

# ERTH 3206

## Oceanography: Its Modern and Geologic Records (aka Depositional Systems)



*Peritidal dolostone (brown) with quartz arenite forming interlaminae and filling syndimentary fractures.  
Tidal and syntectonic influences, Middle Ordovician (Carillon Formation), eastern Ontario.*

*Field and Seminar Course,  
Fall 2018*

*Instructor*  
**Prof. George R. Dix**  
*Department of Earth Sciences  
Carleton University, Ottawa, Canada*

## ***SAFETY INFORMATION***

A field course requires: attentiveness to the elements; your position relative to those around you; and, many attributes of the natural and urban surroundings.

### *Outcrop Locations*

Outcrop exposures include a quarry, road outcrops, and a river outcrop. All have potential dangers that must be accommodated. Quarry walls can be unstable; road traffic must be monitored; and, river outcrops can be slippery. None of these areas are dangerous unless you are not paying attention to your surroundings and the location of other people. Do not climb on outcrops above other people; move away from quarry walls once you have collected necessary information; watch your footing along river courses.

### *Climate*

The Fall in the Ottawa region can have very changeable weather. You need to carry a daypack with you that includes a rain jacket, sun hat, sunscreen, water bottle, and sunglasses (to protect from the glare off the water). A light pair of gloves is also a good idea especially if your hands are repeatedly wet and dry, and dusty to boot. Use moisturizing skin cream at the end of the day; your skin will thank you.

### *Hydration*

It is important to remain hydrated, and water will be available to fill up water bottles before leaving for the day and when we are spending part of the day away from the vans. A day in the salty ocean air is exhilarating, but tiring. Although there will be temptation to stay up late at night, you need a good rest so that you have your wits about you the next day in the coastal zone.

### *Communications*

The instructor, other course participants, and Carleton University are not responsible for any loss or damage to your personal belongings such as a camera and cell phone. Please make sure that you have all your belongings before leaving a field area.

### *Rules and Regulations*

Rules and regulations associated with Carleton's on-campus courses apply for the duration of this field course, and this includes the period of travel away from, and return to, Ottawa. You are also a Carleton "ambassador" representing the University for this period of time. Participants will be using a variety of transport modes: OC Transpo, walking, school bus. You are expected to act in a responsible manner at all times.

The University's Students' Rights and Responsibility policy applies off campus (see <http://carleton.ca/studentaffairs/wp-content/uploads/SRR-Policy.pdf>)

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## What's EARTH 3206 about?

The course introduces the concept of sedimentary depositional systems and the relationship to oceanographic conditions: the range of types from deep ocean to terrestrial settings; physical, chemical, and biological processes that are characteristic of a given environment, the sedimentary record (or *facies*) of depositional systems. This is another layer (field-based evidence) of your growing database related to the origin, deposition, classification, and (sequence) stratigraphic architecture of sediments and rocks that you learned in EARTH 2314. Neither course stands alone, you **MUST** incorporate what you learned previously, including topics from other 2<sup>nd</sup> year courses (e.g., paleontology, mineralogy), in order to develop greater maturity in confidently resolving sedimentary geological problem/questions.

The course involves a 1-day a week field component during the months of September and October, then a later seminar component wherein we explore the changes in sedimentary systems through geologic time.

### ***WHAT'S EXPECTED OF YOU? . . HOW TO APPROACH THE COURSE? . . WHAT TO WRITE DOWN? . . HOW WILL YOU BE ASSESSED?***

#### ***LEARNING OUTCOMES***

1. Recognize the range of sedimentary (physical, chemical, biological) attributes associated with a variety of sedimentary depositional systems.
2. Develop understanding of the dynamics of sedimentary systems in response to change in tectonics, climate, and oceanography.
3. Synthesize the range and any signature feature of sedimentary attributes for a given environment to enable critical comparison among depositional systems.
4. Work in a team to reinforce the ability to critically assess geological field data and published (literature) information.
5. Reinforce presentation (written, oral) skills.

#### **Geological fieldwork is unique and far different from classroom learning.**

You need to immediately immerse yourself (physically, mentally) in the learning process. If you follow instructions, you will rapidly build expertise over the duration of the course.

#### **Read and re-read the guidebook and information available on CuLearn between field days**

These are your sources of reference, and active learning is essential; this means, reading the required sources of information in a timely manner so that you are prepared for the field each week. Readings are required **PRIOR** to each field day; you will learn only if you meet these expectations.

#### **Fieldwork and this course are not competitions for marks.**

You are part of a group that, collectively, needs to gain understanding about depositional systems and reinforcement in sedimentary facies analysis. Support each other, talk to each other. Offer guidance where needed or asked for. As the group improves, so do you.

