

ERTH 2314 Sedimentation and Stratigraphy

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This course examines the origins, transport, and deposition of sedimentary grains, and how sediment layering reflects larger scale processes (tectonics, eustasy, and sediment supply) related to development of the Earth's surface through time. The second topic forms the basis of stratigraphy, the foundation of our understanding of geologic time, and the tool used at all scales (nano-scale to hemispheric) to predict micro- to hemispheric earth patterns (igneous, metamorphic, sedimentary).

The instructional base for the course is multifold: a) the *CuLearn* website; b) a textbook; and c) a Lab Reference Manual. Lab assignments provide a practical exposure to theory and ideas discussed in class, and are a mixture of computer-based, hand (rock, sediment) sample analysis, mapping, and microscopy to illustrate the integrated nature of sedimentological and stratigraphical datasets.

There are no specified office hours: talk to me after a lecture, or before/after lab periods, or come by my office. If more time than a quick chat is needed, an appointment will be made. Email should be used only for emergency needs; don't ask a question for which the answer is on the course website.

Academic assessments are shown as a % of your final mark:

Tests (theory)		
Test #1	10 %	Oct 1 nd
Test #2	15 %	Nov 19 th
Test #3	20 %	University exam period
Tests (practical)		
Lab exam #1	10 %	Oct 17 th
Lab exam #2	15 %	Dec 5 th
Laboratory assignments	20 %	due weekly
Written assignments	10 %	due on date defined

Course Learning Resources

Reading sources

1. **textbook**
Miall, A.D., 2015. *Stratigraphy*. Springer (available from Carleton Bookstore)
2. **Side Notes (see CuLearn website)**
A set of “notes” addressing concepts dealt with in class is provided online. These are not “course notes” or “lecture notes” but information augmenting what we will discuss in lecture and adding to understanding of the textbook.
3. **Laboratory Reference Manual** (download from CuLearn website; bring to lab; you can take the file to Staples for printing, or print at home)

Lecture/Lab resources

1. **Website (CuLearn)**

The website provides access to lecture/lab schedule, lab assignments, lab ref. manual. Lecture topic readings (textbook, side notes) are defined. Lecture slides are posted after the lecture. All lab assignments must be downloaded for the appropriate week ahead of the lab period. The website has many other learning resources (e.g., rock classification systems, etc.), and should be carefully explored.

Review an upcoming week’s lecture and lab requirements well before the lecture/lab periods so that you complete pre-lecture or pre-lab readings. You are expected to bring all lab materials (assignment, lab ref. manual, hand lens, grain-size comparator card) to the lab.

Many labs will be handed in at the end of the lab period.

2. **Sedimentary toolkit**

For each lab, please bring the following:

- hand lens*
- grain-size comparator card*
- coloured pencils,
- normal pencil and pen, and
- a scale (in mm/cm)

* available from Science Stores (Steacie Building)

ERTH 2314 Lecture Schedule and Topics

(note: *a,b* refers to the 1s and 2nd lecture slots each week; readings: **Txt**: textbook; **SN**: SideNotes)

Wk 1 (Sept 5)

- b Introduction to course (online only, no class) SN: 1

TOPIC 1: CHARACTERIZING SEDIMENTARY SUCCESSIONS

Wk 2 Sept 10, 12

- a Standard methods SN: 2a,b; **Txt**: 65-75; 311-334; 343-364
b Sedimentary database SN: 3; **Txt**: Chap 2

TOPIC 2: THE LITHOSTRATIGRAPHIC TOOLBOX

Wk 3 Sept 17, 19

- a Sedimentary database (cont.) SN: 4; **Txt**: Chap 2
b Deconstructing a sedimentary section In-class exercise

Wk 4 Sept 24, 26

- a Siliciclastic rock classification and significance SN: 5;
b Sediments move! SN: 9

Wk 5 Oct 1, 3

- a **Term test #1**
b Carbonate/evaporite classifications and significance SN: 6,7

TOPIC 3: PUTTING ORDER TO SEDIMENTARY VARIATION

Wk 6 Oct 8 (no class - statutory holiday), 10

- b Other rock types SN: 7,8

Wk 7 Oct 15, 17

- a Facies concepts = environmental criteria SN: 10; **Txt**: pp. 77-123
b Siliciclastic facies models SN: 11; **Txt**: pp. 134-150; 162-185

Wk 8 Oct 22-26 Fall Break (no classes)

Wk 9 Oct 29, Oct 31

- a Siliciclastic facies models (cont.) SN: 11; **Txt**: pp. 134-150; 162-185
b Interpreting siliciclastic facies patterns in-class exercise

