

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

Instructor: Dr. A. G. Plint. Rm 1072, BGS, gplint@uwo.ca; 519-661-3179.

Teaching assistant: Slavena Galić

Lectures: Two lecture hours/ week; Tuesday & Thursday, 11:30-12:30am Room: TBA

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, core) that any practicing exploration geologist would use.

Learning Outcomes:

Upon successful completion of this course, students should 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

Week	Main Topics	Lab Sessions
1	<u>No classes Sept 5, 9, 10</u> – Plint leading 4450y field school.	
2	Sept 12. Terminology used to describe clastic sediments; fabric, texture, composition	
3	Sept. 17. Origin of carbonate sediment grains, bioclastic & inorganic.	Sept 16. West Alberta stratigraphy- Rock Identification
	Sept 19. Origin of Chemical Sediments, evaporites, ironstones, organic sediments	
4	Sept 24. Characteristics of fluids, Fluid flow, turbulence, flow structure, Reynolds number, Froude number.	Sept 23. West Alberta stratigraphy- Facies Concepts and Correlation Principles
	Sept 26. Transport of loose granular sediment, Hjulstrom diagram, bedform phase diagram, bedforms produced by unidirectional currents	
5	Oct 1. Bedforms produced by oscillatory currents	Sept 30. West Alberta stratigraphy – Correlation Principles and Environmental Synthesis

	Oct 3. Sediment gravity flows, slides, slumps, debris flows	
	Sat. October 5 and Sun Oct 6: Outcrop Club field trips	Non-credit field trips – you encouraged to attend.
6	Oct 8. Sediment gravity flows, turbidity currents & associated structures.	Oct 7. Intro to Seismic Stratigraphy; Seismic Exercise
	Oct 10. Basin Types: Rift basins.	
7	Oct 15. Mid-term test in regular lecture room.	Oct 14. No lab - Thanksgiving
	Oct 17 Divergent margin basins & ocean basins	
8	Oct 22. Convergent margin basins, back-arc & forearc	Oct 21. Seismic exercise
	Oct 24. Strike slip basins, epeiric basins, intracratonic basins	
9	Oct 29. Practical Stratigraphy - methods available to modern stratigraphers; outcrop, core, cuttings, wireline logs, FMI, 2-D and 3-D seismic.	Oct 28. Seismic + core exercise
	Oct 31. Historical Geology; Evolution of ideas; Herodotus to Werner	
	Saturday November 2nd.	Lab test # 1
10	Nov 4. No class- Fall Break	
	Nov 6. No class- Fall Break	Nov 4. No lab – Fall Break.
11	Nov 12. Evolution of ideas; Hutton to Lyell	Nov 11. Seismic + core exercise
	Nov 14. Evolution of ideas; Darwin to the Deep-Sea Drilling Project.	
12	Nov 19. Stratigraphy; Lithostratigraphy and terminology	Nov 18. Lab: Exploration Game part 1- Log correlation
	Nov 21. Allostratigraphy & Sequence Stratigraphy	
13	Nov 26. Biostratigraphy	Nov 25. Lab: Exploration Game part 2 - Intro to Isopach Mapping & Drilling Strategy
	Nov. 28. Magnetostratigraphy & Chronostratigraphy	
	Saturday November 30th	Lab test # 2
14	Dec 3. Cyclostratigraphy, carbon-isotope strat.	Dec 2. Lab: Exploration game part 3 - Exploration drilling, risk minimization; profit or loss.
	Dec 5. Catch-up, Review, or free time, as necessary.	

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% Mid-Term 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 tests will be set and marked. Your ability to complete these test is strongly dependent on the degree of effort that you put into working through the other 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 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