## **FINAL GRADE ASSESSMENT**

### **1. *quality of participation in the field and the later seminar component***

This reflects your contribution to observations and discussion on the outcrop and from the literature. It does not equate with the amount of talking but, instead, the quality of what you offer; how you incorporate what you have read and heard into generating new information, adding to the group's understanding.

### **2. *notebooks***

At each stop, you will make observations about what you see in the field and your mapped sections. The notebook contains a summary of what you observe and understand, and section descriptions. You don't copy what others are writing; you learn to think about what you are hearing, what you see in outcrop, and summarize your observations and interpretations. It is this ability that controls how your notes will eventually lead you to summarize sedimentary environmental attributes, facies, and their integration. Notebooks are not rewritten each night; they represent on-the-spot notation. This is something to be learned.

### **3. *summary of environmental assessment***

Your mark is represented by (1) how organized and well defined your descriptions/sections are in your notebook (20 %); (2) a summary of sedimentary attributes associated with general environmental settings (70%); (3) seminar presentations (10 %); and (4) quality participation in field and seminar discussions (qualitative assessment that will be used to move your mark across a boundary grade (e.g., B+ to A-). An example of a summary depositional systems table is below:

<b>Depositional System</b>	<b>Lithology (or range)</b>	<b>Sediment Texture/Fabric</b>	<b>Sedimentary Structures</b>	<b>Interpreted Processes</b>	<b>Stratigraphic Geometry</b>	<b>Other notes</b>
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This is but *one* example, and you are encouraged to develop your own design and column types; for example, you might think that it is very important to incorporate tectonic (trailing, foreland) setting. Although there are many environmental settings defined in the field guide, you should try to group them as subsets under more general environmental headings, if appropriate.

You will produce a hard copy of the table using large format paper that will be available. Neatness counts too!

**Your notebook and table are due November 7th.  
Late submissions are not accepted**

## **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)



## **ERTH 3206 Field Itinerary**

### **September-October**

**Sept 11**      **Sedimentary Facies: concepts and tools (overview of course)**  
Rm 2130 HP (0830-1000)

**Attributes of marine transgression**  
road outcrop, Hawthorne Rd (southern Ottawa)

**Sept 18**      **Shallowing upward successions (shale, carbonate)**  
river outcrop, Hog's Back Park

**Sept 25**      **Dolostone/limestone peritidal cycles**  
road outcrop: Riverside Dr (south of Mooney's Bay)

**Peritidal to subtidal carbonate cycles**  
road outcrop: McCarthy Rd (Ottawa)

**Oct 02**      **Outer platform cycles; reciprocal stratigraphy**  
road outcrop, Aviation Parkway

**Oct 9**        **Event stratigraphy (storm systems)**  
road outcrop: below Royal Mint, Ottawa

**Bioturbation: its sedimentological / diagenetic significance**  
road outcrop: below National Art Gallery (downtown Ottawa)

**Oct 16**      **Siliciclastic shelf systems**  
road outcrop, Rockcliffe Parkway, Ottawa

**Oct 30**      **Vertical succession of changing depositional systems**  
Hwy 417 Panmure Rd exit (Arnprior)

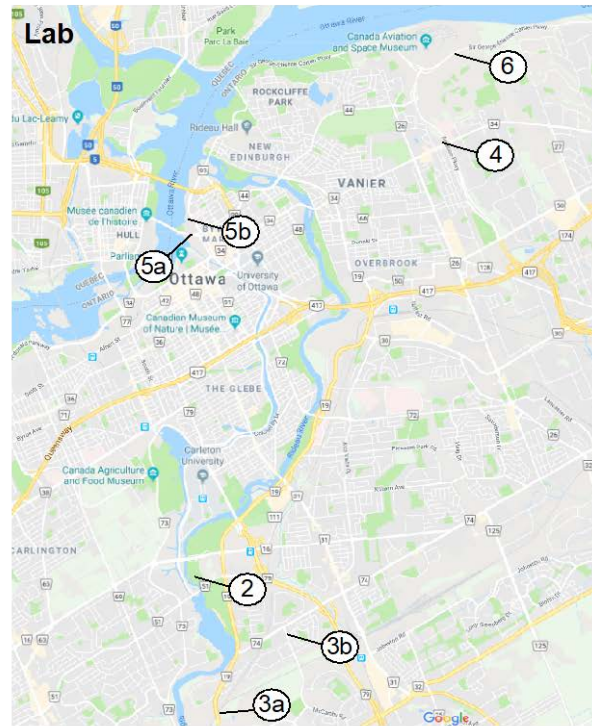
### ***November 7 and 14***

In-class seminars (Rm 2130 HP) in conjunction with participants of EARTH 3203. Together you will explore change in sedimentary/oceanographic systems through geologic time. Papers will be assigned to groups (2-3 people) who will read, discuss, then present to the class. This will be followed by class discussion on the given theme for that particular seminar period. More information will be provided prior to Fall Break. Seminar topics and source papers are found on CuLearn website.



