

ERTH 3003 - Geochemistry and Isotope Geochemistry - Fall 2019

This course looks at geochemical processes from deep Earth to surface environments, and the use of isotopic variations to define geochronological frameworks and geochemical pathways, in order to better understand the Earth's history.

Prerequisites: EARTH 2102 (mineralogy to petrology), 2104 (igneous systems, geochemistry and processes) and 2105 (geodynamics).

Lectures: three hours a week (Monday 14:35-17:25) in 3120 HP.

Labs: ~ 2 hours a week (Thursday 16:35-18:25) in 3120 HP.

*Please, note that the first lab will take place on **Sept. 12th***

Instructor: Hanika Rizo (office hours by appointment or if my door is open).

Office HP 2221

Telephone ext. 3894

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TA's: TBA

Course objectives: The main objective of this course is to understand how the principles of chemistry are used in order to study different processes in Earth Sciences. At the end of the course, each successful student should be able to: 1) understand how different chemical elements behave and are distributed in multiple geological environments, 2) have insight into the Earth's chemical differentiation into core, mantle, crust, as well as the origin its oceans and atmosphere, 3) be familiar with several geochronological techniques and their applications, 4) understand elemental and isotopic fractionation, 5) understand element behaviour during igneous processes, alteration of rocks, and its impact on the composition of the rivers and oceans.

Course topics and plan (might change during the semester):

Week	Lecture and lab
Sept. 9-13	Intro to geochemistry, properties of elements, the periodic table
Sept. 16-20	Nucleosynthesis, origin of the elements, planetary accretion
Sept. 23-27	Geochemical reservoirs. Earth's differentiation (composition of core, mantle, crust, hydrosphere).
Sept. 30-Oct. 4	Trace elements (igneous processes, mixing, weathering)
Oct. 7-11	Major elements (igneous processes, mixing, weathering)
Oct. 14-18	No lecture on Oct. 14 th (Holiday, University closed). Mid-term exam during the lab period on Oct. 17th
Oct. 21-25	<i>Fall Break, no classes</i>
Oct. 28-Nov. 1	Low temperature geochemistry
Nov. 4-8	Introduction to geochronology I

Nov. 11-15	Introduction to geochronology I
Nov. 18-22	Stable isotope geochemistry
Nov. 25-29	Geochemistry project
Dec. 2-6	Geochemistry project. Deadline Dec. 5 th .

Evaluation: Midterm Exam	30%, Friday, October 17 th
Final Exam	30% (not cumulative; December exam period)
Problem sets	25%
Geochem. Project	15%

Course requirements:

- You are expected to attend all lectures and labs.
- Arriving late to class distracts students, the professor and the teaching assistants.
- **Cell phones MUST be turned off during lectures.**
- Recording (audio and/or video) of lectures or labs is forbidden unless requested by the Paul Menton Centre.
- A written medical note must be submitted if you cannot meet a deadline for an assignment or miss an exam due to illness. Please note that in this course, on all occasions that call for a medical certificate you must use (or furnish the information requested in) the form found at: http://carleton.ca/registrar/wp-content/uploads/med_cert.pdf. Note also the contents of the 'deferral page' link.
- You will have one week to complete lab assignments. Failing to hand in a lab or assignment by the deadline will result in a mark of zero on the specific lab/assignment.

Useful resources:

Books

- Faure, G., 1998. *Principles and Applications of Geochemistry: a comprehensive textbook for geology students*. Prentice-Hall.
- White, W.M., 2013. *Geochemistry*. John Wiley & Sons, Inc. (Also available as an e-book).
- Albarède, F., 2013. *Geochemistry; An Introduction*. Cambridge University Press. (Also available as an e-book).
- Dickin, A.P., 2005. *Radiogenic Isotope Geology*. Cambridge University Press. There is an online version of his radiogenic isotope textbook here: <http://www.onafarawayday.com/Radiogenic/>

Websites

Webelements: <http://www.webelements.com/>

Geochemical Earth Reference Model (GERM): <http://earthref.org/GERM/>

cuLearn: Course lecture slides and labs will be posted on cuLearn. All information concerning the course, including assignments, will also be posted on the site. Note that posting of pdf copies of journal articles on cuLearn is a violation of copyright regulations. However, all students have access to journal articles via the library electronic subscriptions and each student is allowed one copy for personal use.

Academic Integrity

It is your responsibility to review Carleton's policy on Academic Integrity - Section 14 of the Calendar.

<http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/acadregsuniv14/>

Plagiarism

The instructor is required to report all incidents (or suspected incidents) of plagiarism to the Dean. All work handed in must be your own. Plagiarism and cheating are viewed as being particularly serious and the sanctions imposed are accordingly severe. Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy. The Policy is strictly enforced and is binding on all students. Plagiarism and cheating – presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student – weaken the quality of the graduate degree. Academic dishonesty in any form will not be tolerated. Students who infringe the Policy may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; a refusal of permission to continue or to register in a specific degree program; academic probation; or a grade of Failure in the course.

Requests for Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website:

carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Religious obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the *Paul Menton Centre for Students with Disabilities* (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/pmc.

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline