TGDG
Toronto Geological Discussion Group

Mini-Symposium:

Mineral Exploration, Innovation and Change

November 24th, 2016

Changing world – changing exploration

John F.H. Thompson
Wold Professor, Cornell University, Ithaca, New York, USA jft66@cornell.edu
PetraScience Consultants, Vancouver, Canada john@petrascience.com

Bio:
Dr. John F. H. Thompson has a BA from Oxford University and M.Sc. and Ph.D. degrees from the University of Toronto. In 1982, he joined the BP Minerals group (Rio Tinto) initially in Australia, followed by positions in the UK and Salt Lake. In 1991, John became Director of the Mineral Deposit Research Unit (MDRU) at the University of British Columbia. He returned to industry in 1998 as Chief Geoscientist for Teck, and then Vice President Technology and Development. He left Teck in 2012 and is now the Wold Professor of Environmental Balance for Human Sustainability at Cornell University and Principal, PetraScience Consultants based in Vancouver, an exploration, development and technology consultancy.

John is Vice Chair of Genome BC, a member of the Global Futures Council on Advanced Materials with the World Economic Forum, and Chair for the Resources for Future Generations 2018 conference. He was a co-founder of Geoscience BC and the Canada Mining Innovation Council. He has board and advisory positions with public and private companies and other organizations.

Abstract:
The world continues to change, most recently through global connectivity and digital technology that have been termed the "Fourth Industrial Revolution". This revolution is already impacting energy use, transportation, and employment. When combined with new materials and associated applications, there is potential for disruptive changes to metal markets and hence mining and exploration.

These developments build on existing trends that already affect mining such as population growth, basic human needs, emerging economies, and heightened expectations for quality of life and a clean environment.

Predicting how these factors will play out in the short to long term is challenging. Potential decline in metal demand would clearly reduce exploration expenditure while rapid increases in metal use, or supply constraints, could cause metal-specific exploration booms, as happened with rare earth elements in 2010-11. Neither support consistent exploration efforts.

Mining and exploration have always adapted to fluctuating demand. The first primitive miners responded to early metal use, and new mines and more sophisticated tools developed over the subsequent 8000 years. The rate of change increased with the industrial revolution, new bulk mining methods, and dramatic changes in processing. Exploration responded with explorers going to new places, with new ideas and technology, and many excellent discoveries followed. While a spirit of adventure and field skills have remained consistent ingredients for success, many aspects of modern exploration would be unrecognizable to practitioners operating thirty-five years ago. Change will continue but predicting the end-result in thirty-five years is as difficult as it would have been to predict the present thirty-five years ago.

Does the exploration industry innovate? A look at 30 years of change.
Lynda Bloom (Analytical Solutions Ltd.) –

Bio:
Lynda Bloom is president of Analytical Solutions Ltd., a geochemical consulting firm established in 1986 and distributor of certified reference materials. After earning a M.Sc. at Queen's University in Geological Sciences, she gained experience as an exploration geochemist planning and interpreting geochemical surveys across Canada, and in many South America and African countries. She is recognized as a world-expert on assay methods and has traveled extensively worldwide to review sampling and analytical procedures.

Lynda was awarded the 2013 Queen's Jubilee Medal award for her dedicated volunteer work in the mining industry. She serves on advisory boards including the Ministry of Natural Resources-CANMET Advisory Committee, Canadian Securities Administrators Mining Technical Advisory and Monitoring Committee and the Canadian Mining Innovation Council- Footprints Project Advisory Board.

TGDG
Toronto Geological Discussion Group

Collaboration: The Key to Fundamentally Transforming the Minerals Sector
Carl Weatherell (Executive Director & CEO, Canada Mining Innovation Council)

Bio:
Carl Weatherell joined the Canada Mining Innovation Council (CMIC) as Executive Director and CEO in 2013.

Carl is a change agent known for challenging the status quo, discovering new ways of doing things and taking ideas to execution. He is a natural connector often bringing together disparate and seemingly unrelated people, groups and organizations to create new partnerships. Carl has been described as a rebel and a heretic.

