

<b>The Ohio State University</b> <b>Colleges of the Arts and Sciences New Course Request</b>
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**School of Earth Sciences**

Academic Unit

**GEOL SCI**

Book 3 Listing (e.g., Portuguese)

**622 Stable Isotope Biogeochemistry**

Number	Title	UG	GS
Isotope Biogeochem		Level	Credit Hours
18-Character Title Abbreviation			
Summer	Autumn	Winter	Spring X
			Year 2008

Proposed effective date, choose one quarter and put an "X" after it; and fill in the year. See the OAA curriculum manual for deadlines.

**A. Course Offerings Bulletin Information**

Follow the instructions in the OAA curriculum manual. If this is a course with decimal subdivisions, then use one New Course Request form for the generic information that will apply to all subdivisions; and use separate forms for each new decimal subdivision, including on each form the information that is unique to that subdivision. If the course offered is less than a quarter or a term, please complete the Flexibly Scheduled/Off Campus/Workshop Request form.

Description (not to exceed 25 words):

**This course focuses on theoretical and applied aspects of stable isotope biogeochemistry in the natural environment with emphasis on carbon, oxygen, and nitrogen.**

Quarter offered: **Spring** Distribution of class time/contact hours: **2 – 2hr cl, 1 hr recitation**

Quarter and contact/class time hours information should be omitted from Book 3 publication (yes or no):

Prerequisite(s): **Senior standing in any science program, or graduate student standing in any of the sciences or permission of the instructor.**

Exclusion or limiting clause:

Repeatable to a maximum of \_\_\_\_ credit hours.

Cross-listed with: **N/A**

Grade Option (Please check): **Letter\_X** S/U  Progress  What course is last in the series? \_\_\_\_

Honors Statement: Yes  No **X** GEC: Yes  No **X** Admission Condition  
 Off-Campus: Yes  No **X** EM: Yes  No **X** Course: Yes  No **X**  
 Embedded Honors Statement: Yes  No **X**

Other General Course Information:

(e.g. "Taught in English." "Credit does not count toward BSBA degree.")

**B. General Information**

Subject Code **GEOL SCI** Subsidy Level (V, G, T, B, M, D, or P) **B, M, D**

If you have questions, please email Jed Dickhaut at [dickhaut.1@osu.edu](mailto:dickhaut.1@osu.edu).

## 1. Provide the rationale for proposing this course:

Stable isotopes are used in a wide variety of biogeochemical disciplines (biology, geology, biogeochemistry, soils science, paleoclimatology, etc...) yet no course is offered on campus on the topic. Many graduate students in the School of Earth Sciences, Department of Ecology, Evolution, and Organismal Biology, and in the School of Natural Sciences use stable isotopes in their research. The interdisciplinary applications of this technique would be beneficial to students in all of these disciplines. As a new faculty with expertise and a research program in stable isotope biogeochemistry, and with a stable isotope laboratory on campus, Grotzli is well prepared to offer this modern state of the art course. When this course was offered in WQ06 as a Special Topics 694, there was a waiting list for the course, and Grotzli continues to get asked by students across the University to offer it again.

2. Please list Majors/Minors affected by the creation of this new course. Attach revisions of all affected programs.  
 This course is (check one):  Required on major(s)/minor(s)  A choice on major(s)/minors(s)  
 An elective within major(s)/minor(s)  A general elective:

3. Indicate the nature of the program adjustments, new funding, and/or withdrawals that make possible the implementation of this new course.  
**New course taught by new faculty. No GTAs required for this course.**

4. Is the approval of this request contingent upon the approval of other course requests or curricular requests?  
 Yes  No  List:

5. If this course is part of a sequence, list the number of the other course(s) in the sequence: \_\_\_\_\_

6. Expected section size: **30** Proposed number of sections per year: **1 section every other year**


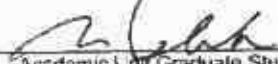

7. Do you want prerequisites enforced electronically (see OAA manual for what can be enforced)? Yes  No

8. This course has been discussed with and has the concurrence of the following academic units needing this course or with academic units having directly related interests (List units and attach letters and/or forms):  
 Not Applicable

