

New geophysical and geological insights into how crustal architecture influences the gold and base metal endowment of Precambrian terranes

Saturday, March 4, 2023



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Agenda

- 9:00-9:40 Dr. Mostafa Naghizadeh: The Larder Lake Gold Transect; Comparison of the results from various seismic prospecting methods
- 9:40-10:20 Dr. Ademola Adetunji: Conductivity footprints of the world class gold districts in the Red Lake and Timmins, Canada
- 10:20-10:40 Break
- 10:40-11:20 Dr. Rajesh Vayavur: Upper Crustal Architecture of the Eastern Sudbury Ni-Cu-PGE Camp by 3-D Integration of Geology and Geophysical Datasets
- 11:20-12:00 Dr. David Snyder: Cost-Benefit Analysis for Geophysical Surveys Used in the Metal Earth project
- 12:00-1:00 Lunch
- 1:00-1:40 Dr. Rasmus Haugaard: Crustal Variations in Metal Endowed Versus Less Endowed Areas of the Abitibi Greenstone Belt: Insights from the Matheson and Swayze transects
- 1:40-2:20 Dr. John Ayer: Geophysical signatures and crustal architecture of variably endowed greenstone belts: New insights from Rainy River and Timmins (Powerpoint presentation provided by Dr. Gaetan Launay).
- 2:20-3:00 Dr. Taus R.C. Jørgensen: Crustal Architecture and VMS Endowment: Insights from the Rouyn-Noranda Camp, Abitibi Greenstone Belt
- 3:00-3:20 Break
- 3:20-4:00 Dr. Chong Ma: Crustal Architecture of the Sturgeon-Savant Lakes region and implications for VMS endowment
- 4:00-4:40 Dr. Jeff Harris: A Study of faults in the Superior Province of Ontario and Quebec using the Random Forest machine learning algorithm: Spatial relationship to Au mines

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The timing and distribution of mineralization in Precambrian Orogens is influenced by crustal architecture which is often established long before mineralization occurs. Gold occurrences in such settings are commonly associated with crustal-scale faults. Once established, these faults provide critical pathways for hydrothermal and mineralizing fluids which during repeated fault reactivations can result in remobilization or introduction of new auriferous fluids resulting in overprinting gold events.

This course will highlight new results from Laurentian University's Metal Earth program where in excess of 1,000 km of reflection seismic, magnetotelluric and gravity surveys have provided some of the highest resolution imaging across 13 transects with differing mineral endowment in granite-greenstone terranes of the Superior and Southern provinces. The results will highlight crustal architecture and metallogeny derived through integration of the geophysical studies at detailed and regional scales integrated with geological, geochemical and geochronological data.

The course will consist of presentations by Metal Earth researchers with the first half of the course led by researchers focusing on the geophysical techniques utilized at regional- and high-resolution scales including new reflection and passive seismic, magnetotelluric and audio magnetotelluric, gravimetric and magnetic data. Areas of focus in the first part of the course will include the Larder, Timmins and Red Lake gold camps and the eastern part of the Sudbury Ni-Cu-PGE camp, cost benefit and the relative effectiveness of seismic technologies and will also be discussed.

The second half of the course will be led by research focused on the crustal architecture and metallogenic comparisons of the endowed gold camps in the Timmins and Matheson areas versus the less endowed Swayze and Rainy River areas. The crustal architecture of the volcanogenic massive sulfide (VMS) endowed Noranda and Sturgeon Lake camps will also be compared. These contributions will also emphasize integration of field and laboratory geological, geochemical and geophysical studies providing new insights into the geological and metallogenic framework of endowed terranes, and the architecture of the structural conduits controlling the upward migration of melts and mineralizing hydrothermal fluids. A presentation on mineral potential mapping will also be included to help provide more focused guidance into specific areas of higher mineral potential.

A.M. Speakers & Topics

Dr. Mostafa Naghizadeh: The Larder Lake Gold Transect; Comparison of the results from various seismic prospecting methods

Dr. Ademola Adetunji: Conductivity footprints of the world class gold districts in the Red Lake and Timmins, Canada

Dr. Rajesh Vayavur: Upper Crustal Architecture of the Eastern Sudbury Ni-Cu-PGE Camp by 3-D Integration of Geology and Geophysical Datasets

Dr. David Snyder: Cost-Benefit Analysis for Geophysical Surveys Used in the Metal Earth project

P.M. Speakers & Topics

Dr. Rasmus Haugaard: Crustal Variations in Metal Endowed Versus Less Endowed Areas of the Abitibi Greenstone Belt: Insights from the Matheson and Swayze transects

Dr. John Ayer: Geophysical signatures and crustal architecture of variably endowed greenstone belts: New insights from Rainy River and Timmins (Powerpoint presentation provided by Dr. Gaetan Launay).

