WAYNE STATE UNIVERSITY

Department of Geology

GEL 3400
Sedimentation and Stratigraphy

"No vestige of a beginning…no prospect of an end." – James Hutton

Fall 2008 COURSE SYLLABUS

Meeting Times Tuesday 9:00-10:30 a.m., 11:00 a.m.-2:00 p.m. Room 0319 Old Main
Thursday 9:00-10:30 a.m. Room 0319 Old Main
Supplemental Instruction: Thursday 11:00 a.m.-noon

Instructor Lawrence D. Lemke
Room 0224 Old Main
Phone: 577-6412
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Office Hours Wednesday 9-10 am, and by appointment

Course Materials Required Text: Prothero and Schwab, 2004, Sedimentary Geology, 2rd edition.
Recommended: Stow, 2005, Sedimentary Rocks in the Field: A Color Guide

Course Grading Final grades will be determined using the following weighting scheme:

- Homework/Lab Assignments 20%
- Field Trips 10%
- First Exam 15%
- Second Exam 15%
- Oral Presentation and Class Participation 20%
- Term Paper 20%

All assignments will include a due date. Late assignments will not be accepted for credit unless permission is given by the instructor *prior to* the due date.

Grades will be assigned based on the following scale:

85-100	A
75-85	B
65-75	C
55-65	D
<55	F

The instructor may take class participation and effort into account when assigning final grades for students whose average score sits close to the borderline between two grades.

Course Prerequisites

Physical Geology (GEL 1010 or equivalent); Mineralogy (GEL 2130) or concurrent enrollment. One college level course in Physics, Chemistry, and Algebra strongly recommended.

Course Objectives:

This course provides an introduction to and overview of sedimentology and stratigraphy – two closely related disciplines dealing with the description and interpretation of sedimentary materials. It is intended to provide practical experience in sedimentologic and stratigraphic applications that will assist geologists and environmental scientists who need to:

(a) describe the physical characteristics of sediments and sedimentary rocks,
(b) infer the physical conditions and interpret depositional environments in which such sediments were deposited, and
(c) interpret the three-dimensional architecture of sedimentary strata for the purposes of predicting the distribution of economically or environmentally important units such as groundwater aquifers, petroleum reservoirs, or their confining beds.

Mastery of the material presented in this course will benefit students seeking professional employment in applied geology or environmental management as well as students seeking advanced academic degrees in science or engineering disciplines that involve subsurface characterization and geologic modeling.

By the end of this semester, students should be able to:

1. Describe the concepts and principles governing single-phase fluid flow and sediment transport.
2. Describe and classify common siliciclastic and carbonate rocks in hand sample and thin section.
3. Recognize, describe, and interpret common sedimentary structures.
4. Measure, describe, and interpret an outcrop section of sedimentary strata or a sedimentary rock core.
5. Construct, correlate, and interpret a stratigraphic cross section.
6. Understand the complimentary *litho-*, *bio-*, *chrono-*, and *allo*stratigraphic approaches to stratigraphic analysis.
7. Apply appropriate facies models to interpret sedimentary depositional environments.

Course Format and Procedures:

GEL 3400 is a four credit hour course designed for undergraduate students in geology and environmental science. The course is structured in a blended lecture and lab format. Several times during the semester, we will take advantage of the block scheduling on Tuesdays to explore the characteristics of modern sediments and sedimentary rocks in the field. This may result in class meeting slightly earlier than scheduled or ending slightly later than scheduled or at a location other than the Wayne State University campus.

Early in the semester, each student will choose a specific depositional environment that will form the basis for a research investigation culminating in a 5 to 10 page term paper and a 15-minute oral presentation to the class. A mandatory class field trip is planned for the weekend of October 17-19. Students are expected to attend all class meetings and should be prepared to answer questions and participate in class discussions. Students may be excused from class, however, to participate in religious observances or for urgent personal situations, provided that arrangements are made with the instructor in advance.

