GRADUATE STUDENT HANDBOOK

Department of Earth Sciences Dalhousie University



Department of Earth Sciences Room 3006 Life Sciences Centre Dalhousie University Studley Campus 1459 Oxford Street Halifax, Nova Scotia CANADA B3H-4R2

http://www.dal.ca/faculty/science/earth-sciences.html 1-902-494-2358

Cover Image: Aerial photo from the south of the Himalayan mountain chain in Nepal, including Chomolungma (aka Sagarmāthā or Mount Everest, the world's highest peak at 8844 m) and Makalu (8463 m) (4th highest peak). The horizontal distance between the peaks of Mt. Everest and Makalu is 25 km. The relief is ca 5 km. i.e. the bottom of the valleys in the foreground is 4,000 m. The mean elevation o the Tibetan Plateau in the background is ca 5400 m. The photograph was taken at cruising altitude of ca. 8,500 m.

The top of the Chomolungma is covered by Paleozoic to Mesozoic marine sediments, all the other peaks are made of highmetamorphic grade rocks and Miocene leucogranites.

Several faculty members and students in the Dalhousie Departments of Earth Sciences and Oceanography have been carrying out geological research at high altitudes in Bhutan, India and Nepal, in order to understand the formation of the world's highest mountains during the collision of India with Eurasia. Computer modelling is providing successful simulations of the mountain chain's history. We are also studying changes in the Asian monsoon over the past few million years, as well as the seismicity and its causes.

QUICK LINKS

Faculty of Graduate Studies Main Website Faculty of Graduate Studies Regulations FGS Graduate Calendar FGS Preparing for a defence

Department of Earth Sciences Main Website Department of Earth Sciences Course Timetable Department of Earth Sciences Events Calendar

Dawson Geology Graduate Society (DGGS)

Funding, scholarships, travel grants (from FGS)

Dal-Online for Graduate Student Information System (GSIS) Dalhousie University Dalhousie University Killam Library Dal International Students Support Services

Registrars Office

Off-campus living

Email Addresses: Firstname.Lastname@dal.ca

Department Chair: Dr. James Brenan Graduate Coordinator: Dr. Yana Fedortchouk Department Administrator: Mr. Sean Hartwell Administrative Secretary: Ms. Norma Keeping

Important Dates

Important dates for graduate students and post docs

NOTE: While these dates are current to the best of our knowledge, some dates are based on dates from previous years and are only approximate. Dates change. Please contact the FGS website or website of the funding agency to determine the actual date. The Department of Earth Sciences will not be responsible for incorrect dates in this list. They are meant as a planning guide.

Approximate Date	Event			
August				
1	Deadline to submit your Annual Progress Report via GSIS			
	Deadline for those expecting to graduate in Fall to submit approved thesis to FGS* via Dalspace			
mia				
mid	Deadline to submit completed Banting pdf application to department office			
4 th week	FGS deadline for Banting post-doctoral fellowship application			
September				
1 st or 2 nd week	Classes begin			
mid	Dept deadline for Ph.D. students applying for NSERC-PGS			
mid	Banting Post-Doctoral Fellowship Deadline to NSERC			
mid	FGS Deadline for depts to submit NSERC-PGS PhD rankings			
October				
mid	Deadline to submit nominations for the Lew King Scholarship and Nedimović Family Scholarship			
mid	NSERC Deadline to submit Alexander Graham Bell Canada Grad Scholarship to NSERC (PGS and CGS)			
November				
	Department application submission deadline (to the department) for students who are wishing to be			
15	considered for a Nova Scotia Graduate Research and Innovations Scholarship			
December				
1	FGS internal deadline for rankings and completed applications from dept for NS Graduate Research and Innovation Scholarship			
1	NSERC Deadline for CGS-M			
"Stop day"	DEPARTMENT ANNUAL GRADUATE STUDENT REVIEW (All Dal and external members of all supervisory committees should attend)this is the day after classes end but before exams begin			
15	Dept fixed deadline for completed applications and supporting documents to the dept for a post- doctoral Killam fellowship			
mid	Deadline for those expecting to graduate in May 2017 (without registering for the winter term) to submit approved thesis to FGS* via Dalspace			
January				
early	Approximate deadline for departments to submit to FGS their rankings for Killam Post-doc fellowships			
February				
1	Department application submission deadline (to the department) for students who are wishing to be			

considered for a Nova Scotia Graduate Research and Innovations Scholarship

early Department application submission deadline (to the department) for students who are wishing to be considered for a Killam scholarship

mid	Deadline for The James Bourque Northern Doctoral Scholarship in geography
mid	Deadline for Royal Canadian Geographic Society RCGS Graduate Research Scholarships
mid	Approximate FGS deadline for applications to be complete, accepted by the department, and submitted to FGS by students wishing to be nominated for a Killam scholarship
mid	FGS internal deadline for rankings and completed applications from dept for NS Graduate Research and Innovation Scholarship
mid	Approximate Admission deadline for students to be considered for a Killam pre-doctorate scholarship
mid	Approximate FGS deadline for Killam pre-doctoral rankings and applications from departments
March	
1	FGS Approximate deadline for renewal of Killam pre-doctoral scholarship
mid	FGS Application deadline for Eliza Ritchie Doctoral Entrance Scholarship (Women)
April	
1	FGS deadline for department to nominate M.Sc. Student in first year for A.S. Mowat Prize
early	Deadline for those expecting to graduate in May 2017 to submit approved thesis to FGS* via Dalspace
4 th week	Deadline for those expecting to graduate in October 2017 (without registering for the summer term) to submit approved thesis to FGS* via Dalspace
May	
mid	FGS deadline for James Robinson Johnston Graduate Entrance Scholarship for African Canadians
mid	FGS deadline for Indigenous Black and First Nations Graduate Entrance Scholarship
June	
1	Dept submits allocations for FGS scholarships (applicants accepted after this time will not receive FGS scholarship funding)

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Overview of the Department of Earth Sciences at Dal

Early history. Dalhousie University became established in 1818 and the Department of Geology (subsequently more broadly renamed Earth Sciences) started when the College of Science began in 1879 with Rev. Dr. David Honeyman, "Professor of Geology, Paleontology and Mineralogy". The first geology graduate degree (and the second College of Science degree) was awarded in April 1903 to M.Sc. student Loran Arthur De Wolfe, whose thesis regarded the structure and stratigraphy at North Sydney and Sydney Mines, Cape Breton Island, Nova Scotia. Over the past decades our department graduate student population ranged from 25-40, with 7-14 new graduate students each year. Other details are available on the <u>department's web site</u>.

Research strengths. Our department has maintained its strong interest in tectonics and stratigraphy, and currently our strengths vary widely, with emphasis on high temperature geochemistry and petrology, tectonics and geodynamics, surface processes and the environment, geophysics, petroleum geoscience and biogeochemistry. Currently we are a demographically young department, with 10 professors, four instructors all of whom are involved in research, and nine technical and administrative staff members who help our graduate students reach their research goals. A complete list of Earth Sciences faculty and their research interests are provided below.

Research facilities. In addition to mineral separation, GIS, and microscopy facilities, we have a number of specialized lab groups available to our graduate students: **Experimental petrology facilities to simulate** high temperature or high pressure environments, a **JEOL8200 Electron Microprobe** (a regional facility), Canada's only **Cosmogenic Nuclide Dating Facility** (¹⁰Be, ¹⁴C, ²⁶Al, ³⁶Cl), Canada's only **Fission Track Facility**, a **Noble Gas Lab** currently focusing on (U-Th)/He thermochronology, a **Petroleum Research and Seismic Stratigraphy Team**, **Environmental Computing clusters** (climate and human impacts on Earth), **Physical Modeling labs** for geodynamics and surface patterns, an **ICP-OES Lab** for major and minor elemental geochemistry, as well as **laser ablation ICP-MS**, an **XRF**, and a **Seismic Geophysics cluster** focused on tectonics studies and crustal imagery.

Financial support. At least 95% of our Canadian and International graduate students have a full annual stipend, provided by some combination of the supervisor's grants, the department, the Dalhousie Faculty of Graduate Studies, teaching-assistantships, or by scholarships or grants to you. The cost of living in Halifax is moderate for cities with half-million population, and our stipend is based on providing you with a comfortable standard of living. Your full support package also covers fees, including medical and foreign fees, and tuition for all required courses. M.Sc. students are guaranteed 2-years of funding, and Ph.D. students with a M.Sc. degree are guaranteed 3-years. Extensions to these periods are common but are contingent upon your progress.

Location. 44°38'9.80"N, 63°35'39.67"W. We enjoy a beautiful Atlantic Ocean coast which offers surfing and sea-kayaking, a high density of natural lakes and streams for swimming, boating, and fishing, and four full seasons with snowy winters, cool rainy springs, warm summers (high 20s °C), and colourful autumns. One of the benefits of our location for graduate studies is the large number of geoscientists in the Halifax and Nova Scotia region who can serve as graduate co-supervisors or committee members. These include the **Geological Survey of Canada-Atlantic**, **Nova Scotia Department of Natural Resources, Canada-Nova Scotia Offshore Petroleum Board**, scientists at local environment, energy, and mineral sources companies, and geoscientists in Dalhousie **Oceanography Department**, and at

Saint Mary's University, Acadia University, and St. Francis Xavier University which all offer

additional facilities or expertise to our graduate students. See our list of adjunct faculty for geoscientists that you may want for your supervisory committee. Within an hour of campus, our local geology is as diverse as it is fascinating—including the Cambro-Ordovician Meguma Formation quartzite and shale, the Carboniferous Windsor Group evaporites, intrusive and extrusive igneous rocks related to Appalachian tectonics and rifting, a well-studied passive continental margin which contains salt-tectonic controlled oil and gas reserves, Cretaceous weathering and erosion, a multi-glaciation Quaternary stratigraphy, world-renown salt marshes, and the Bay of Fundy with the highest tides in the world, all located on a remarkably interesting and resource-rich rifted continental margin of Eastern Canada!

Graduate Programs Offered

Currently we offer two graduate programs: M.Sc. and Ph.D.

Both programs are thesis based and the focus is on independent research.

There are no 1-year programs or course-based graduate degrees.

