Integrated Field Studies

Department of Earth and Environmental Sciences

ERTH4040 Summer 2025

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)

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Course Description

A field-based course, of up to 2 weeks, which includes detailed exercises in geological mapping integrated with advanced concepts in mineralogy, petrology, economic geology, structural geology and tectonics. Students are based for the entire duration of the course off-campus, at an international location, or within Canada.

Course Prerequisites

ERTH3000 and two from ERTH3010, ERTH3020, ERTH3140 and ERTH3303. Permission from the course instructor is also required. The course will not be run unless there is a minimum of 8 students registered. There is a cap of 16 students and priority will be given to students in their final year of study and those who require the course credits for their degree. An auxiliary fee will be applied to this course to cover equipment, vehicles, food and accommodation.

Course Exclusions

None

Student Resources

All materials will be available on Brightspace or made available before leaving the campus. This includes field equipment listed in the course materials section. The TEAMS course space will be available for questions and discussions.

Course Structure

Course Delivery

There will be 3 introductory lectures to be arranged in the winter semester. Attendance will be mandatory. Additional reading will be required before the trip begins. The course will be held on location.

Course Materials

Before the trip: All lecture notes and handouts for the preliminary lectures will be posted on Brightspace. Students must have a valid passport and all necessary documents to travel to the UK.

In the field: The following will be provided;

Field trip guidebook and journal articles (on Brightspace or as printed handouts);

Maps, aerial photos and exercise sheets.

*Silva or Suunto compass /clinometer or you can bring your own compass / clinometer that you used in ERTH2110 Field Methods.

*Safety glasses, and visible safety vest.

Any testing equipment (e.g. HCl bottles) will also be provided.

**Provided as a rental from the department. See the course checklist for details.*

Field-equipment and supplies required: This list is for guidance only and will be updated before the trip and registered students will be provided with a full checklist.

Outdoor clothing and footware: Sturdy, water-resistant field boots are essential you must not really on light trail shoes or sneakers. You must be equipped for poor weather which includes a full set of waterproof outer layers including a jacket and rain pants. Gaiters are highly recommended. You should also dress in several layers of warm clothing, which should include a hat and gloves, so you can adapt to changing conditions. Keep your jacket and rain pants, in your day pack at all times. On that note, you will need a comfortable day pack for your field equipment, spare clothes, food and water.

Mapping equipment: You need to have a Suunto or Silva style compass clinometer, similar to the one you used for ERTH2110 Field Methods. A water-resistant field notebook is essential. You should also have a selection of pencils including some with harder leads (2H to 4H) for mapping, as well as and a pencil sharpener and eraser. A set (2 minimum) of Indian-ink style pens will also be required for inking-in your map (e.g. Staedtler drawing pens or similar with 0.20mm and 0.35mm). A set of good quality, coloured pencils is also required for colouring your final maps and sections. A protractor and a ruler will be required for some of the exercises. A cell phone is not required, but if you bring your phone, the app OS Locate is extremely useful in helping you locate your exact position on your map. This does not require a network connection to work. You should buy a high-quality waterproof bag (e.g. an aquapac) for your phone if you are using it in the field.

General geological gear: A hand lens w/ lanyard is essential. Basic testing equipment, e.g. a hardness kit, magnet, etc. will be useful. **Please note:** it is illegal to carry a non-folding knife with a blade longer than 3 inches (7.6 cm) anywhere in the UK. A small rock hammer is also useful but not required. If you want to collect samples then sample bags, marker pens and masking tape will be required.

Other equipment: You should also have a reliable wristwatch or other way of telling the time, with you at all times. A refillable water bottle is essential and a container for your lunch and snacks will also be useful. Sun protection and sunglasses are useful to have, and insect repellent can be helpful, although during May in the West Highlands, biting insects usually not an issue. A small first aid kit is also essential for treatment of minor ailments. Please note that many of these other items can be purchased in Fort William. This may be better than packing a lot of material into your flight baggage.

Assessment

This will be a project-based course. Many of the projects will be done with field partners, or in small groups, but each student must hand in their own final work each of the projects. Projects will be graded based on accuracy and thoroughness of field data, and how this has been presented, i.e. all materials will be treated the same as if produced by a qualified, professional geoscientist. Final grades for the trip to the SW Highlands will be calculated based on the scheme below. However, this may be modified depending on progress in the field which may be affected by weather and any unforeseen events such as power outages, etc. however unlikely these may be.

