ERTH 2380

Geochemistry- Winter 2026

Department of Earth and Environmental Sciences

Lectures When: Tues, Thurs: Online

Tutorials When: Fri: 11:35am-1:25pm

Tutorials Where: Life Sciences Building (LSC), Room LSC 2030

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.
Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor(s)

Name	Email	Office Hours
Professor: Dr. Simone Booker	Simonebooker7@gmail.com	By email
Teaching Assistant:		By email

Course Overview

An introduction to the principles of chemistry applied to geologic systems, including overviews of the chemistry of rocks and minerals, isotopes in the geologic environment, processes that control the speciation and mobility of elements in different geological environments, and the use of geochemical data in solving geologic and environmental problems.

Course Prerequisites

ERTH2001 & CHEM 1011/CHEM 1012 or equivalent, or permission of the instructor.

Course Exclusions

None

Course Delivery

This course consists of online **lectures** that will be posted 2x per week (Tu, Th @ 10am). There is also **a separate in-person tutorial** that meets 1x per week (F @ 11:30am -1:25pm). Tutorials are hands-on applications of lecture material; therefore, it is expected that you will attend and ask questions. Tutorials are designed to help students further understand principles and applications of lecture material. Please bring **a pencil, a ruler, and an eraser to all labs**.

If you miss a tutorial: Email the teaching assistant and professor ASAP. We will arrange a make-up deadline or grade redistribution. If you know ahead of time that you will be missing a tutorial, please let us know early so we can make the necessary arrangements.

Student Resources

All materials other than the course textbook will be available on Brightspace. This includes plug-ins for MS Excel and links to other freeware / software programs as required.

Course Materia

Required Textbook:

Hugh Rollinson and Victoria Pease **"Using Geochemical Data to Understand Geological Processes"** 2nd edition. ISBN 978-1-108-74584-0

This book is strongly recommended for **all** petrology courses and the 1st edition was widely used by geoscientists as a reference book. The second edition is even better!

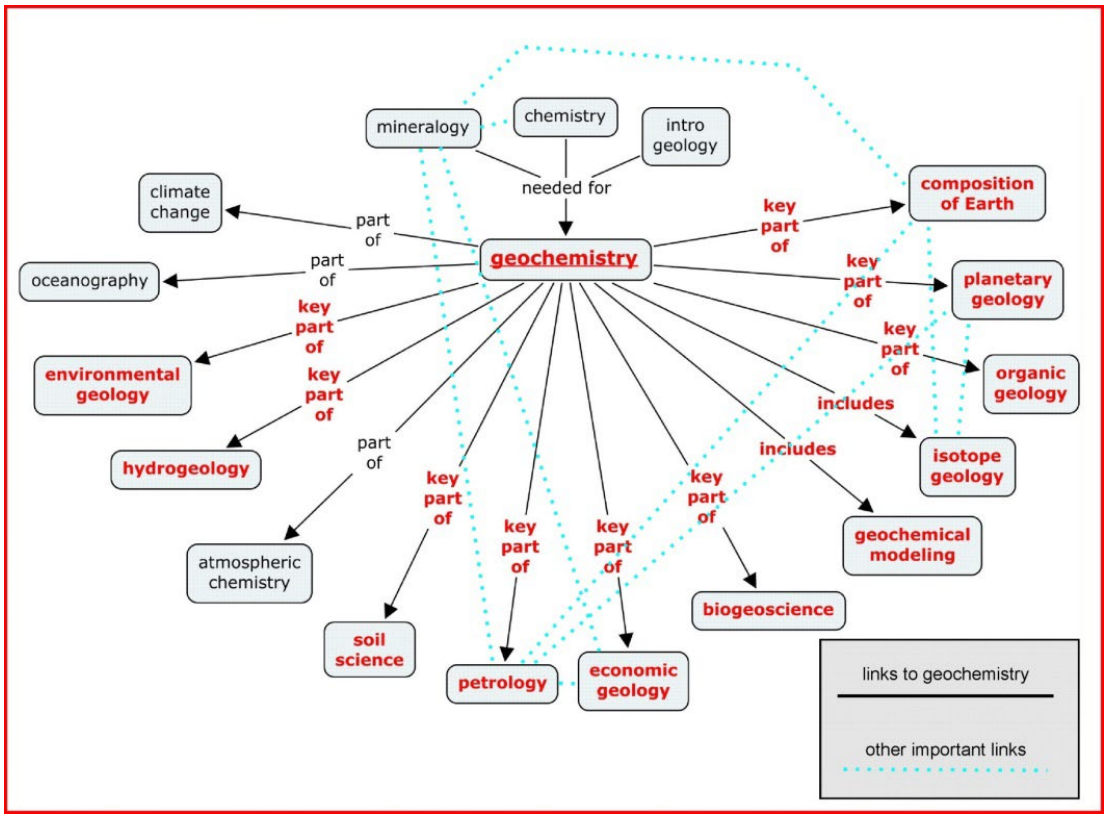
Other materials required:

All handouts and other materials will be provided. A computer or tablet that runs MS Office is essential.

