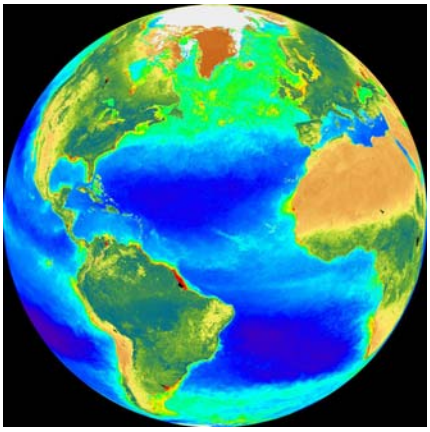
Geo-Sci 415

Introduction to Geochemistry



Spring, 2012

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Course Structure and Goals

Geochemistry is really just another way of looking at our world that focuses on the numerous reactions taking place in various parts of our planet. In this course, we want to explore the "big picture" aspects of this science, so that you will see how chemical processes are at work in geological settings. This is a large undertaking, but by studying some selected examples of geochemistry at work, you will be able to reach the following goals:

- evaluate the role of geochemistry in determining the environmental evolution of our planet;
- interpret the behavior of naturally complex geochemical systems;
- predict the outcome of geochemical processes.

In addition, by working within the realm of geochemistry, you will have the opportunity to:

- develop proper, careful and accurate research skills;
- explain your findings and conclusions to your peers;
- write about geochemical investigations clearly and accurately.

The class is scheduled for two sessions per week, during which we will spend much of our time engaged in discussions and solving problems. In order for you to benefit and contribute to these discussions, you will need to prepare for each class by reading the appropriate articles available on the course Moodle web site and writing out answers to questions that we developed in the previous class. In order for this format to work attendance at each class is required.! We will also be doing some experimenting this semester with "blended learning" with assignments to be done on-line in lieu of class time.

Products and Assessment

There are four principal components that will be used for assessing your comprehension of geochemistry and assigning a grade.

Readiness Assurance Tests (RATs): **Three** Readiness Assurance Tests will be given during the semester, which will be based on the major concepts contained in the readings. These tests will be done in three stages. You will take the test individually in the traditional manner during the first part of the class. Then, you will take it a second time as a team effort. Each part of the test will be graded separately and your score will be a composite of the individual and team tests (60% solo; 40% team). The third part of the test is the "appeal," which will allow you to review your notes and readings to challenge the results of the team test

Mini-Project: This a short investigative tasks that will mostly comprise evaluations and syntheses of previous studies, although there may be an opportunity for original data collection. This will be done as a team project with an oral presentation and a written report. Teams will decide among themselves how to allocate the responsibilities for research, presentation and writing. The completed report will be approximately 10 to 15 pages, with supporting tables and figures. Project reports are to be written in journal-article style, using the Geological Society of America Bulletin as a format guide. Additional guidelines for the written document will be forthcoming
Your team can choose one of two topics:

General topic A: For a planet other than the Earth, you will investigate what is known about the geochemistry of the interior, the crust, and the atmosphere, and the processes by which that composition evolved.

General topic B: Element cycling is an important part of the Earth system. You will investigate the levels of a particular element in different Earth materials and the processes controlling the transfer among different "reservoirs."

Timeline:

Teams choose topic and submit plan of individual responsibilities	Feb 16
References and one-page summary due:	Mar. 15
Presentation:	May 1
Report due:	May 7

Assignments: These will consist of questions that you answer in class (team-based), or problems that you solve as homework (nidvidual). There will be an assignment of some kind in almost every class.

Course Summary: As the last component of the course I want you to write a brief summary of the three most significant learning experiences for you that have resulted from this course. These can be related to the topics covered in class, the projects you have done on your own, some new curiosity about the Earth that has resulted from your exploration of geochemistry, or even some unexpected discoveries you have made about yourself. Approximately 5 pages should suffice, but longer is acceptable. Be sure to support your reflection with the specific evidence that will help me evaluate your understanding of the substance and application of geochemistry.

Grade Calculations:	Readiness Assurance Tests	25%
	Mini-project	30%
	Assignments	25%
	Course Summary	20%

Each component of the course will be evaluated using a scoring rubric, which will be distributed in advance.

Projected Schedule

Dates	Topics	Readings*

Part 1: Unique Events

Jan. 24, 26	Origins and Geochemical Processes	
Jan 31	*Readiness Assurance Test #1*	*B1, F2, MRU3*
Feb, 2, 7	Radioactive Decay & Geologic Time	
Feb. 9, 14	Nucleosynthesis	
Feb. 16, 21	Origin of the Earth and Other Planets	

Part 2: Unidirectional Changes

Feb. 23	*Readiness Assurance Test #2*	*MRU 4, HGL 5, E+ 6*
28, Mar.1. 6	Evolution of the Earth's Core, Mantle & Crust	
Mar, 8, 13, 15	Evolution of the Atmosphere & Ocean	
Mar. 20, 22	*Spring Break*	

Part 3: Cyclic Processes

Mar 27	*Readiness Assurance Test #3*	*BB 7, F8, M9*
Mar. 29, April 3	Chemical Weathering	
April 5, 10, 12	Stable Isotopes and Applications	
April 19, 24. 26	Biogeochemical Cycling	
May 1	*Project Presentations*	

***** Numbers refer to documents available on course Moodle site. These are excerpts from various books and articles as listed below.

Reading List and Source Books: The numbered citations below refer to the specific readings listed in the course schedule. The books listed are good places to start for information about your research projects.

B 1: Brownlow, Arthur H., **Geochemistry (Second Edition)**, Prentice-Hall, Upper Saddle River, NJ, (1996). p. 51-61; 69-83

F 2: Faure, Gunter, **Principles and Applications of Inorganic Geochemistry (Second Edition)**. Prentice-Hall, Upper Saddle River, NJ (1998). p. 8-21

MRU 3: McSween, Harry Y., Jr., Richardson, Steven M., and Uhle, Maria, **Geochemistry: Pathways and Processes (2nd Edition).** Columbia University, New York (2003). P. 313-341

MRU 4: McSween, Harry Y., Jr., Richardson, Steven M., and Uhle, Maria, **Geochemistry: Pathways and Processes (2nd Edition).** Columbia University, New York (2003). P. 227-243.

HGL 5: Hillgren, V.J., Gessman, C.K., and Li, J., An experimental perspective on the light element in the Earth's Core; **in** Canup, Robin M., and Righter, Kevin (Editors), **Origin of the Earth and Moon,** University of Arizona Press, Tucson, AZ (2000).p. 245-263.

E+ 6: Eriksson, P.G., Altermann, W. and Ohmoto, H., Evolution of the Hydrosphere and Atmosphere; **in** Eriksson, P.G. and others (Editors), **The Precambrian Earth: Tempos and Events,** Elsevier, Amsterdam (2004). p. 359-388.

BB 7: Berner, Elizabeth Kay, and Berner, Robert A., **Global Environment: Water Air, and Geochemical Cycles.** Prentice-Hall, Upper Saddle River, NJ (1996). p. 141-171.

F 8: Faure, Gunter, **Principles of Isotope Geology (Second Edition)**, John Wiley & Sons, New York (1986). p. 429-447.

M9: Mackenzie, F. T., **Our Changing Planet (3rd Edition)**. Prentice-Hall, Upper Saddle River, NJ (2003), p. 171-195