

OCN 643 – Topics in Marine Geochemistry: Aquatic Geomicrobiology

Fall 2009

Course instructor: Brian Glazer

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Office Hrs: by appointment

Class location and time: MSB 307 – M(4:30-5:30pm) W(3:00-4:00pm) F(1:45-2:45pm)

Course description

The general objective of the course is to provide a one semester, comprehensive overview of the synergy between the biogeochemistry of element cycling and the (microbial) organisms involved. Within the discipline of microbial ecology, biogeochemistry is often given only cursory attention; with biogeochemistry, organisms are frequently viewed as mere catalysts. The aim of this course is to interface across these disciplines, from the perspective of a practical blend of aquatic chemistry, microbial ecology, biogeochemistry, and molecular biology. We will cover a large amount of material through lectures, readings, and student-led discussions.

Prerequisites

OCN 623 or consent from instructor

Student learning outcomes

Upon successful completion of the course, students will be expected to be able to:

- explain the underlying principles of the cross-disciplinary field of geomicrobiology
- identify aquatic chemical processes as they pertain to their own areas of oceanographic interest
- identify aquatic microbial processes as they pertain to their own areas of oceanographic interest
- critically evaluate current scientific research literature

Grading

--1 exam (final)	35%
--Research paper critiques (written review and lead class discussion)	35%
--Participation	15%
--Homework	15%

Materials

There is not a required textbook, however, we will draw heavily upon the following references:

Advances in Marine Biology vol. 48: Aquatic Geomicrobiology by DE Canfield, B Thamdrup, and E Kristensen, Elsevier Academic Press, 2005.

Aquatic Chemistry: Chemical equilibria and rates in natural waters by W Stumm and JJ Morgan (3rd edition), John Wiley & Sons, Inc., 1996.

Performance expectations of an upper-level graduate course

Leading research paper critiques accounts for 35% of final grade

This is meant to develop and reinforce critical literature evaluation and communication skills within the field of aquatic geomicrobiology. Each student will lead two critical discussions of a primary literature research article relevant to timely lecture material as scheduled. Discussion leaders will be responsible for selecting a paper, submitting a written review, and leading class discussion of the article. You will be evaluated on:

- A) Providing an accurate and complete study overview
 - relevant introduction, study design, analytical technique, data handling components
 - relevant statistics, results, figures, tables, authors' conclusions

- B) Providing an accurate and complete study analysis and critique
 - introduction: journal quality, authors, affiliations, abstract, background, scientific rationale
 - methods: study design, samples, experimental treatments, positive/negative controls, data handling, statistics
 - results: figure quality, presentation of study results, confounding variables,
 - discussion/conclusion: interpretation of results, identification of limitations, comparison to other studies, consideration for future studies, suggestions for study improvement

- C) Degree of preparation
 - knowledge of background context, study details, and applicability to course material
 - response to discussion points and questions

- D) Quality of presentation skills
 - speaking style, clarity, volume, cadence, timing, distracters, eye contact

Participation in critique discussions accounts for 15% of final grade

This is meant to develop and reinforce critical literature evaluation and communication skills within the field of aquatic geomicrobiology. Each student will be expected to intelligently participate in weekly critical discussions, and evaluated on the same criteria listed A, B, C, D above.

Performance expectations of an upper-level graduate course (cont.)

Homework problem sets account for 15% of final grade

This is meant to evaluate retention of material covered in course lectures and readings through performing problem solving and relevant calculations. Each student will complete a total of 6 take-home problem sets relevant to timely lecture material as scheduled.

Final exam accounts for 35% of final grade

This is meant to evaluate retention of material covered in the course through connection and interpretation of relevant course material within the context of your own research projects, and is meant to serve as preparation for PQE/Comprehensive –style examinations. Each student will receive a custom, take-home final exam question to be completed in an extended essay format (3-page max).

OCN 643 SYLLABUS - 8/31/09 – *subject to change with enrollment number, travel, etc.*

date	topic	reading source chapter	homework	lead
24-Aug	scheduling meeting & course overview	syllabus		BG
26-Aug	introduction to geomicrobiology	handout		BG
28-Aug	PAPER CRITIQUE #1	handout		BB
31-Aug	microbial systematics & phylogeny	Canfield 1		BG
2-Sep	microbial structure, properties, & growth	Canfield 2		BG
4-Sep	PAPER CRITIQUE #2	handout		JM
7-Sep	HOLIDAY - LABOR DAY			
9-Sep	mass transfer & intro to mineral-microbe interactions	handout	HW1	BG
11-Sep	PAPER CRITIQUE #3	handout		KF
14-Sep	chemical thermodynamics...	Stumm 2		BG
16-Sep			HW2	BG
18-Sep	PAPER CRITIQUE #4	handout		TL
21-Sep				
23-Sep	IODP INVEST Conference, Bremen			
25-Sep				
28-Sep	acids & bases	Stumm 3		BG
30-Sep	chemical speciation	Stumm 6	HW3	BG
2-Oct	PAPER CRITIQUE #5	handout		MM
5-Oct	precipitation and dissolution	Stumm 7		BG
7-Oct	C-DEBI preaward site visit, LA			
9-Oct				
12-Oct	oxidation & reduction	Stumm 8		BG
14-Oct	the solid-solution interface	Stumm 9	HW4	BG
16-Oct	PAPER CRITIQUE #6	handout		SJ
19-Oct				
21-Oct	Subseafloor Biosphere Observatories Workshop, Kailua-Kona			
23-Oct				
26-Oct	trace metals	Stumm 10		BG
28-Oct	chemical kinetics	Stumm 11,13	HW5	BG
30-Oct	PAPER CRITIQUE #7	handout		BB
2-Nov	intro to microbial metabolism & biomineralization	Canfield 3		BG
4-Nov	microbial carbon fixation	Canfield 4	HW6	BG
6-Nov	PAPER CRITIQUE #8	handout		JM
9-Nov	heterotrophic carbon metabolism	Canfield 5		BG
11-Nov	HOLIDAY - VETERAN'S DAY			
13-Nov	PAPER CRITIQUE #9	handout		TL
16-Nov	oxygen	Canfield 6		BG
18-Nov	nitrogen, phosphorus, silicon	Canfield 7,11,12		BG
20-Nov	PAPER CRITIQUE #10	handout		KF
23-Nov	iron...	Canfield 8		BG
25-Nov	... & manganese	handout		BG
27-Nov	HOLIDAY - THANKSGIVING FRIDAY			
30-Nov	sulfur, methane, ...	Canfield 9,10		BG
2-Dec	... & hydrogen	handout		BG
4-Dec	PAPER CRITIQUE #11	handout		MM
7-Dec	chemistry in natural waters	Stumm 15		BG
9-Dec	layered microbial ecosystems	Canfield 13		BG
11-Dec	PAPER CRITIQUE #12	handout		SJ

TBA

TAKE-HOME FINAL EXAM DUE