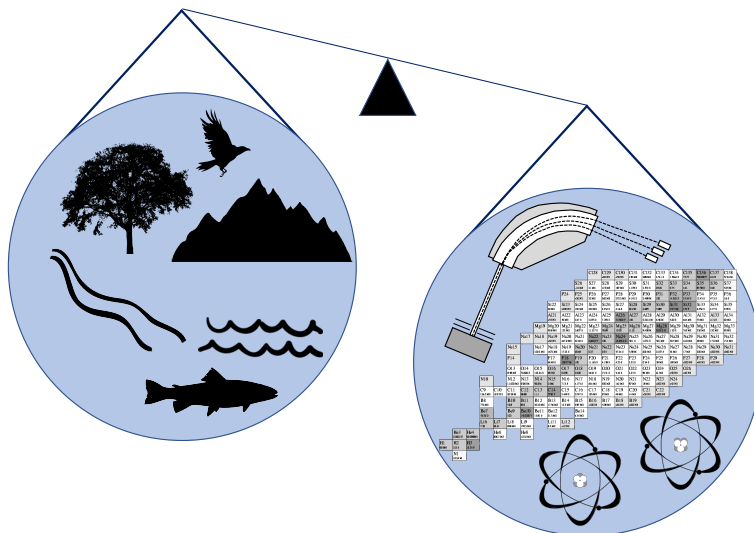


OCG550

ENVIRONMENTAL ISOTOPE GEOCHEMISTRY

Instructor: Dr. Kelton McMahon

Graduate School of Oceanography, University of Rhode Island



Course Description and Learning Outcomes:

This course will introduce graduate and advanced undergraduate students to fundamental concepts in the theory and application of isotope geochemistry to address environmental questions. This course will provide a broad overview of isotope geochemistry across the realms of the geosphere, hydrosphere, and biosphere, with an emphasis on marine systems. We will cover the distribution and fractionation of isotopes, learn about traditional and cutting-edge analytical methods, and explore applications of these concepts as tracers of important ecological and environmental processes.

Prerequisites: Strong background in chemistry, biology, and earth systems recommended. Undergraduate participation with permission from the instructor.

Learning Outcomes:

- **Fundamental Knowledge:** Develop fundamental knowledge of isotope theory across a range of isotope systems, environments, and applications through lectures, peer-peer learning, literature, and case studies.
- **Oral and Written Communication Skills:** Utilize fundamental knowledge of concepts and vocabulary to effectively communicate understanding of stable isotope data.
- **Critical Evaluation Skills:** Gain necessary knowledge of isotope theory and application to constructively evaluate the published literature in the fields of environmental isotope geochemistry.

Instructor:

Dr. Kelton McMahon, Coastal Institute Building rm 335 (Bay Campus),
email: kelton_mcmahon@uri.edu, ph: 401-874-6944

Lecture Time and Place:

Wednesday and Friday, 3:30-4:45p.m.

Location: CACS rm 111, Bay Campus

Required Readings:

For each topic, there will be a series of readings to be completed before each lecture. These readings will be a mix of textbook chapters and current and classic primary literature. All readings will be provided in the Brightspace course website as .pdfs the week before their associated class. The goals of these readings are to provide valuable background on isotope theory to facilitate more in-depth discussions in class and to practice critically evaluating published literature in the field. Available in: *Carothers Library Stacks, #Pell Library Stacks

*EIH: Environmental Isotopes in Hydrogeology by Ian D. Clark & Peter Fritz. CRC Press, 1997.
PSIG: Principles of Stable Isotope Geochemistry by Zachary Sharp. Prentice Hall, 2018 (2nd ed.)
(Available online: https://digitalrepository.unm.edu/unm_oer/1/)

#SIE: Stable Isotope Ecology by Brian Fry. Springer, 2006

#SIEES: Stable Isotopes in Ecology and Environmental Science by Lajtha and Michener, Blackwell, 2007

#SIG: Stable Isotope Geochemistry by Jochen Hoefs. Springer, 2010 (6 th ed.)

Assignments and Grading Policy:

Grades are based on the assignments and percentages below.

Participation in Class Discussions (20%): Everyone will be given the opportunity and expected to articulate their viewpoints on the discussion topic.

Leading class discussion (40%): Each student will lead one class discussion during the semester on a topic assigned at the beginning of the semester. This assignment will require producing and presenting a 15-20 minute mini-lecture on the topic, providing a written synopsis of assigned papers (< 3 pages), and leading classmates through a discussion on the topic.

Written review of literature (20% each, 40% total): Students will review two papers on two different topics throughout the semester. Reviews can be as long as necessary but should evaluate the experimental design of the study in relation to the stated goals and hypotheses, assess the conclusions relative to the data provided, and comment on the overall strengths and weaknesses of the paper.

