Geophysical research to expand mineral exploration in Sudbury

By Nicole Tardif

Dr. Richard Smith

Collecting geophysical data using electrical methods. Photos courtesy of Discovery Int'l Geophysics.

Laurentian University in Sudbury, Ont., prides itself in being one of the best mineral exploration research centres and educational facilities for the geosciences in the world.

The arrival of Dr. Richard Smith, the new CEMI-sponsored Industrial Research Chair in Exploration Geophysics, has further enhanced the facility. Dr. Smith joins Laurentian University as a member of both the Department of Earth Sciences (DES) and the Mineral Exploration Research Centre (MERC). Both organizations include two senior research Chairs (Magmatic Ore Deposits, Precambrian Geology), faculty, post-doctoral research fellows and graduate students, all of whom are involved in research projects directed toward mineral exploration.

Dr. Smith's position is called an "Industrial Research Chair" as the position and research undertaken are to be funded by NSERC and four industry partners based in Sudbury – namely, Vale Inco Ltd., Xstrata Nickel Ltd., FNX Mining Company Inc., and Wallbridge Mining Company Ltd. The Centre for Excellence in Mining Innovation (CEMI) committed an additional $1 million toward the Chair.

"CEMI is excited that it could respond to industry's need for research leadership in the geophysics area with the sponsorship of such an experienced and accomplished individual as Dr. Richard Smith," states Dr. Peter Kaiser, president and CEO of CEMI. Dr. Smith will be working closely with these mining companies and through local, regional, and international linkages with DES, MERC and CEMI, he will have unique opportunities in which to collaborate with global exploration companies and mining-related research centres worldwide. "Dr. Smith provides a much needed geophysical research component to our initiatives," states Dr. Harold Gibson, MERC director.

Richard Smith graduated with honours in Economic Geology at the University of Adelaide in Australia. He has masters' degrees from the University of Adelaide (Economic Geology) and the University of Toronto (Physics), and a Ph.D. in Physics from the University of Toronto. His graduate work focused on how to better understand the electromagnetic data used in mineral exploration. Following graduation, Dr. Smith worked for Lamontagne Geophysics in Toronto; he held a post-doctoral fellowship at Macquarie University in Australia, and then worked in the exploration industry for Pasminco Ltd. as part of a team exploring for lead and zinc deposits, mainly in Australia. Dr. Smith also worked as a research scientist in ground and airborne geophysics for Geoterrex Ltd. and Fugro Airborne Surveys, where he developed geophysical methods for use in mineral and oil exploration.

As the new in-house geophysicist at Laurentian University, Dr. Smith will teach two courses in exploration geophysics. One will be at the undergraduate level and the other as part of the Applied Master's program in mineral exploration offered by MERC and DES. The Applied Master's degree is aimed at professionals working in the exploration industry who wish to continue their education or upgrade their training to gain or retain professional accreditation. The modular nature of the courses allows professionals to choose the ones that most interest them, and even allows them to attend certain sections of one particular course. Those who desire to gain a master's degree can take all the courses on their own schedule while maintaining their employment in industry. Graduate students in the DES also take the courses as part of their M.Sc. and Ph.D. requirements. Undergraduate and graduate students who study here already receive a top-notch education as a result of being exposed to applied research that pushes the limits of what is known in mineral exploration.

In addition, students are in the centre of a flurry of exploration

Fig.1a.

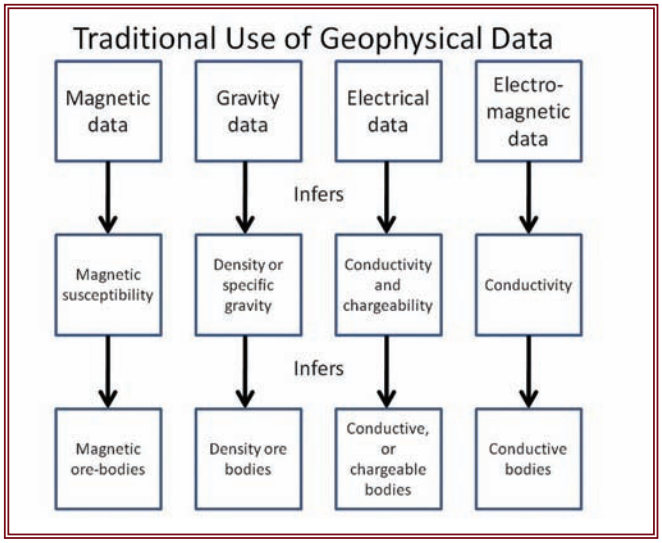
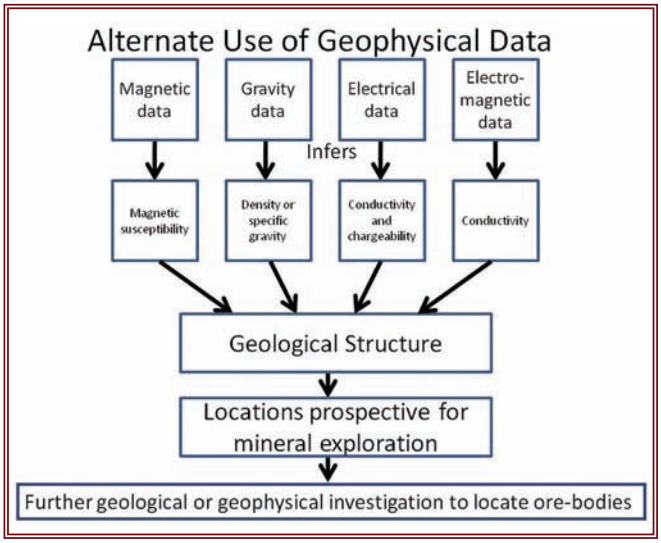


