



Geology of the Kelsey copper-molybdenum property, Okanogan County, Washington
by Michael William Roper

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE in Earth Science (Geology)

Montana State University

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Abstract:

The Kelsey Property is a copper-molybdenum prospect in Okanogan County, Washington. The property is located 4 miles northwest of Oroville, Washington, and 2.5 miles southwest of Osoyoos, British Columbia, on the western side of the Okanogan River Valley.

The Okanogan Valley region has recently become an exploration target for porphyry ore deposits. The north-south trending Quesnel Trough may be a major control for these orebodies. The Kelsey Property is in line with the southerly projection of this structure, and possess the same general geology as typical British Columbia porphyry orebodies, including similar lithology, structure, and alteration types.

The property area is underlain by greenschist facies metamorphic rocks of Permian to Triassic age. The sill-like Silver Nail pluton was emplaced in Triassic to Jurassic time, partly controlled by metamorphic foliation. The multi-phase pluton possesses a central core of coarse grained quartz diorite, and an upper and lower layer of fine grained mafic diorite.

Hydrothermal alteration of the Silver Nail pluton has produced an asymmetric surficial zoning pattern measuring one mile east-west by 2.5 miles north-south. Initial potassic alteration was followed by propylitic alteration depositing iron and copper sulfides in fine, closely-spaced joint fracture filling veinlets, and in sporadic high-grade quartz veins. Minor molybdenite with quartz was deposited late in this phase, associated with slight shearing. A final explosive hydrothermal alteration phase formed the breccia of the Silver Nail pluton, and the associated tactite and massive sulfide alteration zones.

Tertiary volcanic and sedimentary rocks occur in fault contact with older, altered rocks on the west and southeast margins of the property. Faulting is dominated by two trends of post-mineral normal faults. North-south faults are parallel and subsequent to a major normal fault separating Paleozoic-Mesozoic rocks from the Tertiary intrusive volcanic plug along the western margin of the property. Northeast-southwest faults appear to be an echelon dip-slip fault traces reactivated by tensional crustal readjustments, resulting in minor normal fault movement.

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Date April 21, 1973

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by

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Abstract

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GENERAL REGIONAL DESCRIPTION

The Kelsey Property is a copper-molybdenum prospect located approximately four miles northwest of Oroville, Washington, and three miles southwest of Osoyoos, British Columbia. The property has the form of an elongate, north-south trending rectangle including roughly ten square miles. The study area is centered at approximately 119 degrees 30 minutes west longitude, 49 degrees north latitude, and includes land both north and south of the United States-Canada Border (Figure 1).

The writer has concentrated his efforts on that portion of the property on the American side of the border, though a geologic map and some information concerning the Canadian side of the property will be presented. The area discussed in detail in this paper includes secs. 1 and 12, R. 26 E., T. 40 N., and secs. 5, 6, 7, and 8, R. 27 E., T. 40 N., Okanogan County, Washington.

Physiographically the area is situated on the eastern margin of the Northern Rocky Mountain Province, northeast of the Okanogan Range, easternmost of the north-south trending multiple ranges that form the Northern Cascade Mountain Section (Fenneman, 1931). This corresponds to the assignment of the area to the boundary between the Plains of the Interior System to the east and the Coastal System to the west, using the Canadian Cordilleran physiographic divisions (Bostock, 1948).

The Northern Rocky Mountain Physiographic Province is composed of irregular mountain ranges of roughly similar character. These mountain

