

Stratigraphy Syllabus

Department of Earth and Environmental Sciences

ERTH3303 Fall 2023

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor(s)

Name	Email	Office Hours
Professor Grant Wach	grant.wach@dal.ca	Contact through email

Course Description

Stratigraphy is the backbone of the geological sciences; it brings together sedimentology, basin analysis, paleontology, petrology, and structural geology to reconstruct Earth history and its evolution. We survey the impact of sea level change, tectonics, and climate on sediment accumulation. We use outcrop observations, well logs, seismic and sequence stratigraphy to understand and correlate the sub-surface layers. Our studies focus on sedimentary basins across Canada and the World with practical work including field trips, a term paper, laboratory (including core description) & in-class exercises, class presentations and debates. Field trips examine basin evolution and stratigraphy and study evidence from outcrops to discern past paleoclimates and the history of sedimentation. Field trips include exercises measuring and recording outcrop data and completing comprehensive field reports.

Course Prerequisites

ERTH 2203 – Sediments and Sedimentary Rocks

Student Resources

A list of student resources is available on Brightspace under General Course Files.

Course Structure

Course Delivery

All lectures, labs, and field trips will be presented in person. Course material such as PowerPoints will be available on Brightspace (typically after the lecture is presented), but lectures and labs will not be recorded. A number of guest lectures will be presented through recorded media, students will be notified of when these lectures will occur and if the lectures will be presented in class or otherwise.

Lectures

Lectures are every Tuesday and Thursday from 8:35AM - 9:55AM. The first lecture will be held on September 5th, and the final will be on November 30th.

Laboratories

Labs are every Tuesday from 2:35PM - 5:25PM. Excluding the first week of class, the first lab will be held on September 12th, and the final will be on November 28th.

Field Trips

There are two major field trips planned, and one introductory field trip to be held in a lab period. **These trips are mandatory**, excluding unavoidable circumstances. **If you are unable to participate in one of the field trips, you need to notify the professor as early as possible in order to organize an alternative.**

The first will be to **Point Pleasant Park on Tuesday September 12th during the lab time beginning at 2:35PM.** Students will be expected to find their way to the park for the time listed, meeting the group at an agreed location. More information will be given during class prior to the trip. Note the assignment associated with this excursion will be part of the lab grade component, not the field trip report grade component.

The second trip and first major excursion will be to **Rainy Cove/Cambridge Cove on Saturday September 23rd.** The third trip will be to **Joggins Fossil Cliffs on Saturday October 21st.**

For these Saturday field trips, plan to be out for the entire day - we will be departing Dalhousie around 7:00AM and could arrive back as late as 7:00PM, so pack enough water, food, and supplies for the excursion. If you are running late, *please notify the instructor or TA as soon as possible* so as not to be left behind. If you do not show up within the requested time frame and do not notify anyone, **we will be leaving without you.**

These trips are taken with the assumption that everyone has at least some experience working in the field. You will be notified of specific potential hazards, as well as emergency contact information suited to the site we access. You will be provided with numerous field safety forms

detailing the risks and your acceptance of such - you will not be permitted to participate in any field trip prior to signing these forms. If you are unsure of anything regarding these field trips and your participation in them, please notify the professor and/or TA.

Course Materials

Suggested readings from both the mandatory and suggested materials will be provided on Brightspace.

Mandatory

- Access to EARTH 3303 – Stratigraphy (Sec 1) – 2022 Fall on Brightspace
- Stratigraphy Class Reader (w/ labs, field excursions, & assignments)
 - o Available through Brightspace
- The Last Billion Years, Atlantic Geoscience Society (2022, 2nd Edition)
 - o Available from the Bookstore

Suggested

- Sedimentology and Stratigraphy, Gary Nichols, 2nd Edition (2009)
 - o Available from the Bookstore, and 2 copies available from the Sexton Library
- Principles of Sedimentology and Stratigraphy, Sam Boggs Jr., 4th Edition (2006)
 - o 4th & 5th editions are available at the Killam Library

Assessment

Component	Weight (% of final grade)	Date Due
Labs	40%	Labs are due at the beginning of the following week's lab unless stated otherwise
Participation	15%	Attendance, in-class assignments, & debates
Field Trip Reports	20%	Field trip reports/exercise material are due 2 weeks after the field trip date
Term Paper	25%	Sept 14 – Topic submission Oct 5 – Essay outlines due for feedback Nov 21 – Finished Term Paper

**Note there will be no midterm or final exam.*

Please refer to the Course Content schedule for a more detailed listing of labs, field trips, and associated assignments and due dates.

Labs

There are 11 set lab periods for the semester, 9 of which will have a lab assignment that contributes to the 40% lab grade component. The two lab periods that do not have a lab assignment cover field trip preparation and the end-year debate, the latter of which will be included in your participation grade. The lab assignments are as follows: Point Pleasant Park Field Trip & Creating a Stratigraphic Log, Fossil Identification and Use in Correlation, Fort McKay Core Description, Muskeg Lake Environmental Remediation, Frank Slide Risk Assessment, Hurricane Katrina Levee Design & Hurricane History, Drilling & Logging a Water Well, and Mineral Occurrences in NS.

Completed lab assignments are due by the beginning of the following week's lab period unless otherwise stated. For example, the Fossil Identification and Use in Correlation lab will be held on September 26th, with the finished assignment due by 2:35PM on October 3rd. Labs may be submitted either in physical copy or scanned and submitted through Brightspace. Please note, when scanning in a multi-page assignment for submission, be sure to combine the pages into a single Word or PDF file, rather than a collection of multiple image files.

Participation

15% of your grade will be based on your participation in the course. This will include your attendance at lectures, labs, and field trips, completion of in-class assignments and lecture reviews, and participation in the year-end debate. If you are unable to attend a scheduled course period, please contact the professor and TA to indicate you will not be present. In-class assignments are given during many of the lecture periods to engage students in the material and provide an opportunity for hands-on learning, while lecture reviews are typically a set of questions regarding a guest lecture to ensure information retention. In-class assignments and lecture reviews will not be graded on strict criteria but will be collected as part of your participation grade - if you complete the work and show evidence of understanding, it will count towards the 15% participation component. In-class assignments are due at the end of the class they are given in, and there will be individual submission boxes provided on Brightspace for the lecture reviews.

Field Trip Reports

For the two major field trips to Rainy Cove/Cambridge Cove and Joggins Fossil Cliffs, you are to complete a Field Trip Report for each site. These reports will each be worth 10% of your final grade. The report will consist of the completed set of exercises provided to you, a summary of the trip and the purpose of the report, an introduction and conclusion, and a background written on the geologic setting of the area, alongside relevant references. Field Trip Reports are due roughly two weeks after the field trip takes place; as the trips take place on Saturdays, the reports will be due the following Monday. Reports can be completed in teams of four or less, preferably aligning with the groups you worked in

while in the field. For reports that are completed by more than one person, *please provide a brief breakdown of the work between team members*. If at any point you feel a team member is not contributing fairly to a group assignment, please reach out to the professor and/or TA to resolve.

Term Paper

Rather than a final exam, you will be asked to complete a Term Paper for your primary assessment in the course. You will be provided with a template on formatting expectations. To encourage an early start in the semester, you will need to choose your topic by **Thursday September 14th**, either from a provided list of topics or of something stratigraphy-related that interests you. If you would like to receive any feedback prior to submission of the final copy, it must be submitted by **Thursday October 5th**. An outline submission is not required, but *strongly suggested*.

The finished term paper is due at the **beginning of the lecture period on Tuesday November 21st**. **Extensions will not be provided**. For every day or part of a day that the paper is late, there will be a *5% reduction on the overall Term Paper grade* (i.e. if submitted 4 days past the deadline, the maximum total you could receive on the paper would be 80%, or a loss of 5% off your total course grade). Considering this assessment is worth the most of any individual assignment, and you are provided over two months to complete it, we suggest it is handed in on time.

Other course requirements

All work will be done on a *professional level* of presentation in both laboratory and class. This course will help prepare you for your professional career and future professional accreditation (APGNS, APEGGA, etc.). As such, students are expected to maintain a high ethical and professional standard in their work and behavior.

Related Courses

ERTH 4153 – Petroleum Geoscience and Energy Systems

ERTH 4157 – Petroleum Geoscience and Energy Systems Field Methods (Trinidad)

ERTH 4131 – Advanced Petroleum Geoscience (not offered every year)

Conversion of numerical grades to final letter grades follows the

[Dalhousie Grade Scale](#)

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

Attendance is mandatory for all labs and field trips and is ***strongly recommended*** for the lectures. There are no make-up sessions and part of your grade will be based on attendance. Some assignments may be able to be completed online, however the lab experience will not be comparable and will only be used as a last resort. A Student Declaration of Absence may be submitted up to two times per semester. If you are unable to attend a lecture, lab, or field trip, please notify the professor and/or TA prior to.

Late penalty for all assignments, including labs, field trip material, papers, etc. **will be 5% per day** (or part of a day) after the due date. **No exceptions.**

Course Policies related to Academic Integrity

All data will be your own work. Ask questions of both your classmates, TAs, and the instructor but **do not copy others' work**. Plagiarism will result in direct referral to the University Senate Committee on Academic Discipline & Integrity. For any assignment completed in a group, please provide a brief breakdown of the work between team members. Both Field Trip Reports can be completed in a team of four or fewer. For lab work, you will be notified during the lab whether the assignment can be submitted in a group. The Term Paper is to be a completely independent assignment subject to additional scrutiny.

