University of Toronto-Scarborough

Department of Physical and Environmental Sciences

EESC36H3 Petrology - Fall 2019

Instructor: Dr. Heidi Daxberger, ESBC 466, phone: 416-208-5136, heidi.daxberger@utoronto.ca
Office hours: Monday 3.30 pm to 4.30 pm, and by appointment
Teaching Assistant: **Adriano Roberto**

Lectures: **Thursday, 2 pm – 4 pm (Room IC326)**

Labs: **Wednesday, 1 – 4 pm (Room EV 224) – additional available times will be posted if possible**

Overview:

Petrology is the study of rocks. This course examines the origin, evolution and distribution of "hard rocks", i.e. igneous and metamorphic rocks. In the classroom portion fundamentals on igneous melt generation, evolution and crystallisation processes will be introduced. Furthermore, we will look at magmatic and metamorphic processes in various plate tectonic settings e.g. generation of new oceanic crust at mid ocean ridges or partial melting and metamorphism along subduction zones. Optical mineralogy (microscopy) using polarizing light microscopes will be used for identification of rock forming minerals, petrographic description and classification of selected rock samples and thin sections.

Part of this course is a 2-day field trip to the Bancroft area during which we will look at a variety of **Igneous as well as Metamorphic Rocks. The region surrounding Bancroft was part of intense deformation, metamorphism and intrusive/extrusive magmatism due to mountain building processes over 1 Billion years ago. During this trip the students will get a chance to practice practical skills such as mineral and rock ID, collecting data in the field and recording field observations.**

Course objectives:

- Students can **describe** the theory of how polarizing light microscopy works.
- Students can **apply** rock identification and microscopy techniques.
- Students can **explain** concepts on magmatic and metamorphic processes and can **relate** these to plate tectonic settings and thermal controls.
- Students **apply** the appropriate terminology.
- Students can **describe and classify** the various given samples/data (hand samples, rock thin sections), **analyze** geochemical data and can **distinguish** between the different rock types.
- Students are able **to conclude** possible rock formation processes based on the given samples/data.

Important:

Important point: our lab exercises are held in a space classified as a *laboratory* – this means that we all **should be dressed in lab coats – please bring them for tutorials (labs) and wear them at all times**. Another consequence: **there is no eating or drinking in the lab**.

Readings:

Required text: **- Earth Materials - Introduction to Mineralogy and Petrology,** Klein & Philpotts, 2013, Cambridge Univ. Press

- Plate Tectonics – Cont. Drift & Mountain Building, Frisch-Meschede-Blakey – **Free Download – Quercus link!**

- Mineralogy-Petrology Lab Manual (B19-C36, Quercus)

- Polarizing Light Microscopy Guide (Quercus)

Lecture & Lab Schedule - Subject to change:

	Week	Date	topic	Date	topic	Quizzes	Quiz Date
Mic Intro	1	4.9. Wed.	Lab times: Lect. 1: Microscopy Introduction	4.9	Intro to Microscopy	Mic. Quiz 1 (how microscopy works)	Sept. 5 - 10
	1	5.9.	Lect. 1: Microcopy Intro.				
Igneous R	2	12.9.	Lect. 2: Igneous Rocks & Earth's Properties	11.9.	Lab 1 - Mic Minerals		
	3	19.9.	Lect. 3: Magma, Melting	18.9.	Lab 1/2 - Mic. Min/Ign.		
	4	26.9.	Lect. 4: Magma & tectonic setting	25.9.	Lab 2 - Mic. Ign.		
	5	3.10.	Lect. 5: Melting - Crystallization - Phase diagrams	2.10.	Lab 3 - Mic. Ign.	Quiz 2	Oct. 3-8
	6	10.10.	Lect. 6: Magma evolution & tectonic settings	9.10.	Lab 4 - Mic. Ign.		
		12 - 18.9.	Reading Week				
	7	24.10.	Midterm	23.10.	Lab 5 - Mic. Ign. + Bell Ringer 1		
Metam. R.	8	31.10.	Lect. 7: Metamorphism types and rocks	30.10.	Lab 6 - Mic. Meta.		
	Sat. - Sun. Nov. 2-3.		C36-C37 field trip				
	9	7.11.	Lect. 8: Metamorphic minearls & textures	6.11.	Lab 7 - Mic. Meta.	Quiz 3	Nov. 6-12
	10	14.11.	Lect. 9: Metamorphic conditions & reactions	13.11.	Lab 8 - Mic. Meta.		
	11	21.11.	Lect. 10: Metamorphic conditions & tectonic setting	20.11	Lab 8 - Mic. Meta. + Bell Ringer 2		
	12	28.11	Recap	27.11.	Lab exam		Field Trip Report Due: Dec. 1, 2019, midnight

