

Topics 5095: Concepts in Geochemistry

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Office hours: Thursdays, 9:15am -10:15am, and by appointment

Lecture: T/Th, 8:00am - 9:15am, HH 114

Course Description

The course will serve as an introduction to the broad topic of geochemistry. It will be divided into two basic parts: (1) the geochemical structure of Earth from the core to the surface; and (2) practical applications for geochemistry and geochemical techniques. Discussion will begin with an overview the discipline of geochemistry, which will serve as a framework to interpret the geochemical evolution and structure of the internal and external components of Earth. Following this portion, we will examine modern advances of analytical techniques and applications in geochemistry using real world examples from literature.

Required Materials

We will read primary literature in class. Papers will be distributed via Moodle. Expect ~ 50-100 pages per week.

Course Grade Point Distribution:

Weekly writing assignments	25 %
Weekly problem sets	10 %
Poster	20 %
Portfolio	45 %
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Total	100 %

Expected student outcomes

Students completing this course will be able to:

- 1) Recognize how geochemistry informs us about the structure and composition of our planet
- 2) Identify geochemical tools used in research
- 3) Apply fundamental geochemical tools in research

Students will demonstrate outcomes 1-3 through:

- Weekly writing assignments where students create an abstract of class discussions/readings
- Weekly “problem sets” focused on interpreting geochemical techniques presented in research papers
- Midterm project where students will distill the information from the first 6 weeks of class in a single, 3’x4’ electronic poster format (PowerPoint, Illustrator, etc.) designed for audiences ranging from 6-8th grade.
- Final portfolio consisting of a synthesis of course material created from weekly assignments

Abstract guidelines – 1 page, single spaced, 1” margins, Times New Roman, 12 pt. font for text with up to 1 extra page for figures. Figures must include captions and proper citations. Text must be written in paragraph format, with full, complete sentences and correct grammar and expressions. This should be considered a synthesis of the themes present within your assigned readings for the week and will serve as a summary guide for each section of your portfolio.

Portfolio guidelines – The portfolio should include a title page with author information, which should be followed by a preface, Table of Contents, and an outline of the rest of the document. For the body of the material there is no page minimum or maximum, and there are only two requirements: (1) that references be placed where appropriate; and (2) there must be some vehicle for daily/weekly reflection on each topic. You have the creative freedom to express the material that you have learned throughout the course of the semester in any way, but it should represent a complete and evolved collection and synthesis of your thoughts and information you have learned as a direct result of the activities, assignments, and readings in this course.

PART 1 - INTRODUCTION TO CONCEPTS IN GEOCHEMISTRY

- 0 Th 1/12 Introduction to concepts in geochemistry
- 1 Tu 1/17 **ORIGIN OF ELEMENTS** - planet formation, elemental distributions in the solar system
Th 1/19 Discussion, Problem set #1 Determining the age of Earth (bring your computer if possible)
Weekly reading abstract 1 due.
- 2 Tu 1/24 **MANTLE/CORE** - differentiation, element partitioning @ high T, P
Th 1/26 "Lab", Problem set #2 Sample preparation (HH 206 / Chem 206)
Weekly reading abstract 2 due.
Problem set #1 due.
- 3 Tu 1/31 **LITHOSPHERE 1** - crust formation, elemental transfer @ low T, P
Th 2/2 "Lab", Problem set #2 Sample preparation continued (HH 206 / Chem 206)
Weekly reading abstract 3 due.
- 4 Tu 2/7 **LITHOSPHERE 2** – soil formation, chemical weathering of continental material
Th 2/9 Discussion, Problem set # 3 Igneous rock composition (bring your computer if possible)
Weekly reading abstract 4 due.
Problem set #2 due.
- 5 Tu 2/14 **HYDROSPHERE 1** - surface water, sub-surface water, element transfer to ocean
Th 2/16 Discussion, Problem set #4 Chemical weathering of igneous rocks
Weekly reading abstract 5 due.
Problem set #3 due.
- 6 Tu 2/21 **HYDROSPHERE 2** - physico-chemical controls on seawater composition, geological
record of the chemical evolution of seawater
Th 2/23 "Lab", Problem set #5 Chemical sediments - the record of paleo-seawater
Weekly reading abstract 6 due.
Problem set #4 due.

