

**ERTH 2314**  
**Sedimentation and Stratigraphy**

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*Prerequisite Knowledge Base: EARTH 1006 and EARTH 1009: general concepts of plate tectonics, paleogeography, continental and oceanic crust, rock types and processes of formation, geologic time (scale), origin of the Earth, basic 1000-level CHEM and PHYS*

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) required readings (online sources; c) a Lab Reference Manual; d) pre-recorded lectures and lab introductions; and e) synchronous teaching and online support for the lab. 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 stratigraphic datasets.

TAs will be on hand a lab support, and will establish office hour outside of the lab periods. You can send me an email with respect to labs if you have already spoken with a TA and need more help. For lectures, contact me directly by email. If more time than a quick response is needed, we'll set up an appointment for a virtual meeting. Please examine the course website to see if the answer to your questions is already defined.

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

Tests (lecture-based)		
Test #1	10 %	Oct 5th
Test #2	15 %	Nov 16th
Test #3	20 %	December formal exam period
Tests (lab-based)		
Lab exam #1	10 %	Oct 8th
Lab exam #2	15 %	Nov 26th
Laboratory assignments	15 %	due weekly
Written assignments	15 %	as defined on CuLearn

***Lectures and labs can be accessed independent of synchronous teaching, and a brief introduction to each lab will be made via the Big Blue Button portal. Both instructor and TAs will be available online during each lab period.***

## Course Resources

### Required Readings

#### 1. Selected readings

The best textbook does not have an online version. Thus, readings are assigned as pre-lecture or pre-lab assignments, meaning that you need to read them before the lecture, listen to the lecture, go back over the readings to pick up on ideas / concepts that you may have missed.

#### 2. Laboratory Reference Manual (from the CuLearn website; there is no need to print this out – it may remain as online version, but you can print it out if you need to; it is 40-50 pages in length so taking it to Staples would be economical)

### Lecture/Lab resources

#### 1. Website (CuLearn)

The website provides access to lecture/lab schedule, lab assignments, lab reference manual. Lecture readings are defined for each week. Lecture video podcasts are posted before each week of lectures, and lecture slides are posted. All lab assignments are accessed through the website; some can be filled out online, others need to be downloaded and printed. ALL LABS ARE SUBMITTED ELECTRONICALLY THROUGH THE CuLEARN WEBSITE.

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.

Many lab assignments are handed in at the end of a lab period (there will be timed acceptance).

#### 2. Sedimentary toolkit

Despite remote learning, you should assemble the following for the lab:

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

\* available from Science Stores (Steacie Building)

Although we won't meet in a lab setting, nor in the outdoors, you should establish this toolkit as a means to appreciate the character of sedimentary analysis. Between classes, you can make use of the first two items by examining building stones (on walls), soil, or sediment wherever available.

## ERTH 2314 Lecture Schedule

*All lectures are available online;*

*it is strongly recommended that you watch the lectures during the scheduled lecture periods*

(*a, b* refers to the 1st and 2<sup>nd</sup> lecture slots each week; required readings (R) are numbered (1, 2a) as illustrated on the CuLearn website under Required Readings)

### Wk 1 Sept 7, 9

- a *Labour Day (holiday, no class)*
- b Introduction to course, requirements/expectations      R: 1, 2

### TOPIC: CHARACTERIZING SEDIMENTARY SUCCESSIONS

### Wk 2 Sept 14, 16

- a Standard methods      R: 2-6
- b Sedimentary database      R: 7-10

### Wk 3 Sept 21, 23

- a Deconstructing a sedimentary section      R: 11-12
- b Siliciclastic rock classification and significance      R: 13

### Wk 4 Sept 28, 30

- a Carbonate/evaporite classifications and significance      R: 15, 16
- b Other rock types      R: 16, 17

### Wk 5 Oct 5, 7

- a **Test #1**
- b Sediments indicate motion      R: 14

### TOPIC: PUTTING ORDER TO SEDIMENTARY VARIATION

### Wk 6 Oct 12, 14

- a *Thanksgiving holiday*
- b Facies: concepts, environmental criteria      R: 18

### Wk 7 Oct 19, 21

- a, b Siliciclastic facies models      R: 19

### *Wk 8 Oct 26-30th Fall Break*

### Wk 9 Nov 2, 4

- a, b Carbonate/evaporite facies models      R: 20

### Wk 10 Nov 9, 11

- a Carbonate/evaporite facies models (cont.)
- b Dolostone: a case of hydrology      R: 21

### Wk 12 Nov 16, 18

- a *Term test #2*
- b Coastal Geology: processes, controls, and societal impact

### Wk 13 Nov 23, 25

- a Sequence Stratigraphy: developing the model      R: 22-23
- b Sequence stratigraphy and facies patterns      R: 24-25

### Wk 14 Nov 30, Dec 2

- a Integrating sea level, sediment supply/production, and tectonics
- b Course summary

### **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 asks you to summarize 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 coherent 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 Schedule

*Each week, we will make use of the Big Blue Button to initiate the lab, with TAs and the instructor available throughout the lab period*

### Sept 10

*LAB 01: Textural Analysis and Stratigraphic Logs*

Assignment: due Sept 17

### Sept 17

*LAB 02: Sediment Texture*

Assignment: due end of lab

### Sept 24

*LAB 03: Grain-Size Analysis*

Assignment: due end of lab

### Oct 01

*LAB 04: Siliciclastic Sediment and Rocks*

Assignment: due end of lab

### Oct 8

*Lab Exam #1: Texture, Stratigraphy, Sediment, and Siliciclastic Rocks (=10% of final mark)*

### **Information for Written Assignment #2 is provided: due Oct 15**

### Oct 15

*LAB 05: Organic-Rich Rocks*

Class Seminar

### Oct 22

*LAB 06: Sedimentary Bedforms*

Assignment: due end of lab

### **Information for Written assignment #3 is provided: due Nov 02**

### Nov 5

*Lab 7: Chemical Rocks and Sediment*

Assignment: due end of lab

### **Information for Written Assignment #4 is provided: due Nov 12**

### Nov 12

*Lab 9: Stratigraphic section*

Assignment: due Nov 19

### Nov 19

*Lab 10: Provenance and Grain Size Change*

Assignment: due end of lab

### Nov 26

*Lab review - Big Blue Button meeting*

### Dec 3

*Lab exam #2: Stratigraphy, Bedforms, Carbonate Sediment and Rocks (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 lecture and lab environments

## **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](https://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](https://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](mailto: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](https://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](https://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](https://students.carleton.ca/course-outline)