Earth Sciences 2260a, Stratigraphy and Sedimentology: From Beds to Basins

Instructor: Dr. A. G. Plint. Rm 1072, BGS, gplint@uwo.ca; 519-661-3179.
Assistants: TBA.
Lectures: Two lecture hours/ week; Tuesday & Thursday, 11:30-12:30am PAB (Physics & Astronomy Building) Rm. 117
Labs: Three laboratory hours per week; Monday 2:30-5:30 pm, BGS Rm. 1015.

Corequisite: ES 2200a/b
"Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites."

Syllabus and Outline:
The aim in this course is to show how Historical Geology, based on stratigraphy, lies at the very core of Geology as a science. Remember that, without the element of **TIME**, Geology is nothing more than chemistry, physics and biology! It is essential to appreciate the enormity of geological time, and to understand the different methods that are available to determine both the *relative* ages of rocks, and also their *absolute* age.
The course has three distinct parts. First we will look briefly at the origins, composition, transport and deposition of sedimentary rocks because it is necessary to know what the building blocks look like before we start to build stratigraphic successions.

The second part (and this will be only a brief review) will examine how and why sedimentary basins form in the first place. Sedimentary basins will be considered in terms of plate tectonic mechanisms and plate settings.

The third part will involve a brief historical review of the evolution of the concept of Geological Time and the gradual rejection of the biblical timescale during the early 1800's. We will examine various ways of dividing up packages of sedimentary rocks into manageable pieces, and consider methods that are available to correlate rock successions from local to intercontinental scales.

In the first two labs, we will look at some of the main types of sedimentary rock in hand specimen. In subsequent labs, we will look at various stratigraphic problems. Much of the emphasis will be on using 'real world' industry data (wireline well logs, seismic) that any practicing exploration geologist would use.

Learning Outcomes:

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

1. Identify the principal detrital and biogenic components of sedimentary rocks.

2. Identify the most common types of physical sedimentary structure, and describe their origin in terms of fluid flow.

3. Relate the formation of the main types of sedimentary basin to causative plate tectonic mechanisms.

4. Apply the geological timescale as a basis from which to analyse the history of a sedimentary basin.

5. Describe how various physical, chemical and biological concepts and techniques can be used as a means to establish correlation between stratigraphic successions.

6. Apply the knowledge and concepts above to analyse a variety of real-world stratigraphic data-sets, including seismic reflection profiles and wireline log cross-sections, in order to deduce basin-forming processes and predict likely lithofacies distributions.

7. Analyse incomplete geological data in order to make reasoned predictions about the distribution of economically-valuable rocks, and to assess the level of uncertainty in those predictions.

Anticipated Class Schedule

Lecture	Main Topics	Lab Sessions
	No class Thursday Sept 7 – Plint leading 4450y field school.	
1	Sept 12. Terminology used to describe clastic sediments; fabric, texture, composition	Sept 11. 1 hr. Lab lecture - Introduction to course: Lab:West Alberta stratigraphy- Rock identification
2	Sept. 14. Origin of carbonate sediment grains, bioclastic & inorganic.	
3	Sept 19. Origin of Chemical Sediments, evaporites, ironstones, organic sediments	Sept 18. West Alberta stratigraphy- Facies Concepts
4	Sept 21. Characteristics of fluids, Fluid flow, turbulence, flow structure, Reynolds number, Froude number.	
5	Sept 26. Transport of loose granular sediment, Hjülstrom diagram, bedform phase diagram, bedforms produced by unidirectional currents	Sept 25. West Alberta stratigraphy - Correlation Principles & Environmental Synthesis
6	Sept 28. Bedforms produced by oscillatory currents	

7	Oct 3. Sediment gravity flows, slides, slumps, debris flows	Oct 2. Lab Lecture: Review of Earth's plate structure, plate motion; basin types. Lab: Intro to Seismic Stratigraphy:
8	Oct 5. Sediment gravity flows, turbidity currents & associated structures.	
	No classes Oct 9 to 13 (Fall Break.)	
9	Oct 17. Rift basins.	Oct 16. Basin Types: Seismic Exercise
10	Oct 19. Mid-term test in lecture room.	
11	Oct 24. Divergent margin basins & ocean basins	Oct 23. Basin Types: Seismic
12	Oct 26. Convergent margin basins, back-arc & forearc basins, foreland basins	
13	Oct 31. Strike slip basins, epeiric basins, intracratonic basins	Oct 30. Lab Exam # 1
14	Nov 2. Practical Stratigraphy - methods available to modern stratigraphers; outcrop, core, cuttings, wireline logs, FMI, 2-D and 3-D seismic.	
15	Nov 7. Historical Geology; Evolution of idea; Herodotus to Werner	Nov 6. Lab lecture: Introduction to wireline logs. Lab: Exploration Game part 1.
16	Nov 9. Evolution of ideas; Hutton to Lyell	
17	Nov 14. Evolution of ideas; Darwin to the Deep-Sea Drilling Project	Nov 13. Exploration Game part 2 - Intro to Isopach Mapping & Drilling Strategy
18	Nov 16. Stratigraphy; Lithostratigraphy and terminology	
19	Nov 21. Allostratigraphy & Sequence Stratigraphy	Nov 20. Exploration Game part 3- Developing Predictive Exploration Models & Economic Considerations.
20	Nov 23. Biostratigraphy	
21	Nov 28. Magnetostratigraphy & Chronostratigraphy	Nov 27. Review of Oil Game outcomes. Revision & Review of Lab Exercises
22	Nov. 30. Cyclostratigraphy, carbon-isotope strat.	
23	Dec 5. Catch-up and/or review	Dec 4. Lab Exam # 2; 5th December
24	Dec 7. Review, or free time, as appropriate.	

Course Materials:

Text: Gary Nichols: *Sedimentology and Stratigraphy*. (2nd Edition), Wiley-Blackwell. (This text, which is strongly recommended, is also useful for 3314b). New and second-hand copies are commonly available on Amazon – commonly cheaper than the UWO bookstore.

Evaluation

5% Three 5-10 minute pop-quizzes at the start of three random classes
15% MidTerm Test (1 hour, Short answers)
30% based on **TWO** lab exams (3 hours each)
50% Final Exam (Short Answer and Short Essay Style, 2 hours)
No electronic devices are permitted during any examination or test.

Laboratories. I do not give 'brownie points' for attending lab sessions. I make the assumption that you are sufficiently mature to realize that attendance is an integral, and critical part of the course. Some key ideas and skills will be discussed and developed *only in the labs*, and hence *attendance is "strongly recommended"!* Two lab problems will be set and marked. Your ability to complete these marked problems is strongly dependent on the degree of effort that you put into working through the lab exercises.

Academic Offences:
"Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:
http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

Absence from Exams
If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see:
http://www.uwo.ca/univsec/handbook/appeals/medical.pdf

Accommodation due to Illness
A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's Office) for visits to Student Health Services.
The form can be found here:
www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf
(which includes a link to the Student Medical Certificate)

Emotional/Mental Health Distress
Students who are in emotional/mental distress should refer to Mental Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.

Accessibility
Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.
www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_disabilities.pdf

Support Services
Students who are in emotional or mental distress should refer to mental Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of of options about how to obtain help.
Registrarial Services are available at : http://www.registrar.uwo.ca/, and Student Support Services are listed at http://westernusc.ca/services/

Religious Holidays
Please see this link for University policy on accommodation for Religious Holidays.
www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf