TGI-4 Intrusion-related Mineralization Project: Identifying New Vectors to Hidden Mineralization

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Intrusion related deposits (primarily in the form of porphyry deposits) are the most important sources for Cu, Mo, W and Sn, plus major sources of Au, Ag, and PGEs. Worldwide they account for over 50% of Cu and 95% of Mo production. In Canada, they account for over 40% of Cu and about 25% of Au production. Porphyry deposits are large, low- to medium-grade deposits in which mineralisation is hosted within and immediately surrounding distinctive intrusive phases within larger intrusive complexes that commonly have a complex and prolonged emplacement history. The metallogenic contents of intrusion related deposits are diverse, reflecting a variety of tectonic settings, with Cu and Cu-Mo deposits relatively abundant in island- and continental-arc terranes, whereas Mo and W-Mo deposits associated with extension of continental crust.

The purpose of this project is to develop more effective exploration criteria to identify and evaluate fertile intrusive mineralizing systems at depth. Studies into Cu-Mo/Au and W-Mo-Sn systems will focus on answering the two following questions. (i) Are there distinctive proximal and distal footprints for each deposit type that will allow identification of, and vectoring towards hidden economic deposits? (ii) Is there evidence within the root systems of fertile intrusive phases that conditions were met that triggered a hydrothermal-magmatic system of size and duration sufficient to develop a large porphyry deposit?

The alteration halos associated with intrusion related mineralization can be extensive. Along with other features associated with mineralisation (i.e., epithermal vein development) these represent a much larger target than the actual economic orebody itself. In the right circumstances alteration and other vectors can be applied to identify hidden deposits. However where the ore is hidden beneath an unconformity or tectonic boundary, or just too deeply buried, other exploration methods are required. Consequently research activities are planned that will define and/or refine methods to detect hidden intrusion related ore through surficial geochemistry, biogeochemistry, up-flow of volatiles, indicator mineral dispersal and the geophysical characteristics of intrusion related deposits. For instance, dispersal trains of indicator minerals is a well established method for diamond exploration, but has the potential to be applied to other mineralising systems within glaciated terrains. Furthermore, through the application of trace element fingerprinting of minerals, it might be possible to develop methods utilising more common phases.

Although the Canadian Appalachians host an extensive array of Siluro-Devonian intrusions many of which have substantive mineral resources associated with them, the geoscience knowledge base for these systems is in many cases fundamentally lacking. Numerous intrusions remain inadequately dated, and the overall genetic models are generally insufficient to place these deposits into a tectonic context. By resolving this contextual control it is hoped it will possible to predict where the mineralogically fertile systems occur and thus focus exploration.

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