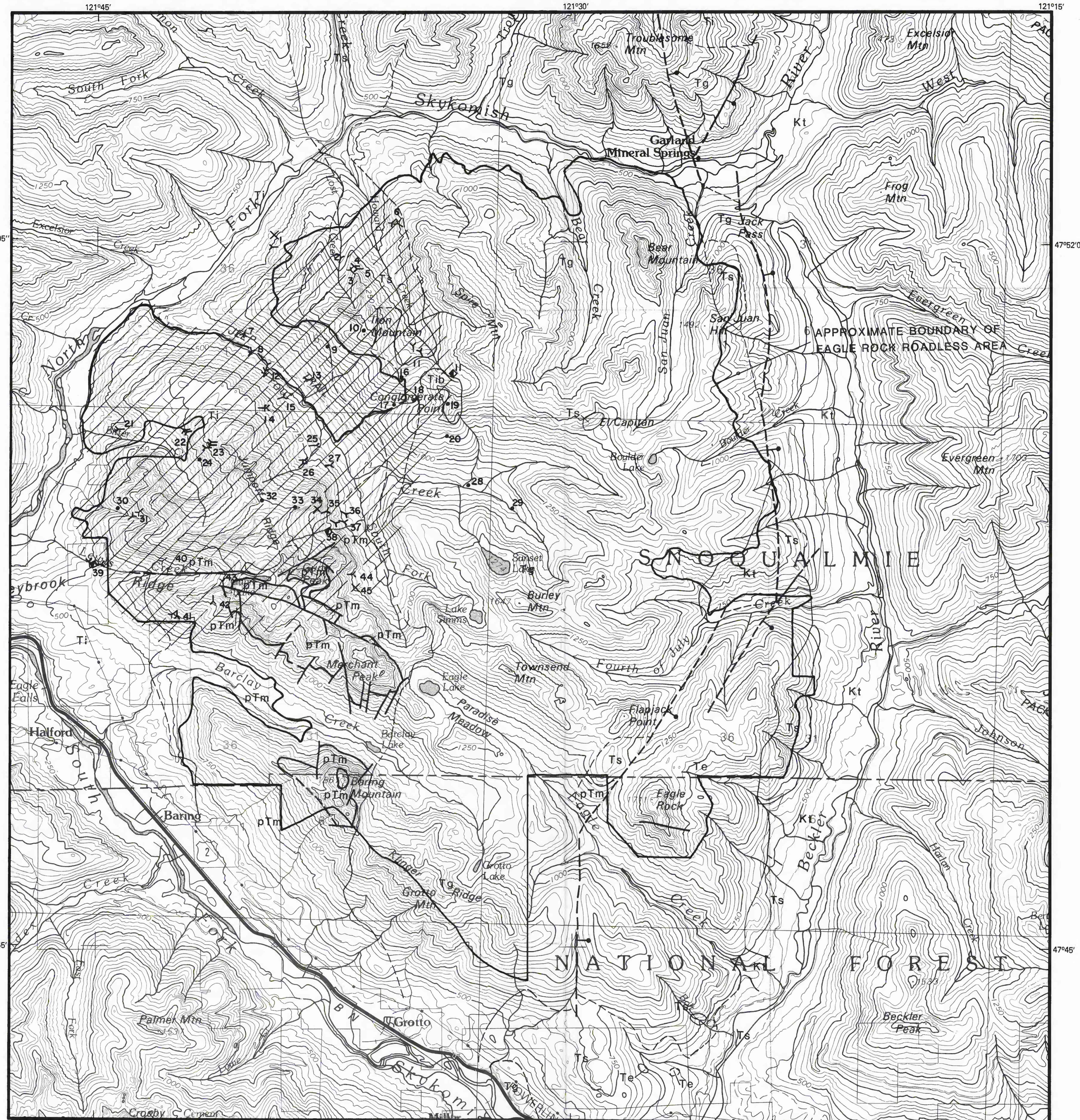
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1380-B
PAMPHLET ACCOMPANIES MAP



