

Intensive Earth Sciences Modular Course

Exploration for Hydrothermal Ore Deposits:
Genesis and Exploration

GEOL 5607

APRIL 6
UNTIL
APRIL 13



LaurentianUniversity
Université **Laurentienne**

HARQUAIL School of Earth Sciences
École des sciences de la Terre

hes.laurentian.ca

MERC

Mineral Exploration Research Centre
at the HARQUAIL School of Earth Sciences

merc.laurentian.ca

SCHEDULE OF EVENTS

► **TUESDAY, APRIL 6**

8:30 am - 9 am

Course introduction and assignments /
Dr. Harold Gibson, HSES

Greenstone Gold I

9:00 am - 10:30 am

Comparison of the tectonic setting and timing of world class gold deposits within the Superior Craton / *Dr. John Ayer, MERC, HSES*

10:30 am - 11:50 am

Orogenic gold deposits: Part A: Fault-valve model, high-pressured fluids and swarm seismicity / *Dr. Bruno Lafrance, HSES*

11:50 am - 1:00 pm

Part B: Structural analysis and geometrical and kinematic controls on vein formation / *Dr. Bruno Lafrance, HSES*

► **WEDNESDAY, APRIL 7**

Greenstone Gold II

8:30 am - 10:30 am

Formation of orogenic gold deposits: insights from investigations into the sources of metals and fluids / *Dr. Iain Pitcairn, Stockholm University*

10:30 am - 12:30 pm How gold becomes coarse: discussing high-grade ore zones in Archean Au deposits / *Evan Hastie, Ontario Geological Survey/HSES*

► **THURSDAY, APRIL 8** **Epithermal**

8:30 am - 12:30 pm

Introduction to epithermal deposits, their characteristics and variations, and transition to the tops of porphyry deposits / *Dr. Jeffrey Hedenquist, Consultant, U. Ottawa*

1:30 pm - 2:30 pm

The McLaughlin low sulfidation Au-Hg deposit; relationship to active hydrothermal systems in the California Coast Ranges / *Dr. Ross Sherlock, MERC and Metal Earth Director, HSES*

► **FRIDAY, APRIL 9** **Sedex**

8:30 am - 10:30 am

The Irish Zn-Pb Orefield / *Dr. Murray Hitzman, Director iCRAG, University College, Dublin*

10:30 am - 12:30 pm

The Central African Copper Belt sedimentary rock-hosted copper deposits / *Dr. Murray Hitzman, iCRAG, University College, Dublin*

► **SATURDAY, APRIL 10** **VMS Deposits**

8:30 am - 12:30 pm

The tops and bottoms of VMS deposits / *Dr. Harold Gibson, HSES*

► **SUNDAY, APRIL 11** **Porphyry (Cu, Mo, Au) Deposits**

8:30 am - 12:30 pm

Genesis and geochemistry of porphyry deposits / *Dr. Pete Hollings, NOHFC Chair in Mineral Exploration, Lakehead University*

1:30 am - 2:30 pm

The Woodjam Au-Cu porphyry district, Quesnellia British Columbia; porphyry exploration in covered terranes / *Dr. Ross Sherlock, MERC and Metal Earth Director, HSES*

► **MONDAY, APRIL 12** **IOCG Deposits**

9:30 am - 1:30 pm

Geology and exploration for IOCG deposits / *Dr. Hamid Mumin, Brandon University*

► **TUESDAY, APRIL 13** **Au-rich VMS**

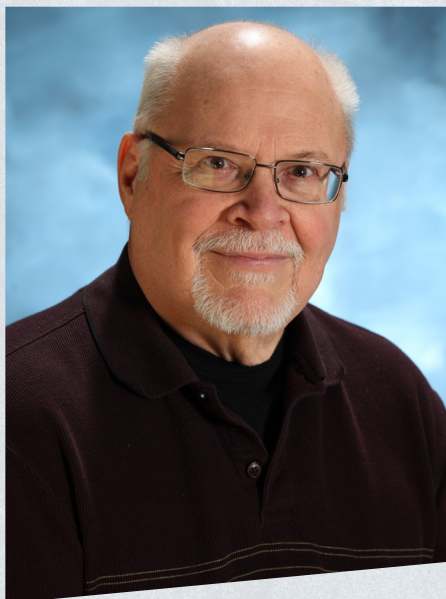
8:30 am - 10:30 pm

Gold-rich VMS deposits / *Dr. Harold Gibson, HSES*

10:30 am - 1:30 pm

Effective exploration targeting criteria and ranking criteria / *Dr. Ross Sherlock, MERC and Metal Earth Director, HSES*

> John Ayer



► John Ayer 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 on the Abitibi and coordinator of the Greenstone Architecture project at Laurentian University (LU) under the Discover Abitibi Initiative.