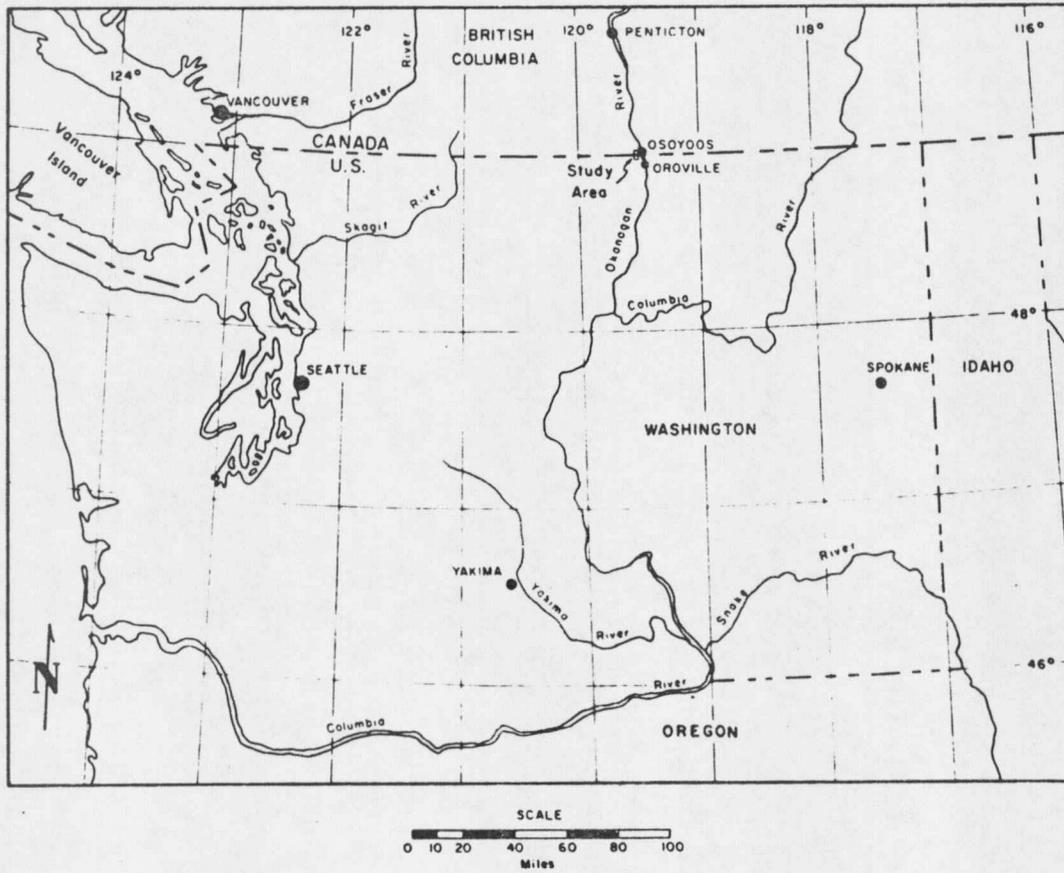


Figure 1. Index map of Washington showing position of study area.

units are divided by relatively continuous north-south trending valleys. The continuity of these so-called 'trenches' is in part structural, but has been made more distinct by glacial erosion. These linear depressions, from east to west, include the Rocky Mountain Trench, Purcell Trench, Selkirk Valley, and the Okanogan Valley (Figure 2). The Kelsey Property is situated in the Okanogan Valley, approximately one mile west of Osoyoos Lake, a glacially widened portion of the Okanogan River.

Topography in the property area is moderately rugged, with elevations ranging from 1000 to 3000 feet. Mountains in the general area possess summit altitudes of 5000 to 7000 feet. The Okanogan River enters the United States on the eastern margin of the study area and flows south through a broad, alluviated valley to join the Columbia River approximately 60 miles to the south. Perhaps the major geomorphic agent that has acted upon the topography in this locality has been the Okanogan Lobe of the Cordilleran Ice Sheet (Flint, 1935). This piedmont glacier advanced to the southeast from source areas in the mountains of South Central British Columbia, ultimately reaching the vicinity of the confluence of the Okanogan and Columbia Rivers. The most recent geomorphic agent shaping the local topography appears to have been the periglacial Okanogan River, which produced the present bench-like configuration of the surface of the Kelsey Property by the scouring of its channel margin.

