Eskay Creek represents an unusual precious metal-rich, polymetallic volcanic-hosted sulfide deposit located in the Iskut River area of northwestern British Columbia, Canada. The bulk of the mineralization consists of stratiform clastic beds and lamination of commonly graded sulfide and sulfosalt debris that are hosted by a thick interval of carbonaceous mudstone at the contact between felsic volcanic rocks and overlying basalt. The stratiform orebodies, economic concentrations of precious metals have been recognized in discordant mineralization in the footwall rhyolite. Detailed mineralogical investigations of the carbonaceous mudstone hosting the stratiform mineralization at Eskay Creek revealed the existence of a distinctive alteration halo around the deposit. Interaction of the host mudstones with hydrothermal fluids resulted in the widespread formation of carbonates. Qualitative and quantitative X-ray diffraction analysis showed that altered mudstone is abundant ankerite with ferroan magnesite, magnesite, siderite, and calcite being locally present. Calcite was found to occur in the outer part of the alteration halo and forms an important component of mudstone away from the deposit. Carbonate alteration of the mudstone was accompanied by the formation of kaolinite as an abundant byproduct. Different carbonate species suggest that carbonate alteration of the fine-grained carbonaceous host rocks was largely restricted to areas overlying upfished zones of mineralizing hydrothermal fluids and associated discordant mineralization in the footwall rhyolite. Carbonate alteration in the halo around the deposit is interpreted to have taken place at low to moderate temperatures from fluids containing a high content of carbon dioxide.

Eskay Creek has generated significant interest because it is among the most Au-rich deposits known. Key features include the bedded and commonly graded nature of the clastic ore, the high concentrations of precious metals and other elements, and the low temperatures (<200 °C) of sulfide and sulfosalt deposition. This study reports the initial results of a first comprehensive mineralogical study of the carbonaceous mudstone, and suggests that hydrothermal alteration of the fine-grained mudstone can be recognized up to tens of hundreds of meters from the orebodies. A total of 180 mudstone samples were selected from exploration drill core as well as surface outcrops. The Eskay Creek deposit is located in the Iskut River area at the western margin of the allochthonous Stikine terrane of the northern Canadian Cordillera (above, inset). Middle Jurassic submarine and subaerial volcanic and sedimentary rocks in the Iskut River area yield U-Pb zircon ages between 181 and 172 Ma (Childe et al., 1993). Deposit host rocks are folded into a shallowly north-plunging, north-northeast-trending, upright, open anticline (above). Stratiform mineralization at Eskay Creek is host to ore ranging from the immediate ore zones to a maximum distance of approximately 4.4 km from ore. Mudstone samples were further subdivided into contact and hanging-wall mudstones. The contact mudstone was analyzed at the mine cutoff, and the hanging-wall mudstone. Economic concentrations of precious and base metals at Eskay Creek are mainly confined to laterally discontinuous, locally banded, stratiform ore lenses hosted by a thick mudstone interval at the contact between felsic volcanic rocks and overlying basalt (see map of primary ore zones above). Although the mineralizing hydrothermal system was active over a quite extensive area, it is currently not well established whether mineralogical gradients within the footwall alteration halo and within the mudstone hosting the mineralization can be used for target vectoring. Due to the absence of readily recognizable alteration features in the carbonaceous mudstone, previous research has focused on the hydrothermal alteration pattern of the footwall rhyolite (Barrett and Sherlick, 1996). This study reports the initial results of a first comprehensive mineralogical study of the carbonaceous mudstone, and suggests that hydrothermal alteration of the fine-grained mudstone can be recognized up to tens of hundreds of meters from the orebodies. Carbonate alteration at the contact and hanging-wall mudstone at Eskay Creek is widespread, but ankerite (locally ferroan magnesite, magnesite, siderite, and calcite) appear to be restricted to areas overlying upfished zones of mineralizing hydrothermal fluids and associated discordant mineralization in the footwall rhyolite. This alteration may be used to indicate proximity to hydrothermal activity within tens of meters to mineralization.

References

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