Transfer from M.Sc. to the Ph.D. program is possible after the first two semesters of the M.Sc. program. Some students have taken advantage of Dal's <u>Interdisciplinary Ph.D. program</u>

Requirements	M.Sc.	Ph.D.	
Typical Duration	• 2 years (after 2.33 years, funding may not be available)	• 4 years (after 4.33 years, funding may not be available)	
Qualifying Exam	Currently not required	Currently not required	
Registration	• Fees and course registration is required for all semesters including the semester you defend	• Fees and course registration is required for all semesters including the semester you defend	
Courses	 ERTH6300 and ERTH6350 are required; two additional courses at the graduate-level are required; your supervisory committee or the graduate advisory committee may request additional courses if important deficiencies are perceived 	 ERTH6300 and ERTH6350 are required; your supervisory committee or the graduate advisory committee may request additional courses if important deficiencies are perceived 	
Part time participation	Possible in special circumstances	Currently not possible	
Thesis proposal defence	• In April, usually at the end of the first two semesters	• In April, usually at the end of the first two semesters	
English Communication	 Students are required to communicate in writing and orally in English at a high level of technical quality and proficiency 	 Students are required to communicate in writing and orally in English at a high level of technical quality and proficiency 	
Conference Presentation	Presentation at local, national or international conference is required	Presentation at a national or international conference is required	
Other requirements	 Attendance at all Department Colloquium Seminars at least in your first year 	 Attendance at all Department Colloquium Seminars at least in your first year A Pre-Defence Lecture to the Department of Earth Sciences in your third year 	
Thesis	 Two formats are possible (see thesis formats for details) A traditional format A manuscript format (usually at least 1 submitted manuscript, often two manuscripts) 	 Two formats are possible (see thesis formats for details) A traditional format A manuscript format (a minimum of at least 1 accepted or published manuscript and a minimum of 2 additional manuscripts ready for submission at the time of defence; most Ph.D. manuscript-style theses have three or four manuscripts in addition to the introductions and synthesis chapters) 	
Oral defence of thesis	Typically 2 hours, public	• Typically 2-3 hours, public	

Potential Thesis Supervisors

Research Fields		h	Graduate Thesis Supervisors	Thesis research topics	Email @dal.ca	
High T Geochemistry Petrology & Mineralogy		Fedortchouk, Yana		Diamonds, mantle geochemistry, platinum group elements, high pressure high temperature mineral experiments, igneous petrology, ore genesis	Yana	
		Mine	Brenan, James	Experimental mineralogy, geochemistry, petrology	ibrenan	
	nistry ectonics chronology Thermo- Structural		Structural	<u>Gruiic, Diordie</u>	Tectonics, structural geology, microstructural analysis, geo- and thermochronology, mid-crustal flow, tectonic-climate interactions, modelling of deformation systems, Himalaya, Alps, <u>Dinarides</u> .	Dgrujic
mistry			Thermo- chron	Coutand, Isabelle	Fission track analysis, thermochronology, detrital zircon/apatite, Active tectonics, climate vs. tectonic forcing of orogens and basins, Andes, Alps, Himalaya, western Canada,	Icoutand
Geocher T		Geo	Cosmo- chron	Gosse, John	Geomorphology, natural hazards, active tectonics, landscape evolution, geochronology, cosmogenic nuclides, Neogene-Quaternary, glacial dynamics, Canadian Arctic, Nepal, Mongolia, southwestern USA, southern central Andes, Atlantic Canada	<u>Iohn.Gosse</u>
Low T Ital Sciences		Stable	lsotopes	Sherwood, Owen	Stable isotopes systems, paleoclimatology, Quaternary-Holocene, deep- sea corals, marine geoscience, isotopic fingerprinting related to environment and petroleum industries	Owen.Sherwood
		Aqueous	eling	Sterling, Shannon	Biogeochemistry, environmental sciences, modeling impact of climate changes, global hydrology, streams and hydrology, groundwater, Nova Scotia	Shannon.Sterling
	Plug, Lawrence		Plug, Lawrence	Natural systems of patterns, numerical modeling, fracture systems over wide spatial scales, geomorphology, permafrost, non-reductionist modeling, surface processes, forestry models, sustainability, climate change, Nova Scotia, Alaska, Yukon, Mars	Lawrence.Plug	
	Envi			ТВА	Coastal geoscience	
Geophysics Systems	Systems	iphy Sedimer	CO2 storage	Wach, Grant	Petroleum systems, interpretation of offshore records including 2D and 3D seismic, core, well logs, stratigraphy, sedimentology, surface processes, petroleum systems architecture, facies models, outcrop analogues to offshore systems, submarine mass wasting complexes, Scotia Shelf, African petroleum systems, Trinidad, Brazilian and Venezuelan shelves, CO2 storage	Grant.Wach
oleum S		Stratigre		ТВА	Geophysics	
	Aarine Barine Ba		Nedimović, <u>Mladen</u>	Geophysics, change (<u>seismics</u> , GPR, Lidar, <u>Vibracoring, etc</u>)	Mladen	

In addition to the professors listed above, all of our instructors serve on thesis committees:

Ann Marie Ryan (Environmental Geology, Critical Zone Chemistry)

Chris Greene (Geographic Information Systems-GIS, Remote Sensing)

Michael Young (Bedrock geology, Arctic tectonics, Mapping, Mineral Exploration and Mining)

Richard Cox (Geochemistry, Micro-analysis, Petrology, Mineralogy)

Retired and emeritus faculty who serve on thesis committees: N. Culshaw, M. Gibling, B. Jamieson, C. Walls, M. Zentilli

BEFORE YOU APPLY!

Contact a potential thesis supervisor in the field of your interest. Supervisors must ensure that (1) funding for graduate student stipend (salary plus fees) is available, (2) that a suitable thesis research project is available and funded (some cost more than \$100,000), and (3) that a position is available among the supervisor's graduate team. YOU WILL NOT BE CONSIDERED for graduate school if you do not have a supervisor. Your supervisor may ask for copies of your transcripts (emailed scans may suffice), a statement of interest written by yourself, and letters of recommendation or names of your previous supervisors before making a decision or interviewing you.

ARE YOU ELIGIBLE?

Dalhousie University, the Faculty of Graduate Studies, and the Department of Earth Sciences value the following criteria:

- 1. High-standing in your current or previous science degree program
- 2. English Language (written and oral, technical English. See FGS requirements for English Second Language).
- 3. Your previous GPA should be above 3.7. For a M.Sc. student, this is based on the average of the last 60 credit hours. For a Ph.D. student this is based on the combined average of the last (maximum) 30 credit hours of a M.Sc., and the last (minimum) 30 hours of the Bachelor's Degree. A GPA less than 3.5 will not normally be considered.
- 4. These FGS requirements must also be met.
- 5. The Department of Earth Sciences seeks energetic and creative students who have a passion to conduct research in fields of Earth Sciences supported by our department. Most of our students have completed an honours thesis in science if applying for a M.Sc., and a M.Sc. thesis or equivalent if applying for a Ph.D. While most of our students have a previous degree in geoscience, this is not a requirement in all cases, and a degree in most physical sciences will be permitted. Additional Earth Sciences courses may be required based on the applicant's academic background.
- 6. Supervisors look to a number of other factors. For instance, for geophysics or numerical modeling research a background in mathematics and physics may be sought. For geochemistry or geochronology research, supervisors may seek students who have demonstrated laboratory competences.
- 7. We do not require SAT or GRE exams.

APPLY.

Follow the instructions at the FGS website for submitting an application. Note the deadlines for application, depending on the graduate program and if you are Canadian or an International student. See the Important Dates section of this handbook. If you are eligible and a potential supervisor has indicated that he or she has a funded project available, then follow the instructions at the FGS website for submitting an application: How to Apply.
Your application is not complete until (i) the application fee is paid; (ii) your application forms are submitted online or by mail; (iii) your <u>OFFICIAL (sealed) transcripts</u> from each of your previous degree granting institutions are submitted to the Department of Earth Sciences; and (iv) at least two letters of reference are received by the Department of Earth Sciences.

SCHOLARSHIPS.

There is a number of scholarships, fellowships, and awards available to Canadian and International applicants. Details are available at FGS Scholarships. Please discuss possibilities with your potential supervisor and the graduate coordinator. Two additional scholarships are available in our department: The Lew King Award (up to \$15,000 per year), and The Nedimovic Family Scholarship (approximately \$3000 per year). Deadlines for COMPLETE applications or nominations can change so please verify the dates by visiting the FGS website or the funding agency's website (also see Important Dates in this handbook). In some instances, admission may not be possible without a scholarship or research/teaching assistantships.

ADMISSION.

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Admission is possible only after: (i) FGS indicates that you are eligible; (ii) a potential supervisor in the Department of Earth Sciences has indicated that she or he is willing to support your research; (iii) that funding for

Before you arrive

Please consider these items before you make the trek to Dalhousie. For international students requiring student visas, please contact Dalhousie Human Resources as soon as you have been officially notified that you have been accepted into the program. The Dalhousie University International Centre (<u>http://www.dal.ca/campus life/student services/international-centre.html</u>) web site offers a lot of information for international students coming to Halifax.

1. Check with your supervisor to determine if you need to arrive before the fall semester, **in case field work or lab work** is required. If field work in another country is required, make sure you are able to obtain the visas to visit and/or conduct educational research in that country well in advance.

2. Contact the Department Administrator (Ann Bannon) for issues regarding **medical insurance and other paperwork** necessary for international students. Apply for or renew your passport in time for your travel dates. You will also need a Canadian Government **Social Insurance Number** if you don't have one.

3. Check if you have been accepted to be a **Teaching Assistant** and confirm the times when the courses begin.

4. Inform your supervisor of your arrival information (**Dates and times, flight information, route if driving, and your emergency contact information**) at your earliest convenience. If you are arranging for someone to pick you up, make sure you exchange cell phone numbers or other means for communication.

5. **Consider your housing options**. Your supervisor is the best resource to determine the most economic places to call home for a few years. Consider the <u>Dalhousie Off-Campus Housing</u> website. Inevitably the **best source of information will be other graduate students in our department**. Halifax is a University town with three large universities—most of the best apartments will be secured at least a month before the semester begins.

6. You may wish to consider the following: (i) local bank institutions or **access to your bank**; (ii) **frequent flier programs**, especially if you are here for a while; (iii) schools in the <u>Halifax Regional</u> <u>School Board</u> if you have children.

When you arrive

Currency:

Canadian Dollars, CAD\$

Banks include Scotiabank, RBC-Royal Bank of Canada, BMO-Bank of Montreal, TD-Toronto Dominion, among others.

Getting to our department:

Airport: Halifax Stanfield International Airport, **YHZ** The airport is not in the city, so the drive will take about 25-40 minutes. Ground transportation from the airport to Halifax is available by taxi (\$60-70), or Metrobus (~\$4.00). Train (VIA Rail Canada) and coach-bus is also available.

Physical Address:

Department of Earth Sciences Office Room 3006 3rd floor of the Biology-Earth Sciences Wing Life Sciences Centre Edzell Castle Circle Dalhousie University Phone: 902-494-2358



Your first contacts should be:

1. Your **supervisor or co-supervisors**, to indicate you have arrived safely

2. The **Graduate Secretary**, Norma Keeping, 902-494-2358, can help you get organized regarding the following items or direct you to those who will:

DalCard (photo ID, giving you library access, email and internet access, myDal and other online portals, and other privileges)

Keys and codes so you can access the Life Sciences Centre, and your office and labs Mailbox in the Department Office

Please also visit the **Graduate Coordinator**, Dr. Yana Fedortchouk, (<u>Yana@dal.ca</u>) Room 4616 in the Oceanography Wing of the Life Sciences Centre, once you get settled or if you have any questions about your graduate program in your first couple of weeks.

