Geochronology of the Moly Brook Mo-Cu deposit, southern Newfoundland: implications for local and regional granite-related metallogeny

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The Moly Brook deposit, located near Grey River on the south coast of Newfoundland, is hosted within deformed granitoid rocks of the Siluro-Devonian Burgeo Intrusive Suite. The deposit consists of a broadly linear zone of N-S-trending, steeply-dipping, sheeted to locally stockwork-style hydrothermal veinlets. Molybdenite and other sulphides occur as disseminated and stringer mineralization within quartz veins and adjacent wall rocks. Undeformed granitic and aplitic dykes and veins appear both spatially and temporally coincident with the mineralization. The results of Re-Os molybdenite and U-Pb (SHRIMP) zircon geochronology constrain the age of the host rock, sulphide mineralization and cogenetic felsic magmatism. The data also suggest a link between the Mo-Cu mineralization and nearby tungsten deposits.

Re-Os molybdenite ages from four molybdenite-bearing quartz veins at Moly Brook yield a weighted mean model age of 380.9 ± 0.8 Ma, or an ^{187}Re-^{187}Os isochron age of 381.2 ± 1.8 Ma. Two samples from the Grey River deposit, in which molybdenite is paragenetically associated with lode tungsten mineralization, yield a weighted mean Re-Os model age of 381.4 ± 1.2 Ma. Both ages are identical within uncertainty and are within the range of previously determined K-Ar ages on hydrothermal muscovite (~ 370–390 Ma). U-Pb (SHRIMP) zircon data from a molybdenite-bearing granite dyke at Moly Brook yields a $^{206}Pb/^{238}U$ weighted average zircon age of 378 ± 3 Ma. The foliated granitoid host rock to the mineralization yields a $^{206}Pb/^{238}U$ weighted average zircon age of 411 ± 3 Ma, which agrees with an earlier Rb-Sr whole-rock date of 412 ± 5 Ma.

The Re-Os and U-Pb data show that Mo-Cu mineralization at Moly Brook was contemporaneous with the formation of W-bearing quartz veins at Grey River and suggest that both are cogenetic with a phase of evolved granitoid magmatism at ca. 380 Ma. The age of the granite dyke is identical to the age of the nearby François Granite (378 ± 2 Ma), while the timing of mineral deposition in the Moly Brook area agrees with Re-Os ages determined for granophile mineralization within the Ackley Granite (380 ± 2 Ma), some 140 km to the east. These results add to evidence for a regionally significant and geologically concentrated episode of Upper Devonian granitic magmatism and related mineralization in this part of the northern Appalachians.

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