## FIELD LOCATIONS

Location of study areas,  
Ottawa region, illustrated  
by lab (week) number  
(north to top)



- Wk 1.* north of Hawthorne – Rideau Rd intersection, Ottawa (45.308435, -75.559618)
2. Hog's Back Falls, south of Carleton University (45.371872, -75.697355)
- 3a. Riverside Dr (s of Mooney's Bay), Ottawa (45.350521, -75.692791)
- 3b. McCarthy – Walkley road intersection, Ottawa (45.364515, -75.676755)
4. Aviation Parkway-Montreal Rd intersection, Ottawa (45.444241, -75.640213)
- 5a. below Royal Mint, Ottawa (45.431504, -75.699908)
- 5b. Nepean Point, below National Art Gallery, Ottawa (45.49004, -75.7698835)
6. TBA: Rockcliffe Pkwy (as shown), or Hog's Back Falls (see Loc. 2), or Rideau River south of Carleton U.
7. Hwy 417 (NW of Panmure Rd intersection)





## WEEKLY ASSIGNMENTS AND ACTIVITIES

### Sept 12

#### ***A) Sedimentary Facies: Concepts and Tools***

- course overview; discussion about approach to field work, field notes and notebook
- in-class review of rock classification systems and lithostratigraphy

#### ***B) Attributes of Marine Transgression***

Location: Hawthorne Rd (southern Ottawa)  
 - school bus (drop off, pick up)

- Activities
- examine stratigraphy and sedimentary facies and patterns of both
  - produce a graphic lithostratigraphic section in field notebook
  - define bedding thickness, lithology, texture, sedimentary structures
  - fit stratigraphy/sedimentology into the regional geology framework
  - define facies succession
  - produce a graphic representation of the general facies succession

#### Learning Outcome(s)

understand and recognize the stratigraphic geometry of marine transgression;  
 understand and recognize the character of sediment and sedimentary structures

### Sept 19

#### ***Shallowing Upward Successions (Tropical Carbonate)***

Location Hog's Back Park (Falls)

#### Activities

- produce a lithostratigraphic section
- place in context of other shallowing upward cycles on carbonate platforms

#### Learning Outcomes

summarize types of shallowing upward successions in carbonates

**Sept 26*****dolostone/limestone peritidal cycles  
peritidal to subtidal carbonate cycles***A) Location Riverside DriveActivities - produce detailed lithostratigraphic section through limestone to dolostone cyclesLearning Outcomes - mapping detailed scale;  
- fitting sedimentary structures to facies analysisB) Location McCarthy Road (Ottawa)  
School bus dropoff, pickupActivities - compare/contrast subtidal platform facies types (produce a table)Learning Outcomes  
- understand and recognize facies attributes of slight changes in environmental conditions**Oct 3*****Outer platform cycles, reciprocal sedimentation***Location Aviation Parkway (Ottawa)  
school bus dropoff, pickupActivities: - piece together stratigraphic section from different groups  
- exam boundary conditions of shale-limestone cycles  
- discussion on regional stratigraphy and demise platformLearning Outcomes  
- consider controls on depositional cycles  
- determine, if possible the origin of this example

**Oct 10*****Event (Storm) Stratigraphy***

Location Below Royal Mint, Ottawa

Activities - map vertical changes in texture and sedimentary structures  
- place textural changes into context of storm deposition

Learning Outcomes

- the impact of storms on continental shelves

***Stratigraphy and fabric of Late Ordovician bioturbation, carbonate shelf***

Location below National Art Gallery (downtown Ottawa)  
*access by OC Transpo (meet downtown)*

Activities describing (drawing) evidence for bioturbation, its spatial |  
association to stratigraphy and event beds

Learning Outcomes

place bioturbation in context of depositional systems, its influence in defining stratigraphy and affecting diagenesis

**Oct 17*****Siliciclastic Shelf Systems***

Location Rockcliffe Parkway  
school bus drop-off, pickup

Activities map stratigraphy, sedimentary structures, and lithology

Learning Outcomes

placement of siliciclastic sands and muds along a shelf and in context of sea level change that influences energy of deposition

**Oct 31*****Changing Environmental Conditions***

Location Hwy 417 (Arnprior)

Activities - map stratigraphic section by groups; group presentations  
- interpret depositional conditions

Learning Outcome

Recognize nature of stratigraphic record of changing depositional conditions