Academic Integrity

Each student in this course is expected to abide by the WSU Student Code of Conduct: http://www.doso.wayne.edu/codeofconduct.pdf.
Any work submitted by a student in this course for academic credit will be the student's own work. For GEL 3400, collaboration on homework and laboratory assignments is allowed in the following instances:

- Students are encouraged to study together and to discuss information and concepts covered in lecture and course readings with other students.
- Students can give "consulting" help to or receive "consulting" help from other students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of any work done by someone else (in the form of an email, an email attachment file, a diskette, or a hard copy).

During examinations, you must do your own work. Talking or discussion is not permitted during the exams. You may not compare papers, copy from others, or collaborate in any way. Any unauthorized collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Accommodations for students with special needs

I am available to discuss academic accommodations that may be required for students with special needs of any kind. Requests for academic accommodations should be made during the first three weeks of the semester, except for unusual circumstances, so that appropriate arrangements can be made.

Professionalism

GEL 3400 prepares students for a professional career path in geology, environmental science, or geoscience education. Students are therefore expected to practice the highest standards of professionalism in class attendance, participation, communication, and in oral and written assignments for this class.

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Fall 2008 Course Outline

Week of	Lab Topics	Lecture Topics	Readings[1]
Sept 1	Lab 1. Sedimentary Textures Read text p. 81-91 before lab!	Overview/Introduction Sedimentary Textures	Ch. 1, 5 (part)
Sept 8	Lab 2. Library Research	Sedimentary Structures; Sediment Transport and Depositional Processes	Ch. 4
Sept 15	Lab 3. Sedimentary Structures **FIELD DAY – Sept 16**	Fluid Flow, Transport and Deposition, Depositional Environments	Ch. 3
Sept 22	Lab 4. Siliciclastic Rocks	Siliciclastic Rocks	Ch. 5, 6
Sept 29	Lab 5. Describing Sed Outcrops **FIELD DAY – Sept 30**	**Research Paper Proposal Due 10/2**	
Oct 6	Lab 6. Carbonate Rocks	Carbonate Rocks	Ch. 11
Oct 13	Facies Model Exercise	Depositional Environments, Facies Models, and Walther's Law	
***	**FIELD TRIP – October 17-19th**	*** *Sed Rocks Exposed!* ***	
Oct 20	**Exam I – Sedimentation (Oct 21st)**	Lithostratigraphy	Ch. 15
Oct 27	Lab 7. Core Description	Biostratigraphy	Ch. 16
Nov 3	Lab 8. Cross Section Construction	Chronostratigraphy	Ch. 18
Nov 10	Lab 9. Cross Section Interpretation	Seismic and Sequence Stratigraphy; Writing Workshop (11/13): In-Class Term Paper Editing	Ch. 17
Nov 17	Lab 10. Sequence Stratigraphy	Review and Catch-up; Writing Workshop (11/20): In-Class Term Paper Editing	
Nov 24	No lab – Thanksgiving[2]	**Exam II – Stratigraphy (Nov 25th)**	
Dec 1	Facies Models: *Class Presentations*	Facies Models: *Class Presentations*	Ch 8, 9, 10, 12, 13, 14
Dec 8	Facies Models: *Class Presentations* Course evaluation	**Term Papers Due:** **December 9th – no exceptions!**	

[1] Course Text: Prothero and Schwab, Sedimentary Geology. Note: for many topics, you will also find useful information in the supplemental text: Stow, Sedimentary Rocks in the Field: A Color Guide

[2] Tues, Nov 25th is officially a 'Thursday' on the University Calendar. The professor will be available during the supplemental instruction period on that day to assist in preparing for your Facies Model oral presentation.

Note: The instructor reserves the right to modify the course content and schedule as the semester progresses in order to take into account changing needs of the students or instructor, weather-related closures, power outages, or any other unforeseen circumstances.

Guidelines for GEL 3400 Term Papers and Oral Presentations

Final Term Papers are due in the Blackboard Digital Drop Box
on Tuesday, December 9th – no exceptions!

1. **Subject**

Each student will choose a specific depositional environment to form the basis for his or her term research project. The focus of the research should be to describe appropriate facies models and their application to descriptions of sedimentary sequences related to your depositional environment of choice. Potential depositional environments are described in Chapters 8, 9, 10, 12, 13, and 14 in the course text and include:

- Fluvial
- Lacustrine
- Volcaniclastic
- Shoreline/Beach
- Tidal Flat
- Evaporite
- Clastic Shelf
- Slope/Basin Carbonate and Clastic
- Sabkha
- Alluvial Fan
- Glacial
- Estuary
- Lagoon
- Barrier Island
- Eolian (Desert, Dune, etc.)
- Carbonate Shelf
- Submarine Fan
- Carbonate Reef

2. **Format**

The paper should be 5 to 10 double-spaced pages, excluding title page, abstract, references, and figures. Use 12 point Times New Roman or equivalent font with one-inch margins. Include the following sections:

- ABSTRACT
- INTRODUCTION
- DEPOSITIONAL PROCESSES
- DEPOSITIONAL FACIES AND FACIES ASSEMBLAGES
- MODERN and ANCIENT EXAMPLES (this could be two separate sections)
- DISCUSSION or CONCLUSIONS
- REFERENCES (use a consistent citation and bibliographic style)

Write the abstract last, after you have completed the rest of your paper. It should be as short and concise as possible – summarizing the main points and highlighting your conclusions. Your abstract should be no longer than 250 words (check this using *Word Count* under the *Tools* menu of Microsoft Word). Generally, the abstract should not include citations. In the abstract (and throughout the paper!) avoid writing in the passive voice whenever possible. [i.e., avoid statements like "The physical characteristics of sediments deposited in fluvial environments are discussed." Instead, write using the active voice whenever possible. (For example: "Physical characteristics such as fining-upward successions of clastic rock textures are commonly preserved in fluvial sediments.")] Strive to be specific and say exactly what you mean.

The introduction sets the stage for the description and documentation of your chosen sedimentary environment. It should include an overview of your topic – define its purpose and scope. State why the topic you are discussing is important. Try to capture your readers' attention here. The main body of the paper should include a discussion of: (a) the depositional processes commonly found in your environment, (b) the resultant depositional facies and facies associations, and (c) at least one example of a modern environment and an ancient sedimentary deposit. *Write from an outline and use topic sentences for each paragraph.*

You will not, in most instances, be documenting your own original sedimentological research in this paper. It is therefore essential that you cite the sources of the information you include in a thorough and appropriate manner. Use a citation format such as GSA Bulletin or AAPG Bulletin and include references for all citations. **Endnote** is a VERY helpful tool for managing references!

Your discussion/conclusion section should not be a reiteration of the abstract or introduction, but should summarize the main points of your paper and note other areas or applications where sediments of the type you have described may be important. If you or other workers have recognized any significant gaps in our understanding of your topic, you may also note this here.

3. **Resources**

Your textbook is a useful starting point for basic references but is certainly not the only avenue available to you. You should avail yourself of electronic search engines (e.g., GEOREF) and hard copy compendiums (e.g., Bibliography and Index of Geology) to search for books and journal articles related to your topic. Be sure to cite your references within the body of your paper and then list them in a reference list at the end of the paper. Useful journals will includc:

Journal of Sedimentary Research
Journal of Sedimentary Petrology
Journal of Geological Society of London
Geological Society of America (GSA) Bulletin
American Association of Petroleum Geologists (AAPG) Bulletin
Sedimentary Geology
Sedimentology
Geology

4. **Research Paper Proposal**

On Thursday, October 2nd, you are required to submit a one-paragraph summary of your chosen research topic along with a major topic outline and at least 5 references.

5. **Term Paper Editing.**

Each student is required to bring a draft double-spaced copy of his or her term paper manuscript to class on November 13th and 20th. On these days, students will exchange, read, edit, and provide constructive feedback on each others' papers. This is a great opportunity to improve your paper and your grade! Everyone is expected to participate.

6. **Oral Presentation**

During the last two weeks of class, each student is responsible for presenting a 15-minute PowerPoint or poster presentation summarizing his or her depositional environment to the entire class. Your objective is to teach the rest of us the essential information we should know in order to recognize and interpret sedimentary deposits from your chosen depositional environment. You must provide a copy of your paper abstract and a one-page summary handout. By this point in the semester, *you* will be the expert and everyone else in the class will benefit from *your* expertise.