He has over 27 years' experience working at the interface of business, government and postsecondary institutions nationally and internationally. Carl has helped position organizations for success and has established, managed or facilitated the development of strategies with a number of organizations and over 13 different consortia comprised of 200 businesses, 30 government organizations and at least 180 different academic institutions.

Carl obtained graduate and undergraduate degrees in chemistry from Carleton University and the University of Waterloo respectively. He holds one patent and has publications in five different technical domains: hydrometallurgical engineering, organometallic chemistry, analytical chemistry, environmental engineering and project management.

Abstract:
The mining and minerals industry is at a tipping point. Companies are all faced with common, complex challenges directly affecting the business of mining and there appear to be no known solutions. Many organizations are asking themselves, "How do we do this?"

This presentation will illustrate why we need to collaborate as an industry. The top 3 factors that make strategic partnerships work will be provided and discussed.

Examples from other industries will be used throughout to demonstrate that yes indeed, large complex challenges can be addressed across an entire industry through collaboration.

Innovation and Exploration
Francois Robert (Barrick Gold Corp.) –

Bio:
François Robert holds a degree in Geological Engineering from Ecole Polytechnique in Montreal, where he also obtained his MSc (1978) and PhD (1983) degrees in Economic Geology. This was followed by post-doctoral studies at the University of Michigan (1984).

He joined the Geological Survey of Canada in 1985 as a research scientist with the Mineral Deposits Division, where he conducted applied research on the geology of gold deposits in Canada and abroad. In late 1997, he joined Barrick Gold Corporation where he occupied various positions in Canada, Australia, and South America. He is currently VP and Chief Geologist for Global Exploration.

He has published a significant number of technical papers in scientific journals and has served on a number of committees of scientific organizations, as President of the Society of Economic Geologists (SEG) in 2015. He has played a significant role in the creation of CMIC's Exploration Innovation Consortium and the establishment of its first major research project, the "Footprint" project.

He has received several national and international awards, including the Silver Medal and Lindgren Award from the SEG and the Duncan Derry Award from the Geological Association of Canada. He was Distinguished Lecturer for the SEG in 2004 and for the CIMM in 1990.

TGDG
Toronto Geological Discussion Group

Metal Earth: An integrated 4D Metallogenic study of our Earth

Harold Gibson (MERC, Harquail School of Earth Sciences, Laurentian University)

Bio:

Dr. Harold Gibson serves as Director of the Mineral Exploration Research (MERC) and Metal Earth and is a Professor of Economic Geology and Volcanology at Laurentian University, Sudbury. Dr. Gibson joined Laurentian University in 1990, after leaving a successful 12-year career in the mining exploration industry, where he worked with Falconbridge Copper, Minnova, and Falconbridge Ltd. Dr. Gibson and his students have conducted research across Canada and Globally. His field based research focuses on volcanogenic massive sulphide (VMS) and epithermal ore systems. Current areas of research include the Paleoproterozoic Flin Flon and Snow Lake VMS districts, Northern Manitoba and Saskatchewan, the Archean Noranda VMS District and Abitibi Greenstone Belt of Ontario and Quebec, the Lau Basin and the Central Indian Mid Ocean Ridge, and VMS and epithermal precious metal deposits of the Mexican Silver Belt. Dr. Gibson has published extensively and has received numerous awards including the William Harvey Gross and Duncan Derry Medals from the Geological Association of Canada.

Resource Modelling: The Next Frontier for Innovation

Oy Leuangthong, (SRK Consulting (Canada) Inc.

Bio:

Dr. Leuangthong is a principal geostatistician in SRK's Toronto office since 2010. She has over 15 years of experience in resource characterization and uncertainty assessment. Prior to joining SRK, she was an Assistant Professor in Mining Engineering at the University of Alberta in Edmonton, Alberta. She has taught geostatistics in various industry courses to engineers and geologists from national and multinational companies in North and South America. She has also consulted on a range of projects in both the mining and petroleum industry. Further, she has authored and co-authored 2 books, 16 journal papers and over 30 conference articles. Her areas of expertise are resource estimation, conditional simulation and uncertainty assessment using geostatistics.

ZTEM: Tracing its development from design innovation to discovery tool

Jean Legault (Geotech) –

Bio:

Jean M. Legault is a +30 year career exploration geophysicist. He obtained his Bachelor's degree in applied science (geophysics) at Queen's University at Kingston, ON and his Master's degree in applied science (geophysics) at École Polytechnique of University of Montreal, QC. He is an experienced geophysicist in both the ground and airborne geophysics sectors since 1985. He is chief geophysicist at Geotech Ltd. (Aurora), a worldwide airborne geophysical service provider, where he is mainly interested in passive and active-source airborne EM methods as geological mapping tools for mineral exploration.

Jean has authored and co-authored over 50 papers and journals articles, and has been a regular speaker at geophysical conferences around the world over the last 10 years. He is a past president of KEGS, co-chair of the SEG Mining Committee, a director of the KEGS Foundation, and a member of SEG, ASEG, EAGE, as well as APEO, APGO and OGQ.

Abstract:

The ZTEMTM (z-axis tipper electromagnetic) airborne passive EM mapping system is now nearing its tenth year of application in the mining and mineral exploration industry and represents one of the core technologies for Geotech Ltd., an Aurora-based airborne geophysical instrumentation and survey company that is the world's largest airborne EM service company. In fact, ZTEM has been flown across 6 continents, in over 20 countries, for over 170 mining companies and accounts for 1 in 4 airborne EM surveys flown by the company since 2007. ZTEM has been credited with the discovery of several deposits, including the Balboa porphyry copper gold discovery at Cobre Panama in 2010. Yet since being introduced in 2007, ZTEM is often still considered a "new" technology. Why is ZTEM still relatively unknown to the public? Our paper traces its development from design innovation to discovery tool.

The modern day development of Geotech's ZTEMTM (z-axis tipper electromagnetic) airborne passive EM technology originally began in 2000 with a receiver design that combined its earlier "Hawk" broadband frequency domain acquisition system, and the 24-bit digital acquisition module for its innovatively new VTEMTM time-domain electromagnetic system, as well as advanced digital signal processing similar to those used in modern MT. This gave rise to a lightweight digital AFMAG towed-bird receiver in 2001 whose sensor proved too small and prone to vibrational noise. Subsequent improvements led to a relatively successful prototype, in 2002, with improved damping and attitude sensors. In spite of these advancements the noise levels were unacceptably large, until the addition of a base-station in 2004, which provided a ten-fold improvement in signal-to-noise and reduced receiver weight. This quickly spurred the development of the modern ZTEM system,

which, in 2007, became the first successful and commercially available AFMAG system of its kind in over 35 years.

Since then the ZTEM system has grown in popularity and is now more routinely used in exploration for porphyry copper, unconformity uranium, epithermal gold and geothermal exploration where it is a key technology for mapping subtle, lateral resistivity variations due to structure, lithology and alteration down to several km depths. One of the keys to ZTEM's success is its innovative and patented design that features a mobile receiver and fixed base-station sensors which has resisted copycat technologies from competitors. And to this day, ZTEM is the only passive, natural field airborne EM technology in the marketplace. The absence of comparable technologies due to reduced R&D budgets available to equipment manufacturers in the recent mining downturn may also have limited a more widespread use of ZTEM by the mineral exploration industry, for perceived lack of competition. And because porphyry copper exploration is primarily undertaken by majors, who tend to be tech-secretive, successful ZTEM applications are not widely shared in the exploration community. Still, in spite of this, another key to the popularity of ZTEM has been its acceptance and study by the university research community who've spearheaded the development of new 2D-3D inversion modeling tools for the interpretation of ZTEM in multi-dimensions along with 3D gravity and 3D magnetic tools. The popularization of ZTEM would not have been possible without key advancements in interpretation software and their widespread use by the mineral exploration community and not just academia.