TGI-4 intrusion-related mineralization project: identifying new vectors to hidden mineralization

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Targeted Geoscience Initiative 4 (TGI-4) is a 5-year Government of Canada program to help produce the next generation of innovative geoscience knowledge and analytical techniques that will result in more effective targeting of buried mineral deposits. The Geological Survey of Canada in collaboration with provincial and territorial surveys, industry, and academia will conduct thematic, knowledge-driven projects based around ore systems. The thematic nature of TGI-4 means that individual projects are not defined by geographic region, but instead integrate data and knowledge from multiple sites across Canada, to optimise ore-ystem categorization.

Intrusion related (e.g., porphyry) deposits are the most important sources for Cu, Mo, W, and Sn, along with Au, Ag, and PGEs. Porphyry deposits are large, low- to medium-grade deposits in which mineralization 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.

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 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? To help answer these questions studies are being undertaken at sites associated with the Triassic-Jurassic porphyry deposits of the BC interior and for the array of mineralized Canadian Appalachian Silurian-Devonian intrusions, for which the fundamental geoscience knowledge is often lacking.

The alteration halos and vein systems associated with intrusion related mineralization can represent a much larger exploration target than the actual economic orebody itself. In the right circumstances alteration and other vectors can be applied to identify hidden deposits. A common problem facing Cordilleran and Appalachian exploration is how to detect mineralized sequences through the extensive surficial coverage. Consequently research activities are focusing on surficial geochemistry, biogeochemistry, up-flow of volatiles, indicator mineral dispersal, and the geophysical characteristics of intrusion related deposits. Indicator mineral dispersal is well established for diamond exploration, but has the potential to be applied to other mineralizing systems within glaciated terrains. Furthermore, utilizing mineral trace element fingerprinting, it might be possible to develop methods for common phases. Also as trees collect various elements through their roots, the chemistry of their bark can be used as a natural probe into the subsurface to help pinpoint buried mineral deposits and increase the effectiveness of deep mineral exploration.

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