Melt inclusions in the ~2.68–2.69 Ga porphyry intrusions, Timmins and Hemlo, Ontario: constraints on magmatism in Archean greenstone belts containing giant mesothermal gold deposits

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[Poster]

Melt inclusions are primary bubbles of magma that attach to surface imperfections on growing crystals. The mineral host grows around the bubble forming the melt inclusion. Some melt inclusions are recrystallized as a result of either slow cooling of the melt after entrapment or due to post-entrapment modifications. For old melt inclusions hosted in rocks that have undergone significant modification via metamorphism and hydrothermal alteration, post-entrapment modifications can involve changes in the bulk chemistry of the melt inclusions rendering them useless for modeling petrogenetic processes. Rarely are melt inclusions adequately preserved in ancient igneous rocks.

In this study, primary melt inclusions were analyzed from the Paymaster porphyry in Timmins, Ontario, where inclusions are well preserved within growth zones in quartz phenocrysts and do not show evidence of post-entrapment modifications despite recrystallization. The presence of inclusions in the Crown Lake (Timmins), Pearl Lake (Timmins), and Moose Lake (Hemlo) porphyries is yet to be confirmed. The Timmins and Hemlo districts contain substantial gold deposits that are not related to the intrusion of the porphyries or magmatic-hydrothermal processes related to porphyry crystallization. However, their chemical characteristics may reflect the source region that ultimately sourced both the porphyry rocks and the spatially related gold deposits in both districts. The deposits in both cases occur in greenstone belts, charac-

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terized by collages of oceanic plateaus, oceanic island arcs, and trench turbidites, which were tectonically assembled in a large subduction–accretion complex.

Major and trace element analyses of the melt inclusions from the Paymaster porphyry at Timmins are being compared to melt inclusions analyzed in younger granites and porphyries within modern arc environments. The Paymaster melt inclusions have bulk chemistry consistent with a calc-alkaline to high K calc-alkaline volcanic arc granite. Primitive mantle-normalized abundance patterns show that the melts are enriched in LILE, HFSE, and LREE relative to primitive mantle whereas HREE and the transition metals show comparable concentrations or are depleted relative to primitive mantle. Notable anomalies that are being investigated are minor depletions in Nb and Sr, and significant depletions in Y, the HREE, Sc, and Ni. However, enrichments and depletions are not extreme, suggesting that the intrusive rocks are not highly evolved (or fractionated). The bulk chemistry of the melts is being assessed to determine if this method of analysis is applicable for the study of very old granites.