Learning Objectives

Why Geochemistry? The study of the distribution of elements and chemical fluxes in the earth is known as geochemistry. This branch of the geosciences forms the basis of understanding for many geological processes. A background in geochemistry will provide the foundation for understanding many of the concepts in igneous, metamorphic and sedimentary petrology, economic geology, environmental sciences and hydrogeology. Geochemical analysis and modeling allows geoscientists to understand processes which occur in every planetary environment from magma formation and crystallization in the deep earth, to weathering and biogeochemical cycling of elements on the planet's surface and atmosphere. In other words, a basic understanding of the nature of geochemistry is essential for any geoscientist.

The overall goal for this course: To describe the periodic table in terms of the Earth and specific geosystems; to analyze and present geochemical data in a meaningful and informative way; to use common software programs to analyze, evaluate and present geochemical data to others through both reports and a presentation and abstract; to critically interpret geochemical data and to model and describe what the data is telling us about earth systems and processes.



Assessment:

Assignment	Total
Plotting Exercises (6 @ 5% each and 2 @ 10% each)	50%

Plotting exercises 1, 2, 3

- ➔ Using major Elements and trace Element data = 5% each

Plotting exercise 4

- ➔ Quantitative modeling of processes using element data = 10%

Plotting exercises 5, 6, 7

- ➔ Isotopes, geochronology, geochemical reservoirs and fluxes = 5% each

Plotting exercise 8

- ➔ Applying geochemical data = 10%

Researching and presenting geochemical data – Term research project 25%

Progress marks: This involves submission of small parts of the project (e.g. keywords, a main diagram, an intro slide and a conclusion slide) throughout the semester = 5% in total.

Extended abstract: To be submitted before the presentations = 10%.

Class presentations: Will be held in a mini conference during the final tutorial time slots = 10%.

NOTE: This section of the course will also be partly peer reviewed by students in the class.

Final Exam *(scheduled by the registrar by Feb 1st and will be held between the 9th and the 26th of April)*

3 hour written exam (closed book) **25%**

Conversion of numerical grades to final letter grades follows the

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Content

Part 1: Geochemical Fundamentals and Analytical Methods

- What is geochemistry? - Nomenclature, terms and broad applications, analytical methods
- Understanding the Periodic Table (basic review of chemistry) - The geochemist's Periodic Table
- *How do we get at the information we need? - Sampling, sample preparation, analytical methods
- *Reporting Geochemical Data - Detection limits, errors, precision, accuracy, using common programs
- The general distribution of elements in geochemical systems
- The distribution co-efficient, modeling processes.
- Oxidation, reduction and speciation of elements.
- What makes things tick/tock? (Reactions, Thermodynamics, Kinetics, Diffusion)

* *For PGeo certifications these are particularly important*

Part 2: Geochemical systems, reservoirs and fluxes including case studies and applications

- **2a - Distribution of elements** in the "solid" Earth and other planetary bodies
  - **Major Elements* in the lithosphere (core, mantle, oceanic crust, continental crust)
  - **Trace Elements* in the lithosphere (REE, HFSE, Alkali elements, etc)
- **2b - Isotope geochemistry**
  - *Radiogenic isotopes* (Rb-Sr, Sm-Nd, (U-Th-Pb) - including *geochronology* (absolute age dating) using *U-Th-Pb, *fission track dating, *U-Th-He, and when time allows U-Th disequilibrium dating, and K-Ar (Ar-Ar)).
  - *Stable Isotopes* (*$^{18}O/^{16}O$, *D/H, *$^{13}C/^{12}C$, *$^{32}S/^{34}S$)

* Note: We have research labs which carry out these analyses here at Dalhousie.

Part 3: Using and presenting geochemical data (this is where you will "take over")

- *Assessing* the "correctness" of data - standards, variations, etc.
- *Presenting* geochemical data
  - *Normalization, plotting, ratios, etc.*
  - *Making appropriate descriptions of the results*
  - *Interpretation* (geochemical classifications, petrotectonic significance, mineral growth rates, reactions, PT-conditions, ages, paleoenvironmental changes, etc).

* Writing-up *reports* and giving *presentations*

Course Policies Related to Academic Integrity

Tutorials: Collaboration during tutorials is encouraged but each student submits their own work for assessment.
IMPORTANT: As the term project will be in part peer review by your fellow students, you MUST attend the mini-conference at the end of the semester whether presenting or not. If you do not attend, you will be deducted 10% of

your final mark. If you are reviewing a fellow student's project and you also do not attend their presentation, you will lose 50% of your own project mark.

Final: Individual work only.

Note: Generative AI (i.e., ChatGPT) may be very useful as a study tool! However, work turned in for assessment should not use generative AI for content.

Brightspace Learning Management System (LMS):

Important course announcements are delivered through the Brightspace Learning Management System. Lecture PowerPoint slides and recordings will be posted.

Student Declaration of Absence:

This course has opted into the student declaration of absence in lieu of sick notes for the in-class test. This mechanism is meant to substitute for sick notes from a doctor related to short absences (less than three days) and does not provide an automatic exemption from any missed assessments. Accommodating the absence is at the discretion of the course instructor. Student Declarations of Absence are only necessary for the in-class test (more information can be found Student Declaration of Absence - Faculty of Computer Science - Dalhousie University). SDAs are not required for missed Lab or classes (see above).

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St.

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders."

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre () for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro.

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2).

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie.

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method.

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.