

Differentiation and critical metal enrichment of granites from the Herberton Sn-W mineral field, North Queensland, Australia

MR. AVISH KUMAR, IOAN SANISLAV AND PAUL DIRKS

James Cook University

Presenting Author: avish.kumar@my.jcu.edu.au

The Herberton Mineral Field is a magmatic-hydrothermal complex situated in the Mossman orogen, North Queensland, Australia, and hosts polymetallic Sn, W, Cu and Zn deposits. The whole-rock geochemistry from the mineral field reveals that most of the felsic rocks are metaluminous and I-type, except for the Sn-bearing Herberton Hill Granite, Jumna Granite, and UNA Porphyry, which exhibit differentiated, S-type, peraluminous characters. Zircon from the Herberton Hill Granite contains 657 ppm P (avg.), and 4007 ppm REE+Y (avg.), while those from the Jumna granite yield 1978 ppm P (avg.) and 19976 ppm REE+Y (avg.). The zircon P and REE+Y, including the major element whole-rock geochemistry, suggest that the Herberton Hill Granite was derived from an I-type protolith through fractionation, while the Jumna Granite originated from a S-type source. These zircons from Jumna, Herberton Hill granite, and the UNA Porphyry have been previously dated at 365, 339, and 333 Ma, respectively. The P and REE+Y contents of the UNA Porphyry are intermediate between those of the Herberton Hill and Jumna granite at 1590 ppm (avg.) and 7563 ppm (avg.), respectively. A mixing trend is observed among the Herberton Hill Granite, Jumna Granite, and UNA Porphyry, suggesting that the magmatic activity associated with the Herberton Hill Granite may have remobilized the Jumna stock, resulting in the formation of the Sn-bearing UNA Porphyry at 333 Ma. Topaz at the Baal Gammon deposit occurs close to the massive sulphides and shows depletion in Ba, K and Na relative to muscovite. Muscovite generally has a wider alteration halo compared to topaz and shows relative depletion in Ge, Y, and enrichment in Cs. This observed element behaviour is likely due to the character of the ligands present in the hydrothermal fluids, where topaz formation occurred in higher F⁻ activity and this may have promoted relative enrichment in Y and Nb and depletion in Ba, K, and Na. The geochemistry of topaz and muscovite reflects the Cu and Zn mineralization episode of the magmatic-hydrothermal system at the Herberton Mineral Field.