MOBILISING YOUR IONS

MOBILE METAL IONS SOIL GEOCHEMISTRY-MAPPING UNIQUE LITHOLOGIES AND CHANGES IN BULK CHEMICAL COMPOSITION IN OVERBURDEN-COVERED TERRAIN

Introduction

The recent development of Mobile Metal Ions "MMI-M", a multi-element (n=45) analytical protocol, provides for the determination of a wide range of metals in soil samples collected for the purposes of base-, precious-, and rare-metals exploration. In support of this partial extraction-approach to exploration additional elements useful in the detection of unique lithologies (i.e., kimberlite), alteration facies related to the development of a variety of styles of mineralization and pathfinder elements accompanying these mineralized zones can now be utilized to assist exploration.

The suite of elements available in the MMI-M and MMI-D protocol are also capable of mapping changes in the bulk chemical composition of bedrock in areas of transported or residual overburden. This would find application in the identification of alteration facies developed about a mineralized zone. Since these alteration systems are almost always larger than the mineralized target the constituent elements in these protocols can be utilized to vector into the metal-bearing system and result in focused exploration and reduced conventional (diamond drilling) exploration expenditures.

Background

With the advent of soil sampling and analytical protocols, based on instrumentation capable of measuring parts per billion and sub-parts per billion concentrations of metals subsequent to ligand-based soil extractions, the mapping of bedrock lithologies in soil samples from overburden-covered terrain has come of age. The use of partial extraction MMI Technology in this regard avoids geochemical signatures based on the strong acid or total dissolution of lithoclasts in transported overburden and identifies only those diagnostic metals residing at high-contrast residence sites in the soil profile.

The availability of accurate and reproducible analyses for light rare earth elements and other "incompatible elements" such as Cs, Rb, U, Tl and Th as well as the lithologic discriminators or compatible elements Ni, Cr, Mg, Ti, Fe and the heavy rare earth elements available in MMI extractions has been utilized to map alteration facies and unique lithologies in the subsurface.

This edition of Mobilizing Your Ions describes the application of the MMI-M and MMI-D protocols to two distinctive exploration programs designed to assess properties for kimberlite and platinum group metals in glaciated terrain of Canada.

Case History 1: C14 Kimberlite

The C14 kimberlite in the Kirkland Lake area was surveyed with MMI Technology using the MMI-D package. A single transect of samples was established over the vertical surface projection of the kimberlite with samples collected at 25 m spacings and from depths at 0-10 cm, 10-20 cm and 20-30 cm. The overburden is characterized by up to 30 m of sand, silt, clay and till with kimberlite boulders and pyrope dispersion trains documented from the adjacent Monroe esker (Clifford Township). The drill-intersected kimberlite is flanked by feldspar porphyry intrusions.

The results based upon calculated response ratios indicate a Mg, Cr and Co anomaly directly over the kimberlite pipe in the 10-20 cm sample and is accompanied by an apical rare earth element (La, Ce, Nd) anomaly over the pipe flanked by two adjacent REE anomalies that are developed at the contacts between the kimberlite and the enclosing wallrock. All observed anomalies were degraded in the 20-30 cm sample demonstrating the effect of deeper sampling on anomaly definition. No anomalous response was observed in the 0-10 cm sample. The apical Mg-Cr-Co and La-Ce-Nd anomalies are interpreted to represent the signature of the kimberlite pipe at depth and the flanking apical REE anomalies the signal of a hydrothermal alteration of wallrock during kimberlite emplacement.

Case History 2: Highbank Lake Property/Fishtrap Lake Intrusive Complex

The project area occurs 300 km north of Hearst, northwestern Ontario where a layered mafic-ultramafic intrusion is being explored for chromitite/sulphide reef-type PGE mineralization. The Fishtrap Lake Intrusive Complex was identified by high-resolution airborne magnetic surveys and stream sediment geochemical surveys that documented high Cr/chromite anomalies. A total of 968 soil samples were collected along transects over the Complex at 25 m and 50 m sample spacings. Analyses by MMI-D and MMI-B mapped the mafic-ultramafic contacts in the intrusion on the basis of Ni/Ti ratios as well as Pd anomalies coincident with Mg, Ni, Co, lesser Cr. Of interest was the encapsulation of the Pd and related element responses by a broad Ag anomaly.

Conclusion

Mobile Metal Ion multi-element protocols with strict adherence to sampling protocols provide flexibility in any surficial geochemical exploration program where the recognition of subsurface geology can be beneficial to the interpretation of commodity and pathfinder element responses. The ability of this approach to differentiate kimberlite-related geochemical signatures as opposed to those of circular non-kimberlitic magnetic anomalies should provide an extremely useful tool to the explorationist.

Acknowledgements

The development of MMI sampling and analytical protocols were pioneered by Alan Mann and Russell Birrell at the Geochemistry Research Centre in Western Australia.

Additional information including case histories and technical bulletins are available at no charge at www.mmigeochem.com.

Dr. Mark Fedikow is an exploration geochemist and mineral deposits geologist based in Winnipeg. He has published numerous articles on mineral deposits and their geochemical expressions in rock, soil and vegetation sample media. Specifically, he has successfully applied the Mobile Metal Ions Process in exploration programs for lode gold, base metal massive sulphides, platinum group metals, magmatic nickel-copper, epithermal gold-silver, porphyry copper deposits and diamandiferous kimberlites in a variety of geological and overburden environments. Dr. Fedikow can be reached by telephone at (204) 998-0271 or by e-mail at ***mfedikow@shaw.ca***