GEOL 347:
Carbonate Sedimentology

Syllabus – Spring 2010

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Office: Brown Hall, Room #105, phone (515) 229-5248
Office hours: Open door policy, *or by appointment*
Lectures: T&Th 8:30AM – 10:00AM, BR 143-4

Readings

There is no specific textbook for an undergraduate course in carbonate sedimentology. Most of the readings assigned will be from Tucker & Wright (1990), but I will not follow this book in a linear way and some parts of it will not be covered or will be condensed. Additional readings will be available at the SLU ANGEL Learning Management Suite (https://angel.stlawu.edu).

Textbook: Tucker, M.E. and Wright, V.P., 1990, Carbonate Sedimentology: Blackwell, 482 p.

Course Notes

Each lecture has a handout that provides material essential for understanding the lecture. These handouts, along with some other course materials, are available for free download at the SLU ANGEL website. You should download lecture handouts before the start of each class. This allows you to follow along as I tend to use lots of pictures and graphs in my PowerPoint presentations. The best strategy is to pay attention and add your own comments on the handouts as we progress. You can treat the collection of lecture handouts as an additional textbook. You should get a three-ring binder in order to keep the handouts organized.

Course Description

Carbonate Sedimentology is an advanced course that offers examination of carbonate sedimentology and depositional environments through classroom, laboratory and field examples. The course includes field trips to several classic localities in the country. The course focuses on the temporal and spatial makeup and controls on mineralogy and constituent composition of sedimentary carbonates, and will introduce students to carbonate facies and field and lab methods, carbonate platform models, sequence stratigraphy, carbonate cycles, orbital (Milankovitch climate) forcing and porosity in carbonates. It will provide an understanding of why no other rock type is as economically important as carbonates being major reservoirs for petroleum, base metals and potable water.

Course Goals

(1) To introduce students to carbonate facies and field and lab methods, carbonate platform models, sequence stratigraphy, carbonate cycles, Milankovitch climate forcing and porosity in carbonates.
(2) To gain experience collecting and analyzing field data.
(3) To understand why carbonates are major reservoirs for petroleum, base metals and potable water.
(4) To comprehend how the study of modern carbonate sedimentary environments can help us better understand ancient environments and manage modern environmental change.

Course Expectations

Attendance and active participation is required at all classes and field trips, and students are expected to be on time as a courtesy to one another. You are allowed three "cuts" or unexcused absences. Missing a fourth class will result in an automatic 0.25 reduction to the final course grade! Additional 0.25 grade reductions will be incurred for each additional absence. Excused absences are for reasons beyond your control and are unavoidable, such as being hospitalized. You may need to provide documentation if asked.

Lecture course will be a mix of lectures and in-class projects and discussion and presentation of assigned readings. Make sure to do the reading so that you can participate in class discussions. Regarding presentations, students who fail to give their presentation on the scheduled date will be given an automatic zero for the entire assignment. Under extreme circumstances, presentations may be rescheduled.

Field Trip Policies

Field trips are an integral part of this course and are mandatory. Observations and concepts from the field trips will be included in the final exam. Reports are due not later than one week after the field trip, unless otherwise instructed. If a report is not submitted on the date it is due (and no extension has been granted), it receives an automatic zero. Reports are to be placed in your instructor's box outside Brown 143-144. Please note that as part of department policy late write-ups cannot be accepted by your instructor.

It is essential to bring appropriate clothing to the field trips. Bring warm outer clothing because you will be working outside for several hours (e.g. bring gloves, jacket, hat, boots).

Unless provided by the instructor, you will also need to bring field notebook, rock hammer, acid bottle, compass, hand lens and grain size card. Please contact Mr. Matt VanBrocklin regarding the equipment available at the department.

Course Schedule

(May be subject to modification as the semester progresses to allow the most effective completion of all field and in-class activities). Readings are from Tucker & Wright, unless otherwise stated.

WEEK #	DATE	DAY	LECTURE TOPIC	READINGS	QUIZ #
1	1/19/10	T	Introduction. *Carbonate Petrography.* Carbonate Grain Types.	Preface, pp. 1-13	1
	1/21/10	Th	Grain Types, *cont.* Limestone Classification	pp. 13-25, D, E&K	
2	1/26/10	T	Introduction to Project #1: Petrographic analysis of shallow-water carbonates	Revisit Ch. 1, use Atlas of Carbonate Rocks by Adams & MacKenzie	
	1/28/10	Th	Project #1: Petrographic analysis of shallow-water carbonates, *continued*		
3	2/2/10	T			
	2/4/10	Th			
4	2/9/10	T	Major Controls on Carbonate Sedimentation. *Modern Carbonates*	pp. 28-34, S&H	2
	2/11/10	Th	Peritidal Carbonates: Arid vs. Humid. *The Tidal Flat Model.* Shoal Complexes	pp. 137-149, 127-137	3
5	2/16/10	T	*The Reef*	pp. 190-227, J	4
	2/18/10	Th	Resedimented Limestones Jeopardy-Type Quiz #1	pp. 256-271	5
6	2/23/10	T	Modern Carbonate Environments: Trucial Coast. *Arid Carbonate Coastlines*	pp. 93-100	
	2/25/10	Th	Holocene Carbonates of the Shark Bay	L&C	
7	3/2/10	T	Introduction to Project #2: Stratigraphic Section Description and Graphic Log Drafting	P&S *Box 15.1* (pp.334-338) Ch. 8	
	3/4/10	Th	Project #2: Stratigraphic Section Description and Graphic Log Drafting, *cont.*		
8	3/9/10	T	**MID-TERM EXAM**	Revisit previous readings	
	3/11/10	Th	*No. classes. Instructor running the Tropical Coastal Environments field course on Bahamas*		
9	3/16/10	T	*Spring Break!*		
	3/18/10	Th			
10	3/23/10	T	Carbonate Platform Models: Ramps	Read (1985)	6
	3/25/10	Th	Carbonate Platform Models: Rimmed Shelves	Read (1985)	
11	3/30/10	T	Carbonate Platform Models: Isolated Platforms	Read (1985)	
	4/1/10	Th	Greenhouse World Platforms	Read (1998), Hoffman & Schrag (2000)	7
12	4/6/10	T	Icehouse (& Transitional) World Platforms		
	4/8/10	Th	Jeopardy-Type Quiz #2		