Component Weight	**(% of final grade)**	**Date**
Pre-trip lectures and reading test	***5%***	*[1]First or second day of trip*
Field skills assessment	***5%***	*[2]During the main mapping exercise*
Ex-1 Dalradian geology mapping	***40%***	*[3]Main mapping exercises. This includes the maps at Kentallen and Cuil Bay (20%), Onich (10%) and Rubh Cladaich (10%).*
	10%	*[4]Map presentation and discussion*
Ex-2 Moine Highlands structural analysis	***20%***	*[5]Three days in total with Ex-2*
Ex-3 Strontian plutonic complex analysis	***10%***	*[6]Three days in total with Ex-3*
Field Notebook	***10%***	*[7]See note below*

[1]Based on the pre-trip lectures and assignment reading on the geology of the region.

[2]Will involve you demonstrating geological measurement skills in the field.

[3]Material to be handed in will include final versions of maps, cross-sections and other structural measurements and controlled sketches.

[4]This will involve a short presentation outlining your understanding of the geology of the mapped sections for the Dalradian Highlands as presented in your maps and other materials to be submitted.

[5]This is an exercise mapping in a poly-deformed terrane with older structures in the Moine Highlands. This will be a two-day excise, part of which will be completed while looking at the contact zone of around the Strontian Granite.

[6]This exercise will involve looking at the variations in rocks represented in a section of the Strontian Granite and the relationships between the pluton and the surrounding rocks of the Moine Highlands.

[7]Your field notebook will be submitted at various stages of the course for initial grading and feedback. A final mark for your field notebook will be assigned at the end of the course based on the combined work recorded throughout the course.

We have additional exercises that may be included depending on weather conditions during the field school. These would be substituted the exercises listed on page 3.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

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

Other course requirements

N/A

Course Policies on Missed or Late Academic Requirements

This will be a relative short but intensive, field-based course which will require a high level of preparedness and focus. There will be a series of short lectures during the Fall and Winter semesters to help prepare students for the course. *Any student missing these lectures will be withdrawn from the course.*

Students will be required to be at the train station in Fort William, Argyll, Scotland, UK on the 29th of April. During the course, we will be cooking for each other (food costs will be covered by the auxiliary fees) and everyone will be expected to participate in this, as well as keeping our accommodation clean and tidy. We will also be helping with the changeovers (general cleaning, changing bedding and towels) upon arrival and before we depart.

There will be two, short assessment exercises (each worth 5%) which will be carried out on the first or second day of the course, and during one of the days of mapping. Students will be assessed immediately upon completion, and there will be no additional advanced warning of the field-based assessment. Students will not be allowed to avoid or opt out of these tests. The same policy applies to all the single-day exercises (also worth 30% in total). The single-day exercises are to be handed in at the end of the evening of the day. Refusal to complete these or deliberate avoidance will result in forfeiture of the full 5%.

The main mapping exercise and an assessment of the field-notebooks will be on continuous as the course progresses. There will be a short map defence upon completion of the mapping exercise. Final submission of the map and cross-section will be expected before leaving on the final day of the course. There will be no exceptions. Failure to submit any material without express permission will result in a final mark reduction of 10% per day. After 5 days the material will not be marked and an F will be entered as the final course grade.

While in the field you must also be properly equipped (see the required equipment above). If you are not properly equipped will not be allowed to complete the day's exercises and will be deducted 5% of your final mark for that day.

If you have a serious medical problem, a contagious illness or another emergency, you must immediately tell an instructor. We will be working in a rural setting, in a foreign country. You must therefore understand and follow all local laws. You will also be representing both the department and Dalhousie University. You must listen to the course instructors who are there to help make this as rewarding an experience as possible, and of course will help oversee your safety. As it is will be impossible to make up any missed days in the field, missing days due to unsafe or inappropriate behavior, alcohol abuse, etc. may result in dismissal from the course as will deliberate mistreatment of a fellow student, causing conflicts, or any form of antisocial behavior. Respect your instructors, follow their instructions, and always respect your fellow students. We will rely on each other to make this course a success.

Course Policies related to Academic Integrity

The standards of academic integrity as described in the section on page 6 will be applied to this course. Students are encouraged to discuss all aspects of the course but are required to submit their work assignments individually. Remember that the use of AI bots will not help you when it comes to the final grade.

