GEO 388H/376E – Environmental Isotope Geochemistry (Spring 2013)

Unique Numbers: 27635 (376E) & 27705 (388H)

Class: JGB 3.222; MWF 1-2

Professor:

Dan Breecker, JGB 4.124, 471-6166, breecker@jsg.utexas.edu

Office hours: M&W 2-3; or by appointment

Online course information: https://courses.utexas.edu/webapps/login/ plus your EID

Textbooks (optional):

Sharp, Z.D., 2007, Principles of Stable Isotope Geochemistry, Pearson Education, Inc.

Faure G and Mensing T (2005, 3nd ed.) Isotopes: Principles and Applications. Wiley.

General:

This course is an introduction to the concepts of isotope geochemistry as applied to processes that occur at or near Earth's surface.

Goals of the Course:

Develop a familiarity with the techniques, theory and application of isotope geochemistry in the fields of paleoclimatology, hydrogeology, ecology, pedology, geomorphology, and others. Learn the terminology used in isotope geochemistry. Stimulate thinking about the application of isotope geochemistry to your current and future research.

Course Schedule:

Week	Date	Topic	Assignments
1	14-Jan	Introductions, overview of syllabus, goals for course, what is an isotope?, the power of measuring ratios	
	16-Jan	Stable Isotopes, Intro and theory	
	18-Jan	Fractionation of stable isotopes (Equilibrium Fractionation)	
2	21-Jan	NO CLASS MLK Jr. HOLIDAY	
	23-Jan	Fractionation of stable isotopes (Kinetic Fractionation, diffusion)	
	25-Jan	Fractionation of stable isotopes (Rayleigh Fractionation)	PS1
3	28-Jan	Isotope mass balance	
	30-Jan	Measurement of stable isotope ratios	
	1-Feb		PS1 due
4	4-Feb	Processes: Hydrologic Cycle	PS 2
	6-Feb	Processes: Hydrologic Cycle (continued), triple oxygen isotope composition of water	
	8-Feb	Processes: Photosynthesis, Biologic Pump, carbon cycle	
5	11-Feb	Processes: Trophic levels	PS 2 due

	13-Feb	Processes: Fluid rock interaction	
	15-Feb	Processes: mass-independent fractionation	
6	18-Feb	Applications: Hydrogeology: Groundwater flow and recharge	
	20-Feb	Applications: Paleoclimate: ice cores, ocean seds, devil's hole	
	22-Feb	GUEST LECTURE: Dr. Bill Schlesinger, Changes in soil organic matter in forests exposed to high CO_2	
7	25-Feb	Applications: Ecology: ecosystem carbon exchange	
	27-Feb	Applications: Paleoclimate: soil carbonate	
	1-Mar	Applications: Paleoclimate: speleothems	
8	4-Mar	Clumped Isotope Geothermometer	
	6-Mar	Compound Specific Isotope Analysis	
	8-Mar		
9	11-Mar	NO CLASS: Spring Break	
	13-Mar	NO CLASS: Spring Break	
	15-Mar	NO CLASS: Spring Break	
10	18-Mar	Intro to radiogenic isotopes, chart of nuclides, Decay modes, age equation	
	20-Mar	^{14}C	
	22-Mar	^{14}C	PS 3
11	25-Mar	^{210}Pb and U-Pb	
	27-Mar	Tritium	
	29-Mar	Rb-Sr & Sr isotopes as tracers	PS3 due
12	1-Apr	Weathering: Sr and Nd in the ocean	
	3-Apr	Sr isotopes as an indicator of soil erosion	
	5-Apr	U series	PS 4
13	8-Apr	Measurement of radiogenic isotope ratios	
	10-Apr	Cosmogenic surface age dating (theory)	
	12-Apr	Cosmogenic surface age dating, ^{10}Be, ^{26}Al, ^{20}Ne	PS 4 due
14	15-Apr	^{36}Cl, ^{222}Rn	
	17-Apr	^{137}Cs	
	19-Apr	Ca isotopes?	
15	22-Apr		
	24-Apr	Student presentations (1)	
	26-Apr	Student presentations (3)	10 page paper due
16	29-Apr	Student presentations (3)	
	1-May	Student presentations (3)	
	3-May	Student presentations (3)	

Course Structure:

Class periods will consist of a mixture of lecture and discussion. You are expected to participate in the discussion, and your grade in this course is partially based on your participation.

Reading:

No textbook is required for this course. However, reading relevant chapters in the textbooks listed above may help those who learn best by reading. Journal articles will be posted to blackboard for reading and will be announced in class.

Problem sets:

Four problem sets will be assigned during the semester. Problem sets are due 1 week after they are handed out. Late problem sets will NOT be accepted. The problem sets generally require that you apply concepts learned in lecture in new ways (i.e. they ask you to take an extra step) and are designed to simulate problems encountered in the course of scientific research. The problems require you to use a computer. Make copious notes on your calculations and keep the electronic files so you can refer to them in the future.

Final Project:

388H: a 10 page, double spaced paper summarizing research in stable or radiogenic geochemistry that is of interest to you and/or applicable to your own research. A 10 minute oral presentation of your paper to the class, followed by five minutes of questions from the audience. Participation (questions) from the audience are expected and your grade in this course is partially based on your participation. You must sign up for a time to give your oral presentation.

376E: the paper is required, the oral presentation is not required. However, participation in the questioning and discussion after oral presentations made by those students in 388H is required.

Grading:

Problem sets (60%)
4 total (15% each)

Final Project (30%)

Class participation (10%)

Office Hours:

Office hours are for questions about lecture, readings and help with problem sets. Please take advantage of office hours. Appointments outside of hours will be made under special circumstances.

Blackboard:

In this class we use Blackboard (https://courses.utexas.edu/webapps/login/ plus your EID) to distribute course materials, to communicate online, and to post grades. You can find support in using Blackboard at the ITS Help Desk at 475-9400, Monday through Friday, 8 a.m. to 6 p.m., so plan accordingly. Check your Blackboard and email regularly for class updates. Email is recognized as an official mode of university correspondence; therefore, you are responsible for reading your email for university and course-related information and announcements.

The University of Texas 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 Honor Code and written policies on academic dishonesty. Cheating or plagiarism will not be tolerated. Any student caught violating University policy will be referred to the Dean of Student Affairs for disciplinary action. *All written work must be in your own words!*