



# Manitoba Mining & Minerals Convention



## Short Course

### Exploring for Volcanic Massive Sulphide Deposits

Geological understanding of volcanic massive sulphide (VMS) deposits continues to evolve with on-going seafloor studies complimented by research projects targeting well-preserved ancient deposits such as those occurring in the Paleoproterozoic Flin Flon Belt. Presentations by experts will provide an up-to-date synthesis of the geological setting of VMS deposits as well as innovative VMS exploration techniques that span regional to deposit-scale methods. The course draws on, but is not confined to, collaborative industry-university-government research projects carried out in the Flin Flon area over the past several years.

Thursday, November 15, 2007	
1:00 p.m.	<a href="#">Classification and Key Characteristics of VMS Deposits; Keys to Discovery</a> <a href="#">Jim Franklin</a> ( <i>Franklin Geosciences</i> )
1:40	<a href="#">Evolution of the Paleoproterozoic Flin Flon Belt and Lithotectonic Association of VMS Deposits</a> <a href="#">Ric Syme</a> ( <i>Manitoba Geological Survey</i> )
2:00	<a href="#">Lithogeochemical Methods for Identifying and Tracing VMS-Prospective Units in a High-Grade Meta-Igneous Terrane</a> <a href="#">Herman Zwanzig</a> ( <i>Manitoba Geological Survey</i> )
2:20	<a href="#">Recognizing VMS Hydrothermal Systems and Intrusions that Trigger Them</a> <a href="#">Alan Galley</a> ( <i>Geological Survey of Canada</i> ) and <a href="#">Jim Franklin</a> ( <i>Franklin Geosciences</i> )

3:00	<a href="#">The Role of Extension and Rifting in VMS Formation and Location: Criteria for Recognition</a> <a href="#">Harold Gibson</a> ( <i>Laurentian University</i> )
3:40	<a href="#">Submarine Mafic Lavas: How to Determine Vent Proximity and its Significance to VMS Exploration</a> <a href="#">Michelle DeWolfe</a> and <a href="#">Harold Gibson</a> ( <i>Laurentian University</i> )
4:00	<a href="#">What Do You Do When there is no Footwall – the Hangingwall Expression of VMS Systems</a> <a href="#">Doreen Ames</a> ( <i>Geological Survey of Canada</i> )
4:20	<a href="#">Geophysical Techniques used for VMS Exploration – Examples from the Flin Flon Belt</a> <a href="#">Alan Vowles</a> ( <i>HudBay Minerals Inc.</i> )
4:40	<a href="#">Going Deep – Seismic Exploration Techniques to Use in Mature VMS Mining Camps</a> <a href="#">Don White</a> ( <i>Geological Survey of Canada</i> )

## **Dr. Jim Franklin**

*Franklin Geosciences*



### **Classification and Key Characteristics of VMS Deposits; Keys to Discovery**

Jim Franklin is a consulting geologist with over 38 years of experience in the study of mineral deposits and regional metallogeny. He is a graduate of Carleton University (B.Sc., M.Sc) and the University of Western Ontario (Ph.D.). After teaching at Lakehead University (1969–1975) and consulting for Noranda Inc during that period, he joined the Geological Survey of Canada (GSC), where from 1975 to 1993 he directed major research programs on gold deposits in southern Churchill Province, volcanogenic massive sulfide deposits in Churchill and Superior provinces and coordinated the GSC's marine minerals program. As Chief Geoscientist of the GSC from 1993 until 1997, he was responsible for coordinating GSC's entire scientific program, as well as federal-provincial relations. Currently he is a director or science advisor of seven exploration companies, and sits on numerous boards for professional and scientific groups. His consulting work is focused on new discoveries of volcanogenic massive sulfide deposits, orogenic and porphyry-style gold in Precambrian terrains, magmatic nickel-copper sulfides and various types of uranium deposits. Jim Franklin has just retired as co-editor of CIM's Exploration and Mining Geology journal. He recently (2006) was awarded CIM's Selwyn Blaylock medal, and previously received its A.O. Dufresne and Julian Boldy Memorial awards. He also holds GAC's Duncan R Derry medal, and SEG's Thayer Lindsley and Distinguished Lecturer awards. He is a Fellow of the Royal Society of Canada, a registered professional geologist in the Province of Ontario, and an Adjunct Professor at Queen's, Laurentian and Ottawa Universities. He is a Past President of both the Geological Association of Canada and the Society of Economic Geologists. He has published over 125 papers and book chapters, and over 150 abstracts.



# Ric Syme

*Manitoba Geological Survey*

## **Evolution of the Paleoproterozoic Flin Flon Belt and Lithotectonic Association of VMS Deposits**



Ric Syme is Director of the Manitoba Geological Survey. He joined the Manitoba government in 1976, after graduating with a Master's degree in Geology from the University of Saskatchewan. Ric has prior industry experience as an exploration geologist, and while with government he has worked in the Lynn Lake and Flin Flon greenstone belts and was a contributor to the Shield Margin and Western Superior NATMAP and LITHOPROBE projects.



# Herman Zwanzig

*Manitoba Geological Survey*

## **Lithogeochemical Methods for Identifying and Tracing VMS-Pro prospective Units in a High-Grade Meta-Igneous Terrane**



Herman Zwanzig was born just outside Berlin but raised in London where he graduated in geology from the University of Western Ontario. He obtained his M.Sc. in 1969 at the University of Manitoba and his Ph.D. in 1973 from Queen's University, specializing in structural geology. His early work and studies took him across Canada from the Huronian to the Appalachians, Superior Province and Cordillera until he settled in Winnipeg in 1972 and worked with the Manitoba Geological Survey. Since then he has mapped and led projects in the greenstone belts and gneissic domains of the Paleoproterozoic Trans-Hudson Orogen.