Base from U. S. Geological Survey Skykomish River, 1:100,000, 1975

Geology generalized from Tabor and others, 1982b

SCALE 1:50 000
1 ½ 0 1 2 3 MILES
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MINERAL RESOURCE POTENTIAL MAP OF THE EAGLE ROCK ROADLESS AREA, SNOHOMISH AND KING COUNTIES, WASHINGTON

By
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1983

CORRELATION OF MAP UNITS

Unit	Age	
Tib	Miocene	TERTIARY
Te	Miocene	TERTIARY
Tg	Miocene	TERTIARY
Ti	Oligocene	TERTIARY
Ts	Eocene	TERTIARY
Unconformity		
Kt	Upper Cretaceous	PRE-TERTIARY
pTm		PRE-TERTIARY

AREA OF MODERATE POTENTIAL FOR COPPER AND SILVER RESOURCES

GEOLOGIC CONTACT--Dashed where approximately located

FAULT--Dashed where approximately located

ADIT

CAVED ADIT

SHAFT

X PROSPECT PIT

● CLAIM

LIST OF MAP UNITS

Tib INTRUSIVE BRECCIA (MIOCENE)

Te EAGLE TUFF (MIOCENE)

Tg GROTTO BATHOLITH (MIOCENE)

Ti INDEX BATHOLITH (OLIGOCENE)

Ts SWAUK FORMATION AND VOLCANICS OF SKYKOMISH AREA (EOCENE)

Kt DARRINGTON PHYLLITE OF MISCH (1966) AND TONGA FORMATION OF YEATS (1964) (CRETACEOUS)

pTm MELANGE (PRE-TERTIARY)--INCLUDES GUNN PEAK AND BARCLAY CREEK FORMATIONS OF YEATS (1964), MIGMATITIC GNEISS AND ASSOCIATED ULTRAMAFIC ROCKS OF TABOR AND OTHERS (1981)

1. Kittening prospect
2. Kipling prospect
3. Marion prospect
4. Roosevelt prospect
5. Upper Roosevelt prospect
6. Keystone prospect
7. Sunset mine
8. Miss Helen prospect
9. Kipling Extension No. 1 prospect
10. Kipling No. 1 prospect
11. Cooperative prospect
12. Dorian prospect
13. Non-Pareil mine
14. Aimee prospect
15. Dorian No. 2 prospect
16. Imperial prospect
17. Frauk prospect
18. Boston prospect
19. Step Brother prospect
20. R. P. prospect
21. Maud prospect
22. Bitter Creek Mine
23. Calumet Mine
24. Manson No. 3 prospect
25. Judge Extension No. 1 prospect
26. Ridenour No. 3 prospect
27. Venus prospect
28. Florence Extension No. 3 prospect
29. Stem Winder Approach prospect
30. Tip Top prospect
31. Gunn Peak prospect
32. Atlantic prospect
33. Summit prospect
34. Lost Treasure prospect
35. Climax prospect
36. Monitor prospect
37. Anie prospect
38. Merchant Mine
39. Index Bornite Mine
40. Snowslide prospect
41. Uncle Sam prospect
42. Blue Mountain prospect
43. Racer prospect
44. Hidden Treasure prospect
45. Copper prospect

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 submitted to the President and the Congress. This report presents the results of a mineral survey of the Eagle Rock Roadless Area (06054) in the Mount Baker-Snoqualmie National Forest, Snohomish and King Counties, Wash. The Eagle Rock Roadless Area was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