You will need to register for graduate courses. Discuss this with your supervisor. Two of these (ERTH6300 and ERTH6350) are usually completed in the first year, so you should probably register for those. See the section on Graduate Courses for more complete information. **You must be registered for REGN9999 for all three terms.** For more information see **Registration Information**: http://www.dal.ca/faculty/gradstudies/currentstudents/registration.html.

In mid-September, we will have an **organizational meeting for all Graduate students** in our department. Before this meeting, the Graduate Coordinator will give new graduate students a 1-hour tour of the department to let you know the research facilities that are available for your use. For students beginning at times other than September, please request a tour after you arrive.

Welcome to our Department!

Graduate Life at Dal

Graduate student life at Dalhousie University will certainly keep you busy during your time here, with a healthy mix of work and play. In fact, the **Dawson Graduate Geological Society** (DGGS) may well form your first core group of friends upon your arrival here, with existing students able to advise you on any issues or queries regarding many aspects of city and campus life, your thesis program, and courses. The DGGS is the elected body that represents the needs and interests of our graduate students at the **Dalhousie Student Union (DSU) and Dalhousie Association of Graduate Students (DAGS)**.

Upon your arrival in Halifax, you may need some time to organize **accommodation** – current graduate students may be able to assist the search with a friendly couch upon which to spend a few nights to acclimatize. Please feel free to ask your supervisor to help contacting graduate students.

The **DSU**, the **DAGS**, and the **International Centre** are the primary organisations for graduate student representation, and will organize a number of social events throughout the year. DSU events include oncampus music events, boat parties, poster sales and farmers markets, as well as orientation tours and extra-curricular courses on social awareness. DAGS is the primary funder of the DGGS and offer training to the executive, while the International Centre will arrange for culture-specific festivals and get-togethers for students of all backgrounds.

As a society, DGGS meet daily for coffee at 10:30, bi-weekly for FridayGeoBeer (and every other week for Undergraduate GeoBeer), often incorporating the Dalhousie Informal Rock Talks (DIRT). During DIRT, academic, government, industry, and student speakers are invited from near and far to present in a friendly, laid back atmosphere followed by a few social drinks in the Milligan Room atop the Life Sciences Centre, commanding the best view of Halifax Harbour. DGGS events are often subsidized by the DSU and DAGS, but are generally kept within affordable limits in order to encourage all to partake. At least one main event is organized per month by DGGS, be it a seasonal holiday event, Art Gala, music evening, a hockey game, theatre trip, field trip, or something out of the ordinary, while every other year in early August, graduate students try to organize a field trip together. This has, in the past, incorporated a tour around the UK, Iceland, Utah and Newfoundland. While organized wholly by the graduate student body, there are many external opportunities for supplementary funding that can be accessed. The expectation from the department is that the travelling group arranges this trip in advance and with full permission of their supervisor for the period of leave. Upon return, an informal and fun presentation on the geology and trip is given to the department. Among other events by graduate students, the most regular are meals out in the local restaurants, karaoke nights and music pub nights out.

Many of our faculty and graduate students enjoy and participate in the classical music and art scene on and off campus. Symphony Nova Scotia plays mainly at the Rebecca Cohn Auditorium on campus, there are several university and local classical bands or choirs, and several venues for a wide range of local and international art.

Beyond the classics, Halifax has a very lively nightlife that is geared in large part towards students. Along with a multitude of pubs and restaurants downtown, there are many activities such as trivia, karaoke and beer and wine tastings, among other things, that occur on a weekly basis at places such as the Tea Room, and the engineering bar (Sexton Campus). In and around Halifax there are also opportunities for scuba diving, fishing, skating, and cross-country skiing.

One thing the current graduate students can guarantee is that you will receive a warm Maritimes welcome the Dalhousie Department of Earth Sciences.

Graduate studies in Earth Sciences at Dal

There are a number of differences in graduate programs among departments, universities, and nations. We hope you will take advantage of some of these differences. While experiencing our work ethics and research protocols, please allow us to learn more about your academic and research experiences.

Thesis-based graduate degrees

Our M.Sc. and Ph.D. programs are thesis-based. This means that you will spend much of your graduate time focused on research and not courses. By the end of your M.Sc. degree we hope that you are prepared to conduct independent research, and by the end of your Ph.D. you will have independently led a major research project. Your thesis topic will be chosen by you and your supervisors. **By the end of your first semester, you should know at least one hypothesis that you will test or one question that you will solve, why it is important, the broad implications of your research, and at least some of the methods you will employ to achieve your objectives**. While ERTH 6300 will help in accomplishing this by the end of the first semester, this responsibility lies with you and your supervisory committee. You should be prepared to defend your **thesis proposal** at the end of your second semester.

Graduate courses

Relative to other international programs, in Canada there are usually fewer courses required. At Dalhousie, graduate-only courses are indicated with a 6000-level course number, and courses with 5000-level numbers are available to graduate and undergraduate courses. See the <u>Earth Sciences Graduate</u> <u>Calendar</u> for a complete course listing. While over two dozen graduate-level courses are listed in the Graduate Calendar, faculty members can also provide Directed Studies (ERTH 6250) courses designed specifically for graduate students taking them. You, your thesis supervisor, supervisory committee, and the graduate advisory committee will help determine which courses you should take. Note also that there is an Internship Course (M.Sc. students can repeat the course once, and Ph.D. students twice) for students who wish to break for a few months from their thesis to work in industry or government (your graduate stipends are discontinued during that time).

ERTH 6300 and 6350 are compulsory for M.Sc. and Ph.D. They are to be taken in the first year of study.

ERTH 6300 "*Research Design and Scientific Presentation*" provides instruction in the philosophy of science, the scientific method, ethics, the roles of authors and reviewers, how to report uncertainty in measured data, develops skills in written and oral presentation of scientific results, and provides guidance to help students recognize interesting scientific questions, and choose appropriate and feasible methodologies. The public thesis proposal defence is considered a part of ERTH 6300. **ERTH 6350** "*Research Topics in Earth Sciences*" is a modular class that has field trips and lecture components. In additional to the module on the Geology of Nova Scotia, students are introduced to a wide range of earth sciences research conducted by Nova Scotian geoscientists, ranging from mantle

dynamics to Martian surface processes. Because many of our graduate students have a non-traditional background (i.e. B.Sc. in Earth Sciences), a key goal of the course is to help students develop breadth in Earth Sciences.

M.Sc. students require a minimum of two additional courses at the Graduate Level. Passing grade for all graduate courses is B-. For students hoping to be nominated for a transfer to the Ph.D. program a minimum grade of B+ is required in ERTH 6300 and 6350. Some M.Sc. or Ph.D. students may be requested by their supervisory committee or the department graduate advisory committee to take additional courses depending on perceived deficiencies that may hinder the completion of their thesis.

Your thesis supervisory committee

In our department, all graduate students require a thesis supervisory committee. The thesis supervisory committee has several responsibilities. First, it is composed of scientists who have expertise in Earth Sciences and, when possible, in your field of interest. The committee will seek to help you reach your graduate goals by providing access to facilities, funding, and guidance. Second, the committee will help establish your graduate program, including course work and research topic and methodologies. Third, the committee will help resolve rare instances of disagreement between you and your supervisor. Typically your thesis supervisory committee members will serve on your thesis examining committee as well. More information is provided in the section on Supervision.

Appointment	Program	Supervisor	Co-Supervisor	Comments
Pogular ECS Mombor	Ph.D.	Yes	Yes	Must have a Ph.D.
(Are employed by Dalhousie. All of our professors and some instructors)	M.Sc.	Yes	Yes	Must have Ph.D. or M.Sc.
Adjunct (FGS) (Most of our instructors and some non-Dalhousie	Ph.D.	No	Yes	Must have Ph.D.
scholars with appropriate academic qualifications who have regular involvement with Dalhousie graduate programs; nominated by our department)	M.Sc.	No	Yes	Must have Ph.D. or M.Sc.
Adjunct (Scholar) (Have the	Ph.D.	No	No	Can serve on one supervisory committee concurrently
actively engaged in research; nominated by our department)	M.Sc.	No	Yes	Can serve on one supervisory committee concurrently

Qualifications of the Supervisor according to FGS Regulations Section IX.

All graduate students will have one supervisor or two co-supervisors and at least two additional members, at least one of whom is from the Department of Earth Sciences. Regular Dalhousie faculty members with FGS membership should constitute no less than 50% of the membership of a supervisory committee.

By the end of your first semester you should have had a thesis supervisory committee meeting. During that meeting, you should establish the minimum number of committee members and determine what courses are needed or requested. A thesis topic and possible hypothesis or question should be proposed, although it may change several times before your final thesis proposal defence. You should have at least one thesis committee meeting per year. On occasion it is permissible to have one or more members of the committee participate remotely (e.g. teleconference, Skype, etc.).

Dal's Graduate Student Information System-GSIS

It is your responsibility to keep the information on your online GSIS updated. It has important information such as your contact information, program requirements, thesis supervisory committee membership, and progress reports. You should communicate the thesis supervisory committee

membership and the courses that you and your committee have agreed for you to complete to Department Secretary Norma Keeping before the end of the first semester. Occasionally updates to your GSIS will require your approval. **NOTE: You have to submit an Annual Progress Report before August 1 each year.** Failure to do this will likely mean that you will not receive salary, and some scholarships and fellowships require updated annual reports to be renewed.

Work schedule

We all work at different efficiencies and read and write at different fluencies. Therefore, there is no set number of hours for a graduate student work week. However, as a general guideline, you should expect to work beyond 40 hours per week to achieve your thesis objectives in a reasonable time (part-time M.Sc. students should seek clarification from their supervisor). This work includes lab and field work, thesis writing and research, course work, and any research and teaching assistantships. Most of us have found that we work longer hours in order to achieve our goals, including working weekends and evenings, because we very much enjoy conducting research and writing effectively. You may find that as various deadlines are approaching (e.g. termination of your stipend; written assignments for ERTH 6300; proposals for funding, revisions of manuscripts) that you may have to work late. Fieldwork often requires more than 8 hours per day because of camp duties at the beginning and end of each day. At times physical model or laboratory experiments will require you to work after hours. Your supervisor will expect you to commit to completing your research, course work, and other duties in an efficient manner to meet agreed upon deadlines. While most students set an ambitious schedule, if you feel that your work schedule is becoming too ambitious, please discuss this with your supervisor or thesis supervisory committee as soon as possible.

Holidays/Vacation

The Dalhousie community enjoys many **holidays** throughout the year. There may be fewer or more than you are accustomed to. Many are government holidays, some observe religious events, and some are just for Dal. While study breaks during the fall and winter semester offer a brief reprieve from attending classes, graduate students are expected to continue to work on courses or research or take advantages of field courses offered during study breaks. If there are any religious holidays that you feel you should observe that are not one of our normal holidays, please inform your supervisor. Usually permission will be granted.