**School of Natural Resources (concurrence letter by Dr Eckert, see APPENDIX I)**  
**Dept of Ecology, Evolution, and Organismal Biology (concurrence letter by Dr. Curtiss, see APPENDIX II)**

9. Attach a course syllabus that includes a topical outline of the course, student learning outcomes and/or course objectives, off-campus field experience, methods of evaluation, and other items as stated in the OAA curriculum manual and e-mail to [asccurrofc@osu.edu](mailto:asccurrofc@osu.edu).  
**SEE APPENDIX III**

**Approval Process** The signatures on the lines in ALL CAPS ( e.g. ACADEMIC UNIT) are required.

1. Academic Unit Undergraduate Studies Committee Chair		<b>ANNE CAREY</b>	<b>8 Feb 2007</b>
		Printed Name	Date
2. Academic Unit Graduate Studies Committee Chair		<b>MOTOMU IBARAKI</b>	<b>2/21</b>
		Printed Name	Date
3. ACADEMIC UNIT CHAIR/DIRECTOR		<b>FRANK W. SCHWARTZ</b>	<b>13 Feb 07</b>
		Printed Name	Date

4. After the Academic Unit Chair/Director signs the request, forward the form to the ASC Curriculum Office, 105 Brown Hall, 190 West 17<sup>th</sup> Ave. or fax it to 688-5678. Attach the syllabus and any supporting documentation in an e-mail to [asccurrofc@osu.edu](mailto:asccurrofc@osu.edu). The ASC Curriculum Office will forward the request to the appropriate committee.

5. COLLEGE CURRICULUM COMMITTEE	_____	Printed Name	Date
6. ARTS AND SCIENCES EXECUTIVE DEAN	_____	Printed Name	Date
7. Graduate School (if appropriate)	_____	Printed Name	Date
8. University Honors Center (if appropriate)	_____	Printed Name	Date
9. Office of International Education (if appropriate)	_____	Printed Name	Date
10. ACADEMIC AFFAIRS	_____	Printed Name	Date

**Appendix I: Letter of concurrence from the School of Natural Resources**

See letter by Prof. Peter Curtis, Department Chair EEOB, attached.

**Appendix II: Letter of concurrence from the Department of Ecology, Evolution,  
and Organismal Biology**

See letter by Prof. Neil Andrew, SENR Academic Affairs Committee Chair, attached.

## Appendix III: Course Syllabus

### Stable Isotope Biogeochemistry (Geol Sci 622) 5 credit hours

**Instructor:** Dr. Andrea G. Grottole, Assistant Professor

**Contact:** 329 Mendenhall      **Email:** grottole.1@osu.edu

#### Required Textbook:

Hoeffs, J. (2004) *Stable Isotope Geochemistry* (5<sup>th</sup> 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. JJ 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 Scientific.

#### 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,  $^{14}\text{C}$  as a tracer tool in biogeochemistry will also be included where relevant. The recitation will focus on discussion of emerging published research and evaluating real-time data from the mass spectrometer. The reading material will be drawn from the texts listed above as well as relevant seminal, and new journal articles.

<b>Grading:</b>	Participation: 25%	Student presentations: 25%
	Data Analysis: 25%	Take home final exam: 25%

As an upper level course, overall participation and engagement in discussions will be emphasized.

Student presentations should be a review of the relevant literature on a given topic, be 30 minutes in duration, and consist of a power point presentation. Presenters will distribute 1 or 2 relevant papers to the class one week before their presentation. A copy of the power point presentation will be uploaded onto Carmen for all students to refer to and study.

Data analysis exercises will be conducted in the 3<sup>rd</sup> floor computer lab in Mendenhall. Students will correct the raw isotope data from the mass spec, and interpret the results. In addition, students will visit each of the mass spectrometry facilities in Mendenhall.

The take-home final exam will be handed out the first day of class. For the exam, students will write a 5 page research proposal that outlines a project that either: 1- expands their current Ms or PhD research to a topic that utilizes stable isotopes as the main tool, or 2- expands the isotopic analyses and approaches already in the student's Ms or PhD research to a new level or in a novel direction. This exercise is designed to enhance the student's current graduate research.

**Course pre-requisites and expectations:**

This is an upper undergraduate and graduate level course. Students must be either science majors, graduate students in any one of the sciences, or have permission of the instructor.

**Academic integrity (Academic Misconduct):** The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's *Code of Student Conduct*, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct* and this syllabus may constitute Academic Misconduct. Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's *Code of Student Conduct* is never considered an excuse for academic misconduct. For additional information, please refer to the Code of Student Conduct at [http://studentaffairs.osu.edu/resource\\_csc.asp](http://studentaffairs.osu.edu/resource_csc.asp)

**Students with disabilities:** Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office for Disability Services at 614-292-3307 in room 150 Pomerene Hall to coordinate reasonable accommodations for students with documented disabilities. For additional information, please refer to [http://ada.osu.edu/resources/fastfacts/Syllabus\\_Statement.htm](http://ada.osu.edu/resources/fastfacts/Syllabus_Statement.htm).

**Policy on Religious Holidays:** The University recognizes/observes holidays as listed on <http://www.ureg.ohio-state.edu/ourweb/more/Content/bigcal.html>. If you observe any other religious holidays, please make special arrangements in person with the instructor within the first two weeks of class.

**General Class Schedule\***

H=Hoefs, CF = Coleman and Fry, T=Treatise in Geochemistry

Week	Weekly Topic (readings)
1	Introduction carbon, oxygen and nitrogen isotopes (H 1)
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)
4	Isotopes ( $\delta^{13}\text{C}$ , $\delta^{18}\text{O}$ and $\Delta^{14}\text{C}$ ) in the atmosphere (H 3.9; CF 11.2)
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)
6	Geologic isotopic composition of the ocean (H 3.7) (A Glacial World)
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)
8	Isotopes in freshwater systems ( $\delta^{13}\text{C}$ , $\delta^{18}\text{O}$ , $\delta^2\text{H}$ ) (H 3.6)
9	$\delta^{13}\text{C}$ and $\Delta^{14}\text{C}$ Enrichment Studies (CF 2, 4)
10	Future of stable isotopes in biogeochemistry, take home exam, course eval.

\*The recitation will focus on discussions of emerging published research and evaluating real-time data from the mass spectrometer. There is no fixed weekly schedule for the specific papers to be discussed or of the data that will be analyzed as it will depend on what has been recently published, and what samples are being analyzed on the mass spectrometer at that time.

**School of Environment and Natural Resources**

210 Kottman Hall  
2021 Coffey Road  
Columbus, OH 43210-1085

Phone (614) 292-2265  
Fax (614) 292-7432  
<http://snr.osu.edu>

January 16, 2007

Dr. Andrea G. Grottoli  
School of Earth Sciences  
275 Mendenhall Lab  
125 S. Oval Mall  
Campus

Dear Dr. Grottoli:

The Academic Affairs Committee of the School of Environment and Natural Resources (SENR) met on Tuesday, January 9, 2007. They unanimously voted to concur and support your proposed course: Geol Sci 622 Stable Isotope Biogeochemistry.

The committee was delighted to learn that this course was to become a regular offering. Environmental scientists and some graduate students in SENR are especially favorable of this proposed course.

It is our collective endorsement that this course be approved. Your effort to promptly move it to a regular course offering is commendable.

Best wishes in all of your endeavors.

Sincerely,

A handwritten signature in cursive script that reads "Neil J. Andrew".

Neil J. Andrew, Chairman  
SENR Academic Affairs Committee



Department of Evolution, Ecology  
and Organismal Biology

318 West 12<sup>th</sup> Avenue  
Columbus, OH 43210-1293

Phone 614-292-8088  
Fax 614-292-2080

Date: December 15, 2006

To: Dr. Andrea Gottoli, School of Earth Sciences

From: Peter Curtis, Chair, EEOB

Re: Concurrence for Geol Sci 622

I am happy to provide a letter of concurrence for the course "Stable Isotope Biogeochemistry (Geol Sci 622)". This course appears highly useful, should be of interest to a number of students in my department, and does not overlap any courses that we teach.

