

Stable Isotope Biogeochemistry (Geol Sci 622)

5 credit hours

Instructor: Dr. Andréa G. Grottoli, Assistant Professor

Required Textbook:

Hoeffs, J. (2004) Stable Isotope Geochemistry (5th Ed). Springer. 244 pp.

Additional Suggested Reference Material available at OSU libraries:

Treatise on Geochemistry Volume 4 (2003), The Atmosphere (ed. RJ Keeling)

Treatise on Geochemistry Volume 5 (2003), Surface and Groundwater, Weathering, and Soils (ed. JI Drever)

Treatise on Geochemistry Volume 6 (2003), The Oceans and Marine Geochemistry (ed. H Elderfield)

deGroot, PA (2004) Handbook of Isotope Analytical Techniques. Elsevier

Coleman and Fry (1991) Carbon Isotope Techniques. Academic Press.

Lajtha, K. & Michner, RH. (1994) Stable Isotopes in Ecology and Environmental Science. Blackwell Scinetific.

Overall Course Goal:

This course focuses on stable isotope biogeochemistry with emphasis on carbon, oxygen, and nitrogen. The goal is to expose student to both theoretical and applied aspects of isotope biogeochemistry so that they can: 1- understand and critically evaluate research articles containing stable isotopic data, and 2- see how isotopes might be used to enhance or broaden their own research. Theoretical principles, isotope fractionation, and variation of isotopes in nature with emphasis on the ocean, atmosphere, and biosphere will be presented and discussed. Stable isotope techniques, applications of stable isotopes in research, and introduction to mass spectrometry will form the applied component of the course. Although not a stable isotope, ¹⁴C as a tracer tool in biogeochemistry will also be included where relevant. The reading material will be drawn from the texts listed above as well as relevant seminal, and new journal articles.

Grading:

Participation: 25%

Student presentations: 25%

Group research project: 25%

Take home final exam: 25%

Course pre-requisites and expectations:

This is a graduate level course. Upper level undergraduates are welcome and will be required to complete all of the same coursework. When grading, expectations for graduate students will be higher than for undergraduates. Students must be either science majors, graduate students in any one of the sciences, or have permission of the instructor.

Geol-694 Class Schedule (subject to change)

Week	Weekly Topic and Activities
1	Introduction carbon, oxygen and nitrogen isotopes (H 1), class survey Organizational meeting for project and presentations
2	Fractionation, measurement, standards and instrumentation (H 2; CF 10)
3	Isotopes ($\delta^{13}\text{C}$, $\Delta^{14}\text{C}$, $\delta^{18}\text{O}$, $\delta^{15}\text{N}$) in corals and biologically mediated carbonates (H 3.11, CF 10.5) Introduction to using the mass spectrometer II
4	Isotopes ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$ and $\Delta^{14}\text{C}$) in the atmosphere (H 3.9; CF 11.2) (CO_2 , CH_4) Analyzing samples on mass spec
5	Stable isotopes ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\Delta^{14}\text{C}$) in the biosphere (H 3.10; CF 11.3 & 12) Correcting data, interpreting data
6	Geologic isotopic composition of the ocean (H 3.7) (A Glacial World) Statistical analysis of data, graphing data
7	Carbon isotopes ($\delta^{13}\text{C}$, $\Delta^{14}\text{C}$) in dissolved and particulate matter in the ocean and fresh water (H 3.8; CF 11.4 and 10.5) Interpretation of data in broader context, discussion of relevant literature
8	Isotopes in freshwater systems ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$, $\delta^2\text{H}$) (H 3.6) Interpretation of data in broader context, discussion of relevant literature
9	$\delta^{13}\text{C}$ and $\Delta^{14}\text{C}$ Enrichment Studies (CF 2, 4) Poster preparation
10	Future of stable isotopes in biogeochemistry, take home exam, course eval. Poster presentation, final data discussion