We recognize that students occasionally need a break longer than a weekend. We also realize that many of you must travel long distances to be with family. As a rule of thumb, students who receive a stipend for the entire year should plan to take off no more than two weeks total for vacation, excluding the break between the Fall and Winter semesters, i.e. from Dec 24 to the start of classes in January. **However, we encourage you to use the full two weeks.** Please seek permission from your supervisor well in advance for more than 2 weeks of vacation time in a given year. Contract deadlines, proposal submission deadlines, time-sensitive experiments, ship time, field work, and other events may need to be considered. Your supervisor or source of funding has the right to discontinue funding for your stipend and fees while you are on an extended vacation. Please also note that while we encourage you to participate in as many field experiences as possible (e.g. Dawson Geology Graduate Society events), some supervisors may consider those experiences will not be considered vacation and will be permitted.

Sleep

Until recently, the need for **sleep has generally been poorly understood and undervalued** in North America. Personally, most of us recognize that we cannot work as efficiently and we make simple mistakes when we are tired. From a safety point of view and the efficiency of using standard operating procedures, we discourage students and supervisors against conducting chemistry experiments or operating equipment while tired. In the past decade, neurobehavioral research has provided the physical evidence that links sleep to cognitive skills and memory—two traits that are critical for the high level of creative and focus required for graduate research. While there are no set durations for sleep, you should aim at a minimum of seven hours. If you frequently cannot meet this goal owing to research-related responsibilities, please discuss this with your supervisor.

Off campus participation

Off campus participation occurs when a student is temporarily not physically present on campus or in the field. The most common situations leading to off-campus participation are (i) unexpected family or health issues; or (ii) opportunistic short-term employment or contractual work (this excludes ERTH-8893 Work Co-op; not usually permitted in the first year of a graduate degree; note that international student visa holders may not be employed except under very special circumstances); (iii) off-campus training or research. In the instance of prolonged (> week) health or family issues, please alert your supervisor and keep him or her appraised of the situation. In the instance of short-term employment, permissions should be sought at least two months prior to engaging in the short-term employment. Usually only in the instance that the work is considered relevant to the thesis research or degree will permission be granted. In many instances, stipend and fees may not be paid to the student during the offcampus short-term employment. If you anticipate requiring off-campus participation of your graduate program, please obtain permission from your supervisor and the department graduate coordinator and FGS. Some of our students have offices at GSC-Atlantic or other universities where their primary cosupervisor is. This is not considered off-campus participation, and students commute to Dalhousie for classes and other work. Medical and maternity/paternity leave is not considered off-campus participation (discussed below).

Leaves

Leaves of absence are necessary when graduate students require time away from their graduate program. These include parental leaves and medical leaves. A leave of absence, including parental leave, frees a student from paying tuition fees and releases the university from providing student services, such as consultation with professors and library privileges. Leaves of absence are normally arranged in semester blocks. Supervisors will not expect any progress to be made during a formal leave. **Applications for a Leave of Absence, including parental leave, must be received prior to the term** for which it is to take effect. Retroactive approval for a Leave of Absence will only be granted in extraordinary circumstances. In addition to an official approval through the Faculty of Graduate Studies, students should meet with their supervisor and graduate coordinator to discuss a time line for returning to their program and completing degree requirements. Students may not hold any Dalhousie Scholarships during a leave of absence, including parental leave, nor may they study elsewhere and receive credit at Dalhousie University. It is possible that other scholarships may permit a limited amount of funding. Please check with the funding agency to determine the consequences of your leave on your award, and on continuing upon your return. Graduate students expecting a child are eligible for an **approved leave of absence** pursuant to FGS <u>Regulation 5.8</u>.

A **program continuance** may be an option for graduate students who do not qualify for an approved leave of absence. The purpose of a program continuance is to allow students to participate in an exceptional academic or career opportunity not covered by the Leave of Absence regulation. For details, inquire with the FGS. Students must consult their supervisor before applying for a program continuance.

Salary, fees, tuition, scholarships, grants, and other money matters

All amounts are indicated in Canadian Dollars (\$CAD). At least 95% of our graduate students are fully funded to pay salary stipends, fees, and tuition.

Cost of Living in Halifax Regional Municipality.

Halifax has an average cost of living for Canada. Two litres of milk cost around \$4.00, a movie averages \$12.00, gas ranges from \$0.90 to \$1.40 per litre, and our provincial sales tax is 15%. The cost of a single bedroom apartment can be more than \$1200. From a survey of our graduate students in 2013, here are their median costs of living (n=12):

2013 Monthly Costs of Living	Median
	Monthly
Apartment rental (varies significantly, most shared an apartment)	\$690
Food and personal necessities	\$350
Other items (clothes, phone, books, car or bus payments, traveling home)	\$250
Total	\$1290

Salary.

This is money for your living expenses, text books, personal computer and internet, phone, and other personal items. It may be in the form of a wage (for employment at Dalhousie such as teaching or research assistantships) or in the form of a stipend (from scholarships or your supervisor's grants) in which you are free to work on your own research and help your research group.

In September 2013 the department raised the **MINIMUM recommended graduate salary to \$1250/month** for twelve months, one of the highest in the Faculty of Science. This amount was based on feedback from single and married graduate students at the time, and our review of the costs of living in HRM. It was higher than the estimated cost of living for individuals in 2013. NSERC grants and other 5year agreements provide most of the source of funding for salary, graduate salaries will be re-evaluated every five years, over which time the actual cost of living will likely have increased.

The \$1250/month is a minimum. Most students have this salary, regardless of Ph.D. or M.Sc., age, GPA, or marital status. There are some exceptions. While most students who receive scholarships and awards will be expected to use that money toward the cost of tuition, salary, and other fees, some students will have scholarships or awards that provide more than this. Some students are supported by research grants or contracts that may also provide more. Some students take on teaching assistantships or research assistantships to supplement their salary. In some instances when a supervisor cannot afford a full annual stipend of \$15,000, a student will be asked to be a teaching or research assistant in order to meet the minimum salary. And in rare occasions a student will want to be a part of a graduate research program even though the professor does not have funding to support a stipend. For those occasions where a student is self-supporting, the Department Administrator or Chair will ask for confirmation that

the student has access to sufficient funding independent of the supervisor's funding throughout the prescribed program.

It is important that you sign all forms required for your salary to begin on time. The Department Administrator Ann Bannon usually indicates which forms are required and when. She will usually provide an email reminder. Ask her if you have any questions. It sometimes takes more than one month for salaries to begin being directly deposited so please do not delay in submitting the completed forms.

It is necessary for all funded graduate students to complete their annual reports on the Graduate Student Information System. FGS and funding agencies may discontinue funding if annual reports are not completed and accepted by the due date.

Tuition and fees.

In addition to your salary, you and your supervisor must pay for tuition and fees, plus the cost of your thesis research. You may have scholarships, fellowships, grants, or awards, and your supervisor may have grants, awards, and contracts that can pay for your tuition and fees.

Other Financial Benefits

Your fees (typically paid by your supervisor) will cover

- 1. Membership of Dalhousie Student Union (DSU)
- 2. Membership of Dalhousie Association of Graduate Students (DAGS)
- 3. Membership of DalPlex Gym and Sports Facilities
- 4. Metro bus/ferry unlimited travel pass
- 5. Dalhousie Student Service and Facilities Renewal Fees
- 6. DSU Health and Dental Insurance (if required)
- 7. International Student Association (if applicable)
- 8. International Differential Fees (if applicable)



2015-2016 Earth Sciences Graduate Handbook, Dalhousie University

Important:

- 1. Have at least one thesis committee meeting per year with all committee members
- 2. Submit an Annual Progress Report by August 1 each year

3. Visit the FGS website for "preparing for your defence" to determine key deadlines for submission of forms, submission of your thesis to your supervisory committee, to the department, to the FGS, and to the examining committee.

- 4. Pay attention to deadlines for thesis submissions to prevent paying tuition and fees needlessly
- 5. Pay attention to deadlines for funding, conferences, field trips

Other responsibilities and expectations

1. Qualifying or comprehensive exams

Currently our department does not require a qualifying or comprehensive exam for M.Sc. or Ph.D. candidates. However, the mandatory course ERTH-6300 Research design, which includes the thesis proposal defence, will require you to demonstrate the foundational knowledge and technical English communication skills needed to conduct and disseminate your research. In our department, Ph.D. students have an additional evaluation after 2.5 years at Dal, during which they must present a lecture (maximum 40 minutes) on some aspect of their completed research, justifying its importance, outlining the impact on the immediate and external science community, demonstrating the effectiveness of the methodologies chosen, and establishing the feasibility of the remaining research required for the Ph.D. thesis.

2. Thesis proposal defence

Every graduate student in Earth Sciences will prepare and defend a thesis proposal. The purpose of the thesis proposal is to:

(i) provide the student with an experience in both written and oral technical communication to an audience of scientists with various specialties;

(ii) provide the student with time to learn the background of previous work completed on the topic, and to appreciate the importance of the research to be endeavored;

(iii) to help the student decide which available methods, questions, and directions the student may take on to achieve the degree;

(iv) provide the student and supervisory committee with a deadline and forum to clarify the goals of the research;

(v) to help the student and supervisory committee evaluate the feasibility of the research plan, anticipate obstacles, and discuss options for altering plans if (a) initial results are unexpected, (b) if third party data are not available on time, (c) equipment or software are not available or suitable as planned, and (d) funding or other circumstances changes; and

(vi) provide an opportunity for the student to report data and interpretations available at the time.

In April, usually at the end of the first two (fall, winter) semesters, all new M.Sc. and Ph.D. students are required to defend their thesis proposal. In our department this is a graded component of ERTH-6300. It is conducted in one day at an open (public) forum. Each student is given 15-20 minutes (depending on the number of students) to present their thesis proposal. Each presentation is followed by ca. 20 minutes of discussion, with questions asked in the following order: an external examiner, members of the supervisory committee, the supervisor(s), instructors of ERTH-6300, and the audience (typically professors from our department, other graduate students, geoscientists from Oceanography, GSC-Atlantic, NS-DNR, and other nearby universities and geoscience institutions). After all thesis proposal defences are completed, the faculty and members of the supervisory committees discuss the results *in camera* (a closed confidential discussion). Pending the outcome of the thesis proposal defence you may be required to (i) resubmit a revised thesis proposal to your supervisory committee, (ii) retake ERTH-6300, (iii) take additional courses in Earth Science or other science, or (iv) complete other requirements. The criteria for passing are provided to each student in the mandatory ERTH-6300 course.

3. Attendance and participation in Department of Earth Sciences colloquia

All graduate students and faculty are expected to attend the colloquium lectures. Some weeks will have two speakers. The designated time for the colloquium lectures is Thursday (sometimes Tuesday) at 11:30 am to 1:00 pm, although some special lectures may be provided outside these times. There are many reasons we want you to attend and participate in discussions. The lectures often provide an opportunity for our department members to get updated on major developments in fields of science that are in or outside our fields of expertise. The speakers usually put a lot of effort to prepare for their talk. We want to show our interest in learning and respect of these lecturers, many of whom are distinguished lecturers. Students enrolled in ERTH-6300 are requested to attend at least one lecture per week, as part of the participation grade for the course.

4. The "Pre-defence Lecture" for Ph.D.s

Every Ph.D. student in our department is expected to give a lecture to the department at least one year prior to defence. This should happen around 2.5 years into your program, i.e. usually in the third winter of your program.

The purpose of the pre-defence lecture is for the department as a whole to give our Ph.D. students some feedback, share in their excitement about research progress to date, but also discuss with the supervisor and any committee members present about the progress and timeline for the graduation. This lecture is up to 40 minutes, i.e. double the time you will have to present during your thesis defence. Thus the department will likely learn much more about the details and choices of your thesis in the pre-defence lecture. The lecture and ensuing question period is also an important component in the evaluation of your candidacy for the Ph.D. program.

The lecture has a great deal of flexibility regarding format and content. This is followed by another ca. 40 minutes of questions and discussion from the audience. Then all faculty members and thesis supervisory committee members who are present will meet in camera to discuss (i) the lecture and Q&A session, (ii) the progress made in the first few years of the degree program, and (iii) any concerns about the thesis plan, and future work.

Format of Ph.D. Pre-defence Lecture at 2.5 years

The format is often something along this outline, but it is ultimately up to you and your supervisor(s):

1. General objectives/goal of the thesis and why it is important (ca. 4 minutes)

2. A brief overview of the chapters/papers completed or to be completed (ca. 5 min)

3. Detailed presentation of one of the papers or chapters completed, with conclusion (ca. 20 min,...for this component, many

students give a version of a previous lecture they presented at GAC, AGS, AGU, AAPG, etc)

4. A summary of work to be completed, with timeline (ca. 5 min)

5. Concluding remarks

Ph.D. students should make the arrangements for this lecture:

(i). **Ensure that it happens in the semester corresponding to ca. 2.5 after your arrival**, but not during summer months or during any study or holiday breaks or other university closures.

Examples:

Your start date	Schedule your 2.5-yr Lecture
September 2016	Jan-Mar 2019
January 2017	Sep-Oct 2020
May 2017	Nov-Dec 2020

(ii). **How to determine the date, time, and location.** First, contact Darlene (or another department administrator) who will coordinate with the colloquium series coordinator to determine which dates are available. The typical times are Tuesday and Thursday at 11:30-1:00 pm, when most faculty should be present. You and your supervisory committee will then choose the date and time when most of the committee members can be present at the lecture. Note that while all committee members do not need to be present, the co-supervisors and at least half of the supervisory committee should be. Only in special circumstances should a supervisor participate remotely. Once a date and time has been selected, contact Darlene and the graduate coordinator.

(iii). At least two weeks before the scheduled pre-defence lecture, provide Darlene with your name (as you wish it to appear on the notice for your lecture), a **title for your lecture, an abstract** (less than 200 words), and an optional figure or photograph regarding your lecture, which should all fit on a single page (see appendix for the template).

The Graduate Coordinator or other representative of the department will chair the Pre-defence Lecture, Q&A session, and subsequent *in camera* session. This person will ensure that the **Department of Earth Sciences Pre-Defence Lecture Form** (see appendix) is completed, and the outcomes are conveyed to the student, and that the form is handed to Norma Keeping for archiving in the student's file.

5. Deadlines

You are responsible for meeting the deadlines of your graduate program. There are various deadlines, and while your supervisor, department, and external units will try to remind you, they are your responsibility. See the **Important Dates** section of this handbook, the FGS website, and websites for funding agencies and conferences for some deadlines. Examples include: ensuring you register and pay tuition for your graduate program and required courses, and complete forms and your Annual Progress Report to receive your pay cheques (missing a deadline can delay your salary by weeks).

Your supervision

For more information, please see the FGS regulations regarding supervisors and thesis supervisory committees at:

http://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=2&chapterid= 399&topicgroupid=1434&loaduseredits=False

All graduate students must have a supervisor before being admitted to their graduate program.

Currently our department is small compared to many Ph.D. geology programs in Canada. This may mean that our department may lack the internal expertise that you require for optimal supervision in some elements of a Ph.D. program (not usually the case for a M.Sc.). However, we are fortunate to be surrounded by a large geoscience community, with a large Oceanography department which includes marine sedimentologists and paleooceanographers; three other geoscience departments in the province of Nova Scotia (Acadia U., St. Francis Xavier U., and Saint Mary's U.); plus the Geological Survey of Canada-Atlantic and the Department of Natural Resources. Thus we have the opportunity to provide strong supervision.

By 'supervision' we mean

- 1. developing innovative and important research projects
- 2. attempting to secure funding for the research project
- 3. assisting in the facilitation of equipment or lab space, or access to the field or datasets
- 4. mentoring during (and often long after) your experience at Dalhousie
- 5. helping to administer your graduate program
- 6. intellectually challenging you in many ways
- 7. helping you gain experience in authoring and reviewing manuscripts and proposals
- 8. introducing you to other researchers and ideas
- 9. ensuring a high standard of scientific ethics, safety, lab practices, and thesis quality
- 10. maintaining an active and high quality supervisory committee

Supervisor

A sole supervisor must be a member of the regular faculty of the Department of Earth Sciences, Dalhousie University.

Co-supervisors

Often graduate students have shared supervision by faculty members of our department. It is also common that a faculty member or research scientist at another institution wishes to supervise a student through our program, at which time the supervision must be shared by a faculty member at Dalhousie. This serves to protect both the student and the department from the very rare instance that off-campus supervision is inadequate. The policy does not imply that a non-Dalhousie co-supervisor is ineffective or deficient in any way. In fact, quite often the non-Dalhousie co-supervisor provides the funding for the student and the research, facilitates most of the research, provides most of the thesis direction and editing, has high standards for the thesis, provides a more direct pathway for applied and socially relevant applications of the research, and leads to opening more doors for future employment. In instances where one co-supervisor is not a Dalhousie faculty member, the Dalhousie co-supervisor should have relevant expertise to engage with the student about the thesis research, and help provide guidance regarding research methodologies, course selection, and thesis format. The Dalhousie co-

supervisor is responsible for maintaining information on the student's GSIS. Both co-supervisors are jointly responsible for the administration of the graduate student's program, including forms submitted to the chair for a thesis defence, setting committee meetings, and routine contact with the student. Although the University and FGS consider the co-supervisors to equally share the responsibility of supervision, our department recognizes that co-supervisors often do not have equal levels of involvement in the supervision, funding, and administration of a graduate student's research program, and therefore we informally refer to the more involved co-supervisor as the "principal co-supervisor". Also, for grant applications that require an indication of the number of supervised and co-supervised HQP, we recognize the right for the "principal co-supervisor" to indicate that they are the student's supervisor.

Thesis supervisory committee

The principal roles of this committee are:

- 1. providing administrative and research guidance
- 2. providing breadth of research expertise and insights
- 3. helping the supervisors facilitate the proposed research through either direct involvement in the student's thesis or providing access or links to funding and apparatus, software, or databases
- 4. assisting in course recommendations and recognition of knowledge deficiencies
- 5. minimizing the probability of overspecialization of a student's research, particularly if access to adequate facilities or supervision in that field is limited
- 6. providing timely feedback on parts of the thesis or on questions posed by the student or (co-) supervisor
- 7. reading and editing the entire submitted thesis in a timely manner
- 8. deciding when a thesis has met the required high standards and is ready to be defended
- 9. making decisions where there may be differences of opinions between a student and (co-)supervisor
- 10. seeking and participating (even if remotely) in committee meetings (at least one per year)
- 11. routinely checking the feasibility of the research and evaluating the student's progress
- 12. contacting the graduate coordinator if there are deficiencies or problems that may negatively affect the student's graduate experience or the department or university.
- 13. attending the annual graduate student review whenever possible (December Stop Day of each year,
- i.e. the day immediately before December exam week)
- 14. typically in our department, some of the members of the thesis supervisory committee will be members of the thesis examination committee
- 15. to participate in a Ph.D. student's pre-defence lecture

Composition

1. All members of supervisory committees are either Regular, Adjunct (FGS) or Adjunct (Scholar) members of the Faculty of Graduate Studies.

2. One supervisor or two co-supervisors and <u>at least</u> two additional members, at least one of whom is from the student's graduate department. Committees larger than 5 are discouraged owing to scheduling difficulties and the potential of delays in feedback.

3. Regular members of the faculty at Dalhousie should constitute no less than 50% of the membership of a supervisory committee.

4. Refer to tables entitled *Serving on a Supervisory Committee*, given in Section 9.1 of the FGS Regulations, which define explicitly the permission to serve on Supervisory Committees.

The greatest challenge for the thesis supervisory committee is deciding when a thesis is complete and ready for defence (see the section below "When is the thesis ready to defend?"). There are many reasons to want to include more research in the thesis, and sometimes it is difficult to know when to stop.

There are also many pressures to accept a substandard thesis: (i) the desire for rapid publication without a thorough evaluation of the assumptions; (ii) the student has landed an ideal job; (iii) the student is close to exceeding the time limit on his or her thesis program. There are no acceptable reasons to accept a substandard thesis. Doing so lessens the quality of our previous student's degrees, but the quality of our entire department or university. Furthermore, it is at odds with the desire for our students and faculty to strive for excellence, innovation, and international impact. To prevent the pressure to accept a substandard thesis (usually this means incomplete, but also scientifically unsound or not rigorous), the student and supervisory committee should discuss the objectives and scope of the thesis that must be met, and revisit and if necessary revise these objectives during each committee meeting.

Thesis supervisory committee meetings

This is the opportunity for you and your committee to exchange ideas regarding your thesis progress and your next objectives. Importantly, *committee meetings* serve to help the student ensure that objectives and requirements for the thesis are clear and understood by the student and committee members. There is no set format or duration for a committee meeting, except that it is chaired by the supervisor or principal co-supervisor, and usually involve some or all of the following:

- 1. progress (including new data or interpretations, research activities, presentations at workshops or meetings, manuscripts),
- 2. enrolment or completion of course work
- 3. research challenges or difficulties
- 4. indications of any changes to the thesis direction or previous goals
- 5. recommendations for future objectives
- 6. recommendations for authorship of co-authored publications
- 7. discussions to ensure clarity of expectations
- 8. scientific and academic advice from the committee
- 9. review of previous items that were to be addressed
- 10. establish a list of action items with clear deadlines
- 11. discussion regarding whether more expertise is needed on the supervisory committee as new developments occur in the student's thesis research
- 12. leaves, internships, holidays

The student should ensure that notes are taken during the committee meeting, and that the major developments during the meeting are expressed in their annual report on GSIS. The student should email to the entire supervisory committee an informal summary of the meeting within days of its occurrence and ask for confirmation or clarification of points raised.

The supervisor or principal co-supervisor will need to print, complete, and submit to Norma Keeping the Department of Earth Sciences **Thesis Supervisory Committee Meeting Form** (see appendix).

A thesis committee meeting should be held:

1. Near the end of the first semester. This means that at least two members of the committee other than the supervisor have already been selected by this time.

