

APPLIED GEOCHEMISTRY SEMINAR

186-590

Time: Mondays; 5:30-8:30PM in FDA-232

Professors: Drs. A. Mucci and A. Williams-Jones

Seminar course devoted to a combination of theoretical/experimental investigations and field-based case studies that illustrate the applications of geochemical principles to solving geologic problems. Classes will involve critically evaluating papers in geochemistry published in international refereed journals. Each student will also prepare and lead part of a class or classes devoted to a geochemical subject of their own choosing. Students will prepare and participate in several team debates on topics chosen by the instructors and the class.

POTENTIAL SEMINAR TOPICS AND SUBTOPICS

(Students will also have the opportunity to propose topics and subtopics not listed below)

Principles of Geochemistry

Main Topics

*Speciation

Subtopics

- Speciation
- Hydration/hydrolysis
- Complexation
- Acid-base reactions (pH scales and measurements)
- Redox reactions

*Equilibrium conditions

- Mineral solubility
- Phase equilibria (stability relationships)
- Buffered/unbuffered systems
- Irreversible thermodynamics
- Isotope systematics
- Fluid inclusions
- Ostwald ripening
- Adsorption

*Reaction kinetics

- Steady state concept
- Early diagenesis/sedimentary geochemistry
- Weathering and composition of natural waters
- Acid mine drainage/remediation
- Metal deposits
- Colloids

*Experimental measurements of thermodynamic properties

Environmental geochemistry

- *Global change/climate change
 - Volcanic eruptions
 - El Nino and La Nina/Southern Oscillation
 - Carbon capture and sequestration
- *Oceanography & limnology
 - Ocean acidification, biogeochemical processes, scavenging (particle reactive elements), colloids (formation, coagulation, reactivity), diagenesis
- *Pedology
 - Weathering, development of soil profiles
- *Atmospheric chemistry
 - Contaminant partitioning in rain drops
 - The ozone hole
 - Acid rain
- *Elemental geochemical cycles
 - Biogeochemical processes
- *Energy sources and waste
 - Greenhouse gases
 - Geothermal energy
 - Nuclear waste disposal/mobility of radioisotopes
- *Groundwater pollution
 - Groundwater flow and contaminant transport
 - Wastewater treatment

Ore geochemistry

- *Mechanisms of ore formation
 - Hydrothermal processes
ore fluids, metal transport, hydrothermal alteration, metallic mineral deposition, boiling, dilution, mixing, colloidal transport/deposition
 - Magmatic processes
partial melting, ore metal solubility, fractional crystallisation, sulphur solubility, liquid immiscibility, metal partitioning between silicate and other magmas (sulphide, fluoride, oxide, carbonate)
 - Sedimentary/diagenetic processes
Redox tracers, trace metal accumulation, adsorption of metals by clays, bacteria and organic matter, metal mobilisation at the oil/water interface
- *Exploration geochemistry
 - Soils
 - Stream and lake sediments
 - litho geochemistry
 - Biogeochemistry

Each student is expected to give one or two seminars during the semester as well as participate in two to three team debates. Topics for individual presentations are to be chosen by the student and approved by one of the professors. Appropriate publications will be identified/selected with the aid of the professors. The student will supply the rest of the class with a copy of the selected paper a week prior to the presentation as well as a short abstract and useful figures/tables at the time of the presentation. Topics of debate will be chosen by consensus in class based on input from the instructors.

Method of evaluation:

Seminar(s) preparation and presentation	35
Debate(s) preparation and presentation	35
Participation	30

Course material are available at: <http://eps.mcgill.ca/~courses/c590/>