EAS 6216 – Environmental Isotope Geochemistry

Fall 2012

TuTh 9:35-10:55, 1229 ES&T

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Course Website: http://shadow.eas.gatech.edu/~kcobb/isochem

Goals:
Isotope geochemistry plays an increasingly important role in a wide variety of geological, biological, and environmental investigations. This course is designed to provide an introduction to the principles and applications of isotope geochemistry, and briefly summarize the analytical techniques used in the field. Homework problems will illustrate the applications of isotope geochemistry to real-world environmental problems, while in-class student presentations at the end of the semester will enable more in-depth study of particular isotope systems. The students' interests will help shape the material covered in the course, so the schedule of topics listed below is subject to change.

Required Textbook:
Faure, G. and Mensing, T., 2005, Isotopes: Principles and Applications, 3rd edition, Wiley.

Recommended Textbooks:
Dickin, Alan. P. 1995. Radiogenic isotope geology. Cambridge University Press.
Hoefs, Jochen. 2004. Stable isotope geochemistry. Springer-Verlag.
Criss, Robert. 1999. Principles of Stable Isotope Distribution. Oxford University Press.

Great read:
Burchfield, Joe D. 1990. Lord Kelvin and the age of the Earth. Univ. of Chicago Press.

Grading:
25% 5-6 Problem sets
25% Midterm
25% Presentation
25% Final

Class Schedule:

DATE	TOPIC	READING
8/21	Introduction	
PART 1:	**RADIOGENIC ISOTOPES**	
8/23	Nucleosynthesis, physics of the nucleus	pp. 1-33
8/28	Making Isotopic measurements – mass spectrometry	None

8/30	K-Ar and ^{40}Ar-^{39}Ar dating	pp. 113-126, 144-159
9/4	Rb-Sr dating, Sm-Nd dating	pp. 75-89, 194-207
9/6	U-Th-Pb dating – the age of the Earth	pp. 214-220, 223-227, 256-264
9/11	U-series disequilibrium I	pp. 497-516
9/13	U-series disequilibrium II	pp. 516-527, 531-533
9/18	Cosmogenic isotopes I	pp. 625-645
9/20	Cosmogenic isotopes II	TBD
9/25	Radiocarbon dating	pp. 613-625
9/27	Analytical methods & Data analysis for geochemists	
10/2	Al-Mg and the formation of the solar system (Take-home MIDTERM distributed)	
PART 2:	**STABLE ISOTOPES**	
10/4	Physical fundamentals	
10/9	Stable isotope mass spectrometry	
10/11	Raleigh fractionation	
10/18	Water isotopes in the hydrosphere, atmosphere, and biosphere I	
10/23	Water isotopes in the hydrosphere, atmosphere, and biosphere II	
10/25	Geothermometry and paleoclimate proxies I	
10/30	Geothermometry and paleoclimate proxies II	
11/1	Recent advances with triple oxygen isotopes	
11/6	Carbon isotopes in the biosphere	
11/8	Carbon isotopes in the geologic record	
11/13	“Clumped” isotopes: potential and challenges	
11/15	Nitrogen isotopes and the biological pump	
11/20	Isotopes in the hunt for life on Mars	
PART 3:	**STUDENTS DECIDE**	
11/22	NO CLASS (Thanksgiving)	
11/27	Student Choice	
11/29	Student Presentations I	
12/4	Student Presentations II	
12/6	Student Presentations III, exam distributed	
12/13	**Take-home FINAL EXAM due, 8am**	