- 2. In the second semester, prior to the submission of the thesis proposal
- 3. At least once a year after that
- 4. Within six months prior to a submission of a final thesis that the student believes is ready for defence

Annual Graduate Review

The Annual Graduate Review is held by the Department of Earth Sciences on Stop Day (the day after classes end; no exams are permitted on this day), which is in the first or second week of December. It provides a means for the Department as a whole, but especially the Graduate Coordinator and Graduate Secretary, to get feedback from supervisors and supervisory committees about the progress of each graduate student. It also provides a time when the graduate faculty can meet to discuss (i) changes in the administration of graduate programs, and (ii) anticipated deficiencies or problems. An action list is generated, which may include prompts for communications with students about deadlines, or subsequent additional discussions with supervisory committee members. A week before the Review, the graduate coordinator circulates to supervisors and committee members a database of information regarding student progress. Supervisors and co-supervisors should update the database information for their students and return email it to the graduate coordinator prior to Stop Day.

Your thesis

Your thesis is a very important document.

Important information about your M.Sc. or Ph.D. thesis is contained in the Dalhousie Thesis Guidelines, at http://www.dal.ca/faculty/gradstudies/currentstudents/thesesanddefences/format.html

1. Your thesis is a formal product of a **significant effort** you have put into testing a hypothesis or solving a specific question.

2. It may be the largest body of written work that you ever accomplish.

3. Unlike some geology departments which may emphasize course work or practical job training, **we emphasize scientific research**, while providing the course work and training necessary to develop your skills for future industry or academic careers.

4. In addition to years of field, lab, or computer work, your thesis has also resulted from

- (i) years of communications with your supervisor
- (ii) ideas which were developed before and after you arrived
- (iii) funding which was sought before and during your research
- (iv) communications with your supervisory committee, co-authors, members of the department, and your peers in the department and your supervisor's research group
- (v) training and experiences that you have gained during courses at Dal, workshops, conferences, short courses, field experiences, and assisting your supervisor's research team, mentoring and teaching assisting undergraduate and graduate students, reviewing papers or proposals, and acting as an ambassador for your science, your supervisor's research group, our department, and Dalhousie. All of these are likely expressed in some way in your thesis.

5. It is a permanent record of your graduate thesis research from which you and others can gain guidance for future research.

Compromise

There is a significant amount of compromise during all stages of the thesis process.

Here are some examples:

(i) *Student:supervisor* Defining the research questions to be addressed or hypotheses to be tested (ii) *Student:supervisor* Research methods to be applied

(iii) *Student:supervisor* Participation in activities beyond the direct tasks related to the thesis

(iv) *Student:supervisor* Deadlines for finishing chapters, papers, experiments, data collection, thesis (v) *Student:supervisory committee:* Scope and edits on the thesis

(vi) *Student:Co-authors* Journal selection, article composition, edits, co-authorship and order of authors

(vii) *Student:all* Changes to thesis composition along the way, owing to personal events, failure of experiments beyond the control of the student and supervisory team, loss of funding, or failure to achieve data or other support from a third party.

When is the thesis ready to be defended?

Many theses, especially Ph.D. theses, are complex projects. Therefore, it can be difficult to assess when the thesis is completed and ready to defend. There may also be other factors that become important in a student's life, such as family responsibilities or job opportunities, and a student may feel it is necessary to defend the thesis before the supervisory committee believes the thesis is defendable.

One of the more frequent questions a graduate student asks is *How many manuscripts are required for a thesis*? Owing to the differences among the different facets of Earth Sciences, and the difficulty in predicting the impact of a given body of research, the Department does not have a firm requirement.

However, based on a review of the past 15 years of thesis in our department, the following outlines provide a summary of the standard we would expect to maintain:

M.Sc. manuscript-based thesis	Ph.D. manuscript-based thesis
Abstract	Abstract
Chapter 1 (Required: Introduction. Introduces problem, hypotheses to be tested, motivation for the research, and provides a brief outline of the thesis)	Chapter 1 (Required: Introduction. Introduces problem, hypotheses to be tested, motivation for the research, and provides a brief outline of the thesis)
Chapter 2 (Optional: Background, for material not included in the introduction, but necessary to provide context for the manuscript(s))	Chapter 2 (Optional: Background, for material not included in the introduction, but necessary to provide context for the manuscript(s))
Chapter 3 (or 2) (Required: Manuscript 1. Must be prepared for submission in a peer-reviewed journal before defence, or if possible already submitted).	Chapter 3 (or 2) (Required: Manuscript 1. Should be published at the time of defence, or in special circumstances, at least in revision after review for a peer-reviewed journal).
Chapter 4 (or 3) (Optional: Manuscript 2 prepared for a peer reviewed journal, or additional chapter which is not prepared as a manuscript which may provide information for a more balanced agreement, a methodological development, or other such information)	Chapter 4 (or 3) (Required: Manuscript 2. Must be prepared for submission in a peer-reviewed journal before defence).
Chapter 5 (or 4 or 3) (Required: Conclusions and Implications)	Chapter 5 (or 4) (Required: Manuscript 3. Must be prepared for submission in a peer-reviewed journal before defence).
References (a list of all references used throughout the thesis)	Chapter 6 (or 5) (Optional: It is common for either a fourth manuscript or a chapter that provides the student to document additional results, or provides a synthesis of the impact of the entire (or some aspect of the) thesis.)
Appendices	Chapter 7 (or 6 or 5) (Required: Conclusions. This us usually a short chapter that outlines the major conclusions of the entire thesis research, summarizes the major implications, and gives recommendations for future work on the subject.)
	References (a list of all references used throughout the thesis)

It is important to maintain effective communication between the student and thesis supervisory committee to minimize misunderstandings and clarify the thesis objectives and expectations, especially if changes may be required before the thesis can be deemed 'complete'.

Here are some important considerations:

1. Ultimately, the decision regarding whether or not a thesis is ready for defence lies with the **thesis supervisory committee**. Their decision must be communicated to the Chair of the department, on a Ph.D. Thesis Submission Form, before a specific defence date can be set and before the thesis can be submitted to an external examiner. Combined, your thesis supervisory committee members have decades of experience in your or related fields of earth science, and based on their combined experience, they likely have a better understanding of the level for an experiment, map, or model required to meet the current state-of-the-art in your field, and the extent of the research that your thesis requires.

- 2. However, normally, **it is the supervisor and student** who agree on the composition of the thesis, and who make the decisions when changes must be made to the composition (for many reasons, as expressed above).
- 3. The short research proposal prepared as part of ERTH 6300 should not be regarded as a final, binding account of your thesis research plan. However, in our Department, the research proposal provides an outline of the goals for the M.Sc. or Ph.D. thesis research to be undertaken. The two should correspond in general, but details may change in response to a variety of factors, e.g., a change of programme (M.Sc. to Ph.D.), new directions suggested by fieldwork, unexpected features in your samples or data, or access to better analytical or computing methods. For Ph.D. students, both the timing of the 6300 proposal (year 1 of 4) and its short length (5-7 pages) mean that your final thesis research plan will almost certainly depart in some way from that outlined in your ERTH 6300 proposal.
- 4. In the case of a manuscript-format thesis, the student's contribution to both the research and the writing of any multi-authored paper must be clearly specified at the beginning of each manuscript chapter. The Student Contribution Form

(http://www.dal.ca/faculty/gradstudies/currentstudents/thesesanddefences/forms.html) should be filled out by the supervisor and submitted with the thesis. Manuscripts on which the student is not first author will be permitted in a thesis. However, the number of manuscripts first authored by the student must not be less than 50%. Before the introduction of the manuscript for which the student is not a first author, a clear statement that indicates why manuscript is a part of the thesis must be included.

- 5. Manuscripts for publications may require a little more data, a little less detail or less of a balanced argument, and reformatting of figures, than required for a traditional-style thesis chapter.
- 6. In Earth Sciences it is becoming rare for a graduate student to have a single-authored manuscript. It is also becoming common for a student to participate as co-author on manuscripts that will not comprise the thesis but will help them in their career pursuits. It is the student's and supervisory committee's responsibility to ensure that for the thesis as a whole (i) the M.Sc. or Ph.D. student completed most of the research and writing; (ii) that the Ph.D. student's intellectual contribution to the manuscript was not only significant, but that for at least one of the manuscripts the student devised the approach, conducted the research and wrote the majority of the paper with only the editorial guidance of the supervisor; and (iii) that the Ph.D. student can defend any data, methodological approach, assumption, result, figure, and interpretation in any manuscript included in the thesis, regardless of co-authorship.
- 7. Supervisors and supervisory committees will try to reasonably accommodate a student's personal life or job. However, the quality or completion of a thesis should not be reduced because a student has family issues, an employment opportunity, or wishes to begin another degree. In fact we anticipate that most of our students will be sought after for high paying jobs or graduate work. But if the thesis is not completed to a satisfactory level before the job deadline or next thesis begins, the supervisory committee has the right to indicate that the thesis is not ready for defence.

Your thesis defence

A thesis defence is one of the most important academic events for the Department of Earth Sciences and Dalhousie University. It serves to ensure the high academic standard for thesis quality established by our department. It provides an open forum for a student to demonstrate that the thesis data, interpretations, approach, and significance can be defended. It allows a student to demonstrate depth of knowledge of the field of research in front of a committee of experts, and an audience of peers and other geoscientists. It provides the supervisor(s) and the department an opportunity to demonstrate the quality of their graduate programs.

Students and supervisors should consult the FGS Regulations for more information: <u>http://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=2&chapter</u> <u>id=399&topicgroupid=1435&loaduseredits=False</u>

M.Sc. thesis defence

Administered by the Department.

Each Master's thesis shall be defended orally. The student shall be present and examined by an Examining Committee during a public defence, following the criteria given below:

- 1. The defence should only proceed if the thesis supervisory committee agrees that the thesis is ready for defence.
- 2. The supervisor provides written notice by email to the Department Chair, copying the Graduate Coordinator and Graduate Secretary, that the thesis is defendable and that a defence should be scheduled. Considering that the external examiner may require 1 month to review the thesis, the department requires at least 1.5 months notice. The Graduate Coordinator notifies the FGS for informational purposes.
- 3. Note that there are several considerations regarding the timing of a thesis defence. (i) They cannot occur on a weekend, holiday, or scheduled study break. They should not occur in the months of June or July when many of our faculty and graduate students are in the field. (ii) The defence should be scheduled before dates set by FGS and the Registrars Office regarding deadlines for convocation or tuition fee requirements for the following semester.
- 4. The supervisor or principal co-supervisor, in consultation with the student and thesis supervisory committee will propose an external examination committee in writing by email to the Department Chair. At this time, only one external examiner needs to be suggested. A CV and complete address and contact information for the proposed external examiner should be provided. The Department requires that the external examiner has no relationship with the student and (co-)supervisors i.e. a 'beyond arm's length' involvement with them. For example, external examiners shall not have: (i) published with the supervisor or co-supervisors even on review articles or presentations in the past 10 years; (ii) have not interacted with the student, or the supervisor's or co-supervisor's lab or research group even for fee-for-service activities in the past 10 years; (iii) worked in our department in the past 10 years; or (iv) graduated from our department in the past 5 years. An external examiner shall have successfully supervised or co-supervised two or more students who have graduated from thesis-based graduate programs, or shall have 10-years of research or industry experience and served on at least two thesis committees of students who have graduated from thesis-based graduate programs. The external examiner does not have to be an active university faculty member. The external examiner

should be present at the defence. The Department Chair will decide if the proposed external examiner is suitable for the defence. The supervisor should NOT contact the external examiner (it is the role of the department chair (or designate) to communicate with the external examiner regarding the defence date and time, potential conflicts of interest, the willingness of the examiner to provide careful evaluation of the thesis, and the ability of the examiner to participate in person at the defence).

