Syllabus and Course Outline (Spring, 2012)
Geo 376T: High-Temperature Geochemistry (UID: 27765)

Meeting time: MWF 10:00-11:00 am, EPS 1.126
Instructor: Prof. John Lassiter
e-mail: lassiter1@mail.utexas.edu
phone: 1-4002
office: JGB 4.138
office hours: Wed. 11:00 am - 1:00 pm or by appointment

Required texts:

Bill White's on-line Geochemistry *textbook at*
http://www.geo.cornell.edu/geology/classes/geo455/Chapters.HTML

Lecture notes and other class material will be posted on Blackboard.

Potentially Useful Supplemental Reading:

Principles and Applications of Geochemistry, Gunther Faure

Geochemistry: An Introduction, Francis Albarede

Supplemental reading will be placed on reserve in the Geosciences library

Course description: This course will provide an in-depth introduction to modern geochemical methods, with particular emphasis placed on the utilization of geochemistry in the study of "hard rock" geologic processes. Students will learn how geoscientists utilize trace elements, radiogenic and stable isotopes to examine and constrain geologic processes. We will examine the chemical behavior of different classes of elements and how elemental abundances and ratios in geologic materials can be used to examine processes such as melt generation, fluid transport at subduction zones, and even the large-scale differentiation of the Earth into crust, mantle, and core. We will also explore the mechanisms responsible for stable isotope fractionation, and how stable isotope variations can be used to explore processes ranging from the waxing and waning of the ice caps to hydrothermal ore formation and the nature and origin of mantle plumes. Finally, we will examine radioactive decay and naturally occurring radioactive decay systems, and the use of radioisotopes in geochronology, tectonics, and other areas of the Earth Sciences. The course will also provide an introduction to modern analytical methods and the analytical instrumentation housed in the Dept. of Geological Sciences at UT. Throughout the course, the interconnections between geochemistry and other subfields in the geological sciences, including geophysics, petrology, and tectonics, will be explored.

Course Credit: Student grades will be based on the following:

Homework Assignments	30%
Midterm Exam	20%
Presentation/Paper	20%
Final Exam	30%

In addition to completing homework assignments and exams, students will write a 5-8 page paper on a research topic of their choice, examining a particular problem in the geologic sciences in depth and discussing how geochemical investigations have been or could be utilized to examine this problem. Students will present the results of their literature investigation in a ~20 minute class presentation.

Students with Special Needs: Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259.

The University Honor Code: "The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the University is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community."

Students are expected to read and to strictly adhere to the University's written policies on academic dishonesty. Cheating or plagiarism will result in a zero for the exam or assignment in question, and students caught violating University policy will be referred to the Dean of Student Affairs for disciplinary action.

For homework assignments, students are encouraged to communicate and exchange ideas, but all submitted work must be your own.

Preliminary Schedule: Subject to change based on class needs and interests

Week	Date	Topic	Assignment
1	18-Jan	Introduction	
	20-Jan	Overview of the Periodic Table (charge, ionic radius, bonding)	
2	23-Jan	Overview of the Periodic Table (Element groups, chemical bonding, etc.)	
	25-Jan	Origin of the elements (nucleosynthesis)	
	27-Feb	Origin of the elements (nucleosynthesis)	
3	30-Jan	Basic thermodynamics: Equilibrium, phase rule, and phase diagrams	
	1-Feb	Kinetics and Diffusion	
	3-Feb	Element Partitioning, Partition Coefficients, and Henry's Law	hand out HW#1
4	6-Feb	Partial melting and fractional crystallization	
	8-Feb	Partial melting and fractional crystallization	
	10-Feb	Partial melting and fractional crystallization	HW#1 due
5	13-Feb	Mixing and Assimilation Trends	
	15-Feb	Mixing and Assimilation Trends	
	17-Feb	Radiogenic Isotopes-Theory and Practice	hand out HW#2
6	20-Feb	Radiogenic Isotopes-Theory and Practice	
	22-Feb	Radiogenic Isotopes-Theory and Practice	
	24-Feb	Stable Isotopes-Theory and Practice	HW#2 due
7	27-Feb	Stable Isotopes-Theory and Practice	
	29-Feb	Review	
	2-Mar	**Mid-term Exam**	
8	5-Mar	Origin of the solar system: Constraints from Meteorites	
	7-Mar	Origin of the solar system: Constraints from Meteorites	
	9-Mar	Formation, Composition and Differentiation of the Earth: Core, Mantle and Crust	Midterm Exam
9	12-Mar	**Spring Break-No class**	
	14-Mar	**Spring Break-No class**	
	16-Mar	**Spring Break-No class**	
10	19-Mar	Formation, Composition and Differentiation of the Earth: Core, Mantle and Crust	deadline to select paper topic
	21-Mar	Introduction to analytical methods and facilities	
	23-Mar	Introduction to analytical methods and facilities	
11	26-Mar	Introduction to on-line resources	
	28-Mar	Case study-Mantle differentiation and the origin of ocean island and mid-ocean ridge basalts	
	30-Mar	Case study-Mantle differentiation and the origin of ocean island and mid-ocean ridge basalts	hand out HW#3
12	2-Apr	Case study-Mantle differentiation and the origin of ocean island and mid-ocean ridge basalts	paper abstract due
	4-Apr	Case study-Subduction zone processes and origin of arc volcanism	
	6-Apr	Case study-Subduction zone processes and origin of arc volcanism	HW#3 due
13	9-Apr	Case study-Subduction zone processes and origin of arc	

		volcanism	
	11-Apr	Case Study-Age and origin of the continents	
	13-Apr	Case Study-Age and origin of the continents	hand out HW#4
14	16-Apr	Case Study-Age and origin of the continents	
	18-Apr	Case Study-Geochemistry and Geodynamics	
	20-Apr	Case Study-Geochemistry and Geodynamics	HW#4 due
15	23-Apr	Case Study-Geochemistry and Geodynamics	
	25-Apr	Case study-TBA	
	27-Apr	Case study-TBA	
16	**30-Apr**	Class presentations	
	2-May	Class presentations	
	4-May	Class presentations	Papers due

FINAL EXAM: Monday, May 14th, 2-5 pm, unless changed by the Registrar