Sincerely,

A handwritten signature in black ink, appearing to read 'P. Curtis'.

Peter S. Curtis

**School of Earth Sciences**

275 Mendenhall Laboratory  
125 South Oval Mall  
Columbus, OH 43210-1398

Phone (614) 292-2721  
Fax (614) 292-7688  
e-mail [earthsciences@osu.edu](mailto:earthsciences@osu.edu)  
[www.earthsciences.osu.edu](http://www.earthsciences.osu.edu)

January 31, 2007

To whom it may concern:

It is with great pleasure that I submit a new course request for Geological Sciences 622, Stable Isotope Biogeochemistry. This five-credit course focuses on the theoretical and applied aspects of environmental stable isotope biogeochemistry with emphasis on carbon, oxygen, and nitrogen. 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,  $^{14}\text{C}$  as a tracer tool in biogeochemistry will also be included where relevant. The recitation will focus on discussions of emerging published research and evaluating real-time data from the mass spectrometer. The reading material will be drawn from the texts listed above as well as relevant seminal, and new journal articles.

***Background and Rationale:***

The School of Earth Sciences (SES) has a core of faculty that study in the field of geochemistry or biogeochemistry (Grottoli, Folland, Lower, Chin, Lyons, Thompson, Carey). Currently, SES offers several courses in geochemistry (Principles of Geochemistry Geol Sci 621, Principles of Isotope Geology Geol Sci 620, Environmental Isotope Geochemistry Geol Sci 628), but none in biogeochemistry. Whereas geochemistry typically focuses on only the physical world, the field of biogeochemistry deals with biological world and the interface between the biological world and the physical world. This is an emerging area of science, is interdisciplinary in nature, and has broad implications and applications in the fields of geology, biology, soil science, atmospheric science, paleoclimatology, and hydrogeology. The demand for such a course is evident in the fact that when it was offered as a Special Topics course last year, there was a waiting list. Grottoli continues to be asked to offer this course by students from the School of Earth Sciences, the School of Natural Resources, the Department of Anthropology, and the Department of Ecology, Evolution, and Organismal Biology. The interdisciplinary nature of stable isotope biogeochemistry makes it a very useful course to offer with broad appeal to students across a wide range of departments at OSU. As a new faculty with expertise and a research program in stable isotope biogeochemistry, and with a stable isotope laboratory on campus, Grottoli would like to offer this course regularly at OSU.



***Course Objectives, Structure, and Assessment Plan:***

The goal of the course 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. The course will consist of two, two-hour long lectures each week, and a one-hour recitation. Lectures will include a combination of didactic teaching, student presentations, and critical discussion of presented materials. The recitation period will be used to visit the mass spectrometry facilities within the School of Earth Sciences (Grottoli Stable Isotope Biogeochemistry lab, Folland Radiogenic lab, and Olesick Elemental Geochemistry Lab), learn more about the instrumentation in each of these facilities, and for working in the computer lab on real-time stable isotopic data.

The course will be continuously assessed using:

- i. Student SEI's to evaluate instructor performance.
- ii. Formal and informal feedback from students with suggestions for improvement of the class.
- iii. Formal peer evaluations by non-participating faculty in the School of Earth Sciences.
- iv. Annual formal assessment by the Curriculum Committee of the School of Earth Sciences.

The interdisciplinary nature of stable isotope biogeochemistry promises to make this course a solid contribution to the academic programs in School of Earth Sciences, the School of Natural Resources, the Department of Anthropology, and the Department of Ecology, Evolution, and Organismal Biology. I look forward to making Geol Sci 622 a regular course offering, and hope that you give my application your sincerest consideration. If you have any questions, please feel free to contact me directly.

Sincerely,



Andrea Grottoli, Assistant Professor  
School of Earth Sciences  
614-292-5782  
Grottoli.1@osu.edu