a northwest-trending zone of Yellowjacket that probably continues to include the rocks at the Blackbird mine.

GEOLOGY

The study area is underlain by two Proterozoic Y dominantly clastic metasedimentary formations which are intruded by felsic plutons of Proterozoic Y, Cretaceous, and Tertiary ages (see generalized geology on map). Locally these rocks are covered by alluvium and morainal deposits. The metasedimentary and granitic rocks are cut by thrust faults and numerous steeply dipping normal faults. Observed cobalt-copper mineralization is confined to the lower metasedimentary formation.

The Yellowjacket Formation (Yy) is a fine- to medium-grained metagraywacke and schist that underlies most of the study area. Primary sedimentary features are preserved in garnet-grade rocks in the southeastern part of the area, but are obliterated as metamorphism increases across the area to sillimanite-grade at the northwestern boundary.

The Big Creek Formation (Ybc) is a fine- to coarse-grained, slightly feldspathic white metaquartzite with massive beds in which there are sparse crossbeds and finely laminated biotitic layers. The metaquartzite occurs as allochthonous plates that have been placed over the Yellowjacket Formation and Proterozoic granite along a thrust or low-angle normal fault.

Biotite granite (Yg) occurs as comagnatic porphyritic and nonporphyritic phases. The porphyritic variety is medium to coarse grained and weakly to strongly foliated; the nonporphyritic variety is medium to coarse grained and strongly foliated. Gossans developed in the biotite granite in Squaw Gulch and lower Clear Creek are an alteration product that may be related to an unseen younger intrusion, such as the Bighorn Crags pluton.

Tan, medium-grained, nonfoliated to weakly foliated two-mica granite (Kg) is possibly an outlier of the main phase of the Idaho batholith, which is exposed in Owl Creek about 3 mi north of the study area.

Scattered dikes and small stocks of pink, medium-grained biotite granite, porphyritic rhyolite, and porphyritic dacite (Ti) are related to the Tertiary Bighorn Crags pluton, which crops out on Clear Creek at the southwestern edge of the study area.

Quaternary alluvial and colluvial deposits (Qu) are found in the Salmon River and Panther Creek canyons. Valley-glacier moraine and outwash are found in Clear Creek.

Generally northeast-southwest- and east-west-trending, steep faults control the exposure of the allochthonous metaquartzite (Ybc) and the Proterozoic granite (Yg). Movement has probably been recurrent from the Proterozoic (Hughes, 1983) to the Tertiary.

GEOCHEMISTRY

By

Byron R. Berger, U.S. Geological Survey

Trace elements useful for the assessment of the mineral resource potential in the study area were identified through the sampling and chemical analysis of minus-80-mesh stream sediments within and around the study area. Seventy-nine samples originally collected by Cater and others (1975) and Knowles (1975) were reanalyzed, and included with eighty-nine samples collected during the present study. Threshold values correspond to natural breaks in the distribution of values and generally were well above background levels.

Several suites of elements were noted for the study area; these suites correspond to major lithologic units or restricted mineralized zones within the major units. An association of cobalt, copper, and boron occurs in the Garden, Elkhorn, Cougar, and Indian Creek drainages; both Elkhorn and Indian Creek have known cobalt-copper mineralization. Arsenic is a common pathfinder element for cobalt systems, but few values exceeded the lower detection limit of 200 ppm for the analytical method used. Nickel values above the detection limit (5 ppm) range from 10 to 30 ppm and appear to correlate with areas in which amphibolite or possible mafic tuffs crop out. An association of lead and tin occurs in the vicinity of Lick Creek and the lower reaches of Clear Creek, most likely reflecting the distribution of the Proterozoic granite.

Direct comparison of stream-sediment data from the study area and from the area of the Blackbird mine is difficult because available published data only cover areas peripheral to the mine. However, Bennett (1977) had several samples from streams that drain the north side of the ridge containing the Blackbird deposit; this area should be free of surface mine workings. Therefore, his reported cobalt values of 200-300 ppm probably reflect reasonable values for streams that drain the deposit but that have not been contaminated by mining activity. Comparable values (150-300 ppm) of cobalt in sediment from upper Garden Creek in the study area strongly suggest the presence of similar mineralization in that area.

GEOPHYSICS

A compilation of aeromagnetic studies (Zietz and others, 1978, and references cited therein) covers the study area and provides some useful information. On a regional scale there are two systems of intersecting troughs defined by contoured total magnetic intensity values; one set trends northwest-southeast and the other is approximately perpendicular to it. The study area and the Blackbird mine lie in a single northwest-trending trough that is intersected near lower Clear Creek by a trough of the other set. These pronounced lows are in sharp contrast to the extreme high values over the Eocene Bighorn Crags pluton to the west, Napoleon Ridge area to the east, Painted Rocks pluton to the north, and other known Eocene granitic rocks in central Idaho. The low values forming these troughs in the aeromagnetic pattern do not seem to reflect any particular rock type but may instead follow major structures in this region. It is perhaps significant that the trends of the troughs parallel major faults in the study area and intersect approximately at the location of the gossans in lower Clear Creek.

MINING DISTRICTS AND MINERALIZATION

By

Leon E. Esparza, Michael S. Miller, and Paul A. Pierce, U.S. Bureau of Mines

There are no mines or mining activity within the study area, but as of 1982 there were at least 40 mining claims located mostly by Noranda Exploration, Inc. A few claims had been located prior to 1960 by other groups or individuals.