Final grades will be assigned accordingly:

A: >93; A-: 93-90; B+: 89-87; B: 86-83; B-: 82-80; C+: 79-77; C: 76-73; C-: 72-70; D: 69-60; F < 60

Classroom Protocols:

Class Attendance and Notification of Excused Absence:

Please notify me as soon as possible for any absences from class so that we can arrange alternative plans for missed course work. Students are expected to attend every class with the exception of excused absences (e.g., illness, severe weather, academic obligations, and sanctioned University events/Holidays). It is the policy of the University of Rhode Island to accord students, on an individual basis, the opportunity to observe their traditional religious holidays. See [Sections 8.51.11 – 8.51.14 of the University Manual](#) for policy regarding make-up of missed class or examinations.

Standards of Behavior:

Students are expected to treat faculty and fellow classmates with dignity and respect. Students are responsible for being familiar with and adhering to the published “Student Code of Conduct”, which can be accessed in the [University Student Handbook](#) (<http://web.uri.edu/studentconduct/student-handbook/>).

Academic Honesty and Integrity:

All submitted work must be one’s own. All work must be properly cited or the assignment will be deemed plagiarism and will receive an F. If you have any doubt about what constitutes plagiarism, please ask me and visit the URI Student Handbook and Sections 8.27.10 – 8.27.21 of the [University Manual](#) (web.uri.edu/manual/).

Accommodations for Special Needs:

I, in concert with the University of Rhode Island, am committed to facilitating the education of all students at URI. This includes providing academic accommodations for students with documented disabilities. Those students with a documented disability are responsible for self-identification to Disability Services for Students in the Office of Student Life (302 Memorial Union, Phone 401-874-2098), providing appropriate documentation of disability, requesting accommodation in a timely manner, and follow-through regarding accommodations requested.

The Graduate Writing Center:

Any student seeking additional assistance with writing for this course is advised to contact the Graduate Writing Center: Room 003, Roosevelt Hall, gradwritingcenter@etal.uri.edu, 401.874.2601. They provide writing support to all URI doctoral and master’s students to foster continuing development of academic and professional writing skills necessary to succeed in graduate programs and academic or professional careers.

Week	Date	Topic
1	01/22/2020	Lect. 1 Course Intro Reading: PSIG 1.1-1.6, 2.1-2.2
	01/24/2020	Lect. 2 Intro to Isotope Systematics Reading: PSIG 1.7, 2.3-2.6;
2	01/29/2020	Lect. 3 Peer Review
	01/31/2020	Lect. 4 Principles and applications of radioactive isotopes Reading: EIH p16-20
3	02/05/2020	Lect. 5 Stable Isotope Fractionation: Equilibrium and Kinetic Reading: SIG 1.3, PSIG 1.6, 3
	02/07/2020	Lect. 6 Instrumentation and Tour of Isotope Facilities at GSO PSIG 2.8
4	02/12/2020	Lect. 7 Environmental Isotopes I -Oxygen, Hydrogen Reading: Gat 1996
	02/14/2020	Lect. 8 Environmental Isotopes II – Carbon, Nitrogen Reading McMahon et al. 2013 pp. 327-341 Class Presentation: Preliminary Topic due in Brightspace 3:30p.m.
5	02/19/2020	Ocean Sciences Meeting: No Classes
	02/21/2020	Ocean Sciences Meeting: No Classes
6	02/26/2020	Lect. 9 Organismal Isotopes – Carbon and Nitrogen Reading: SIE Ch 3, 5
	02/28/2020	Lect. 10 Food Webs and Mixing Models Reading: SIE Ch 3, 5 Class Presentation: Final Group and Topic due in Brightspace 3:30p.m
7	03/04/2020	Lect. 11 Compound-specific Isotope Analysis I Reading: Close 2019; McMahon & McCarthy 2016
	03/06/2020	Lect. 12 Compound-specific Isotope Analysis II Reading: Close 2019; McMahon & McCarthy 2016 Peer Review # 1 due in Brightspace 3:30p.m.
8	03/11/2020	Spring Break: No Classes
	03/13/2020	Spring Break: No Classes
9	03/18/2020	Lect. 13 Radioisotope dating: Guest Lecture Katie Kelley
	03/20/2020	Lect. 14 Peer Review Discussion
10	03/25/2020	Lect. 13 Sediment geochemistry: Guest Lecture Art Spivak
	03/27/2020	Lect. 14 Isotopes as Tracers: Guest Lecture Autumn Oczkowski
11	04/01/2020	Lect. 15 Biochemistry/Physiology: Wales Carter
	04/03/2020	Lect. 16 Paleoclimate: Guest Lecture Becky Robinson
12	04/08/2020	Lect. 17 Student Presentations: C Isotope Tracers of Production
	04/10/2020	Lect. 18 Student Presentations: Paleo nitrogen cycling
13	04/15/2020	Lect. 19 Student Presentations: Tracers of pollution
	04/17/2020	Lect. 20 Student Presentations: Tracers of pollution
14	04/22/2020	Lect. 21 Student Presentations: Isoscapes
	04/24/2020	Lect. 22 Future applications in Environmental Geochemistry Literature Review # 2 due in class