Course Content

There will be two, short, assessments which will be completed by each student individually. The first of these will involve a short exam reviewing the regional and local geology of the region and will be based on the pre-trip lectures and reading. The second assessment will be based in the field and will involve basic orientation skills, map location identification, and will involve a detailed evaluation of your ability to make geological measurements and interpretations which will be important as the main mapping exercise progresses.

The main mapping exercise (exercise 1) will be based on section of the Dalradian Highlands at Onich, Cuil Bay and Loch Leven, composed of polymetamorphic rocks which formed during the Caledonian-Appalachian Orogeny. These rocks in these sections form parts of the Appin Syncline and Loch Leven Anticline as well as other local structures. This will take about 6 days to complete. The goal of this exercise will be to make maps, cross sections, controlled sketches and record detailed observations of the small-scale structures and local stratigraphy, and then construct a geological history of the regional section. This will require very detailed mapping and measurements very on an outcrop scale and further plotting and interpretation of the data. One day will be assigned to finishing maps, cross-sections, etc., and your report for exercise 1.

A second, shorter, mapping exercise will be carried out in Glen Gour, Glen Tarbet and around the margins of the Strontian Granite (exercise 2). Glen Gour and Glen Tarbet are valleys that cut through sections of metamorphic rocks of the Moine Highlands which were deformed during two separate

metamorphic events. Mapping these structures will again involve very detailed measurements of the complex small-scale structures present.

Another exercise (exercise 3) will involve making controlled sketches, measurements, and detailed observations in several areas of the Strontian Granite, famous for the being the type locality where the element strontium was discovered. This will also include looking at rocks from the Moine Highlands at the contact with the granite. Exercises 2 and 3 will take about 3 days to complete.

Other options for single day exercises include looking at classic areas of geology in local areas which may include Glen Coe, Ballachulish or other locations. These will also be designed to test your ability to make accurate and detailed geological measurements on a wide variety of rock-types representing a wide range of geological settings. These may be substituted for some of the days of mapping in the Dalradian Highlands, or for some of the shorter exercises listed above.

Please be aware of the fact, that each evening you will have to work your maps, structural measurements, cross-sections, etc., to be able to complete the course successfully. Depending on the prevailing weather, we may designate time during the day to do this in place of the scheduled fieldwork. This in turn could mean that part of the day assigned to finishing your maps and reports could be spend in the field. We may also carry out early evening excursions to the local outcrops if required. We do not expect you to be out mapping until later in the evening, nor would you be expected to cook if this were to happen.

Current Schedule (preliminary)

Time/Date	**Lecture (Approximately 1 hour 30 mins) each**
Week of March 17th	Meeting about logistics, travel, trip logistics, etc.
Week of March 24th	The regional geology of the Scottish Highlands.
Week of March 31st	The stratigraphy and structure of the Lochaber area.

Date/Time	**Field School activity in the West Highlands of Scotland**
Tuesday, April 29th	Arrival in Fort William. Meeting with the course instructors at Fort William train station in the afternoon. Transport to Ardgour House. Helping with the changeover and short meeting to establish the general protocol for the course.
Wednesday, April 30th	Introduction to the geology of the Cuil Bay/Kentallen section. Start of mapping for exercise 1. Short test based on the pre-trip lectures and reading in the evening.
Thursday, May 1st	Day 2 of mapping of the Cuil Bay/Kentallen section.
Friday, May 2nd	Day 3 of mapping of the Cuil Bay/Kentallen section.
Saturday, May 3rd	Introduction to the Geology of the Onich/Loch Leven section. Start of mapping along the Onich section. Possible field skills test.

Sunday, May 4th	Finish mapping of the Onich section.
Monday, May 5th	Mapping of the Loch Leven section (North Ballachulish, Rubh Cladaich).
Tuesday, May 6th	Revisiting any field areas as required. Maps, cross-sections, sketches, field notebook, etc., due at the end of day. Resupply trip to Fort William as required. Map discussion in the evening.
Wednesday, May 7th	Strontian / Moine Highlands Day 1: Glen Gour and the Moine Highlands.
Thursday, May 8th	Strontian / Moine Highlands Day 2: Introduction to the Strontian Granite.
Friday, May 9th	Strontian / Moine Highlands Day 3: Moine Highlands / Strontian Granite contact. Exercises 2 and 3 to be handed in at the end of the day.
Saturday, May 10th	Leaving Ardgour. Assisting with the changeover and return to Fort William.

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.