GL 9552 Advanced Mineral Deposit Geochemistry
(combined with ES4432A)
Course Outline - Winter 2018

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Schedule

Lectures: 3 hrs per week: Wednesday 9:30-11:30 & Friday 9:30-10:30 KB-K103

Tutorial: 1 hr per week: Friday 8:30-9:30 B&GS 1053

Seminar: 2 hrs per week, Thurs 13:30-15:30 B&GS 1084

Course Description
The principles of metal concentration and deposition in magmatic and hydrothermal environments are examined. Natural and experimental data, including fluid inclusion, stable isotope, metal solubility, mineral stability and metal partition behaviour are used to develop genetic models for ore deposits, which form the basis of mineral exploration strategies.

WHAT ARE THE PRINCIPAL OBJECTIVES OF THIS COURSE?
The portion of the course given in conjunction with ES 4432 focusses on ore deposit models, which are the foundation on which mineral exploration and exploitation are based on. The geochemical tools that are used to study mineral deposits are developed and interpret how deposits form. A variety of ore-forming processes are examined by using a variety of mineral deposit types from igneous, metamorphic and sedimentary environments. The seminars build on this material and a deeper understanding of selected topics is gained through critical evaluation of journal articles.

WHY STUDY MINERAL DEPOSITS?
Mining is one of Canada's most important industries and mineral exploration and exploitation is one of the largest sectors that employs geologists, geological engineers and other Earth scientists and engineers. There is also an environmental cost to mining and in order to understand the environmental impact of mining a solid understanding of mineral deposits is required.

There is no formal text. **Notes from ES 4432 will be posted on the 9552 OWL website**. There are several useful mineral deposits textbooks in the library. These include:

Moon, C.J., Whateley, M.K.G. and Evans, A.M., 2006, Introduction to mineral exploration.
Robb, L.J., 2005, Introduction to ore-forming processes
The USGS also has a number of mineral deposit models on their website
http://minerals.usgs.gov/products/depmod.html

Marking
Most graduate students will attend the same lectures as the undergraduate students and complete all assignments. In addition, recent journal articles will be assigned each week and these papers will be discussed in a seminar held only for the graduate students. For graduate students who have already taken ES 4432, they will not be required to attend the lectures, complete the assignments or mid term for this course. In this case the course marks will be 50% seminar (of which 75% is for presentations and 25% participation, see below) and 50% final oral exam.

The **mid term** will be the same as the undergraduate course on February 14.
The **final exam** will be given separately as a 30 minute **oral exam**, questions for the oral exam will cover both the lecture material (undergraduate lectures) as well as the papers from the seminars.

The **seminar mark**, is determined as follows: All students must read all papers but each week a different student will present an assigned paper to the class and distribute a handout. Weekly seminar marks will be based on the presentations (75%) and participation in the discussion (25%). Note that students are responsible all of the material in papers from the seminars.

Mid Term (joint with 4432)	25%
Assignments (joint with 4432)	5%
Seminars	30%
Final Oral Exam	40%

For students who have already taken GL 4432 for credit the marking scheme is 50% Seminars and 50% Final Oral Exam

Seminar Schedule: There are 10 seminars, which will be on the follow dates: January 18, February 1, 8, 15, March 1, 8, 15, 22, 29, April 5. Papers will be assigned a week before each seminar

Final Oral Exam Schedule: The final exam will be on April 19th in the seminar time slot.

SYLLABUS
Lecture Material Joint with ES4432

1) Introduction
   - background on the mineral exploration industry
   - introduction on why are models in economic geology are important
2) Stable Isotopes
   - nomenclature, fractionation, thermodynamics
   - O and H isotopic compositions of natural waters
   - fluid-rock interactions
   - C and S isotopes
3) Geothermometry
   - estimation of lithostatic pressure
   - use of phase equilibria
   - thermodynamics of mineral exchange reactions
   - isotope geothermometry
4) Diamonds
   - igneous background
   - kimberlites
   - indicator minerals
   - geothermometry and geobarometry of kimberlites and diamonds
5) Magmatic Sulfide Cu-Ni Deposits
   - review of deposit types
   - constraints from experimental petrology
   - sulfide-silicate melt partitioning
   - depositional model
6) Platinum Group Element (PGE) and Chromium Deposits
   - review of the Bushveld and Stillwater complexes
   - constraints from phase equilibria
   - sulfur solubility in silicate melts
   - comparison of the origin of PGE and Ni deposits
7) Fluid Inclusions
   - origin and classification of fluid inclusions
   - interpretation of fluid inclusion data
   - H_2O-NaCl and H_2O-CO_2 systems
8) Porphyry Deposits
   - review of deposit types
   - geochemistry of alteration and mineralization
   - fluid-melt partitioning and metal solubility in porphyry systems
   - similarities and differences of porphyry Cu and Mo deposits

- granite series, porphyry Mo & porphyry Sn deposits

9) Rare Metal Deposits
   - controls of metal solubility in granitic melts
   - tin, tantalum and lithium deposits
   - REE-Nb deposits
10) Solubility and Mineral Deposition
   - controls on metal and gangue mineral solubility
   - causes of mineral deposition
11) Epithermal Gold Deposits
   - classification of gold deposits
   - behaviour of sulphur
12) Orogenic Gold Deposits
   - structural and metamorphic setting
   - fluid inclusion and stable isotopes
   - transport and deposition of gold
13) Volcanogenic Massive Sulfide (VMS) Deposits
   - environments of modern seafloor mineralizing systems
   - hydrothermal alteration in VMS systems
   - chemical reactions of Cu-Pb-Zn deposition

General Information

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

Accommodation for Illness
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http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

Mental Wellbeing
Students who are in emotional/mental distress should refer to Mental Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.

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