PART II: APPLICATIONS IN GEOCHEMISTRY

- 7 Tu 2/28 **ANALYTICAL GEOCHEMISTRY**
Th 3/2 Geochemistry lab-prep (Chem 206 – bring your computer if possible)
Portfolio check
Problem set #5 due.
- 8 Tu 3/7 **SPRING BREAK**
Th 3/9 *Design a geochemistry poster for middle school children using W1-6 info*
- 9 Tu 3/14 **ANALYTICAL GEOCHEMISTRY**
Th 3/16 Geochemistry lab-prep (Chem 206)
- 10 Tu 3/21 **ATMOSPHERE** – Greenhouse climate
Th 3/23 Data analysis of samples (tentative, bring your computer if possible)
- 11 Tu 3/28 **ORGANIC GEOCHEMISTRY** - OC in Meteorites, OC in stromatolites, Biomarkers
Th 3/30 *Posters due – present in class (informal ~5 min)*
- 12 Tu 4/4 **GEOMICROBIOLOGY** - microbe-mineral interaction, biomineralization
Th 4/6 **ENVIRONMENTAL GEOCHEMISTRY** – Chromium and Mercury in the environment
- 13 Tu 4/11 **GEOCHEMISTRY OF MINERAL DEPOSITS** – Guest lecturer: Christian Schardt* HH 108
Th 4/13 Geochemists workbench exercise* (Computer lab HH 108)

- 14 Tu 4/18 **ANALYTICAL GEOCHEMISTRY**
Th 4/20 Research Instrumentation Lab*
- 15 Tu 4/25 **PORTFOLIO final in-class work / data reduction**
Th 4/27 **PORTFOLIO final in-class work / data reduction**

Final Portfolio due
*tentative

Link to Academic Calendar: http://www.d.umn.edu/calendar/academic_cal.html

Statement on participation by students with disabilities: Individuals who have any disability, either permanent or temporary, which might affect their ability to perform in this class, are encouraged to inform the instructor at the start of the semester. Adaptation of methods, materials or testing may be made as required for equitable participation.

Statement on student academic integrity: Academic dishonesty tarnishes UMD's reputation and discredits the accomplishments of students. UMD is committed to providing students every possible opportunity to grow in mind and spirit. This pledge can only be redeemed in an environment of trust, honesty, and fairness. As a result, academic dishonesty is regarded as a serious offense by all members of the academic community. In keeping with this ideal, this course will adhere to UMD's Student Academic Integrity Policy, which can be found at www.d.umn.edu/assl/conduct/integrity. This policy sanctions students engaging in academic dishonesty with penalties up to and including expulsion from the university for repeat offenders.

“...Subd. 1. Scholastic Dishonesty. Scholastic dishonesty means plagiarism; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, misrepresenting, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis...”

Please refer to the student handbook for information about academic integrity and school policies:
<http://www.d.umn.edu/kirby/PDFs/StudentActivitiesHandbook.pdf>

Statement on student conduct code: The instructor will enforce and students are expected to follow the University's Student Conduct Code (<http://www.d.umn.edu/assl/conduct/code>). Appropriate classroom conduct promotes an environment of academic achievement and integrity. Disruptive classroom behavior that substantially or repeatedly interrupts either the instructor's ability to teach, or student learning, is prohibited. Disruptive behavior includes inappropriate use of technology in the classroom. Examples include ringing cell phones, text-messaging, watching videos, playing computer games, doing email, or surfing the Internet on your computer instead of note-taking or other instructor-sanctioned activities.