Dr. Taus R.C. Jørgensen: Crustal Architecture and VMS Endowment: Insights from the Rouyn-Noranda Camp, Abitibi Greenstone Belt

Dr. Chong Ma: Crustal Architecture of the Sturgeon-Savant Lakes region and implications for VMS endowment

Dr. Jeff Harris: A Study of faults in the Superior Province of Ontario and Quebec using the Random Forest machine learning algorithm: Spatial relationship to Au mines

Biographies



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Dr. Ademola Adetunji is a research associate in the Harquail School of Earth Sciences, Laurentian University, Sudbury. His main interests involve using geophysical methods to map variation in subsurface geophysical properties to understand processes that have formed, deformed and preserved the Earth. He obtained his Ph.D. degree at the University of Manitoba where he studied the resistivity structure of the Precambrian Grenville Province. He has taught Geophysics at undergraduate and graduate levels and also has experience in acquisition, modelling and interpretation of integrated geophysical data for mineral, petroleum, groundwater, environmental, geothermal and tectonic targets/investigations in Canada, Nigeria, Saudi Arabia and Oman.



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Dr. John Ayer joined the Mineral Exploration Research Centre as Associate Director in February 2013. He received BSc and MSc degrees from Carleton University and a PhD degree from the University of Ottawa. He worked for 28 years with the Ontario Geological Survey (OGS) mapping Precambrian greenstone belts at detailed to regional scales in the Wabigoon and Abitibi Subprovinces and 10 years for the exploration industry. He was leader for the OGS Precambrian mapping group in NE Ontario, Targeted Geoscience Initiative 3 in the Abitibi and coordinator of the Greenstone Architecture project at Laurentian University (LU) under the Discover Abitibi Initiative. He supervises graduate students as an Adjunct Professor at LU. His academic interests include geochronology, stratigraphy, litho geochemistry and geodynamics with a focus on the controls of metal deposition in Archean Terranes.



Dr. J.R. Harris
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Dr. Jeff Harris is the data analytics lead for Metal Earth which involves the compilation of existing geoscience data as well as newly acquired data over a number of greenstone belts in Ontario and Quebec. He was previously employed at the Geological Survey of Canada as a research scientist conducting research on data analytics, remote predictive and mineral potential mapping with the goal of creating Digital Integration Models which can show the mineralization potential for greenstone belts and help determine why some belts are well mineralized while others are barren. He has authored more than 150 scientific papers and GSC Open-file Reports.



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Dr. Rasmus Haugaard is a Research Associate and Adjunct Professor of Precambrian geology in the Harquail School of Earth Sciences, Laurentian University. His main interests are the petrology, stratigraphy and formation of Archean greenstone belts, their depositional environments and related ore systems. He earned his B.Sc. and M.Sc. at the University of Copenhagen, and his Ph.D. at the University of Alberta studying the banded iron formations of the Slave craton. He has extensive field experience in research and exploration working in various Archean and Paleoproterozoic terrains in east, west and north Greenland, North West Territories, Nunavut, northern Manitoba and Ontario.

Dr. Taus R.C. Jørgensen is a Research Associate at Laurentian University. His current research focus is on the differential metal endowment in Archean greenstone belts by an integrated multi-disciplinary approach involving geophysical and geological methods. Taus has a background in metamorphic petrology and the use of phase equilibria and trace element modeling, whole-rock major and trace element geochemistry, and geochronology in order to constrain high-temperature metamorphic processes, i.e., partial melting, melt segregation, and major- and trace element mobility. He earned a Ph.D. at Harquail School of Earth Sciences, Laurentian University, studying the metamorphic contact aureole related to the Sudbury Igneous Complex.

Dr. Chong Ma is a Research Associate at Laurentian University. He obtained his PhD in Geology at the University of Florida in 2015. Dr. Ma is a structural/field geologist who is passionate about geologic mapping and integrates geochemistry, igneous petrology, and geochronology with field data. His research revolves around the formation, deformation, and evolution of continental crust to understand the tectonic processes associated with subduction, accretion, collision, and extension and the metal endowment processes associated with orogenic gold in shear zones.



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Dr. Mostafa Naghizadeh received his Ph.D. in Geophysics from the University of Alberta in 2009. He worked as a postdoctoral researcher with CREWES at the University of Calgary and Signal Analysis and Imaging Group (SAIG) at the University of Alberta from January 2010 to September 2012. After five years of industry experience as a Processing Geophysicist in Shell Canada, he joined Laurentian University as part of the Metal Earth project. His interests are mineral exploration, geophysical inversion, seismic processing and interpretation, computational geophysics, and hard rock geophysics. Mostafa received the J. Clarence Karcher Award from SEG in 2011.



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Dr. David Snyder is an Adjunct Professor at Laurentian University and serves as an emeritus member of the Canada-in-3D project at the Geological Survey of Canada where he worked as a research scientist (geophysicist) and section head (3D Earth Imaging & Modelling) from 1998 until 2017. Before that he worked ten years at the British Institutions Reflection Profiling Syndicate (BIRPS) at the University of Cambridge, UK. He received a PhD in Geological Sciences from Cornell University in 1988.



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Dr. Rajesh Vayavur is currently working as a Research Associate (Geophysics) with Metal Earth at Laurentian University. His research focuses on 3D potential field modelling and inversion with constraints from seismic and petrophysical data to study the crustal architecture of the Abitibi greenstone belt and identify metal endowed areas. Before joining Laurentian University, he worked as Research Scientist (Geophysics) at ConocoPhillips School of Geology and Geophysics, University of Oklahoma. He obtained a PhD in Geophysics from Simon Fraser University, Vancouver, Canada with a thesis titled "Seismic and potential field constraints on the shallow crustal structure of inner Bering shelf, offshore southwestern Alaska."