A multidisciplinary team of geoscientists from the U.S. Geological Survey and the U.S. Bureau of Mines has evaluated the mineral potential of the Eagle Rock Roadless Area. The Sunset mine, the second largest producer of copper in the state of Washington, has 307,500 tons of indicated and inferred resources averaging 3.46 percent copper. The mine portal is outside the Eagle Rock Roadless Area in a re-entrant of the roadless area boundary along Trout Creek. However, diamond drilling from the second level in the mine intersected two favorable lode zones of mineralization south of the mine portal within the roadless area. Thirteen additional prospects within the roadless area contain copper- and commonly silver-bearing zones ranging in grade from 0.20 to 5.72 percent copper and as much as 4.2 oz silver per ton. However, the vast majority of the occurrences average less than 0.5 percent copper and less than 1.0 oz silver per ton. Mineralization is localized along steeply dipping shears in a regional tensional joint system (Grant, 1969) and lode deposits have been formed by a hydrothermal vein-filling process (Weaver, 1912). Because of the mineralogic zonation of metals within the veins and the potassic alteration associated with copper ores, we interpret the vein deposits to be a porphyry-copper system emplaced in competent rocks having a widely-spaced joint pattern. This model has important ramifications in evaluating the mineral resources of the area because the irregular spacing of fractures in competent rock units may preclude the formation of large tonnage disseminated deposits. The copper-bearing occurrences found in the roadless area between Trout Creek and Bitter Creek may be indicative of a larger deposit at depth. Detailed mapping of structural patterns and altered zones is required to delineate the zones of greatest mineralization. Within the roadless area, all of the outcrop area of the Index batholith and part of the metamorphic volcanic and sedimentary septum have a moderate potential for the occurrence of copper and silver resources in hydrothermal veins. The remaining area of the septum has a moderate but less favorable potential for copper and silver resources. The significance of widespread geochemical anomalies in the Grotto batholith remains an enigma in spite of extensive field studies and sampling of sheared and oxidized zones. A low potential for base- and precious-metal resources is indicated for the Grotto batholith in the Eagle Rock Roadless Area.

INTRODUCTION

The Eagle Rock Roadless Area in the Mount Baker-Snoqualmie National Forest in Snohomish and King Counties is north of U.S. Highway 2, not far from the town of Skykomish. Its 33,100 acres (51.7 mi^2) of mountainous terrain is bounded on the south, west and north by the North and South Forks of the Skykomish River and on the east by the Beckler River. Lower slopes of the area are cut by numerous logging roads. Elevations range from about 700 feet along the Skykomish River on the west, to 6,240 feet on Gunn Peak, the highest promontory.

This report summarizes studies by the U.S. Geological Survey and the U.S. Bureau of Mines, and is designed to evaluate the mineral potential of the Eagle Rock Roadless Area. Investigations by the U.S. Geological Survey included geologic mapping (Tabor and others, 1982b), geochemical reconnaissance (Church and others, in press), and aeromagnetic interpretation (Flanigan and others, in press) conducted from 1978-1982. Detailed investigations by the U.S. Bureau of Mines of the mining activity, production, and field studies of mines and prospects were made during the 1979-1981 field seasons (Johnson and others, 1983). The roadless area includes a major portion of the Index mining district, first described by Weaver (1912).

GEOLOGY

The oldest rocks are highly deformed, pervasively sheared, faulted, and variably metamorphosed marine sedimentary and volcanic rocks including limestone, ribbon chert, graywacke, shale, and basalt of the Gunn Peak and Barclay Creek Formations of Yeats (1964). Marble pods in this probable melange (Frizzel and others, 1982; Tabor and others 1982b) are Permian (Danner, 1966, p. 363). Tectonically overlying or imbricated with the marine rocks is migmatitic gneiss (Yeats, 1964) of probable Triassic age (Whetten and others, 1980). The melange is mostly preserved as a thick septum between two Tertiary granitic plutons. Unconformably overlying the melange unit and also part of the septum between the Tertiary plutons is the Eocene Swauk Formation, a fluviatile, feldspathic sandstone.

Bordering the Eagle Rock Roadless Area on the east and probably separated from the melange by a major strike-slip fault, is a metamorphosed shale and sandstone, and minor basalt of the Tonga Formation of Yeats (1958a). The Tonga ranges from phyllite to graphitic-staurolite-garnet-biotite schist (Tabor and others, 1982b). Basaltic rocks in the Tonga are greenschist, blue-amphibole schist, and amphibolite.

Tonalite to granodiorite batholiths form the bulk of the area: the Oligocene Index batholith lies on the west, and the Miocene Grotto batholith to the east. Faulted against the Grotto batholith are rhyolitic rocks of the Eagle Tuff of Yeats (1958b), a possible extrusive equivalent of the Grotto batholith. Mineralization in the roadless area is associated with the Index batholith. The Index batholith of quartz diorite, tonalite, and granodiorite is geochemically distinct from the younger Grotto batholith which is more varied in composition, ranging from granite to quartz gabbro.

Studies of the orientation of hydrothermal veins within the Index batholith (Weaver, 1912, p. 50-51) indicate a set of conjugate tensional shears that strike N. 75° W. in the eastern part of the Index batholith and N. 45° E. in the western part. Grant (1969, p. 79) notes that of the 19 major mineralized vein systems studied by Weaver (1912), thirteen strike northeast whereas the remaining strike northwest. Structural analysis of the mineralization within the Cascade Range, shows that mineralization is localized along and controlled by regional, transverse structures trending generally northeast (Grant, 1969, p. 34-46). The Index belt parallels the more prominent Glacier Peak belt which Grant (1969) defines as a locus of several major areas of mineralization. The hydrothermal vein system, which cuts the Index batholith and adjacent country rocks in the Bitter Creek-Trout Creek area, does not appear to extend into the Grotto batholith and indicates the Grotto batholith postdates the hydrothermal system.

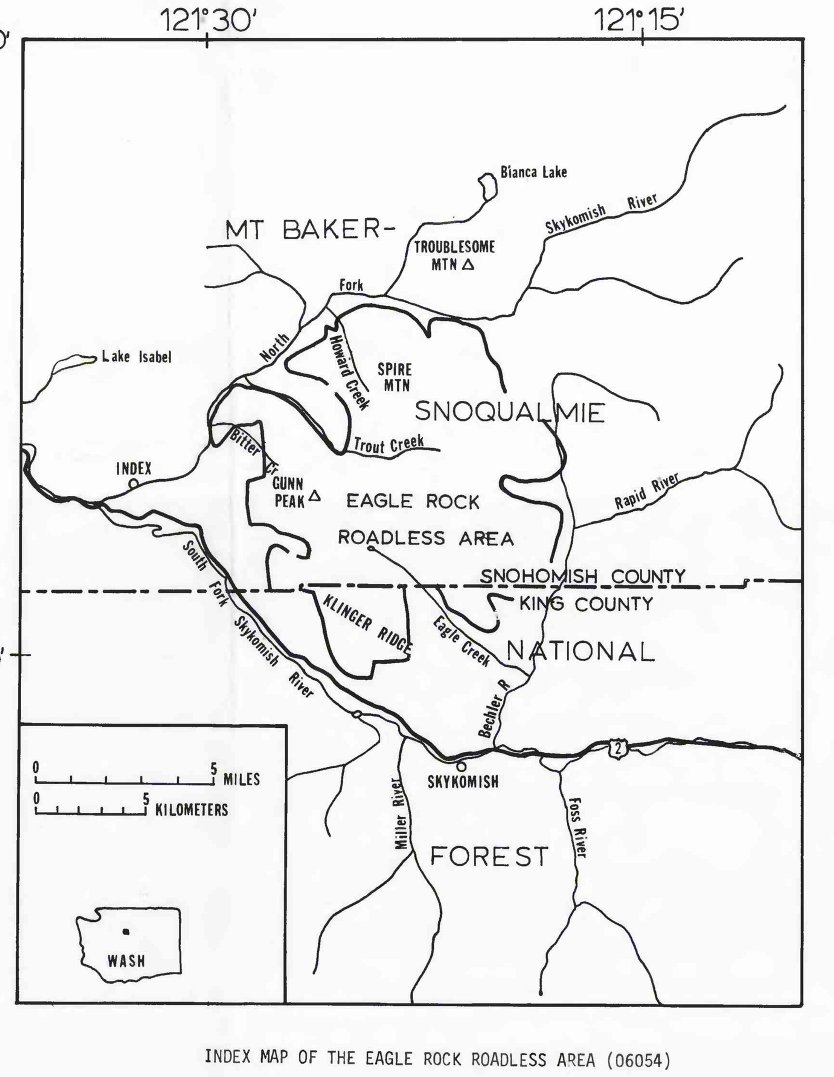
GEOCHEMISTRY

We collected 80 stream-sediment samples from the roadless area in conjunction with the geologic mapping. Sampled stream basins had areas as large as 3 mi^2. In addition, we collected 15 panned concentrates from stream sediments from larger, second-order drainage basins for analysis of the nonmagnetic, heavy-mineral fraction (Church and others, 1982). All analytical results were obtained using direct-current arc emission spectrography.

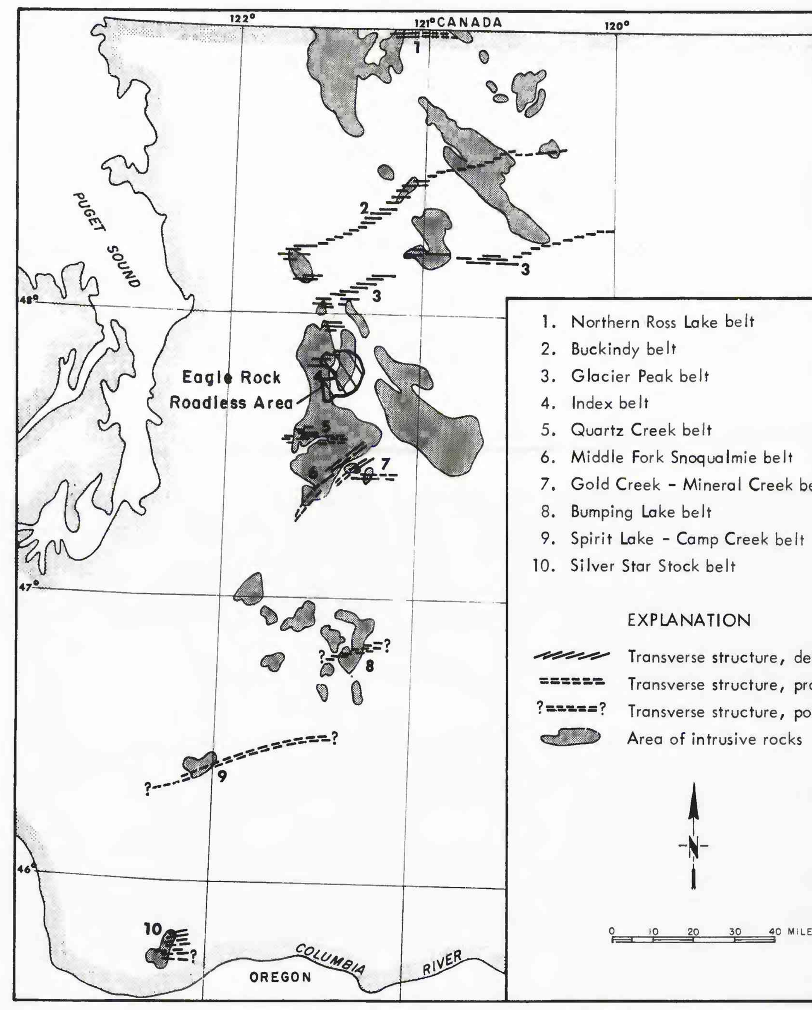
Widespread geochemical anomalies occur in drainages underlain by the Index and Grotto batholiths. In addition, the Index and Grotto batholiths have distinctive elemental suites. The Index batholith is characterized by anomalous concentrations of cobalt, copper, molybdenum, tungsten, lead, and silver with one drainage basin each having anomalous concentrations of zinc and barium. In contrast, the Grotto batholith is characterized by anomalous concentrations of cobalt, copper, molybdenum, tungsten, tin, gold, bismuth, lead, and silver, with one basin having an anomalous concentration of barium (Church and others, in press). The anomalous suite from the Index batholith is typical of geochemical suites generally associated with porphyry-copper systems found in the Canadian cordillera (Pilcher and McDougall, 1976, p. 79-84), whereas the suite associated with the Grotto batholith is the same as the suite associated with the hydrothermal vein systems of the Monte Cristo and Silver Creek districts to the north across the North Fork of the Skykomish River (Church and others, in press). Paralleling the geochemical differences are distinctions in the ores of the two districts that may reflect the respective batholith sources.

GEOPHYSICS

Aeromagnetic data from the roadless area were examined in conjunction with a geophysical study of the Glacier Peak Wilderness (Flanigan and others, in press). The data were compiled from several aeromagnetic surveys; flight directions for the aeromagnetic surveys were generally northeast-southwest, transverse to the regional structure. Flight lines were drape-flown at an elevation of 1000 ft with 0.5 mi spacing. Topographic anomalies are inherent in the data due to imperfect draping in the steep terrain. The magnetic character of the Eagle Rock terrain exhibits a highly complex pattern characteristic of volcanic terranes. No diagnostic magnetic signature could be discerned when compared with the distribution of known deposits in the Index mining district.