Nearly all production from the Blackbird district is from the vicinity of the Blackbird mine. Gold, silver, copper, and lead were mined mainly from the late 1800's and prior to the 1940's; cobalt was mined from the Blackbird district mainly in the early 1900's and in the 1950's.

Mills and facilities for processing the cobalt and copper ores mined near the study area exist at the Blackbird mine. Other mills, for copper, gold, silver, and lead, exist in the Mackinaw and Mineral Hill mining districts.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Introduction

The geologic setting of the study area is compatible with several types of ore deposits. Comparison of the geologic, geochemical, and geophysical data from the study area with similar data from known ore deposits of each type forms the basis for our mineral resource evaluation. The types suggested by the geologic setting are: (1) cobalt-copper, as at Blackbird mine (see pamphlet); (2) porphyry-type copper-molybdenum, similar to prospects in southwestern Montana and east-central Idaho; (3) stratabound copper-silver as found in the Belt Supergroup, especially at the Troy (formerly Spar Lake) and Blacktail Mountain deposits; (4) stratabound lead-zinc as best known from Sullivan, British Columbia; and (5) epithermal precious-metal deposits associated with shallow Tertiary plutons (Bennett, 1980).

Terms for Assessment of Mineral Resource Potential

Areas given low potential for a certain deposit type have either anomalously high values for the element or suite of elements under consideration, or they have characteristics associated with a known deposit (or generalized model) of the appropriate type--but not both. These areas may be considered as marginally favorable.

Those areas with a moderate potential have anomalously high elemental values. In these areas, many of the important characteristics of a known deposit (or deposit model) are found while some other important characteristics may be missing. There will be no evidence of mining activity for this element or suite of elements although there may have been exploration interests. These areas are considered to be favorable.

Areas rated as having high potential have anomalously high values for the element or element suite and most of the characteristics to fit a known deposit (or deposit model). There will be spatial association with past or present mining districts that produced this element from a deposit which would fit the model under consideration. These areas are highly favorable.

Cobalt-Copper

The areas in the Management Zone underlain by the Yellowjacket Formation have high or moderate potential for cobalt-copper mineralization, based on the following: (1) rock units similar to those hosting the stratabound deposit at Blackbird mine occur along strike to the northwest in the study area; (2) apparently stratabound cobalt mineralization similar in form to the Blackbird deposit is found along Elkhorn Creek; (3) geochemical anomalies similar to those around Blackbird are found at Elkhorn and upper Garden Creeks; and (4) the study area occurs in a northwest-trending belt of cobalt-copper mineralization that extends at least 37 mi from Iron Creek, through the Blackpine mine, Blackbird mine, and study area, to the Salmon Canyon Copper Company mine on the north side of the Salmon River.

The geochemical anomalies at Elkhorn and upper Garden Creeks, combined with lithology similar to the Blackbird deposit and cobalt mineralization at Elkhorn Creek, give these two areas a high potential for cobalt-copper deposits. The spatial coincidence of the rock units trending northwestward from the Blackbird mine to the study area and the belt of known cobalt occurrences indicate that the remaining areas of the Management Zone underlain by Yellowjacket rocks have a moderate potential for cobalt-copper deposits.

Copper-Molybdenum

A low potential for porphyry-type copper-molybdenum mineralization is assigned to an area along Clear Creek below Rancherlo Creek and in upper Squaw Gulch, where bright reddish-orange gossans are developed in the Proterozoic foliated, nonporphyritic granite. Extensive stockwork fracturing, quartz and limonite veining, alteration (possibly sericitic), disseminated magnetite mineralization, and the bleaching of originally dark-gray metasedimentary rocks to white "quartzites" are all features attributable to a porphyry-type hydrothermal system and suggest the presence of a buried Tertiary(?) pluton, even though geochemical anomalies were not found. A small exposure of what appears to be epizonal, Tertiary pink granite in a fault block at the mouth of Rancherio Creek provides added credence to this interpretation. The intersection of major regional structural trends inferred from aeromagnetic data and mapping may indicate some structural control. Molybdenum mineralization similar to that inferred here probably is present a few miles east of Panther Creek near the headwaters of Beaver Creek (Bennett, 1977), and at the Napoleon Ridge prospect yet further east near North Fork, Idaho (Bennett, 1980).

Copper-Silver, Lead-Zinc, and Precious Metals

The Yellowjacket Formation is probably equivalent to at least part of the Belt Supergroup (Ruppel, 1975), a very thick sedimentary sequence with many occurrences of stratabound copper-silver mineralization (Harrison, 1974). However, the study area has no identified potential for this mineral system because (1) appropriate geochemical anomalies are absent; (2) the red-bed/green-bed lithologies typical of the mineralized Belt rocks are missing; and (3) the Yellowjacket Formation most likely correlates with the Prichard Formation, one of the few Belt units which is devoid of copper-silver occurrences. Similarly, no identified potential is given for stratabound lead-zinc (a system hosted by Prichard-equivalent rocks at Sullivan, British Columbia) because of the total lack of a lead-zinc chemical signature associated with the Yellowjacket Formation. Finally, epithermal precious-metal deposits in Idaho are commonly associated with felsic Tertiary plutons (Bennett, 1980), such as the Bighorn Crags pluton which is located at the southwestern boundary of the study area. However, no potential is assigned to areas within the confines of the Management Zone because of the lack of both geochemical anomalies and geologic features such as alteration zones, fractures, veins, or mineralized host rocks.

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