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EARTH SCIENCE SECTOR
GENERAL INFORMATION PRODUCT 95e

The Targeted Geoscience Initiative 4 Intrusion-Related Ore Systems

Geological Survey of Canada

2013

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Canada

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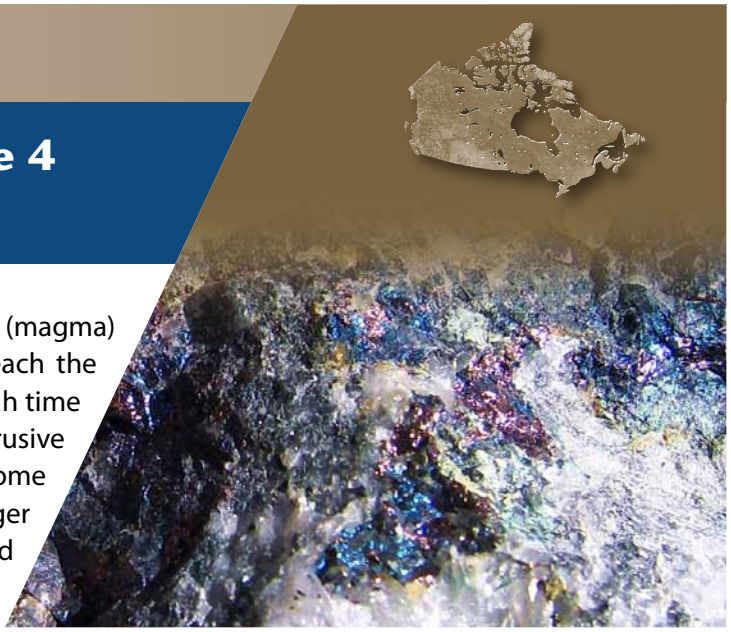
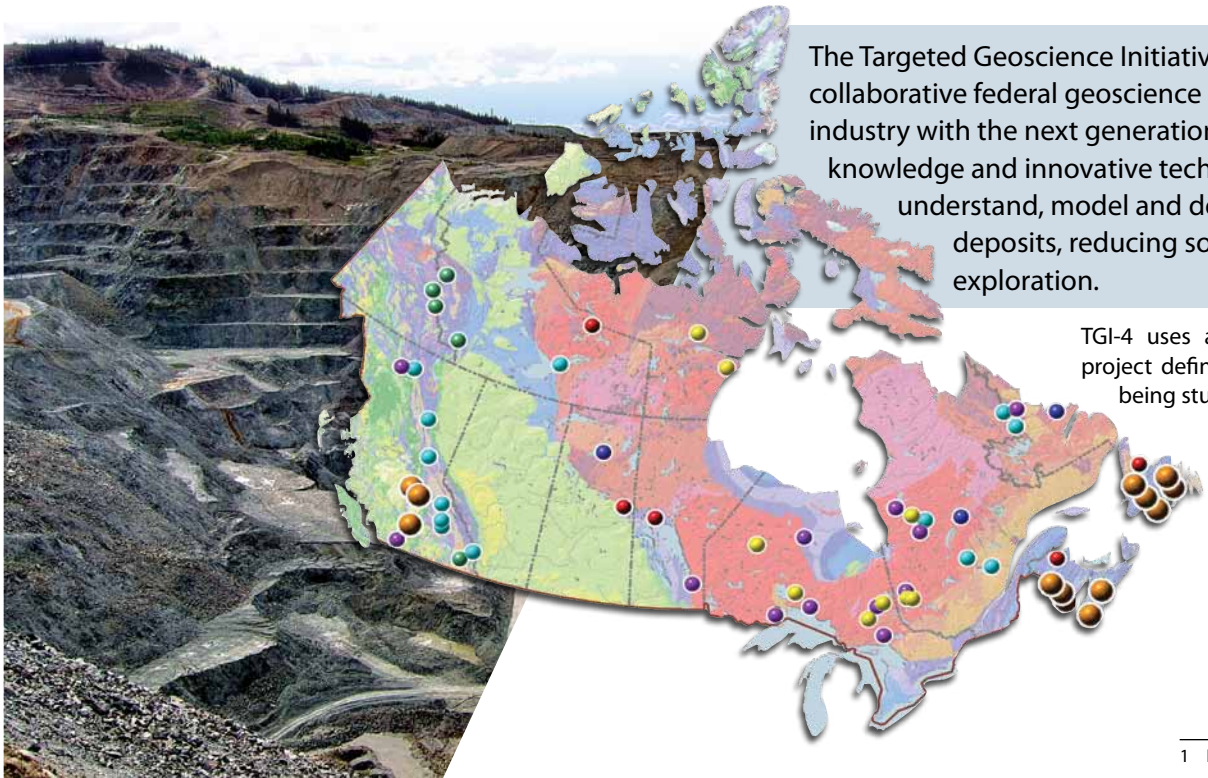
Intrusion-Related Ore Systems



Intrusion-related ore systems are formed when molten rock (magma) intrudes into the Earth's crust but solidifies before it can reach the surface. Because this magma cools very slowly, there is enough time for large mineral crystals to grow, which produces many intrusive rocks that have a coarse-grained, granite-like texture. Some of these rocks may grow crystals that are significantly larger than the rest and have one or more minerals. These are called "porphyry" rocks. As porphyry rocks cool and crystallize, they can produce large volumes of hot, salt-rich fluids that carry high concentrations of base metals such as copper, molybdenum, tungsten and tin.

Porphyry and intrusion-related mineral deposits are important to Canada's economy because they account for more than 40% of our copper and approximately 25% of our gold production. Globally, they contain more than 50% of the world's copper and 95% of its molybdenum. Porphyry deposits typically contain only low to medium concentrations of economically important metals, but these can be within extremely large volumes of rock. The largest single source of copper in Canada is the porphyry-related Highland Valley Copper mine in British Columbia, and the largest copper deposits known worldwide are almost all porphyry-related.[1]

Finding porphyry mineral deposits has been less successful in recent years because most of the more easily found deposits are already in production. It is clear that, in the 21st century, we have to rely more on new discoveries of deposits that are buried under thick sediment or rock. To be able to do this, we need new and more effective exploration criteria to identify and evaluate porphyry and intrusion-related mineralizing systems at depth.



The Targeted Geoscience Initiative 4 (TGI-4) is a collaborative federal geoscience program that provides industry with the next generation of geoscience knowledge and innovative techniques to better understand, model and detect buried mineral deposits, reducing some of the risks of exploration.

TGI-4 uses an ore system approach to project definition. Seven ore systems are being studied:

- VMS
- Lode gold
- **Intrusion-related**
- Ni-Cu-PGE-Cr
- Specialty metals
- SEDEX
- Uranium

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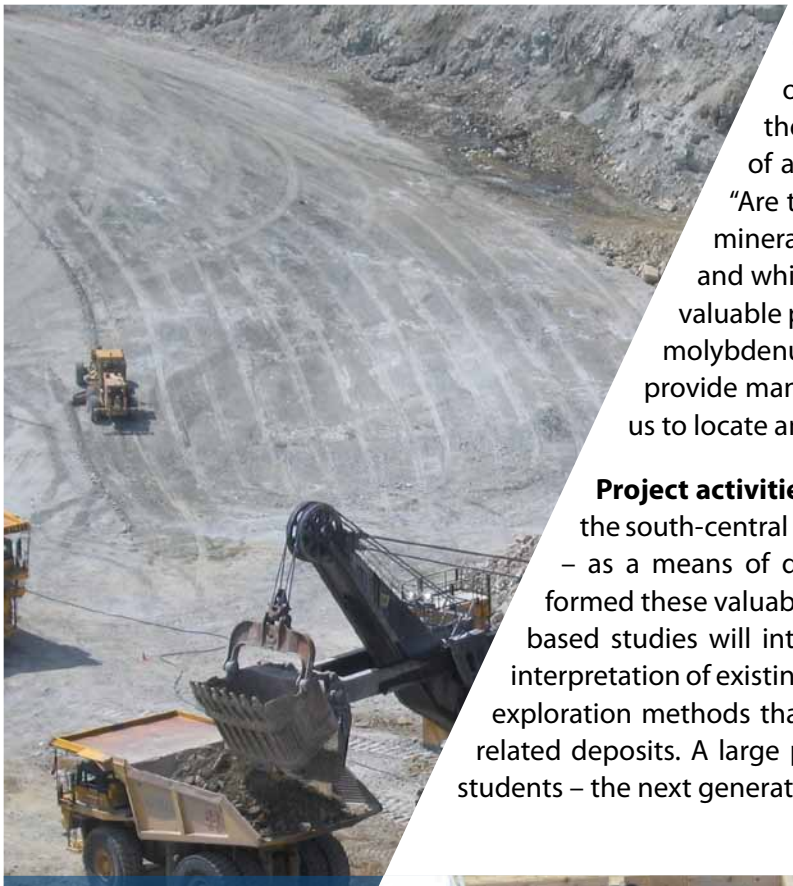

The Intrusion-related ore systems project will focus on two important questions. The first question is, "Are there distinctive characteristics that indicate the location of a deeply buried mineral deposit?" The second question is, "Are there traces of development and growth of the preserved mineral deposits and, if so, what role did different factors have and which factors are important for creating the largest and most valuable porphyry-related deposits?" Studies into Canadian copper-molybdenum-gold and tungsten-molybdenum-tin deposits will provide many of the geological and geochemical clues that will allow us to locate and assess deeply buried mineral deposits.

Project activities will centre on known metal concentrations – such as the south-central district of British Columbia and the Canadian Appalachians – as a means of developing greater understanding of the processes that formed these valuable deposits and testing new exploration techniques. Field-based studies will integrate bedrock and surface information to improve the interpretation of existing geochemical and geophysical data and will lead to novel exploration methods that are developed specifically for finding buried intrusion-related deposits. A large part of this research will include training and mentoring students – the next generation of explorers for intrusion-related mineral deposits.

Targeted Geoscience Initiative 4: Increasing Deep Mineral Exploration Effectiveness

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