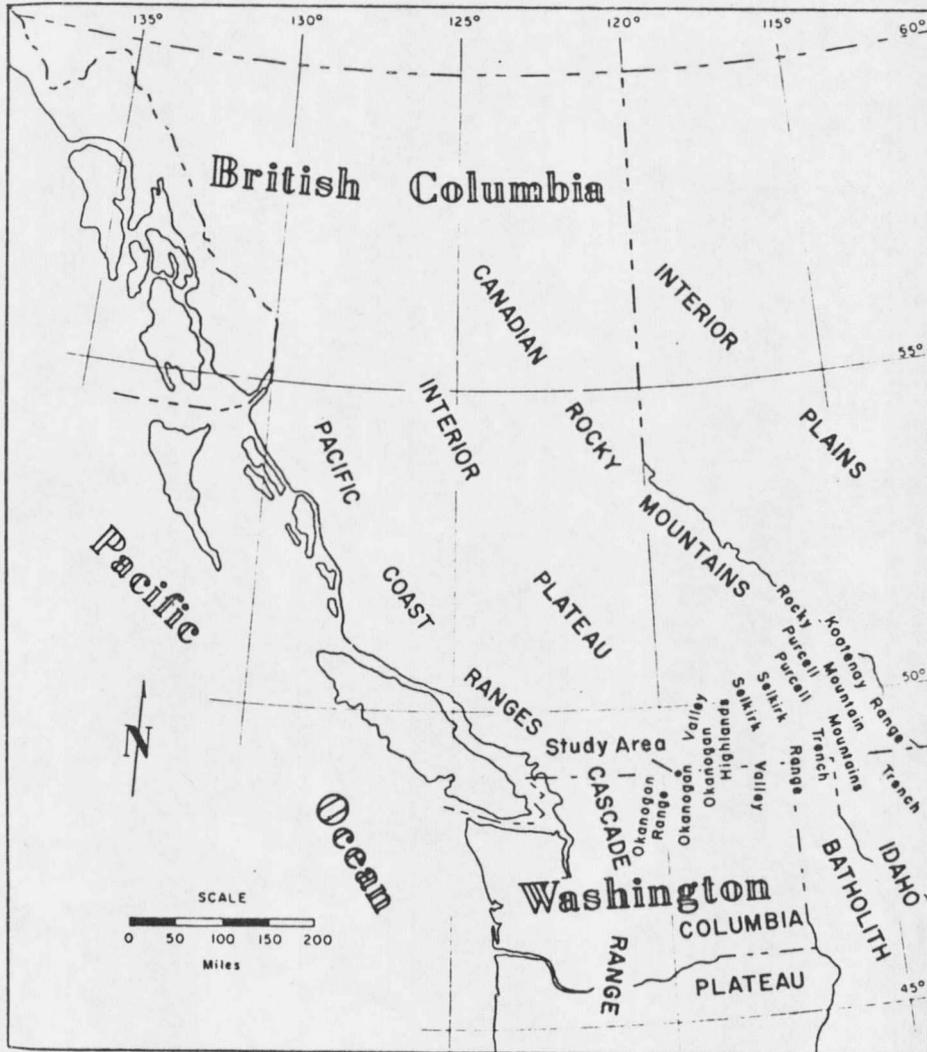


Figure 2. Regional map indicating major physiographic units.
(After Fenneman, 1931; and Bostock, 1948)

The climate in the area is semiarid, locally described as a 'pocket desert', receiving from 5 to 10 inches of precipitation per year. The summers are hot and dry, and the winters relatively mild. The soil varies from a brown soil occurring on glacial or river terraces and alluvial fans in the Okanogan River Valley, to thin, discontinuous, mountainous soil types poorly developed on bedrock or glacial drift (British Columbia Natural Resource Conference, 1956). Natural vegetation is roughly zoned according to altitude. Sage brush and scrub grasses dominate the lower elevations, giving way to sparse coniferous forests above the 2500 foot elevations.

Population in the region is relatively sparse, generally concentrated along the Okanogan Valley. Tourism is a major industry in the area. The main agricultural enterprise is fruit growing in orchards located on low, flat, alluvium covered river terraces. The orchards must rely entirely on irrigation for their water supply. Land not being actively irrigated at the lower elevations is commonly fenced off and used for cattle grazing. The Kelsey Property is located entirely on such grazing land, but is contiguous with irrigated orchard land to the east.

The general area is serviced by a relatively close network of secondary roads which provide good access to the back country. The property itself is well situated with regard to transportation. There is a Burlington Northern railroad depot at Oroville, Washington, with a line

south toward Wenatchee, Washington, and a line northwest into British Columbia. There is a north-south trunk highway (U.S. 97) within a half-mile of the Kelsey Property. In Osoyoos, British Columbia, this highway intersects a major east-west Canadian route (Highway 3). With regard to power, the Chief Joseph Dam and hydroelectric generation system is located approximately 70 miles south of the property.

