

Geology 340 — Earth Surface Processes

University of Tennessee — Spring 2012

Overview and Objectives

The investigation of sedimentary rocks differs significantly from that of either igneous or metamorphic rocks, and is, in many respects, unmatched in terms of the information that can be amassed regarding the history of the Earth's surface. The composition, texture, structure, packaging, and chemistry of sedimentary rocks provide unique insights into everything from the evolution of the biosphere to plate tectonic configuration.

This course aims to provide you with the tools necessary to:

- understand the origin and behavior sedimentary grains
 - describe and classify the major types of sedimentary rocks
 - decipher environments of deposition and diagenesis
 - use information from sedimentary rocks to understand biospheric evolution
 - appreciate the role of the sedimentary record in “telling time”
 - interpret sedimentation patterns in terms of tectonic processes
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Lectures

- Location → MWF 9:05 am until 9:55 am, Rm. 223
- Instructor → Dr. Linda C. Kah (lckah@utk.edu; 974-6399)
- Office Hours → by e-mail appointment

Labs

- Location → Hessler Biology Bldg., Rm. 307; M 12:20-2:15 pm, M 2:30-4:25 pm, or W 2:30-4:25
 - Instructors → Geoff Gilleaudeau (ggillea1@gmail.com); Sarah Keenan (skeenan1@utk.edu)
 - Office Hours → to be announced
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Grading and Assessment

- Lab Section → 30%
 - Midterm Abstract and Presentation → 15%
 - Exams → 15% each
 - Field Trip Report → 10%
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Textbook

- Nichols, G., 2009, *Sedimentology and Stratigraphy (2nd addition)*, Wiley-Blackwell
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*Wherein are related a thousand trifling matters,
as trivial as they are necessary
to the right understanding of this great history.*

Cervantes, Don Quixote of La Mancha, 1615

Syllabus of Lecture Topics — Earth Surface Processes

• Behavior of Sedimentary Particles

W	Jan. 11	– Introduction to syllabus and sedimentary geology	Chapter 1
F	Jan. 13	– Origin of sedimentary grains – weathering	Chapters 6
M	Jan. 16	– <i>NO CLASS – MARTIN LUTHER KING DAY</i>	
W	Jan. 18	– Origin of sedimentary grains – provenance	Chapter 6
F	Jan. 20	– Analysis of grain size	Chapter 2 (section 2.5)
M	Jan. 23	– Analysis of grain shape and texture	Chapter 2 (section 2.5)
W	Jan. 25	– Dynamics of fluid movement	Chapter 4
F	Jan. 27	– Fluid movement and sediment transport	Chapter 4
M	Jan. 30	– Bedform interpretation, part 1	Chapter 4
W	Feb. 1	– Bedform interpretation, part 2	Chapter 4
F	Feb. 3	– Sedimentary structures, part 1	Chapter 4
M	Feb. 6	– Sedimentary structures, part 2	Chapter 4
W	Feb. 8	– <i>MIDTERM EXAM (1)</i>	

• Sedimentary Petrology and Diagenesis

F	Feb. 10	– Siliciclastic rocks in thin section	Chapter 2
M	Feb. 13	– Sandstone, shale, silt, and clay, part 1	Chapter 2
W	Feb. 15	– Sandstone, shale, silt, and clay, part 2	Chapter 2
F	Feb. 17	– Siliciclastic diagenesis	Chapter 18 (section 18.1-18.3)
M	Feb. 20	– Carbonate rocks in thin section	Chapter 3
W	Feb. 22	– Carbonate chemistry	Chapter 3
F	Feb. 24	– Carbonate chemistry, cont.	Chapter 3
M	Feb. 27	– Carbonate diagenesis, part 1	Chapter 18 (section 18.4 to 18.7)
W	Feb. 29	– Carbonate diagenesis, part 2	Chapter 18 (section 18.4 to 18.7)
F	Mar. 2	– Other chemical sediments	Chapters 3 (3.2 to 3.7) and 10
M	Mar. 5	– <i>MIDTERM POSTER PRESENTATIONS</i>	
W	Mar. 7	– <i>MIDTERM POSTER PRESENTATIONS</i>	

• Facies Models

F	Mar. 9	– The nature of sedimentary strata	Chapter 5
M	Mar. 12	– Glacial environments	Chapter 7
W	Mar. 14	– Eolian environments	Chapter 8
F	Mar. 16	– Fluvial environments	Chapter 9
M	Mar. 19	– <i>NO CLASS – SPRING BREAK</i>	
W	Mar. 21	– <i>NO CLASS – SPRING BREAK</i>	
F	Mar. 23	– <i>NO CLASS – SPRING BREAK</i>	
M	Mar. 26	– Deltaic environments	Chapter 12
W	Mar. 28	– Marine shoreline environments	Chapters 11 and 13
F	Mar. 30	– Marine shelf and slope environments	Chapters 14 and 16
M	Apr. 2	– Marine carbonate environments	Chapter 15
W	Apr. 4	– <i>MIDTERM EXAM (2)</i>	
F	Apr. 6	– <i>NO CLASS – SPRING RECESS</i>	

Syllabus of Lecture Topics — Continued

• Stratigraphic Principles and Processes

M	Apr. 9	– Stratal packaging	Chapter 19
W	Apr. 11	– Lithostratigraphy & Biostratigraphy	Chapters 19 and 20
F	Apr. 13	– Magnetostratigraphy & Chronostratigraphy	Chapter 21
 <i>Apr. 14 and 15 – FIELD TRIP – Pound Gap</i>			
M	Apr. 16	– Chemostratigraphic correlation	Chapter 21
W	Apr. 18	– Cycles to seismic	Chapter 22
F	Apr. 20	– Sequence stratigraphy, part 1	Chapter 23
M	Apr. 23	– Sequence stratigraphy, part 2	Chapter 23
W	Apr. 25	– Basin development, part 1	Chapter 24
F	Apr. 27	– Basin development, part 2	Chapter 24
			<i>Field Trip Report – Due</i>
M	May. 4	– FINAL EXAM – 8:00-10:00 am	

EXAMS (three exams at 15% each)

Exams will be comprehensive, but will concentrate on the students understanding of recently presented material and the synthesis of sedimentological data. Exams will combine short-answer and essay questions.

MIDTERM ABSTRACT AND POSTER PRESENTATION (5% abstract, 5% poster, 5% presentation)

Three to four weeks prior to the midterm presentation, each student will be assigned a sedimentary thin section and some basic information about the unit from which the rock was collected. Students will examine their thin section under the microscope and determine petrographic features (grain types, grain texture, cement textures, diagenetic overprinting), and interpret the depositional and/or diagenetic history of the sample. Students will then prepare a conference-style abstract and mini-poster (3x4 foot maximum) that will be professionally presented to the class and to the department. More information on the poster presentation is forthcoming.

FIELD TRIPS (5% final paper, 5% field observations)

We have a one-day field trip for this course. The field trip will focus on interpreting depositional facies, measuring stratal thicknesses, and placing stratigraphic observations into an interpretation of basin development. During the last section of the course, students will be provided with readings about the development of the Appalachian basin and will construct a final paper that will incorporate both background reading and field observations.

Syllabus of Laboratory Topics

Monday, January 18 – NO LAB – MLK Day

Week 1 – Monday, January 23 and Wednesday, January 25

- Grain size analysis

Week 2 – Monday, January 30

- Interpretation of sedimentary structures

Week 3 – Monday, February 6

- Siliciclastic rocks in hand sample

Week 4 – Monday, February 13

- Siliciclastic rocks in thin section

Week 5 – Monday, February 20

- Carbonate rocks in hand sample

Week 6 – Monday, February 27

- Carbonate rocks in thin section

Monday, March 5 – NO LAB – FREE WEEK

Week 7 – Monday, March 12

- Facies analysis

Monday, March 19 – NO LAB – SPRING BREAK

Week 8 – Monday, March 26

- Facies analysis

Week 9 – Monday, April 2

- Correlation exercise, part 1

Week 10 – Monday, April 9

- Correlation exercise, part 2

Week 11 – Monday, April 16

- Sequence stratigraphy exercise, part 1

Week 12 – Monday, April 23

- Sequence stratigraphy exercise, part 2