Supplemental Information: Re-Os geochronologic data for porphyry deposits in the Yukon-Tanana upland, eastern Alaska

Abstract. Rhenium-osmium (Re-Os) geochronology of molybdenite provides a tool to directly date mineralizing events in hydrothermal systems. Numerous molybdenite-bearing porphyry occurrences are recognized in the Yukon-Tanana upland of eastern Alaska. The deposits are related to middle and Late Cretaceous granitoids (Kreiner and others, 2019; 2020). Some of the porphyry districts have multiple superimposed igneous events with relative timing relationships observed through detailed mapping and core logging. These timing relationships indicate multiple pulses of copper and molybdenite mineralization. This study dated molybdenite-bearing veins from porphyry occurrences across eastern Alaska. This includes five samples from the Taurus district, which attempted to directly date mineralization in an effort to understand which of the seven magmatic pulses was the main cause of mineralization.

Re-Os Analysis method. Methods used for molybdenite analysis are described in detail by Selby and Creaser (2004). The analysis was undertaken at both the Crustal Re-Os Geochronology Laboratory at the University of Alberta, Canada, and the Laboratory for Sulfide and Source Rock Geochronology and Geochemistry and the Arthur Holmes Laboratory at Durham University, UK. Preparation of a molybdenite mineral separate at both the Durham and Alberta labs was made by isolating molybdenite-bearing parts of each rock, then metal- free crushing and sieving followed by magnetic and gravity concentration methods. The ^{187}Re and ^{187}Os concentrations in molybdenite were determined by isotope dilution mass spectrometry using Carius-tube, solvent extraction, anion chromatography and negative thermal ionization mass spectrometry techniques. For this work, a mixed double spike containing known amounts of isotopically enriched ^{185}Re, ^{190}Os, and ^{188}Os (Markey et al., 2007; Alberta) or a tracer solution consisting of enriched ^{185}Re and a non-enriched Os isotope composition was used (Selby and Creaser, 2001; Durham). Isotopic measurements were determined using a ThermoScientific Triton mass spectrometer by Faraday collectors. Total procedural blanks for Re and Os are less than <3 picograms and 2 picograms, respectively, which are insignificant in comparison to the Re and Os concentrations in molybdenite. The Reference Material 8599 Henderson molybdenite (Markey et al., 2007) is routinely analyzed as a control sample, which yielded a running average Re-Os date as of 2017 (year of analysis) of 27.78 ± 0.06 Ma (n=18 Alberta) and 27.67 ± 0.08 Ma (n=22 Durham), indistinguishable from the Reference Age Value of 27.66 ± 0.01 Ma (Markey et al., 2007; Zimmerman et al., 2014). Re-Os model ages are calculated assuming a ^{187}Re decay constant of $1.666e^{-11} \pm 5.165\times10^{-14}\ a^{-1}$ (Smoliar et al, 1996).

Samples analyzed by Robert A. Creaser at the University of Alberta, Canada are presented in rows 2-10 in table ***geology_Data_ReOs_Geochronology_YukonTanana_AK_Kreiner*** and by David Selby at the University of Durham, United Kingdom Canada in rows 11-13 in table ***geology_Data_ReOs_Geochronology_YukonTanana_AK_Kreiner.*** The results of the Re-Os age determinations are presented in ***geology_Data_ReOs_Geochronology_YukonTanana_AK_Kreiner***. All uncertainties are given at the at the 2σ-level that includes all known analytical uncertainty, with the age uncertainty quoted including a ~ 0.31% uncertainty in the decay constant of ^{187}Re for comparison to other geochronometers.

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