He supervised graduate students and post doctoral fellows as an Adjunct Professor at UO and LU and is currently the Associate Director of the Mineral Exploration Research Centre at LU.

His academic interests include geochronology, stratigraphy, lithogeochemistry and geodynamics with a focus on the controls of metal deposition in Archean Terranes.

> Bruno Lafrance



► Dr. Bruno Lafrance is a professor at Laurentian University's Harquail School of Earth Sciences and the Mineral Exploration Research Centre, where he serves as Associate Director of the Metal Earth project.

Bruno is a structural geologist who specializes on the applications of structural geology to the study of ore deposits.

His research focuses on the primary structural controls on the formation of ore deposits and their subsequent modification during orogenic events.

Although most of his research has been on gold and volcanogenic massive sulfide deposits, Dr. Lafrance also researched the structural controls on the formation and modification of Ni-Cu-PGE deposits in Sudbury, Ontario. Dr. Lafrance holds a PhD in Geology from the University of New Brunswick and a BSc in Geology from the Université de Montréal.

> Iain Pitcairn



► Iain Pitcairn is a geologist from Scotland who has spent much of his research career investigating the sources of metals, particularly gold, in hydrothermal mineral deposits.

One of his main contributions was development of a method for ultra-low detection limit analyses of gold that he applied to quantify mobility of gold during processes such as metamorphism, hydrothermal alteration of the oceanic crust and in the alteration halos proximal to gold deposits.

He is based in the Department of Geological Sciences at Stockholm University, Sweden, where he has been resident as Senior Lecturer in Ore Geology for the last 15 years, and Head of the Department since 2018.

> Evan Hastie



► Evan Hastie is a professional geoscientist who specializes in Precambrian ore deposits with an emphasis on Au-forming processes. He is currently a Precambrian Geoscientist with the Ontario Geological Survey, Canada, researching and mapping in Precambrian terranes across Ontario.

Evan received his MSc degree from the University of Windsor (2014) and is completing his PhD at Laurentian University, Sudbury, Ontario.

He has a strong background in mineralogy, geochemistry, structural geology and Au deposit research, and applies a wide variety of specialties in an integrated approach that begins with an emphasis on field mapping followed by detailed analytical methods.

> Jeffrey Hedenquist



► Jeffrey Hedenquist conducted research with DSIR–Chemistry Division in New Zealand and the Geological Survey of Japan for 10 years each on geothermal energy development and volcanic discharges, respectively, as well as the formation of epithermal gold and porphyry copper deposits.

Since 1999 he has been an independent advisor to the mineral industry and several governmental agencies, providing assessments of hydrothermal gold and copper projects in over 40 countries, and training related to mineral exploration.

Presently he is also adjunct professor at the University of Ottawa. He received a PhD in geology at the University of Auckland, New Zealand.

> Ross Sherlock



► Ross Sherlock joined Laurentian University's Harquail School of Earth Sciences in 2017 as Chair in Exploration Targeting and Director of the Mineral Exploration Research Centre (MERC).

He is a professional geologist with more than 28 years of experience in the mining industry and academic research. Ross has worked around the world with junior and senior mining companies, both in consulting and government surveys.

Previous to his roles with Laurentian University, Ross was Vice President, Geoscience at Kinross Gold Corp. and Exploration Manager, North America at Gold Fields. Ross completed a Postdoctoral Fellowship at the Mineral Deposits Research Unit at UBC, PhD at the University of Waterloo, MSc at Lakehead University, and BSc (Honours) at McMaster University, Canada. He is a member of the Professional Engineers and Geoscientists of BC and Association of Professional Geoscientists of Ontario (APGO). He is a SEG Fellow and its 2020-21 International Exchange Lecturer.

> Murray Hitzman



► Murray Hitzman holds an SFI Professorship in the School of Earth Sciences at University College Dublin and is also the Director of the Irish Centre for Research in Applied Geosciences (iCRAG).

He served as Associate Director for Energy and Minerals at the U.S. Geological Survey (2016-17) and was the Charles Fogarty Professor of Economic Geology at Colorado School of Mines from 1996-2016 where a primary research focus was the geology of the Central African Copperbelt (Democratic Republic of Congo and Zambia).

He worked in the petroleum and minerals industries from 1976 to 1993 primarily conducting mineral exploration worldwide and was largely responsible for Chevron Corporation's Lisheen Zn-Pb-Ag deposit discovery in Ireland (1990).

Hitzman has B.A. degrees in geology and anthropology from Dartmouth College (1976), an M.S. in geology from University of Washington (1978), and a PhD in geology from Stanford University (1983). He has served on the boards of a number of mineral exploration and mining companies and currently serves as technical advisor for the private company KoBold, focused on utilizing machine learning for cobalt exploration.

> Harold Gibson



► Harold Gibson is a Professor of Volcanology and Ore Deposits at Laurentian University's Harquail School of Earth Sciences.

He is past Director of the Mineral Exploration Research Centre (MERC), and is the Founding Director of the \$104M, Metal Earth Research program, which is Canada's largest mineral exploration research initiative. Harold joined Laurentian University in 1990, after leaving a successful 12-year career in the mining exploration industry.

His research is field based, focuses on volcanogenic massive sulfide ore systems, and over the past 40 years he has developed extensive expertise in the volcanology and setting of VMS deposits globally, as well as those on the modern seafloor. Harold is a recipient of the Duncan R. Derry Medal and William Harvey Gross Award from the Mineral Deposits Division of the Geological Association of Canada, the Julian Boldy Award (2) and Barlow Medal from the Canadian Institute of Mining and Metallurgy, the Lang Lecture Award from the Geological Survey of Canada, and the Research Excellence Award from Laurentian University.

> Pete Hollings



► Dr. Hollings completed his PhD at the University of Saskatchewan in 1998 where he investigated the geochemistry of the 2.7-3.0 Ga Uchi Subprovince from Red Lake to Pickle Lake.

During a two-year NSERC funded post-doctoral fellowship at CODES Dr. Hollings participated in a multi-disciplinary research project investigating the genesis of giant copper-porphyry deposits in Chile.

As a faculty member at Lakehead University since 2001, Dr. Hollings is continuing his research into the relationship between igneous petrogenesis and mineralisation in a variety of deposit types including porphyry, orogenic gold and Ni-Cu-PGE.

He has published more than 100 peer-reviewed papers on these topics. Hollings is currently the NOHFC IRC Chair in Mineral Exploration and Director of the Centre of Excellence for Sustainable Mining and Exploration at Lakehead University.

> Hamid Mumin



► Dr. Hamid Mumin received his Bachelor and Master's degrees in Applied Science and Engineering from the University of Toronto, specializing in Mineral Exploration and the Geology of Ore Deposits.

He completed his PhD (1994) and Post-Doctoral Fellowship at Western University in Economic Geology. He has worked on successful exploration and development projects in Canada and overseas since 1981. Hamid has been a Professor of Economic Geology at Brandon University since 1995. His research has investigated the geology of IOCG (iron oxide copper-gold), gold, VMS, carbonatite and epithermal deposit types, with a particular interest in the application to mineral exploration. He is a past CIM Distinguished Lecturer and a past-president of Geoscientists Canada.

Hamid is Chair of the Department of Geology, and a member of the Manitoba Liaison Committee on Mining and Exploration. He works with industry, government and his students on various exploration and development projects across Canada.



LaurentianUniversity
Canada's Mining University

Enrol today!

For additional modular course information, registration information, course fees, and our updated schedule, visit hes.laurentian.ca/modular-courses. Upon registration, full program agenda, and course requirements will be provided.

For more information on how to apply for the Applied MSc in Mineral Exploration, visit our website: hes.laurentian.ca/graduate-programs.



935 Ramsey Lake Road, Sudbury ON Canada P3E 2C6 | 1-800-461-4030



LaurentianUniversity
Université **Laurentienne**

HARQUAIL School of Earth Sciences
Ecole des sciences de la Terre

hes.laurentian.ca

MERC

Mineral Exploration Research Centre
at the HARQUAIL School of Earth Sciences

merc.laurentian.ca