Syllabus and Course Outline (Fall, 2013)
Geo 376T: High-Temperature Geochemistry (UID: 27818)

Meeting time: TTh 9:30-11:00 am, EPS 1.102
Instructor: Prof. John Lassiter
e-mail: lassiter1@mail.utexas.edu
phone: 1-4002
office: JGB 4.138
office hours: Wed. 1:00-3:00 pm or by appointment

Required texts:

*Bill White's textbook "*Geochemistry"
This book is available from Wiley and other booksellers (ISBN: 978-0-470-65668-6). Hardcover, paperback and electronic versions are available.

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 an 8-10 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 investigation in a ~20 minute class presentation.

Each assignment will be given a numeric grade from 0-100. Final course grades are based on the weighted mean of all assignment grades, as follows:

A	93-100
A-	90-92
B+	88-89
B	83-87
B-	80-82
C+	78-79
C	73-77
C-	70-72
D+	68-69
D	63-67
D-	60-62
F	<60

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.

Below is an approximate outline of topics to be covered in the course as well as due dates for assignments. The approximate first half of the course concentrates on examining the various analytical and logical "tools" utilized by geochemists to examine geologic problems. The second half of the course concentrates on applying these tools to a number of important topics in the Geological Sciences. All dates are subject to change depending on the needs of the class. Case study topics are designed to demonstrate how modern geochemical methods can be applied to address fundamental problems in the Earth Sciences, and topics are subject to change depending on time constraints as well as the interests of class participants. If you have a topic of particular interest that you would like to learn more about, let me know and I will try to fit it into the schedule.

Week	Date	Topic	Notes
1	3-Sept	Introduction	
	5-Sept	Overview of the Periodic Table	
2	10-Sept	Origin of the elements (nucleosynthesis)	
	12-Sept	Origin of the elements (nucleosynthesis)	
3	17-Sept	Basic thermodynamics: Equilibrium, phase rule, and phase diagrams	
	19-Sept	Kinetics and Diffusion	hand out HW#1
4	24-Sept	Element Partitioning, Partition Coefficients, and Henry's Law	
	26-Sept	Partial melting and fractional crystallization	HW#1 due
5	1-Oct	Partial melting and fractional crystallization	
	3-Oct	Radiogenic Isotopes-Theory and Practice	hand out HW#2
6	8-Oct	Radiogenic Isotopes-Theory and Practice	
	10-Oct	Stable Isotopes-Theory and Practice	HW#2 due
7	15-Oct	Mixing and Assimilation Trends	
	17-Oct	Review and discussion of paper assignment	
8	22-Oct	**Midterm Exam**	
	24-Oct	Introduction to analytical methods and facilities	deadline to select paper topic
9	29-Oct	Introduction to on-line resources	
	31-Oct	Origin of the solar system: Constraints from Meteorites	hand out HW#3
10	5-Nov	Formation, Composition and Differentiation of the Earth: Core, Mantle and Crust	
	7-Nov	Case study-Mantle differentiation and the origin of ocean island and mid-ocean ridge basalts	HW#3 due

11	12-Nov	Case study-Mantle differentiation and the origin of ocean island and mid-ocean ridge basalts	
	14-Nov	Case study-Subduction zone processes and origin of arc volcanism	hand out HW#4
12	19-Nov	Case study-Subduction zone processes and origin of arc volcanism	
	21-Nov	Case Study-Age and origin of the continents	HW#4 due
13	26-Nov	Class presentations	
	28-Nov	**Thanksgiving Break-No class**	
14	3-Dec	Class presentations	
	5-Dec	Class presentations	Paper due

The final exam will be a take-home exam, to be handed out the last day of class and due on the date of the scheduled final exam (Saturday, Dec. 14)