GL 9508 Analytical Geochemistry
Course Outline - Winter 2018

Instructor: **Robert Linnen**

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Schedule

Lectures: 1 hr per week, Monday 14:30-15:30 Room 1084

Seminar: 2 hrs per week, Wednesday 14:30-16:30 Room 1084

See the schedule below. There are no lectures or seminars the weeks of January 22, February 20 and March 6 owing to Roundup, Reading week and PDAC, respectively.

Lecture Date	Seminar Date
January 8 XRF	January 10 lab tour
January 15 ICP	January 17 XRF seminar
January 22 no class - Roundup	January 24 no seminar - Roundup
January 29 LA-ICP-MS	January 31 ICP seminar
February 5 LIBS	February 7 LA-ICP-MS seminar
February 12 SEM	February 14 LIBS seminar
February 19 no class Reading Week	February 21 no seminar Reading Week
February 26 QEMSCAN-MLA	February 28 SEM seminar
March 5 no class - PDAC	March 7 no seminar - PDAC
March 12 EMPA	March 14 QEMSCAN-MLA seminar
March 19 CL	March 21 EMPA seminar
March 26 IR	March 28 CL seminar
April 2 Raman	April 4 IR seminar
April 9 no class	April 11 Raman seminar
	April 18 Term paper presentations

Course Description

A variety of techniques are used to analyze wholerock (bulk techniques) including X-ray Fluorescence (XRF), Induced Coupled Plasma-Mass Spectrometry and Atomic Emission Spectroscopy (ICP-MS and ICP-AES). Different techniques are used to obtain point chemical

analyses of minerals such as Laser Ablation ICP-MS (LA-ICP-MS), Laser Induced Breakdown Spectroscopy (LIBS) Scanning Electron Microscopy-Energy Dispersive System (SEM-EDS), Quantitative Evaluation of Minerals by SEM (QEMSCAN), Mineral Liberation Analysis (MLA), Electron Microprobe Analysis (EMPA), Cathodoluminescence (CL), Infrared Spectroscopy (IR) and Raman Spectroscopy. The basic theory and practice for these techniques will be introduced and interpretation of data emphasized.

WHAT ARE THE PRINCIPAL OBJECTIVES OF THIS COURSE?

The interpretation of geochemical data requires an understanding of the theory behind the analysis, the strengths, limitations and errors of the technique and how geochemical data can be applied to testing geological hypotheses. This course introduces a number of analytical techniques that are applied to determining the compositions of rocks and minerals, which are then applied to geological problems.

There is no formal text. **The PowerPoint presentations will be posted on the 9508 OWL website**.

Course Structure

The instructor will present a one-hour lecture per week on an analytical technique. The seminar will consist of students selecting journal papers that show applications of the technique from the preceding lecture and problem solving with that technique, and presenting them to the class. Each student will also write a term paper on an analytical technique not covered in the lecture material and explain the theory and applications of the technique.

Marking

Seminar	40%
Term Paper Oral Presentation	20%
Term Paper	40%

Seminar: One or more students will present a seminar on a journal paper each week. Students will be assigned topics at the beginning of the term. They will select a paper (or papers) that show the application of the analytical technique in question to research in Earth Sciences. A pdf of the paper will be sent to everyone in the class prior to the seminar. Critical evaluation of the paper by the entire class is expected. The seminar mark will consist of 75% is for presentations and 25% participation in the seminars of others.

Term Paper: Each student will select an analytical technique that is not covered in the course. The theory behind the analytical technique should be explained, as well as examples of applications. *The choice of the technique should be emailed to the instructor, rlinnen@uwo.ca by* ***February 1st.*** Note that a specific technique can only be presented by one person, so the first person to contact the instructor will have that topic. One specific application should be covered in more detail. The paper should also include a discussion of advantages-disadvantages, limitations, errors, analytical costs. A brief comparison of at least one other analytical technique that will produce similar results should be included, as well as a discussion as to why the

technique that is the focus of the paper is more appropriate for the application being proposed. This is to be written as a journal paper. Follow the format of the journal Geochimica et Cosmochimica Acta.

Term Paper Oral Presentation: Each student will make a 20 minute oral (PowerPoint) presentation to the class + 5 minutes for questions on ***April 18th.***

Attendance: Students must participate in all seminars. A maximum of one seminar can be missed if a valid reason is given and the rest of the seminar mark will be pro-rated. Valid reasons for missing a seminar include medical, compassionate, religious holidays, personal (family or work) obligations. 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.

Course Topics

Bulk (wholerock) chemical techniques

1) X-Ray Fluorescence (XRF)
2) Induced Coupled Plasma-Mass Spectrometry (ICP-MS), Induced Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES)
3) Laser Induced Breakdown Spectroscopy (LIBS)

Point Analysis (minerals)

4) Scanning Electron Microscopy-Energy Dispersive System (SEM-EDS)
5) Quantitative Evaluation of Minerals by SEM (QEMSCAN), Mineral Liberation Analysis (MLA)
6) Electron Microprobe Analysis (EMPA)
7) Cathodoluminescence (CL)
8) Laser Ablation ICP-MS (LA-ICP-MS)
9) Infrared Spectroscopy (IR)
10) Raman Spectroscopy

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

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: 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