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Re-Os GEOCHRONOLOGY AND SYSTEMATICS IN MOLYBDENITE FROM THE ENDAKO PORPHYRY MOLYBDENUM DEPOSIT, BRITISH COLUMBIA, CANADA

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Abstract

Precise Re-Os molybdenite ages for the Endako porphyry molybdenum deposit and the Nithi Mountain occurrence, British Columbia, Canada, yield new information on the timing of molybdenite deposition. Three episodes of mineralization are indicated: (1) ~154 Ma, (2) ~148 to 146 Ma, and (3) ~145 Ma. Re-Os dates agree well with new U-Pb and $^{40}Ar/^{39}Ar$ data from granitoids of the Nithi phase (155.2 ± 1.5 Ma), the Endako phase (148.4 ± 1.5 Ma), and a preore dike (147.4 ± 0.6 Ma), and the Casey phase (145.1 ± 0.2 Ma), plus hydrothermal biotite (144.5 ± 0.75 Ma; Villeneuve et al., 2001). The excellent correlation between the Re-Os dates from molybdenite and the ages of granitoids from the area indicates a direct genetic relationship between these plutons and molybdenite mineralization.

These Re-Os data also provide further insight into the systematics and robustness of Re-Os in molybdenite. The Endako molybdenum deposit is the product of two episodes of mineralization, both associated with moderate-salinity (5–15 wt % NaCl equiv) and high-temperature (~440°C) fluids; a third low-temperature (190°–300°C) hydrothermal event is associated with Eocene faulting (Selby et al., 2000). The clear distinction between two of the Re-Os molybdenite dates in the deposit and the close agreement of these dates to the ages of granitoid intrusions suggest that the Re-Os system in molybdenite is not reset by high-temperature (~440°C), moderate-salinity hydrothermal fluids. In contrast, magmatic biotite in a ~147 Ma preore dike has a $^{40}Ar/^{39}Ar$ age of ~145 Ma, identical to the age of the hydrothermal biotite, indicating that ~440°C fluids reset the Ar-Ar system in biotite. Hence, we interpret that the Re-Os isotope system in molybdenite is resistant to resetting by high-temperature fluids (~440°C), in contrast to the $^{40}Ar/^{39}Ar$ system in biotite. The Re-Os system in molybdenite is also unaffected by postore hydrothermal fluids. These data show that molybdenite can provide critical information in understanding sulfide mineral deposition in ore systems, which is not recorded by other isotopic systems in alteration minerals.