The origin and distribution of platinum group metals in the Mt. Milligan alkalic Cu-Au porphyry deposit, British Columbia, Canada

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Porphyry Cu±Au±Mo deposits associated with alkaline to calc-alkaline rocks represent significant sources of platinum

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group elements. Unfortunately, the current understanding of the controls of PGE enrichment in porphyry systems is poorly understood. Recent discoveries have identified PGE-enriched porphyry deposits within the Canadian Cordillera. The purpose of this study is to investigate the occurrence of PGE in one of these systems, in order to better understand PGE enrichment in alkalic porphyry systems.

The Mt. Milligan deposit lies 155 km northwest of Prince George, British Columbia, within the Quesnel Terrane of the Canadian Cordillera. Locally Late Triassic to Early Jurassic volcanics of basaltic, andesitic, latitic, tephriponolitic and trachytic compositions overlay and are sometimes are interbedded with Late Triassic sediments. These rocks, known as the Talka group, are intruded by Early Jurassic monzonite to monzodiorite hypabyssal stocks and dikes which are spatially and genetically related to the Cu-Au porphyry deposit. These rocks have been extensively altered through widespread potassic, sericitic, and propylitic alteration. The reserves at the Mt. Milligan porphyry deposit are estimated to be 299 Mt of 0.22 wt% copper and 0.45 ppm gold. In 2002, PGE concentrations of 0.69–0.62g/t Pd were discovered in two concentrate samples, however no further investigation into the PGE potential of Mt. Milligan was made.

In this study a collection of diamond drill hole (DDH) cores from Mt. Milligan were assayed for PGE as well as other possible pathfinder elements (Au, Cu, Co, Ni, and S). The results of this data showed strong positive correlations between Pd-Au and Pd-Cu which suggests that these precious and base metals were transported as chloride complexes in the hydrothermal system. Scanning electron microprobe, along with transmitted and reflected light microscopy, identified sulphide mineralization (most notably pyrite) as the host phase for PGE and that the principal PGE-bearing phase is merenskyite. An analysis of sulphur isotopes from these samples produced $\delta^{34}S‰_{(CDT)}$ values of -0.7 to 3.4 (0.6 average) for pyrite and 0.4 to -4.1 (-1.2 average) for chalcopyrite, fingerprinting the mantle as the source for the PGE. Furthermore, DDH data provided by Terrane Metals was augmented with the bulk rock and isotopic data from this study to produce a 3-D model of the deposit with the latest Leapfrog © 3-D modeling software. The results show two precious metal-enriched regions in the MBX and Southern Star zones.