INDEX MAP OF THE EAGLE ROCK ROADLESS AREA (06054)



MAP OF THE KNOWN AND SUSPECTED TRANSVERSE STRUCTURAL BELTS IN THE CASCADE RANGE, NORTHERN WASHINGTON (AFTER GRANT, 1969, P. 40)

MINES AND PROSPECTS

Mining history

The Index mining district, centered around Index, Wash., extends into the western part of the roadless area. Mining claims were first located in the early 1890's, with the first major production coming from the Sunset mine at the turn of the century. Most prospecting and claim-staking occurred between 1895 and 1905, with little being done after 1910. More than 950 mining claims had been located in or near the roadless area by 1980. Sixty-two claims are patented (Johnson and others, 1983).

Production from the Eagle Rock Roadless Area has been small, but the Sunset mine, 400 ft northeast from the area boundary, was the state's second largest copper producer. Mining ceased there in 1949 after production of nearly 13 million lb of copper, 156,000 oz of silver, and 1,500 oz of gold (Toepher, 1953).

During the three years ending in 1981, U.S. Bureau of Mines personnel examined mines, prospects, and claim groups in and near the roadless area. Additional data was obtained from county records, government files, and the literature. Forty-two underground and five surface mine workings were examined, and where warranted, mapped and sampled. Analyses of nearly four hundred samples, taken from mine workings, outcrops, stockpiles, and dumps are on file at the U.S. Bureau of Mines, Western Field Operations Center, Spokane, Wash.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Resource evaluation in the Eagle Rock Roadless Area is based on previous studies of mineralization and our concepts of ore genesis and represents our evaluation as of 1983. This evaluation is focused on three areas of interest: the hydrothermal vein system associated with the Index batholith, the Merchant mine in the ancient melange rocks, and the metal anomaly pattern associated with the Grotto batholith.

The potential for the occurrence of mineral resources in the Eagle Rock Roadless Area can be summarized as follows.

Within the area of the hydrothermal vein system (Weaver, 1912), the Sunset mine (no. 7 on map) has produced 13 million pounds of copper, 156,000 oz of silver and 1500 oz of gold. It has 307,500 tons of indicated and inferred resources (U.S. Bureau of Mines and U.S. Geological Survey, 1980) averaging 3.46 percent copper. Diamond drilling from the mine intersected two copper-bearing zones south of the mine portal within the Eagle Rock Roadless Area.

Seventeen additional prospects in or near the Eagle Rock Roadless Area have potential resources (see map). However, the vast majority of the occurrences average less than 0.5 percent copper and less than 1.0 oz silver per ton. Comparison of the potassic alteration zones and the mineral zonation found within the hydrothermal vein deposits with a porphyry-copper model (Grant, 1969; Lowell and Guilbert, 1970) may suggest undiscovered mineralization at depth between Trout Creek and Bitter Creek. Since all of the mineralization in this system is within the Index batholith or the metamorphic septum it intrudes, mineralization is probably associated with the Index batholith. We have assigned a moderate potential for the occurrence of copper and silver resources to these two rock units.

Mineralization at the Merchant mine (no. 38 on map) may be related to the hydrothermal vein system described above or it may represent a metamorphosed massive-sulfide deposit of pre-Tertiary age. The geochemical signature is very similar to that of the hydrothermal vein system. The Merchant mine (no. 38 on map) and the Kittening prospect (no. 1 on map) contain sufficient inferred resources to warrant further exploration if copper prices were to increase by $4.00 per pound. Both mines have geologic and geochemical indications of further potential for copper and silver resources.

Geochemical anomalies are abundant in the outcrop area of the Grotto batholith, but field studies of this area did not locate any altered or mineralized zones either within the batholith or along the intrusive contact. A low potential for base- and precious-metal resources is assigned to the rocks east of the sedimentary and volcanic septum separating the Grotto and Index batholiths.

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