13	4/13/10	T	*No. classes. Instructor at AAPG meeting in New Orleans.*		
	4/15/10	Th	Carbonate Sequence Stratigraphy	Schlager Ch.6	8
14	4/20/10	T	Project Presentations		
	4/22/10	Th	Project #3: Accommodation Change in Cyclic Carbonate Successions – Fischer Plots	H, B, R & R (09)	
15	4/27/10	T			
	4/29/10	Th	Porosity. Diagenesis. *Carbonate Facies & Reservoir Heterogeneity – The Value of Modern Analogues*	p. 25-28, 314-318	9
16	TBA		**FINAL EXAM**	Revisit all previous readings	

Dunham, R.J., 1962, Classification of carbonate rocks according to depositional texture, AAPG Mem. 1, p. 108 – 121.

Embry, A.F. and Klovan, J.E., 1971, A Late Devonian reef tract on northeastern Banks Island, Northwest Territories, Canada: Bull. Can. Petrol. Geology, V. 19,. 730-781. *Just read section on classification.*

Adams, A.E. and MacKenzie, W.S., 1998, A Color Atlas of Carbonate Sediments and Rocks Under the Microscope: Wiley, 184 pp.

Stanley, S. M. and Hardie, L. A., 1998, Secular oscillations in the carbonate mineralogy of reef-building and sediment producing organisms driven by tectonically forced shifts in seawater chemistry: Paleogeog., Paleoclimat., Paleoecol., v. 144, p. 3-19.

James, N. P., 1983, Reef Environment, In, Carbonate Depositional Environments, In, Scholle, et al. (eds.), AAPG Mem 33, p. 346-440 (lots of pictures of reefs both modern and ancient; note James' reef-mounds should be called banks). *See also James & Bourke on ANGEL*

Logan, B.W. & Cebulski, D.E., 1970, Sedimentary environments of Shark Bay, Western Australia: Memoir of the American Association of Petroleum Geologists 13, 1-37.

Prothero, D.R. and Schwab, F., 2004, Sedimentary Geology: An Introduction to Sedimentary Rocks and Stratigraphy, 2nd edition: W.H. Freeman and Company, New York, 557 p.

Read, J. F., 1985, Carbonate platform models: American Association of Petroleum Geologists Bulletin 69, 1-21.

Read, J. F., 1998, Phanerozoic carbonate ramps from greenhouse, transitional and ice-house worlds: clues from field and modelling studies, *in* Wright, V.P., and Burchette, T.P., eds, Carbonate Ramps: Geological Society London, Special Publication 149, 107-135.

Hoffman, P.F. & Schrag, D.P., 2000, Snowball Earth. Scientific American, January 2000, pp. 68-75.Schlager, W., 2005, Carbonate Sedimentology and Sequence Stratigraphy: SEPM Concepts in Sedimentology and Paleontology 8, 200 p.

Husinec, A., Basch, D., Rose, B. & Read, J.F., 2009, FISCHERPLOTS: An Excel spreadsheet for computing Fischer plots of accommodation change in cyclic carbonate successions in both the time and depth domain: Computers & Geosciences, 34, 269-277.

GRADING

The final grade will be determined based on the following: mid-term exam 20%, final exam 25%, in-class projects 20%, field trip write-ups 15%, quizzes 10%, and project presentation 10%. Class attendance is essential to pass the course. The exam content will focus largely on the lecture notes and any sections recommended directly from the reading material. The final exam is comprehensive and will contain material covered from all parts of the course, including field trips.

There will also be two opportunities to earn extra credit points during the semester. These will be awarded based on a student's success in the *Jeopardy*-type classroom quizzes.
Final grade will be consistent with the 0 to 4 grading scale, and will be determined as follows:

Percent range	Final grade	Percent range	Final grade
97.01 or more	4	76.01-79.00	2.25
94.01-97.00	3.75	73.01-76.00	2
91.01-94.00	3.5	70.01-73.00	1.75
88.01-91.00	3.25	67.01-70.00	1.5
85.01-88.00	3	64.01-67.00	1.25
82.01-85.00	2.75	61.01-64.00	1
79.01-82.00	2.5	61.00 or less	0

Honor code

At St. Lawrence, all members of the University community have a responsibility to see that standards of honesty and integrity are maintained. It is the responsibility of each student to learn and understand the standards of academic integrity expected at St. Lawrence, as expressed in the University's academic honor code. Additional information regarding academic honesty, plagiarism and academic dishonesty procedures and penalties can be found in the Student Handbook.

Special Needs

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Director of the Office of Academic Services for Students with Special Needs (John Meager +5104, Secretary +5537) as early as possible in the semester.