- 5. The Graduate Coordinator, or designate, chairs the M.Sc. defence, but is not a participating member of the Examining Committee. The chair's duty is to ensure that the exam is appropriate and fair and to submit a report as noted below. The Chair is not an examiner, but may ask questions for clarification during the defence.
- 6. The table below summarizes the minimum composition of an examining committee for a M.Sc. thesis defence in the Department of Earth Sciences. In addition to the Chair, one of the Readers must be an independent (i.e. not on the student's supervisory committee) member of the Department of Earth Sciences, who will read the thesis to ensure the department's standard of quality is met. The other Reader can be a member of the student's thesis supervisory committee. In the past, most Department Chairs have also read the thesis and may elect to participate in the thesis defence as a voting member of the examining committee.

	Single Supervisor	Co-supervised
Chair (independent)	1 (Grad. Co-ordinator or designate with Regular FGS membership)	1 (Grad. Co-ordinator or designate with Regular FGS membership)
External Examiner	1 (Appointed by the Department Chair based on recommendations from the supervisor or principal co-supervisor)	1 (Appointed by the Department Chair based on recommendations from the supervisor or principal co-supervisor)
Minimum Examiners	1 Supervisor with Regular FGS* Membership	1 Principal co-supervisor with FGS Membership**
	1 Reader with Regular FGS Membership*	1 Co-supervisor with Regular FGS* Membership
	1 Reader with FGS Membership**	1 Reader with Regular FGS Membership*
		1 Reader with FGS Membership**
Minimum Total	5	6
*Current or em	eritus faculty members at Dalhousie ma	ay be Regular FGS members

*Current or emeritus faculty members at Dalhousie may be **Regular FGS members** **FGS membership includes Regular, Adjunct(FGS), or Scholar(FGS) For information on FGS membership, please consult the FGS Regulations Section 1 on Membership, at <u>http://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid</u> =2&chapterid=399&topicgroupid=1426&loaduseredits=False

- 7. In consultation with the (i) student, (ii) Graduate Secretary, (iii) Graduate Coordinator, on behalf of the Department of Earth Sciences the supervisor or principal co-supervisor contacts the examining committee to arrange a date, time, and location for the thesis defence one month prior to the event.
- 8. All costs related to the defence are paid by the supervisor, principal co-supervisor, or co-supervisors. This includes any flights, accommodation, ground transportation, meals, or communication costs for any members of the examining committee including the external examiner. These costs also include the cost of printed versions of the thesis requested by examining committee members, bound versions of the thesis, and any celebratory functions if the defence is successful. Three weeks prior to the defence, the Department of Earth Sciences Graduate Secretary should be notified of any flight or travel information including accommodation, and examiner's mobile phone number. To help reduce the cost

burden, the Department of Earth Sciences will agree to provide one night accommodation and one meal (up to \$100, excluding alcohol) if the external examiner presents a lecture to the department during his or her visit. Arrangements should be made in consultation with the Department Office and the Earth Sciences Colloquium Series organizer.

- 9. The student is responsible for ensuring that all fees are paid, including tuition and library fees so they are permitted to graduate. Students must be registered for the term in which they present their approved electronic theses to the Faculty of Graduate Studies Office, as well as for the term in which they have their defence.
- 10. The student provides digital copies of the thesis to the examining committee and the Department Chair one month prior to the defence. The student gives the option and will provide hard copies to any examiner desiring it.
- 11. After verifying the following information with the student's supervisor or principal co-supervisor, the student provides in writing by email to the Graduate Secretary the thesis title, thesis abstract, the student's name, previous degrees (date, degree, university), and a list of the examining committee. The department office will advertise the defence broadly (all faculty, adjuncts, students, Faculty of Science, Faculty of Graduate Studies, plus selected scientists and contacts at the various geoscience institutions in Nova Scotia.
- 12. The supervisor or a co-supervisor will ensure that any audio-visual equipment necessary is available for the defence.
- 13. It is desirable for all members of the examining committee to be present at the defence. However, in an effort to reduce global carbon emissions and in the recognition that all examining committee members may not be in Halifax for the defence, the Department of Earth Sciences will permit one examining committee member to participate remotely (e.g. via. Skype or similar telecommunication). Only under special circumstances should a second examiner, or the external examiner, participate remotely. In this case, permission must be sought from the Graduate Coordinator (or independent designate) and Department Chair (or independent designate) as soon as possible. A replacement for the examining committee member may be necessary, or the examination may be delayed until the member can attend. In rare and special circumstances if a member cannot attend owing to urgent conditions out of his or her control (e.g., flight delay owing to weather; serious medical issue), questions should be submitted by email to the Chair of the examining committee if possible, but not to the student or supervisor(s).

Recommended proceedings for a M.Sc. thesis defence in the Department of Earth Sciences:

- 1. Defence Chair welcomes the student, examining committee, and audience, explains the proceedings, and introduces the student.
- 2. The student gives a 20-minute formal presentation in English that summarizes the research and its significance. The intended audience shall be geoscientists with a wide range of backgrounds at the M.Sc. and higher level. Jargon, acronyms, and unnecessary technical terms shall be minimized. Owing to its brevity, the presentation usually cannot include all aspects of the thesis research. The format of the presentation is up to the student and supervisors, but should include the following: (i) thesis objectives, (ii) hypotheses tested, (iii) importance of the problems, questions, or hypotheses being addressed, (iv) a brief summary of methodology and justification for the approach and any difficulties in data collection, reduction, or interpretations, (v) one or a few key results and interpretations, (vi) assessment of uncertainty and validation of assumptions, (vii) conclusions of the thesis, (viii) statement of importance of the conclusions, (ix) future work recommended, and (x) references and acknowledgements.
- 3. The Chair will thank the student, and introduce the examining committee.

- 4. The first round of questions will continue in the following order, with durations estimated as follows:(i) External examiner (15-20 min.)
 - (ii) Independent Reader (15-20 min.)
 - (iii) Other Reader (10-15 min.)
 - (iv) Supervisor, or Principal Co-supervisor (10 min.)
 - (v) Other co-supervisor (10 min)
 - (vi) Department Chair (optional) (10 min)
- 5. At the end of the first round of questions from the examining committee for a M.Sc. Thesis Defence, there is a 10-minute (maximum) duration permitted for questions from the audience.
- 6. The Chair may ask if the student or member of the examining committee require a brief bathroom break of 5 minutes.
- 7. The second round of questions continues, with the external examiner allocated 15 minutes, and all other examiners 10 minutes, in the same order as the first round.
- 8. The Chair may ask a question for clarification, and then will ask the external examiner if he or she has any remaining questions.
- 9. The Chair will then ask the audience and student to leave, so the examining committee can discuss the defence in camera.
- 10. The Chair will ask each member (in the order of questioning) to vote on the thesis according to the following categories: a) approved as submitted; b) approved upon specific corrections with a clear timetable for completion, normally within one month; c) rejected but with permission to re-submit a revised thesis for re-examination with a clear timetable for completion, within one year; and d) rejected outright. At this time, each examining committee member should briefly state their rationale. The Department Chair and Defence Chair cannot vote. The outcome will be based on the majority vote. In the case of a tie, the Department Chair may vote, or in his or her absence, the Defence Chair may vote.
- 11. With assistance from the examining committee, the Chair will review the changes that are required and ask for any clarification if necessary.
- 12. The examining committee will indicate a feasible time for the required edits to be completed. In establishing the due date, the committee should consider (i) the extent of the edits required, (ii) deadlines for convocation, fees, or other FGS deadlines; (iii) if members of the examining committee will need to review the corrections or if the supervisor or principal co-supervisor will evaluate the edits.
- 13. All members of the examining committee but one (usually the supervisor or principal co-supervisor) should sign the Masters Thesis Approval Form (<u>http://www.dal.ca/content/dam/dalhousie/pdf/fgs/thesesanddefences/master thesis approval ext ended.pdf</u>). The signed form should reside in the department office with the Graduate Secretary.
- The Chair will invite the student back, and report the result of the deliberations and thesis defence. The Chair will communicate the nature of the recommended edits if any, and indicate the date that the edits are required. The Chair will ask the student if he or she understands the nature of the most important edits and agrees to the due date.
- 15. The Defence Chair will communicate the results of the defence to FGS.
- 16. When the thesis is considered complete, the supervisor will sign the Masters Thesis Approval Form, and return it to the Graduate Secretary.
- 17. The student will submit the final thesis to the FGS according to the detailed instructions provided by FGS.

Ph.D. thesis defence

Administered by the Faculty of Graduate Studies.

Because the FGS regulates all Ph.D. thesis defences, the student and supervisors are directed to the FGS regulations for the latest version of instructions and proceedings: <u>http://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=2&chapterid=399&topicgroupid=1435&loaduseredits=False</u>

The student and supervisors are also directed to the following website which provides a very useful checklist with deadlines for items required before, during, and after the defence: http://www.dal.ca/faculty/gradstudies/currentstudents/thesesanddefences.html

Each Ph.D. thesis shall be defended orally. The student shall be present and examined by an Examining Committee during a public defence, following the criteria given in the FGS regulations.

- 1. **Six months prior to the anticipated Ph.D. defence**, the student should discuss the potential date and deadlines for forms to be submitted to FGS. The student and supervisor(s) should discuss the composition of the external examining committee, and the supervisor or principal co-supervisor should communicate to the Department Chair that a defence in 6 months is likely.
- Three months prior to the Ph.D. defence, the supervisor completes and submits a *Request to* Arrange an Oral Defence of a Doctoral Thesis Form to the department chair <u>http://www.dal.ca/content/dam/dalhousie/pdf/fgs/thesesanddefences/Request to Arrange Oral D</u> <u>efence of a Doctoral Thesis.pdf</u>.

This should include a CV and complete address and contact information for the proposed external examiner. The FGS rules regarding the eligibility of the external examiner are stated on the form. In addition to these FGS rules, the Department requires that external examiners shall not have: (i) published with the supervisor or co-supervisors even on review articles or presentations in the past 10 years; (ii) have not interacted with the student or the supervisor's or co-supervisor's lab or research group even for fee-for-service activities in the past 10 years; (iii) worked in our department in the past 10 years; or (iv) graduated from our department in the past 10 years. An external examiner shall have successfully supervised or co-supervised two or more students who have graduated from thesis-based graduate programs, or shall have 10-years of research or industry experience and served on thesis committees of at least two Ph.D. students who have graduated from thesis-based graduate programs. The external examiner does not have to be an active university faculty member. The external examiner should be present at the defence. The Department Chair will decide if the proposed external examiner is suitable for the defence, and will submit the signed form to FGS. The supervisor CANNOT contact the external examiner (it is the role of the FGS to communicate with the external examiner regarding the defence date and time, potential conflicts of interest, the willingness of the examiner to provide careful evaluation of the thesis, and the ability of the examiner to participate in person at the defence).