## **Dr. Alan Galley**

*Geological Survey of Canada*

### **Recognizing VMS Hydrothermal Systems and Intrusions that Trigger Them**



Alan Galley has been with the Geological Survey of Canada since 1983. He has undertaken research on the metallogeny of Precambrian gold deposits and various aspects of the volcanic and hydrothermal environment for volcanogenic massive sulphide deposits of ages ranging from the modern seafloor through the Tertiary to the Precambrian. Alan has been involved in several cooperative geoscience programs including EXTECH 1, the CAMIRO VMS project and the first Flin Flon Targeted Geoscience Initiative. He formerly lead the Mineral Deposits and Applied Geophysics Subdivision and currently leads the Central Division of the Geological Survey of Canada.



# Harold Gibson

*Laurentian University*

## **The Role of Extension and Rifting in VMS Formation and Location: Criteria for Recognition**



## **Submarine Mafic Lavas: How to Determine Vent Proximity and its Significance to VMS Exploration (with Michelle DeWolfe)**

Harold Gibson is a Professor of Volcanology and Ore Deposits and Director of the Mineral Exploration Research Centre at Laurentian University. Since joining Laurentian University in 1990, after leaving a successful 12-year career in the mining exploration industry, Harold and his students have undertaken industry and NSERC supported research projects across Canada and in Brazil, Ecuador, Peru, Oman, Mexico and Turkey. His research is field based and includes: submarine eruption processes and their deposits, particularly water depth constraints on pyroclastic eruptions/deposits, volcanic subsidence structures and collapse mechanisms, volcanic and magmatic controls on the location and formation of volcanogenic massive sulphide deposits during the evolution of submarine volcanoes, rhyolite petrogenesis, and hydrothermal alteration, both ore-related and seawater induced. His current research areas include the Paleoproterozoic Flin Flon VMS district, Northern Manitoba and Saskatchewan, the Archean Abitibi Greenstone Belt of Ontario and Quebec, the Lau Basin and Tonga arc, and VMS deposits of the Late Devonian Jebilet and Guemassa terranes, Morocco.



# Michelle DeWolfe

*Laurentian University*

## **Submarine Mafic Lavas: How to Determine Vent Proximity and its Significance to VMS Exploration (with Harold Gibson)**



Michelle DeWolfe received her undergraduate degree in geology from St. Mary's University, Halifax, in 2001. In 2003 she received a master's degree in geology from Laurentian University, where she studied the morphology and emplacement of the North Rhyolite unit associated with the giant Kidd Creek volcanogenic massive sulfide deposit (copper, zinc, tin, silver). Currently in the fourth year of her doctorate at Laurentian, Michelle focuses her research on the volcanic reconstruction of mafic to intermediate flows and associated volcanoclastic units directly overlying the massive sulfide deposits (copper, zinc, gold) at Flin Flon, Manitoba.





## **Doreen Ames**

*Geological Survey of Canada*

### **What Do You Do When there is no Footwall – the Hangingwall Expression of VMS Systems**



Doreen is a research scientist who joined the Geological Survey of Canada in 1983. Her research focuses on impact processes, impact and volcanic stratigraphy, alteration geochemistry and mineralogy as pertains to the understanding of and exploration for base metal mineral deposits. Doreen has gained expert knowledge on mineralizing hydrothermal systems in volcanic and impact environments through her work on Sudbury, Chicxulub, Popigai, modern seafloor studies and Paleoproterozoic VMS deposits in Canada. She is continuing her research on base metal deposits through the TGI-3 program Deep Search and Circum-Kisseynew Flin Flon projects.



## **Alan K. Vowles**

*HudBay Minerals Inc.*



### **What Do You Do When there is no Footwall – the Hangingwall Expression of VMS Systems**

Alan Vowles received his formal training at Cambrian College where he received a Geological Engineering Tech. Diploma. In 2006, Alan was presented with a Geoscientist Merit Award by the Association of Professional Engineers and Geoscientists of Manitoba (APEGM) for his over 35 years of outstanding work, mainly with Hudson Bay Exploration and Development (HBED). For the past seven years, Alan has been a Project Geophysicist for HBED in Flin Flon, Manitoba, where he was directly responsible for a technological advancement which enables the surveying (borehole geophysics) of horizontal holes and ‘up’ holes from underground drill stations to depths in excess of 1000 metres. This new surveying technique has been adopted by Hudson Bay Mining and Smelting as well as Falconbridge and other mining companies. Under Alan’s leadership, the HBED Flin Flon Geophysical Department, has been directly responsible for several discoveries in northern Manitoba, including the Chisel North Mine and the recently discovered Lalor deposit.



## **Dr. Don White**

*Geological Survey of Canada*

### **Going Deep – Seismic Exploration Techniques to Use in Mature VMS Mining Camps**

Don White is a senior research scientist within the Geological Survey of Canada. His research has focused primarily on seismic imaging of the Earth's crust at various scales and depths as part of the Lithoprobe Project. Most recently, Dr. White has led high-resolution seismic studies for uranium exploration in the Athabasca Basin and kimberlite delineation in the Fort a la Corne kimberlite field.

