GEOV 342 Spring 2015
Radiogenic and Stable Isotope Geochemistry

No books are required for purchase: The following resources will be useful for the students:

Excellent Isotope text and class notes from Cornell University:
http://www.geo.cornell.edu/geology/classes/Geo656/656notes05.html

Useful online material from UiT:
http://ansatte.uit.no/kare.kullerud/webgeology/

Radiogenic Isotope Geology (text, online)
Alan P. Dickin, Cambridge Univ. Press
http://www.onafarawayday.com/Radiogenic/

Additionally, there are a number of excellent textbooks available for both general background and specific applications. E.g. one of the better ones for stable isotope geochemistry is: **Stable Isotope Geochemistry, by** Hoefs**, Jochen, 6th ed. 2009**

The course will be run over 2 separate weeks of intense teaching. One week will deal with stable isotopes and another will be dedicated to radiogenic isotope geochemistry. The course will consist of lectures and required problem sets. Students will also be expected to give a short presentation in class on an isotope system/application of their choice. A semester essay is required and will be graded.

CURRICULUM OVERVIEW

FORELESNINGER / LECTURES		
Topic	**Learning objective** students will be able to:	**Number of lecture hours**
Principles of stable isotope fractionation	*Understand :* *What an isotope is* *Equilibrium fractionation* *Kinetic fractionation* *What makes isotopes useful* *Natural abundances*	***5***

	Nomenclature *Principles of measurement (mass spectrometry)* *Principles of and standardization* *Scale conversions* *Sources of error/uncertainty* *Replication, precision, accuracy, significant digits*	
Oxygen and Hydrogen isotopes	*<u>Understand :</u>* *Raleigh distillation* *Isotopes in water/water cycle/hydrosphere* *Meteoric water line & Deuterium excess* *Salinity-$\delta^{18}O$ (global, regional, role of ice)* *Geologic archives of water isotopes incl.:* • *-carbonates (forams, bivalves, spaleothems, corals, otoliths.) potential and problems for each* • *Paleotemperature equations (origin, history, development, and application).* • *Clumped isotopes* • *$\delta^{18}O$ and sea level (carbonates and pore waters)* • *Ice cores* • *Lake sediments* • *Ground water* • *Biominerals,teeth/bone* • *Trees*	***5***
Carbon isotopes	*<u>Understand :</u>* *The carbon cycle and how isotopes move through it.* *Major sources of fractionation* • *Photosynthesis and fractionation (C3,C4)* *Marine and terrestrial* • *Diet and isotope values* *Recorders of carbon isotopes:* • *Pedogenic carbonate* • *Tooth enamel* • *foraminifera* *Examples of major carbon isotope (cycle) excursions in the earth system* • *PETM*	**5**

	• *OAE's* *Carbon isotopes as tracers of ocean circulation and nutrient cycling* *Carbon isotopes in the Atmosphere and recent changes.*	
Case studies of isotope applications in geology e.g. Oxygen, carbon, hydrogen, Nitrogen, S, Sr, Nd, in various settings and materials.	Describe and explain: the state of the art for specific methods and applications of different isotope systems including the related benefits and uncertainty. Research, develop, give a logical and clear presentation	**4-5**
Radiogenic isotopes e.g. Rb/Sr, Sm/Nd og U-Th-Pb		**20-25**

ØVELSER / PRACTICALS Location: Science Building, Allégt. 41		
Topic	**Learning objective** students will be able to	**Number of contact hours**
Principles of fractionation	*Explain* *Equilibrium fractionation* *Kinetic fractionation* *What makes isotopes useful* *Nomenclature* *Principles of measurement (mass spectrometry)* *Calculate or carry out* *Isotope abundances* *Fractionation factors* *δ values* *standardization* *Scale conversions* *error/uncertainty* *precision, accuracy, significant digits*	***4***
O and H isotopes	Calculate, determine, or carry out Raleigh fractionation Salinity-d18O relationships and endmembers Temperature effects	**4**

	Fractionation factors Isotopic mass balance	
C isotope problems	<u>Use</u> carbon isotopes to reconstruct past ocean circulation <u>Calculate and assess</u> Past changes in nutrient cycling and their role in carbon cycling (CO_{2atm}) changes <u>Access and use</u> Major online geological/isotope databases <u>Apply</u> standard spreadsheet and plotting software	**4**
Radiogenic isotope problems	Rb/Sr, Sm/Nd og U-Th-Pb	**12**