Geology of Carbonaceous Mudstones Hosting the Eskay Creek Massive Sulfide Deposit, BC

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Introduction

The Eskay Creek massive sulfide deposit, located in the Skeilat River area of northwestern British Columbia, is not adequately constrained by the classic mineral deposit model of stratigraphic footwall zone mineralization associated with a mafic-ultramafic intrusion. The deposit is characterized by a sequence of carbonaceous mudstone (>30% organic C) and interbedded carbonate (bioclastic and pelagic) and volcanic (rhyolite and basalt) rocks, with a series of sulfide lenses hosted by thick mudstone units. Geochemical and geochronological studies indicate that the deposit formed during the late Eocene, some 36 million years ago, with significant mineralization occurring within the Skeilat River sequence of carbonaceous mudstone and interbedded pelagic carbonate strata. The deposit is currently being studied to determine the correlation between ore mineralization and carbonaceous mudstone, and to identify potential new targets for exploration.

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Geology

The Eskay Creek deposit is located in the Skeilat River area at the western margin of the allochthonous Stikine Belt allochthon of the northern Canadian Cordillera (above left, inset) which is composed of Middle Jurassic subaqueous submarine and subaerial volcanic rocks (181 and 172 Ma; Chilée, 1996). Host rocks are folded into a shallowly north plunging and trending antithetic (above, inset). Stratiform mineralization occurs on the western limb of the fold, near the fold closure, and dips gently to 30° to 45° to the west. The metamorphic grade in the mine area is lower greenschist (below, left) to upper amphibolite facies (below, right). The 100 m (maximum) thick, rhylotchtyphhotrophic to chemical alteration zonation of the Skeilat River sequence of carbonaceous mudstone and interbedded pelagic carbonate strata. The deposit is currently being studied to determine the correlation between ore mineralization and carbonaceous mudstone, and to identify potential new targets for exploration.

Univariate Geochemistry

Exploratory univariate analysis of mudstone compositional data reveals important trends among carbonate mineral phases. Carbonate concentrations appear to correlate to distance from the rhylitech footwall; histogram plots of modal dolomite ([CaMg(CO3)2]–sandstone [CaCO3] and magnesite ([MgCO3]) and siderite ([FeCO3]) clearly demonstrate the importance of dolomite and magnesite in the deposit area. Dolomite enrichment increases in distal rocks (below, left). Carbonate mudstone samples are those proximal to ore occurring above the false rhylitech and below the lowest hanging wall basalt. Near the western hanging wall, less reservoir wall carbonate mudstone samples are collected from mudstone intervals that occur in further up stratigraphy. This analysis was conducted by hand and not automated.

Principal Component Analysis

PCA for a component suite that includes 89 minerals, elements and chemical variables yields a number of important factor loadings: 1) Inorganic 2) Organic 3) Base metals 

Purpose of Research

Precious and base metal mineralization occurs as laterally discontinuous, locally banded, stringer, chalcopyrite anomalous Au concentrations (avg. 46 g/t Au and 323 g/t Ag), a geochemical footprint more reflective of submarine and subaerial deposition temperatures (~200°C), and the grade of the mountains-hosted ores (90 cm thick) is closely related to the rhyolite footwall. Given the absence of readily recognizable alteration in the five-grade mudstone, previous research has focused largely on the footwall rhylitech alteration pattern (Barrett and Sherlock, 1996). Thus, additional work has focused on a new group of volcanian-hosted gold deposits that form in relatively shallow-water environments. The synmagmatic hydrothermal fluid phase separation represents an important control over the precipitation of metals (Harrison et al., 1995).

The research, therefore, aims to characterize geochemical trends within the ore-hosting carbonaceous mudstone, and in deeper parts of the stratigraphic footwall to the rhyolite. Minor gold, the Michael River area of northwestern British Columbia, is currently being explored to determine the correlation between ore mineralization and carbonaceous mudstone, and to identify potential new targets for exploration.

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References

• Chilée, F., 1969, U-Pb geochronology and fluid flow characteristics of the Skeilat River deposit, northwestern British Columbia: Economic Geology, v. 64, p. 1209-1224.