

Faculty of Science Course Syllabus
Department of Earth Sciences
ERTH 3020
Metamorphic Petrology
Winter 2022

Instructor: Lectures: James Brenan e-mail: jbrenan@dal.ca Office location: LSC-OCEAN 3612

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Lectures: Tues and Thurs 10:05-11:25 Location: LSC-BIOL&EARTH B2020A

Laboratories: Wed 11:35-2:25 LSC-BIOL&EARTH B2020A

Office Hours: email me for an appointment, or come in if my door is open

Tutorials: none

Course Description

Metamorphic petrology is the study of the way in which pre-existing igneous, sedimentary, and metamorphic rocks respond to changes in pressure, temperature, and geochemical environment. Metamorphic reactions, deformation and recrystallization, the stability relations of minerals and mineral assemblages under various physical and chemical conditions, and the concept of metamorphic facies are discussed. The relationship of metamorphism to other geological processes is considered. In the labs, microscopic mineralogy and texture are used to decipher the metamorphic history of rocks.

Course Prerequisites

ERTH 3010

Course Objectives/Learning Outcomes

When you are done with this course, you should have the following competencies:

- 1) Identify, describe, and interpret metamorphic mineral assemblages and textures to identify protoliths and reconstruct metamorphic histories;
- 2) Interpret metamorphic textures in terms of formation conditions, kinematics, and overprinting relationships;
- 3) Apply principles of thermodynamics to interpret metamorphic reactions and phase diagrams;
- 4) Interpret metamorphic grade in terms of appropriate metamorphic facies or zones and spatial distribution of metamorphic isograds;
- 5) Calculate and interpret P-T-t conditions of metamorphism using microprobe data and petrographic observations;
- 6) Link metamorphic pressure-temperature-time-deformation paths to processes and tectonic settings of metamorphism.

Required Course Materials

A helpful textbook, that will be referred to in the lectures: John D. Winter "Introduction to Igneous and Metamorphic Petrology". Prentice Hall, 2nd edition, 2010 or 1st 2001.

Other materials will be provided as pdf for download through Brightspace
The Laboratory Handbook is required and available for purchase at the Dal bookstore.

Course Assessment

Component (quantity)	% of final grade	Due Date(s)
Final Exam (1)	25%	Scheduled by the registrar
Midterm (1)	10%	17 February
Lab Quizzes (1)	5%	16 February
Lab Final (1)	12%	4 April
Lab Assignments (9)	18%	weekly
Assignment 1: Thermal model	6%	TBD
Assignment 2: Monazite age	6%	TBD
Assignment 3: Thermobarometry	6%	TBD
Assignment 4: Western CBH	6%	TBD
Assignment 5: Petrogenetic grid	6%	TBD

Other course requirements

none

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

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

Course Policies

Late assignments will not be accepted, and will be given a mark of 0; Missed laboratory assignments will be given one week to hand in, and then will be considered late; Missed lab exams and class tests (mid term) will be made up at a mutually agreed date and time, but only if the student submits a valid Declaration of Absence form within the required reporting period. Otherwise, the exam will be given a mark of 0. Note that students are only allowed two submissions of this form, and otherwise the rules for submission of a valid doctor's note are required. Unless otherwise indicated, all assignments are to be done individually without consulting other current or former class members.

Course Content

List of lecture topics

Date	Lecture Topic	Lab Topic
6 Jan	Introduction; Controls of Metamorphism	No lab
11, 13 Jan	P-T-t paths 1 and 2	Lab 1: Metamorphic Minerals
18, 20 Jan	Basics of Geochronology, Microprobe and Monazite age dating/ Assignment 1 Thermal models	Lab 2: Metamorphic Textures: Planar and Linear Fabrics
25, 27 Jan	More geochron/Stable Mineral Assemblages 1	Lab 3: Metamorphic Textures: Porphyroblasts and Porphyroclasts

1, 3 Feb	Stable Mineral Assemblages 2/3/Microprobe data collection for Assignment 2	Lab 4: Metamorphic Textures: Other Grain-Scale Textures
8, 10 Feb	Metamorphic Reactions 1/2	Lab 5: Image Analysis of LPO
15, 17 Feb	Midterm Test/Petrogenetic grids 1	Lab Quiz 1
22, 24 Feb	No Lectures (study break)	No lab (study break)
1, 3 March	Petrogenetic grids 2/Assignment 3 Petro. Grids	Lab 6: Metabasites and Metamorphic Facies
8, 10 March	Geothermobarometry 1/2	Lab 7: Pelites
15, 17 March	Geothermobarometry 3/Metamorphism of mafic rocks 1	Lab 8: Calcareous, Quartzofeldspathic, and Other Rocks
22, 24 March	Metamorphism of mafic rocks 2/Calcareous and UM rocks 1	Lab 9: High-Grade Regional Metamorphism/ Assignment 4: Progressive metamorphism in the Western Cape Breton Highlands
29, 31 March	Metamorphism of calcareous and UM rocks 2/3 and overflow	Assignment 4: Progressive metamorphism in the Western Cape Breton Highlands (cont)
5 April		Lab Final

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

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

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

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

Statement: <http://www.dal.ca/cultureofrespect.html>

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)

https://www.dal.ca/academics/important_dates.html

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

SERVICES AVAILABLE TO STUDENTS

The following campus services are available to all Dalhousie students. Unless noted otherwise, the services are free.

Service	Support Provided	Location	Contact
General Academic Advising	Help with <ul style="list-style-type: none"> - understanding degree requirements and academic regulations - choosing your major - achieving your educational or career goals - dealing with academic or other difficulties 	Killam Library Ground floor Rm G28 Bissett Centre for Academic Success	In person: Killam Library Rm G28 By appointment: <ul style="list-style-type: none"> - e-mail: advising@dal.ca - Phone: (902) 494-3077 - Book online through MyDal
Dalhousie Libraries	Help to find books and articles for assignments Help with citing sources in the text of your paper and preparation of bibliography	Killam Library Ground floor Librarian offices	In person: Service Point (Ground floor) By appointment: Identify your subject librarian (URL below) and contact by email or phone to arrange a time: https://libraries.dal.ca/research/subject-liaisons/directory.html
Studying for Success (SFS)	Help to develop essential study skills through small group workshops or one-on-one coaching sessions Match to a tutor for help in course-specific content (for a reasonable fee)	Killam Library 3rd floor Coordinator Rm 3104 Study Coaches Rm 3103	To make an appointment: <ul style="list-style-type: none"> - Visit main office (Killam Library main floor, Rm G28) - Call (902) 494-3077 - e-mail Coordinator at: sfs@dal.ca or - Drop in to see us during posted office hours All information can be found on our website: www.dal.ca/sfs
Writing Centre	Meet with a tutor to discuss writing assignments (lab report, research paper, thesis, poster) <ul style="list-style-type: none"> - Learn to integrate source material into your own work appropriately - Learn about disciplinary writing from a peer or staff member in your field 	Killam Library Ground floor Learning Commons & Rm G25	To make an appointment: <ul style="list-style-type: none"> - Visit the Writing Centre in the Killam Learning Commons (Rm G40) and book an appointment - Call (902) 494-1963 - e-mail writingcentre@dal.ca - Book online through MyDal We are open six days a week See our website: writingcentre.dal.ca