3. **One and a half months before the defence**: The defence should only proceed if the thesis supervisory committee agrees that the thesis is ready for defence. The supervisor provides written notice by email to the Department Chair, copying the Graduate Coordinator and Graduate Secretary, that the thesis is defendable and that a defence should be scheduled. Considering that the external examiner may require 1 month to review the thesis, the department and FGS requires at least 1.5 months notice. The student submits to FGS a *Ph.D. Thesis Submission Form* along with the completed

thesis. The student and supervisor or principal co-supervisor will submit to the Department Chair a completed *Ph.D. Examination Information Form*. <u>http://www.dal.ca/content/dam/dalhousie/pdf/fgs/thesesanddefences/PhD Examination Informat</u> ion Form.pdf, and if acceptable, the Department Chair will sign and submit this to the FGS.

- 4. Note that there are several considerations regarding the timing of a thesis defence. (i) They cannot occur on a weekend, holiday, or scheduled study break. They should not occur in the months of June or July when many of our faculty and graduate students are in the field. (ii) The defence should be scheduled before dates set by FGS and the Registrars Office regarding deadlines for convocation, registration, or fee requirements.
- 5. The table below summarizes the minimum composition of an examining committee for a Ph.D. thesis defence for the Department of Earth Sciences.

	Single Supervisor	Co-supervised		
Chair (independent)	1 (appointed by FGS)	1 (appointed by FGS)		
External Examiner	1 (External to Dalhousie, appointed by FGS)	1 (External to Dalhousie, appointed by FGS)		
Minimum Examiners	1 Supervisor with Regular FGS* Membership	1 Co-supervisor with Regular FGS* Membership		
	1 Reader with Regular FGS Membership*	1 Co-supervisor with FGS Membership*		
	1 Reader with FGS Membership*	1 Reader with Regular FGS Membership*		
	1 Graduate Coordinator or Chair of Department (voting member)	1 Reader with FGS Membership*		
		1 Graduate Coordinator or Chair of Department (voting member)		
Departmental Representative	1 (Regular Membership) (non-voting member of the examining committee)	1 (Regular Membership) (non-voting member of the examining committee)		
Minimum Total	6	7		
*Current or emeritus faculty members at Dalhousie may be Regular FGS members **FGS membership includes Regular, Adjunct(FGS), or Scholar(FGS) For information on FGS membership, please consult the FGS Regulations Section 1 on Membership, at				

http://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid =2&chapterid=399&topicgroupid=1426&loaduseredits=False

6. The FGS contributes up to \$1000 toward the cost of travel, accommodation, and meals for the External Examiner. All additional costs beyond this are to be paid by the supervisor, principal co-supervisor, or co-supervisors. This includes any flights, accommodation, ground transportation, meals, or communication costs for any members of the examining committee including the external examiner. These costs also include the cost of printed versions of the thesis requested by examining committee members, bound versions of the thesis, and any celebratory functions if the defence is successful. Three weeks prior to the defence, the Department of Earth Sciences Graduate Secretary should be notified of any flight or travel information including accommodation, and examiner's mobile phone number. To help reduce the cost burden, the Department of Earth Sciences will agree to provide one

night accommodation and one meal (up to \$100, excluding alcohol) if the external examiner presents a lecture to the department during his or her visit. Arrangements should be made in consultation with the Department Office and the Earth Sciences Colloquium Series organizer.

7. The student is responsible for ensuring that all fees are paid, including tuition and library so they are permitted to graduate. The student must be registered for the term in which they present their approved electronic theses to the Faculty of Graduate Studies Office, as well as for the term in which they have their defence.

Your supervisor	The first contact for all inquiries related to your admission into the program, the
or principal co-	administration of your degree, course requirements, committee composition,
supervisor	publication issues, thesis issues, funding, other curricular and extra-curricular
_	activities, internships, training, employment, leave, holidays, completing and
	submitting defence forms to the department chair.
Co-supervisor	If the principal co-supervisor is not a regular Dalhousie faculty member in the
-	Department of Earth Sciences, then the co-supervisor may be useful for
	information or advice regarding administrative issues, thesis format and
	requirements, or helping resolve differences of opinion with your principal co-
	supervisor
Thesis	Helps to ensure you receive a quality graduate research experience, assists in
supervisory	course selection, direction, facilitating equipment, software, and datasets, ensures
committee	the composition of your thesis meets the standards of the department and research
	community, reads and edits the entire thesis. This committee will decide if the
	thesis presented to them is ready for defence, and assists when there are
	disagreements between a supervisor and student.
Co-authors	May or may not be on your committee, composition and edits of your papers,
	journal selection, cover letter to editor, response to reviewers
Graduate	Administration of your degree program and the GSIS, difficulties that your thesis
coordinator	supervisory committee cannot resolve, policy changes, unusual requests,
	communication with the Department Chair and FGS on your behalf, maintenance of
	graduate handbook, administration of scholarship nominations, assists the
	graduate secretary. (Dr. Yana Fedortchouk, <u>Yana@dal.ca</u> , 902-494-8432)
Graduate	Admissions, awards, rare circumstances, changes to graduate programs, examining
advisory	committee. The composition varies each year, and it is chaired by the graduate
committee	coordinator.
Graduate	Funding, registration, GSIS, assists the graduate coordinator (Norma Keeping,
secretary	norma.keeping@dal.ca,902-494-2358
Department	Funding, oversees the administration for graduate students (Ann Bannon,
administrator	<u>ann.bannon@dal.ca</u> , 902-494-1427
FGS	Faculty of graduate studies should be contacted only when absolutely necessary, or
	when preparing for or during thesis defences; usually the graduate coordinator
	will contact FGS on your behalf. For contact information:
	http://www.dal.ca/faculty/gradstudies/about/contact.html
Department Chair	Notify him/her that you are defending; usually reads all theses. Will assess and
	accept forms that need to be submitted to FGS regarding Ph.D. examining
	committee composition and thesis defences.

The following are Graduate Student forms used by the Department of Earth Sciences

Dalhousie University Department of Earth Sciences PRE-PH.D. DEFENCE LECTURE

January X, 201X, 11:30 am Milligan Room, 8th floor Biology/Earth Sciences Wing of LSC

This is the title of my talk: it may be the title of my thesis **Ms. Candy Date**

The rest of this page is an abstract for your talk. It should be with Cambria (this or similar) font, 14 pt., with left justification, and single spacing, as is written here. The date and time are set after you consult with (i) your supervisory committee to ensure your supervisor(s) and as many of the thesis supervisory committee members can participate, (ii) Darlene (to ensure there are no conflicting department events), and (iii) the Graduate Coordinator so he or she can prepare to chair the lecture. The abstract should be about 300 words. It is an abstract for your lecture, not for your entire thesis. It should fit in the space provided here. If you have an interesting image that would be useful then please also include it on this page (e.g. Fig. 1). Your supervisor should edit your abstract. Please email this page to Darlene or Norma.

It is not necessary for your abstract to describe everything that your thesis is about. You will want to start off with the overall goals of your entire thesis, and why they are important. Then you may want to provide details on only one or two of your thesis chapters, your hypotheses or questions being addressed, why they are interesting, your methodological approaches, validity of assumptions, choices of field



Figure 1 Map of the geology of the Nova Scotia study area

or lab site, results, interpretations, and the significance of your results so far.

Note that this abstract is 300 words. There is space for a small image, which for instance may be some graph of your data, or a model output, seismic imagery, or a field photo. Colour images are great, because this form will be emailed to the general geoscience public. However, note that posted hard copies of this form may not be in colour. Please include a caption for the image and a legend if necessary.

Dalhousie University Department of Earth Sciences PH.D. PRE-DEFENCE LECTURE FORM

Student Name J	Date of Lecture
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Thesis Supervisory Committee Members Present (including remote participation)

Name	Role

Other faculty members present for the in camera discussion

Name	Name	Name

Proposed defence month (mm/yy): _____

Check all that apply (provide comments below)

Lecture quality and content meets standard	□□Readings recommended
□ Scientific question, objectives, rationale clearly stated	□□ Changes to methods recommended
□ Notion of importance and impact clearly communicated	Course work or training recommended
Example and best methods or approaches	Requires additional supervision
□ Original intellectual contributions defined	□□ Time-line requires revision
Thesis likely to meet Dal/Dept standards	\square Adequate funding and access to finish

Confidential Comments (Unique situations involving student or supervisory committee that should be noted)

Comments/requirements for supervisor to convey to student

ΥN

(Use back of sheet, or attach sheets, if necessary)

Dalhousie University Department of Earth Sciences REPORT OF GRADUATE THESIS SUPERVISORY COMMITTEE MEETING

Student Name:	_Date of Meeting:
Program: MSc PhD	
Research Topic:	

COMMITTEE MEMBERSHIP:

Supervisory role	Name	Present/Remote/Unavail.
Supervisor or		
Principal Co-Supervisor		
Co-Supervisor		
Member		
Member		
Member		

Please consider the following six items during the committee meeting, and provide a report where indicated (use a separate page if needed).

1) SUMMARY OF STUDENT RECORD:

Program start date:		YYYY/MM/	DD	
Date of	last	committee	meeting:	YYYY/MM/DD
Date of	thesis	proposal	defence:	YYYY/MM/DD
Date of	Ph.D.	Pre-Defence	Lecture:	YYYY/MM/DD
Proposed defense date (approx.):		YYYY/MM/I	DD	

2) SUMMARY OF COURSE WORK AND GRADES:

Course name and number	Grade
ERTH 6300	
ERTH 6350	

Course work completed? YES NO

3) REVIEW WITH STUDENT AND COMMITTEE ANY RECOMMENDATIONS MADE AT THE PREVIOUS COMMITTEE MEETING.

4) BASED ON THE MATERIAL PRESENTED AT THIS COMMITTEE MEETING, HAS THE STUDENT DEMONSTRATED ADEQUATE PROGRESS IN THEIR RESEARCH?

5) PROVIDE A BRIEF ASSESSMENT OF THE STUDENT PROGRESS IN RESEARCH (INCLUDING ANY SIGNIFICANT MILESTONES, SUCH AS PAPERS SUBMITTED, MEETING PRESENTATIONS, ETC), WHICH SHOULD BE DISCUSSED WITH THE STUDENT.

6) RECOMMENDATIONS OF THE ADVISORY COMMITTEE FOR THE STUDENT WITH SPECIFIC DEADLINES, IF APPLICABLE.

Signature of the committee members present:

Student signature:	Date:	

Date of Next Thesis Supervisory Committee Meeting YYYY/MM/DD

Original: to graduate administrator; Copies to all committee members