GEOPHYSICAL SMORGASBORD: AIRBORNE & GROUND METHODS - ADVANCES & APPLICATIONS
KEGS FOUNDATION MINI SYMPOSIUM – 4-DEC-2018
UNIVERSITY OF TORONTO
EARTH SCIENCES BUILDING, ROOM ES 2093
22 RUSSELL STREET

PRELIMINARY PROGRAM

No	Time	Speaker	Title
--	12:30-1:00		Coffee and Posters
--	1:00-1:05	Chair	Introduction
1.	1:05-1:30 (25min)	**Nasreddine Bournas** Geotech Ltd.	*Airborne EM methods applied to VMS exploration - Recent case studies*
2.	1:30-1:55 (25min)	**Adam Smiarowski** CGG Multiphysics	*Breaking through the 25/30 Hz barrier: Helitem35C case study from Fraser Range, Western Australia*
3.	1:55-2:20 (25min)	**Tom Bagley** Laurentian University	*Estimating overburden thickness in resistive areas from two-component airborne EM data*
4.	2:20-2:45 (25min)	**Mehran Gharibi** Quantec Geoscience Ltd.	*Azimuthal effects in the 3D DC resistivity surveys*
5.	2:45-3:10 (25min)	**Francisca Maepa** Laurentian University	*Predicting gold mineral potential from geological and geophysical data in the Swayze greenstone belt using radial basis function link nets method*
--	3:10-3:25		Coffee and Posters
--	3:25-3:35		KF Scholarship Presentations
6.	3:35-4:05 (30min)	**Stephen Mosher** University of Ottawa (Collett Graduate Scholarship recipient)	*Enhanced Characterization of Offshore Seismicity in Cascadia Using AI Applied to Sub-Arrays of Ocean-Bottom Seismographs*
7.	4:05-4:30 (20min)	**Hema Sharma** Western University	*Application of ambient seismic noise analysis and velocity modeling in mineral exploration*
8.	4:30-4:55 (25min)	**Stefan Ellief** Sander Geophysics Ltd.	*The interplay of sampling and accuracy in gravity surveys*
9.	4:55-5:20 (25min)	**TBA**	*TBA*
--	5:20-5:25	Chair	Closing

Posters

No.	Presenter	Title
1.	**Nasreddine Bournas** Geotech Ltd.	*A new approach for kimberlite exploration using helicopter-borne TDEM data*
2.		
3.		
4.		

No 1

Title: *Airborne EM methods applied to VMS exploration - Recent case studies*

Authors: *Nasreddine Bournas, Alexander Prikhodko, Karl Kwan and Jean Legault (Geotech Ltd),*

Presented at: XPLOR 2018

Speaker: *Nasreddine Bournas – Geotech Ltd.*

Abstract:

Airborne EM methods have played a key role in the exploration of Volcanogenic Massive Sulphide deposits due to their excellent electrical properties. Over the past decades, the continuous improvement of modern EM platforms operating either in time domain (VTEM) or with natural sources (ZTEM) has led to significant increase in depth of investigation and their detection power, making it possible to detect deep-seated deposits, which were not detectable in the past. In this presentation, we show some successful examples from VTEM and ZTEM survey results that have led to the discovery of VMS mineralization in various regions of the world..

No 2

Title: *Breaking through the 25/30 Hz barrier: Helitem35C case study from Fraser Range, Western Australia*

Authors: *Adam Smiarowski and Andrew Fitzpatrick*

Presented at: AEM 2018

Speaker: *Adam Smiarowski – CGG MultiPhysics.*

Abstract:

Low-base frequency operation has proven difficult for AEM systems because of the requirement to limit motion of the receiver coils. Previous attempts with base frequencies below 25 Hz have been ineffective because coil motion induces higher noise levels, and the reduced ability to reduce noise through stacking. Recent significant re-design and development of the Helitem system has enabled operation at 12.5 Hz with suitably low noise levels for effective exploration. Here we describe the use of the Helitem35C system, a 12.5 Hz base frequency and with a long, high powered transmitter pulse. The system uses an all-new suspension system to reduce coil motion noise and allow low-base frequency operation. Survey data at 12.5Hz is compared to data from a 25Hz base frequency survey, and is used to demonstrate the value of the extended measuring time in increasing exploration depth. In some areas of the survey the signal in the last time channel of the Helitem35C data exceeded noise levels by a factor of 100. We demonstrate the effectiveness of the 12.5Hz at mapping geology beneath the conductive cover in the Fraser Range.

