

# ERTH 3203

## Applied Sedimentology

Environments and sedimentary processes related to crustal flexure:  
Quaternary and Paleozoic geology of western Newfoundland



*A Holocene wave-cut terrace and related cliff-face, Long Point, western Newfoundland: the escarpment borders a raised Late Pleistocene terrace underlain by Quaternary glacial-derived sediment that, in turn, overlies disconformably a Pleistocene wave-cut terrace developed across a tilted succession of Upper Ordovician siliciclastics and carbonates of cool-water shelf origin*

*Field Course,  
August 29-September 7, 2018*

*Instructors:*  
**Prof. George R. Dix** and **Geoff Pignotta,**  
*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 (e.g., road traffic!). A field course in a maritime coastal zone also requires paying close attention to the ocean, its waves and tides.

#### *Climate*

Western Newfoundland experiences very changeable weather, rapidly shifting from dry to wet, and warm to cold. In your daypack, please carry with you at all times a rain jacket, sun hat, sunscreen, water bottle, and sunglasses (to protect from the glare off the water). A light pair of gloves may also be a good idea especially if your hands are repeatedly wet. Bring moisturizing skin cream to apply after a day in the field; your skin will thank you.

#### *Coastal Systems*

The course involves extensive walking/hiking up and down gradients and in coastal settings where care must be taken with regard to: rogue waves; alga-covered slippery rocks; tide change; stability of cliff-faces; and, also moving inland along river courses and into bogs. In most cases, common sense prevails in making decisions about where to place your foot, as well as when it is time to move off the coastal zone, and the speed of walking along difficult terrain. For those of you who have never experienced a coastal environment, please listen to and learn from the experience of the instructors.

#### *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*

Neither the instructors, the other participants, nor Carleton University are responsible for any loss or damage to your personal belongings. This includes a camera and cell phone.

Participants will stay in comfortable lodgings each night. Contact information will be provided to the participants to pass along to their emergency contacts.

#### *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.

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

## **What's EARTH 3203 About?**

The course introduces the concept of sedimentary depositional systems: 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 10-day field component, then a later seminar component wherein we explore the changes in sedimentary systems through geologic time. More information about the latter part of the course will be distributed in September on your return.

### ***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 your ability to critically assess geological field data and published (literature) information.
5. Reinforce presentation skills of literature research.

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

As the field component is for 10 days only, you need to immediately immerse yourself (physically, mentally) in the learning process. However, don't panic: if you follow instructions each day, you will rapidly build expertise over the duration of the course.

#### **Read and re-read the guidebook.**

Read it once, then each night for information relevant for the next day's assignment. It is important that, each night, you also review the regional geology framework, the stratigraphy, and the evolution of basin development in western Newfoundland so that you can place the day's geology into context. **Ask questions!**

#### **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 in the field, in the vans, and in the evening about the geology. 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 (20%)*  
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 (10 %)*  
At each stop, you will make observations about what you see in the field. This is not a repeat of what the instructors are saying but a summary of what you observe and understand. 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/interpretations. It is this ability that controls how your notes will eventually 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 (70%)*  
Your mark is represented mostly by a summary of sedimentary attributes associated with general environmental settings. If your notes are good, there will be only minimal work in compiling the dataset after your return to Ottawa. Here is one example of what a summary table might look like:

**Depositional Environments, EARTH 3203.**

Environment	Lithology (or range)	Sediment Texture/Fabric	Sedimentary Structures	Interpreted Processes	Stratigraphic Geometry	Other notes
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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 in the departmental Main Office on your return. Please make sure that your table is neatly presented.

**Your notebook and table are due Monday Sept 10 no later than 4 PM.  
Deliver both to the Main Office. 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 its 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 3203 Field Itinerary

Aug 29      *travel: Ottawa to Deer Lake, NL*  
- at Deer Lake: organize lunches, breakfast for Aug 30, 31  
- drive to Middle Brook, NL  
*Geostop: differentiating deformation from metamorphism*

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### ***Part 1: Quaternary and Paleozoic Depositional Settings***

Aug 30      Exposure of the Crust-mantle boundary  
Environment 1: deep-sea oceanic arc (Ordovician)  
Mountain to basin environmental transect (Quaternary)  
                Environment 2: glacial,  
                Environment 3: alluvial fan  
Glacial terraces and rebound (Trout River)  
  
*Geostop: Channelized deep-water conglomerates*

Aug 31      - *travel to Cow Head, NL*  
*Geostop: Precambrian-Paleozoic contact*  
  
Environment 5: dune-beach system (Quaternary)  
Environment 6: pond-estuary-ocean gradient (Holocene)

Sept 1      Environment 7: continental slope (Cambro-Ordovician)  
                a) proximal to distal carbonate slope facies  
                b) Cambrian-Ordovician GSSP, Green Point, NL

Sept 2      - *travel to Stephenville, NL*  
*Geostop: Humber Arm allochthon, Corner Brook lookout, TCH*  
  
Environment 8: deltaic (Quaternary)  
Environment 9: fluvial-coastal (Late Pennsylvanian)

Sept 3      *Time-slice depositional mosaic (Upper Mississippian)*  
                Environment 10: red-beds  
                Environment 11: transgressive fan-delta to evaporite basin  
                Environment 12: reefal carbonate  
  
*Quaternary*  
Environment 13: till (diamicton)  
Environment 14: lacustrine marl (lake)  
Environment 15: peat (swamp, bog)

***Part 2: Collapse of a foreland margin (late Early to Middle Ordovician)***

Sept 4           **- travel to St. George's, NL**

Environment 16: peritidal (tropical) carbonate and sea level

*Geostop: regional disconformity related to the peripheral bulge*

Environment 17: deepening tropical shelf

Environment 18: deep-water Humber Arm siliciclastics

Environment 19: debris flows and deep-water siliciclastics

***Part 3: Transgressive-Regressive (T-R) Cycle***

Sept 5           *Transgression:*

Environment 20: transgressive sand sheets

Environment 21: tropical reefal carbonate shelf

Environment 22: platformal condensed interval

*Regression:*

Environment 23: cool-water mixed siliciclastics and carbonates

Sept 6           *Continued Regression:*

Environment 24: marginal marine to fluvial siliciclastics

Environment 25: paleokarst fill siliciclastics

*Geostop: Big Cove marine-to-fluvial siliciclastic succession  
(a T-R cycle in one outcrop)*

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Sept 7           **- drive to Deer Lake Airport, NL**

**- travel to Ottawa, ON**