Wk 10 Nov 5, 7

- a, b Carbonate/evaporite facies models SN: 12; **Txt**: pp. 190 - 209

Wk 11 Nov 12, 14

- a Dolostones: a case of hydrology SN: 13
b Interpreting carbonate facies patterns in-class exercise

Wk 12 Nov 19, 21

- a **Term test #2**
b Sequence Stratigraphy: development the model SN: 14-16; **Txt**: pp. 215-225

TOPIC 4: A MODERN SYNTHESIS OF STRATIGRAPHY AND FACIES

Wk 13 Nov 26, 28

- a, b Sequence stratigraphy and facies patterns **Txt**: 224-241

Wk 14 Dec 3, 5

- a, b Seq strat (cont.); course review

ERTH 2314 Written Assignments (=10 % of final mark)

Four assignments are offered to help you begin the process of learning to express your observations in writing. The first is simple (hopefully): why are you in the EARTH program. On the basis of different laboratory assignments, the next three help you to learn how to summarize depositional histories of stratigraphic successions based on rock types and sedimentary structures. Details of subject material for assignments #2-4 are provided in the lab one or two weeks prior to the assignment's due date.

Each assignment represents a minor component of the final grade, but may be instrumental in pushing your final mark across a grade boundary.

Purpose

There are two roles for these assignments: the first is to get you into practice of linking observations, then drawing interpretations based on concepts learned in the lab / lecture; the second is to get you into the practice of organizing your thoughts into cohesive written expression.

Format and a rubric are found on the website under Written Assignments

Late assignments are not accepted unless medical/personal exceptions are documented according to University regulations

ERTH 2314 Lab topics

Sept 12

Textural Analysis of Building Stones, and Stratigraphic Logs Assignment: hand in Wk 2

Sept 19 and Sept 26

Wk A: Sediment Texture

Assignment: due end of lab

Wk B: Grain-Size Analysis

Assignment: due end of lab

Oct. 3 and Oct 10

Wk A: Siliciclastic and Organic-Rich Rocks, Pt 1

Assignment: due end of lab

Wk B: Siliciclastic and Organic-Rich Rocks, Pt 2

Assignment: due end of lab

Written Assignment #2 provided: due in lab Oct 17

Oct 17

Lab Exam #1: *Siliciclastic and Organic-Rich Rocks and Texture (=10% of final mark)*

Sedimentary Bedforms

Assignment: due next lab

Written assignment #3 provided: due in lab Oct 31

Oct 31 and Nov. 7

Wk A: Chemical Rocks and Sediment

Assignment: due end of lab

Wk B: Carbonate sediment / rock ID

Assignment: due end of lab

Nov 14

Stratigraphic section

Assignment: due end of lab

Written Assignment #4 provided: due in lab Nov 21

Nov 21

Provenance and Grain Size Change

Assignment: due end of lab

Nov 28

Basin Correlation: stratigraphy, basin geometry, and depositional processes

Group Work and Presentation;

Assignment: due end of lab

Dec 5

Lab exam #2 (15% of final mark)

LEARNING OUTCOMES

ERTH 2314 SEDIMENTATION AND STRATIGRAPHY [0.5 credit]

Origin of sediments, and their transport, distribution, and primary structures; processes of sediment-to-rock transformation; spatial patterns and controls of stratigraphy and methods of correlation. Lectures three hours a week and a laboratory three hours a week.

COURSE LEARNING OBJECTIVES are intended to achieve the following

- develop **memory** of sedimentary geological concepts and attributes
 - **understand** concepts
 - **apply** concepts through practical demonstration
 - learning to **evaluate** datasets
1. Illustrating both understanding and capacity to examine, describe, and identify common sedimentary rocks, grain-size distributions, and sedimentary bedforms.
 2. Illustrating both understanding and capacity to explain, the origin of sediment, sedimentary bedforms, and stratification as products of environmental controls.
 3. Learning to infer temporal and lateral changes in environment through spatial juxtaposition and superposition of sedimentary facies.
 4. Learning to infer sea-level change as a product of tectonics, eustasy, and sediment supply from sedimentary patterns in stratigraphic successions.
 5. Connecting sedimentary geology to resources potential, and impact for society
 6. Learning and demonstrating how to communicate the above understanding and capacity in written and verbal form to peers and instructors.

The Instructor's expectations

that you will complete all necessary pre-lecture and/or pre-lab readings, assignments, tutorials

that you will bring your understanding of basic geological concepts (plate tectonics, general rock type definitions, evolution, hydrology) from EARTH 1000-level courses into use to help understand 2000-level instruction

that you will undertake active learning (see Course Intro-Online) in both the lecture and lab environment

Requests for Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Religious obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/pmc

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline