

GL9701A Modular Course (0.5 Credit)
Mineral Systems and Ore Deposit Exploration Strategy

Instructors: Peter Lightfoot and Robert Linnen

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Schedule

Lectures & Practical Assignments: 9 days, 8 hrs per day (including lunch and breaks),
December 9-17, 2017

Course Description

This course is offered in a modular format to accommodate the schedule of Peter Lightfoot, Richard W. Hutchinson Visiting Industrial Professor, and allow the participation geologists from industry and other universities. It explores the relationship between ore deposits, the host rocks, and the regional tectonomagmatic setting. The concept of a “mineral system” shows how the ore deposits relate to their host rocks, and this in turn informs exploration models and strategy that cover diverse geological settings.

A central theme developed in the lectures and practical labs is to understand and select geoscience information and approach that bet informs exploration decisions. From this perspective, the business cycle is introduced, and the applied requirement to achieve business success in a cradle to grave mine operation is provided in an intensive, nine-day short course. The course is designed for graduate students as well as geologists from industry. Participants from industry will not receive university credits, but can use the hours for continuing professional development (CPD) credits for APGO.

The course is divided into 9 modules over 9 days. The first module is a review of the use of ioGAS, with applications to exploration, given by Peter Lightfoot. The next four modules are also given by Lightfoot who will have a strong focus nickel, particularly on the global giants at Sudbury and Noril'sk. Additional examples of magmatic Ni-Cu-PGE sulfide ore deposits are illustrated ideas are expanded to other ore deposit types like iron oxide copper gold and iron oxide nickel deposits. The second group of modules will be taught by Linnen and examines gold and critical element deposits in the Mineral Systems perspective. Module topics may include, but are not limited to, global exploration and mining industry (project pipeline, global metals supply, exploration toolkit, discovery process). The mineral system concept will include case studies of ore genesis process models. The practical portions of the course will focus on recognising important features in hand specimens and through: Hand samples from the main deposits; Polished thin sections from critical samples, and; Petrological descriptions will aim to address specific genetic and process technology issues.

Each module is completed in a day and consists of a combination of lectures (typically 2-4 hrs/day) and practical assignments (typically 4-5 hrs/day), to be completed by the end of the

module. **All participants must bring their own laptop computer. The ioGAS program will be provided to students during the course, if professionals do not have the program a trial version can be downloaded from the ioGAS website (please wait until the course before downloading as the trial version can only be run for a limited number of days).**

Learning Outcomes

After successful completion of this course students will:

- Be familiar with the mineral system concept and how this concept is applied to mineral exploration
- Interpret different rock and mineral associations in terms of their importance to a mineral system
- Have an appreciation of geometallurgy and the importance of mineralogy to the economic viability of an ore deposit
- Use geochemical data to address a variety of problems in ore genesis, exploration and geometallurgy

Prerequisites:

Participants should have taken an undergraduate ore deposits course and be familiar with both transmitted light and reflected light microscopy. **Note, only one laboratory session will be offered thus there will be an enrolment cap on the course so students are encouraged to sign up early.**

Detailed Schedule

Module 1, December: 9, 2017 (PL) Lecture and Practical: Introduction to ioGAS in mineral exploration.

Module 2, December 10, 2017(PL) Lecture: Introduction to Exploration and mineral industry global driving forces. The exploration project pipeline as a critical element of mine development and business success. The global metals context – state of supply-demand. The exploration tool kit: geology, geophysics, geochemistry, geometallurgy. How discoveries are made and advanced: case study of Voisey’s Bay showing how the exploration tool kit evolved as the knowledge of the deposit grew. Practical: lab on Voisey’s Bay.

Module 3, December 11, 2017(PL) Lecture: Introduction to “mineral systems” and why they matter. This module examines how ore deposits are understood in the context of the country rocks: Linkages between geology and ore deposits. General geological introduction, context and importance of mineral system approach to exploration: Noril’sk-Talnakh and its linkages to Siberian Trap. Practical: lab on the Noril’sk-Talnakh Deposits.

Module 4, December 12, 2017(PL) Lecture: Regional and local structural controls on magmatic sulfide ore deposits. Case Studies of ore genesis with practical laboratory sessions designed to investigate specific geological, petrological, geophysical, and geochemical data sets. Practical: lab on the Chinese nickel systems and structural controls.

Module 5, December 13, 2017(PL) Lecture: Overview and synthesis of the application of concepts in practical business of exploration and project development decision process. A case study of different types of Sudbury ore deposits is provided. Practical: The Sudbury deposits

Module 6, December 14, 2017 (RL) Lecture: Critical metals in orogenic environments. Setting of lithium and tantalum deposits in orogenic environments and exploration strategies. Practical: Tanco and other lithium and rare metal pegmatites

Module 7, December 15, 2017 (RL) Lecture: Critical metals in rift/hot spot environments. Setting of REE deposits. Deposits associated with peralkaline intrusions, silica-saturated syenites and carbonatites. Practical: Nechalacho and other REE deposits.

Module 8, December 16, 2017 (Dr. Peter Thompson, consultant geologist and Dr. Marc Bardoux, Barrick Gold) Lecture: Mineral systems applied to orogenic gold systems. Part 1. The tectonic settings of orogenic gold deposits will be examined with an emphasis on the structural and metamorphic controls on mineralization and exploration strategy. Practical: Structural-metamorphic settings of gold deposits

Module 9, December 17, 2017 (RL) Lecture: Mineral systems applied to orogenic gold systems. Part 2. The relationships between orogenic gold deposits and different series of magmatic rocks will be examined. Practical: Mineralization and alteration of orogenic gold systems as a function of host lithology.

Marking

The first module is not mandatory but is highly recommended. No marks will be assigned to Module 1. Students will attend all the remaining eight modules. A maximum of one of the modules can be missed if a valid reason is given and the rest of the module mark will be pro-rated. Valid reasons for missing a module include medical, compassionate, religious holidays, personal (family or work) obligations or an exam conflict. The instructor and student will agree upon what is valid, but in the case where there is no consensus advice from the Dean's office will be sought.

Modules: **Modules 2 to 9 are graded, each being worth 12.5%.** Assignments for each module will build on the lecture material to address problems in ore genesis, geometallurgy and exploration through the examination of rocks and their context in mineral system, polished thin section and geochemical data. The practical laboratory/assignment will be completed by all individuals and must be submitted at the start of the next module. Grades for most modules will be returned during the course.

General Information

University of Western Ontario policies are listed at http://www.uwo.ca/univsec/academic_policies/. Scholastic offences are taken seriously and graduate students are directed to read the policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found here: https://studentservices.uwo.ca/secure/medical_document.pdf

Industry participation:

This course will be open to participation by registered individuals from the mining and exploration sector. The course will be advertised in venues such as APGO Fieldnotes. Company staff can attend the nine-day short course (or send a different representative on each of the days) at a cost of \$2000 per registration. Participants from the private sector will be responsible for their own travel and accommodation arrangements.

Accessibility Statement

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x.82147 for any specific question regarding an accommodation. Students are not required to sit for more than one hour at a time. For additional information please see www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_disabilities.pdf

Room Location Rm 1065 Biological and Geological Sciences Building, Western University

The Lecture portions of modules will run 9:00 am to 12:00 pm, and will include a break and the Practical session will run 1:00 pm to 5:00 pm (participants can take a break at any time during this session).