
GEOL 546 – CARBONATE SEDIMENTOLOGY AND GEOCHEMISTRY

UNIVERSITY OF TENNESSEE – FALL 2002

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OVERVIEW

Carbonate sediments are extraordinarily complex in that they reflect not only the physical conditions of deposition, but chemical and biological parameters as well. One of the most exciting consequences of this complexity is that the geologic record of carbonate rocks – their distribution in time and space, textural detail, biological makeup, and chemistry – provides a wealth of data about the evolution of Earth surface environments.

Geology 456 is an introductory course for graduate students with three specific goals in mind:

- (1) to afford practical experience in identifying and interpreting carbonate sediments
 - (2) to provide a general introduction to the inherently complex nature of carbonate sediments, to aspects of their depositional and diagenetic record, and to their utility in interpreting long- and short-term changes in Earth surface environments
 - (3) to develop critical skills in reading, reviewing, synthesizing, and presenting scientific information
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COURSE FORMAT

LECTURES – Approximately one half of the allotted class time will be spent in lectures.

DISCUSSIONS – There is no formal textbook for this course. However, I will be providing you with extensive reading lists. Mercifully, important papers will be indicated and students are expected to scan (or read!) these papers prior to scheduled discussions. Specific papers will be assigned to individual students, who will be expected to act as the primary advocate and/or opponent of these papers during class discussions. Class discussions will focus on examining topics within the framework of interpreting ancient depositional and diagenetic trends as well as interpreting changes in these trends through geologic time. Copies of individual readings will be available in the main office.

SHORT PAPERS – Short (3-4 page maximum, double spaced) papers will be due the week following discussion sections. The goal is for each student to provide a concise and thoughtful summary of the discussion topic. Papers should include a statement of the assigned topic, its geologic relevance, and a short discussion of salient issues.

LAB EXERCISES AND TERM PROJECT – The laboratory section of this course aims to complement the relatively broad focus of the lectures. The first 5 lab periods will provide hands-on experience in observing and identifying features of carbonate rocks in hand sample and thin section. The remaining lab periods will be used to complete personal term projects in which students will make their own thin sections and polished thick sections, and analyze them *via* petrographic, cathodoluminescent, isotopic and elemental analysis. At term's end, the students will present results of their term projects in a conference-style abstract and poster presentation. Additional information on term projects will be forthcoming.

BREAKDOWN OF GRADE ASSIGNMENT

10%	Discussions
30%	Short Papers
60%	Lab Exercises (30% final project)

SYLLABUS OF LECTURE TOPICS

W	Aug. 21	Lecture	Course Introduction	
F	Aug. 23	Lecture	Carbonate classification	
M	Aug. 26	Lecture	Carbonate chemistry, part 1	
W	Aug. 28	Lecture	Carbonate chemistry, part 2	
F	Aug. 30	Lecture	Carbonate chemistry, part 3	
M	Sept. 02	No Class	LABOR DAY HOLIDAY	
W	Sept. 04	Lecture	Skeletal components, part 1	
F	Sept. 06	Lecture	Skeletal components, part 2	
M	Sept. 09	Discussion	Beginnings of Biomineralization	<i>(Summary due Sept. 16)</i>
W	Sept. 11	Lecture	Marine diagenesis, part 1	
F	Sept. 13	Lecture	Marine diagenesis, part 2	
M	Sept. 16	Lecture	Marine diagenesis, part 3	
W	Sept. 18	Discussion	Mysteries of Micrite	<i>(Summary due Sept. 25)</i>
F	Sept. 20	Lecture	Meteoric diagenesis	
M	Sept. 23	Lecture	Burial diagenesis	
W	Sept. 25	Discussion	Understanding Ooids	<i>(Summary due Oct. 2)</i>
F	Sept. 27	No Class	EXXON-MOBIL FIELDTRIP	
M	Sept. 30	No Class	EXXON-MOBIL FIELDTRIP	
W	Oct. 02	Lecture	Dilemma of dolomitization, part 1	
F	Oct. 04	Lecture	Dilemma of dolomitization, part 2	
M	Oct. 07	Lecture	Trace elements, part 1	
W	Oct. 09	Lecture	Trace elements, part 2	
F	Oct. 11	No Class	FALL BREAK – EARTH SCIENCE DAY	
M	Oct. 14	Lecture	Isotopes, part 1	
W	Oct. 16	Lecture	Isotopes, part 2	
F	Oct. 18	Lecture	Isotopes, part 3	
M	Oct. 21	Lecture	Carbon Isotopes	
W	Oct. 23	Lecture	Strontium Isotopes	
F	Oct. 25	Lecture	Finish Isotopes (and hand out readings)	
M	Oct. 28	No Class	GSA MEETING	
W	Oct. 30	No Class	GSA MEETING	
F	Nov. 01	No Class	Project meetings	
M	Nov. 04	Discussion	Project progress discussion	
W	Nov. 06	Discussion	Origin of unusual carbonates – Weird Precambrian carbonates	
F	Nov. 08	Discussion	Origin of unusual carbonates – Neoproterozoic “cap carbonates”	
M	Nov. 11	No Class	Project meetings	
W	Nov. 13	Discussion	Biosedimentary structures – Stromatolites	
F	Nov. 15	Discussion	Biosedimentary structures – Reefs through time	
M	Nov. 18	No Class	Project meetings	
W	Nov. 20	Discussion	Secular change – Warm/cold-water carbonates	
F	Nov. 22	Discussion	Secular change – Calcite-aragonite seas	
M	Nov. 25	No Class	Analysis of lab results	
W	Nov. 27	No Class	Analysis of lab results	
F	Nov. 29	No Class	THANKSGIVING HOLIDAY	
M	Dec. 02	Discussion	Project presentation	

SYLLABUS OF LABORATORY EXERCISES

LABORATORY EXERCISES

W	Aug. 28	Laboratory	Classification of carbonates	(Due Sept. 04)
W	Sept. 04	Laboratory	Skeletal components	(Due Sept. 11)
W	Sept. 11	Laboratory	Non-skeletal components	(Due Sept. 18)
W	Sept. 18	Laboratory	Carbonate cements and neomorphism	(Due Sept. 25)
W	Sept. 25	Laboratory	Interpreting paragenesis	(Due Oct. 02)
W	Oct. 02	Lab Project	Thin and thick section preparation	
W	Oct. 09	Lab Project	Petrography and Cathodoluminescence	
W	Oct. 16	Lab Project	Microdrilling	
W	Oct. 23	Lab Project	Sample Powder Splits – due before 7:00 pm	
W	Oct. 30	Lab Project	...continued analysis and documentation...	
W	Nov. 06	Lab Project	...continued analysis and documentation...	
W	Nov. 13	Lab Project	...continued analysis and documentation...	
W	Nov. 20	Lab Project	...continued analysis and documentation...	
W	Nov. 27	Lab Project	Preparation of Poster Presentation	(Due Dec. 02)

SOME FOOD FOR THOUGHT

*Not that I aspire to complete coherence.
The mistake is to confuse our limitations with the bounds of possibility.*

-William Golding

*We will not succeed in answering all your questions.
The answers we have found only serve to raise a whole set of new questions.*

*In some ways, we feel we are confused as ever,
but we believe we are confused on a higher level,
and about more important things.*

-Lawrence Watkin