We strongly discourage the use of AI and large language models in the completion of course work. The purpose of this course is to enhance your understanding of certain topics, which cannot be assisted by AI generated material. If you feel that the use of AI models in the course would improve your comprehension, please discuss with the professor and/or TA to determine potential while encouraging critical thinking and veering away from plagiarism. Keep in mind AI models are not reliable sources, and anything created or found in such programs would need to be cross referenced for accuracy.

Learning Objectives

Upon Successful completion of this course students should be able to:

1. Demonstrate in-depth knowledge and understanding of stratigraphic concepts and terminology through analysis, classification, and identification of strata and unconformities.
2. Gain hands-on experience on the application of stratigraphy through lab exercises & field work.

3. Assess rocks and interpret their meaning in the larger context of Earth's history and sedimentary basin evolution, e.g., Wilson Cycles, passive margins and rift basins, salt withdrawal basins.
4. Understand and explain how sedimentary successions relate to continental drift, climate, biological evolution, and major and singular events on Earth (i.e., mass extinctions, meteorite/ bolide impacts, oceanic anoxic events, igneous eruptions etc.).
5. Organize ideas, summarize what you have learned, and describe findings for academic writing & oral defense of ideas (labs, field reports, debates, presentations, and a term paper).

Course Content

Week	Date	Lesson Topics	Assessments	
			Introduced	Due
1	TUE Sept 5	Lecture 1: Introductions and History of Stratigraphic Thought	X	X
	THU Sept 7	Lecture 2: Geologic Time Scale		
2	TUE Sept 14	Lecture 3: Lithostratigraphy I Lab 1: Point Pleasant Park Field Trip & Creating a Stratigraphic Log	PPP Mini-Field Trip	Term Paper Topic TUE
	THU Sept 16	Lecture 4: Lithostratigraphy II		
3	TUE Sept 19	Lecture 5: Sequence Stratigraphy I Lab 2: Field Trip Prep – Rainy Cove/Cambridge Cove	Rainy Cove/ Cambridge Cove Field Trip Report	PPP Mini-Field Trip TUE
	THU Sept 21	Lecture 6: Sequence Stratigraphy II		
	SAT Sept 23	Rainy Cove/Cambridge Cove		
4	TUE Sept 26	Lecture 7: Field Trip Review/ Biostratigraphy Lab 3: Fossil Identification and Use in Correlation	Fossil Identification & Use in Correlation	X
	THU Sept 28	Lecture 8: Volcanism, Impacts, & Mass Extinctions		
5	TUE Oct 3	Lecture 9: Subsurface Stratigraphy Data & Techniques Lab 4: Fort McKay Core Description	Fort McKay Core Description	Fossil Identification & Use in Correlation TUE Term Paper Outline THU
	THU Oct 5	Lecture 10: Seismic Stratigraphy		
6	TUE Oct 10	Lecture 11: Environmental Stratigraphy Lab 5: Muskeg Lake Environmental Remediation	Muskeg Lake Environmental Remediation	Rainy Cove/ Cambridge Cove Field Trip Report MON Fort McKay Core
	THU Oct 12	Lecture 12: Geology of Mi'kma'ki		

				Description TUE
7	TUE Oct 17	Lecture 13: Mid-Semester Review Lab 6: Frank Slide Risk Assessment	Frank Slide Risk Assessment Joggins Field Trip Report	Muskeg Lake Environmental Remediation TUE
	THU Oct 19	Lecture 14: Field Trip Prep - Joggins		
	SAT Oct 21	Joggins Fossil Cliffs		
8	TUE Oct 24	Lecture 15: Event Stratigraphy Lab 7: Hurricane Katrina Levee Design & Hurricane History	Hurricane Katrina Levee Design & Hurricane History	Frank Slide Risk Assessment TUE
	THU Oct 26	Lecture 16: Guest Lecture		
9	TUE Oct 31	Lecture 17: Geological Dating & Correlation Lab 8: Drilling & Logging a Water Well	Drilling & Logging a Water Well	Hurricane Katrina Levee Design and Hurricane History TUE
	THU Nov 2	Lecture 18: Chemostratigraphy & Magnetostratigraphy		
10	TUE Nov 7	Lecture 19: Heavy Minerals, Provenance, and Paleogeography Lab 9: No lab this week – USE THE TIME FOR YOUR TERM PAPER!	X	Joggins Field Trip Report MON Drilling & Logging a Water Well TUE
	THU Nov 9	Lecture 20: Basin Classification		
READING WEEK				
11	TUE Nov 21	Lecture 21: Economic Stratigraphy Lab 10: Mineral Occurrences in NS	Mineral Occurrences in NS	Term Paper TUE TUE
	THU Nov 23	Lecture 22: Planetary Stratigraphy		
12	TUE Nov 28	Lecture 23: Course Review Lab 11: Debate	Debate(s)	Mineral Occurrences in NS TUE
	THU Nov 30	Lecture 24: Debate II		

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.html>

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at:

https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.