Fig. 1b.



research and activity being conducted by the Centre for Excellence in Mining Innovation (CEMI), major and junior company exploration in the area, the Ontario Geological Survey, and MIRARCO. Many of these organizations are housed in the same building as the DES.

"Dr. Smith will make a substantial contribution toward training the next generation of geoscientists through DES's undergraduate and graduate programs, and nationally and internationally through MERC's intra-Ontario university modular courses," states Gibson.

In the case of the Exploration Geophysics modular course being offered in December 2009, the focus will be on physical properties and how these are used to explore for minerals using geophysical methods. The geophysical methods that will be discussed are magnetic methods, gravity methods, electrical methods, electromagnetic methods (EM), gamma-ray spectrometry methods, airborne methods, seismic methods, borehole logging methods, and techniques for interpreting geophysical data (e.g., using borehole EM and regional geophysical data sets).

Current geophysical techniques, specifically EM, are important in exploration, particularly for Ni-sulphides in Sudbury. EM techniques allow companies to delineate Ni-S deposits without incurring the cost of expensive drilling programs. Ben Polzer, consulting geophysicist for Vale Exploration Canada, remarks that "EM techniques are not traditionally applied to Sudbury's low-sulphide, high-PGE footwall deposits. We are looking forward to Dr. Smith's expertise in this area to provide the missing link between geophysical research and exploration, particularly within the SIC."

In the next five years, Dr. Smith's research will focus on expanding the geophysical understanding of the Sudbury Igneous Complex (SIC) by using modern geophysical tools, and by develop-

ing new tools to acquire, process, and interpret geophysical data. He will initially focus on the SIC, where there is little geological information at depths greater than 1.5 km and where the development of new geophysical models and techniques would more accurately image and delineate mine resources; he will also help local companies to explore for Ni-Cu-PGE footwall deposits.

More specifically, Dr. Smith will be looking at new interpretation techniques to extract more information from pre-existing data and find correlations between the physical properties of the data and the geology. "If a potential area (target) is identified using the results from this new interpretation, it might stimulate the collection of more data and possibly lead to the discovery of new ore bodies in the Sudbury Basin and beyond," Dr. Smith says. He explains the alternate use of geophysical data in Figure 1. "Figure 1a illustrates the traditional use of geophysical methods to find ore bodies. Figure 1b demonstrates how using the geophysics to infer physical properties might be used to infer the geology, which in turn can be used to infer the prospective areas for mineral deposits. Once these prospective areas are located, further work is required. This can be geological work, drilling or more detailed geophysics. There needs to be a better understanding of the physical properties of geophysical data in order to solve geological problems."

In the short term, Dr. Smith is applying for more funding, looking for graduate students, visiting industry partners, and familiarizing himself with the local geology and the geophysical methods currently being used by mining companies in Sudbury. He expects to start seeing results from his research within the next couple of years. He will also be touring the country and delivering lectures for the Canadian Society of Exploration Geophysicists for whom he has been named the 2010 Distinguished Lecturer. His lecture is entitled: "A tutorial on airborne electromagnetic methods and some examples for mineral exploration, hydrocarbon exploration and water exploration."

In the meantime, students at Laurentian University are looking forward to benefiting from the new addition of a geophysics expert. Dr. Andrew McDonald, Chair of DES, states that "the arrival of Dr. Smith fills a long-term void that has existed in the Department of Earth Sciences in being able to offer a complete undergraduate program in Earth Sciences. His expertise in geophysics, from both theoretical and practical perspectives, will provide our students with an unparalleled opportunity to be at the cusp of leading-edge techniques and how these can and are, applied to the exploration for mineral deposits. The Department of Earth Sciences is exceedingly proud of the fact that it has been able to attract a researcher of Dr. Smith's caliber and very much looks forward to working with him as he begins his new career as a Research Chair in Geophysics."

For more information, please visit www.earthsciences.laurentian.ca *and* www.miningexcellence.ca.