No 3

Title: *Estimating overburden thickness in resistive areas from two-component airborne EM data*

Authors: *Thomas Bagley and Richard Smith*

Presented at: SEG 2018

Speaker: *Thomas Bagley – Laurentian University.*

Abstract:

An overburden with variable thickness can obscure the response of underlying geophysical features. For example, the gravity response of an increased thickness of low density overburden might not be distinguishable from a deeper sandstone hydrothermally altered to clay. When the overburden is conductive, it's thickness can be determined from the rate of decay of the off-time airborne electromagnetic data. However, the off-time decay of a thin or resistive overburden is small and difficult to measure. Previous studies have used the on-time resistive-limit response of a single component to successfully map apparent ground conductance in resistive areas. Quantitative resistive-limit models exist for thin-sheet, half-space, thin-sheet over half-space, and thick-sheet over half-space models. This study uses horizontal and vertical component data to estimate the thickness (and conductivities) of a two layered model across the survey profile.

No 4

Title: *Azimuthal effects in the 3D DC resistivity surveys*

Authors: *Mehran Gharibi, Roger Sharpe, and Robert Hearst*

Presented at: SEG 2018

Speaker: *Mehran Gharibi – Quantec Geoscience Ltd.*

Abstract:

Developments in instrumentation and processing tools have made 3D resistivity surveys an effective approach in delineating complex geological environments. In the performance of these surveys a large number of data points are produced, and the properties of the dataset should be explored to optimize and coordinate interpretation efforts. In this study, a field 3D dataset was geometrically decomposed into near maximum-coupled (so-called radial) and near null-coupled (so-called tangential) subsets and inverted using a 3D approach. The results indicate that these two models may represent the subsurface at regional and local.

No 5

Title: *Radial Basis Function Link Nets method for predicting gold mineral potential from geological and geophysical data in the Swayze greenstone belt (SGB)*

Authors: *Francisca Maepa and Richard S. Smith*

Presented at: SEG 2018

Speaker: *Francisca Maepa – Laurentian University*

Abstract:

The radial basis function link network (RBFLN) machine learning method is a neural network technique that has gained favor in the mineral exploration realm for its robustness and ability to discriminate between deposits and non-deposits. As mineral deposit targets become deeper and harder to find, spatial data modelling and machine learning techniques that help to predict regions that hold potential for new deposits are sought. The identification of new mineral deposits becomes possible with greater understanding of the mineral systems that were involved in the deposition of mineral deposits. The Swayze greenstone belt hosts a few low-grade high-tonnage deposits and reviewing the mappable criteria that resulted in gold mineralization could help in the discovery of new drill targets and possibly new mineral deposits. Using geological, geochemical, structural and geophysical datasets that are markers for processes that led to gold deposition and proxies to mineralization, RBFLN can make predictions to produce mineral prospectivity maps. Receiver operator characteristic (ROC) curves are used to evaluate the sensitivity and specificity of predictive models. Overall, RBFLN shows an area under curve of 0.88 and an efficiency of classification of 83%. The results show that RBFLN was successful at delineating new areas for more detailed exploration.

No 6

Title: *Detecting Offshore Seismicity in Cascadia Using Logistic Regression Applied to Sub-Arrays of Ocean-Bottom Seismographs*

Authors: *Stephen Mosher*

Speaker: *Stephen Mosher – University of Ottawa (Len and Genice Collett Scholarship recipient)*

Abstract:

TBA.

No 7

Title: *Application of ambient noise analysis and velocity modeling in mineral exploration*

Authors: *Hema Sharma, Sheri Molnar, Dan Hollis, and John McBride*

Presented at: SEG 2018

Speaker: *Hema Sharma –Western University*

Abstract:

A hard rock geologic setting of Canadian shield makes mineral exploration using seismic techniques often difficult due to the complicated boundaries in the subsurface. Mineral exploration utilizes diamond drilling to explore below surface, but this approach is costly and only offers a narrow view of the subsurface environment. Other geophysical methods have been conducted, but either do not offer a resolution that is useful for exploration (gravity and magnetic), or they only offer a shallow range of view as they cannot model results accurately below a depth of 500 m (EM and IP). Therefore, to get subsurface properties for a large area, seismic data collected using non-invasive techniques can be utilized. Data acquisition using ambient noise sources is one of the non-invasive technique, that is a much cheaper and viable method of analyzing the complex subsurface structure. The current study uses ambient noise data to analyze the noise sources and their direction, and to estimate the subsurface velocity structure at the Marathon PGM-Cu project in Marathon, Ontario, Canada. An initial 3D velocity inversion model from a larger 90-geophone array accomplished at the site has resolved westward dip of the gabbro slab in the upper 1.5 km.

No 8

Title: *The interplay of sampling and accuracy in gravity surveys*

Authors: *Stefan Elieff*

Presented at: SEG 2018

Speaker: *Stefan Elieff, Sander Geophysics Ltd.*

Abstract:

When presented with a gravity data set for any area, two numbers are typically of interest: the resolution and the accuracy. The resolution is the spatial size of the smallest features visible in the data; the accuracy quantifies the reliability of the features in the data. It is well understood that to resolve features, an area must be sampled with a spacing that is small enough to see those features. It may be less obvious that sampling can play an important role in determining the accuracy of a survey, either through undersampling or oversampling. The different sampling patterns of ground or airborne gravity surveys affect the accuracy of the resultant grids.