Marking Scheme:

8 Lab assignments (each 3.5 %)	28%
3 Online Quizzes (each 1.5%)	4.5%
2-Day Field Trip (4 % report, attendance 2%)	6%
2 Bell Ringer (each 1 %)	2 %
Glossary	2 %
i-clicker (participation)	2 %
Midterm	25.5%
Final Exam (Theory 20%, lab exam 10%)	30%
Total	100%

Lectures and Lab exercises:

ALL students are expected to attend ALL lectures. ***It is the responsibility of the student to ensure that notes are obtained for any classes missed.***

Labs are mandatory for all students and the respective assignments are graded. During tutorials you will have a chance to work more independently in order to strengthen your knowledge; during the lectures you'll receive more guidance throughout the material. The knowledge acquired during the laboratories can also be tested in the 3 Online Quizzes.

Required lab materials:

- A drafting ruler, pencils, color pencils, eraser
- A notebook for notes (having some simple drafting paper, is also very useful for this course)

2-Day Field Trip – Hastings County (Marmora, Burleigh Falls to Bancroft etc.) – Group Work:

This field trip is mandatory for all students. A fee for transportation will arise, which we will keep as low as possible.
During the field trip groups of 2-3 students will look at the local rock formation, describe and ID these, 2% of the grade will be based on participation and 4% will be based on your written field trip report. Deadline: TBA, 2019.
For more information on the field trip report see quercus -> files -> field trip assignment. An equivalent alternative assignment will be given if a student cannot participate during the field trip.
Furthermore, we are outdoors and therefore some preparations are needed:

- Be prepared for any kind of weather (sun vs. rain: rain jacket, warm cloth/layers, sun screen, hat)
- Sturdy footwear (at least running shoes, preferably hiking boots) -> **NO open-toed shoes, sandals, or heels!!!**
- Adequate clothing (long pants, layers, rain cloth)
- Safety goggles or light tinted sun glasses
- Daypack with an adequate amount of water and lunch (+ smaller snack)
- If possible small camera, field book (e.g. small notebook), pencil & pen

Additional required safety equipment (e.g. hard hats, additional safety goggles) will be supplied by the department.
Additional information will be given in timely fashion, as it is still unclear if it will be a 2-day trip (accommodation, equipment such as sleeping bag etc.)!
Field trip date: November 2-3, 2019
Fee: TBA (approx. 60 $)

i-clicker (Lecture participation) – Individual submission:

i-clickers are mandatory for this class and they will be used for participation marks during the lectures (I-clicker). Total **participation is worth 2% of the final grade** (grade is not based on right answer, but participation). We will start using/testing the I-clickers in the first week. Graded participation will start in the **second week (Lecture 2)**. You can miss up to 20% of the I-clicker participation without losing grades. If your participation is between 100-75% off all lectures, you will get the full 2%. If your participation is between 75 and 50% you will get 1% of the participation mark. If your participation is below 50% no participation marks will be given (0%). **Each student can only use their own clicker! Submitting answers for a fellow student, who is not present during class, is an offence covered under the code of Academic Integrity (see section below)!**

Quercus Glossary (2%):

Part of the course work is to create **four glossary posts (each 0.5%, total 2%)**. The glossary (make your own geodictionary) is hosted on quercus and will include the most important new terminology of the course. You can select **four terms** from the glossary list on quercus. Student contributions will be monitored by the TAs and instructor throughout and by the end of the term (grade based on quality of term definition – figure/diagram if applicable).
Two of the posts have to be finished by Wednesday October 8 (terms up to lecture 6), 2019 and the second two post by December 5, 2019!

Bell-Ringer Test – Individual Work: **BR 1: 23.10.2019** **BR 2: 20.11.2019**

In the course schedule above, you will find three dates for Bell Ringer Tests (each worth 1%, total 3% of final grade). These will be held in preparation for the final exam. These c. 20-minute tests will test your mineral, rock ID skills and is based on the lecture/lab samples. Before the Bell Ringer happens, the lab (ESCB 224) will be open to look at the lab samples again.

Online Quizzes – Individual Work:

Three online quizzes will be posted (see course schedule) and each quiz is 1.5 % (4.5% total) of final grade. Each quiz will consist of roughly 8 - 15 questions (multiple choice, True/False).

Study Questions – Group or Individual Work:

I will post a set of study questions on each course topic, which should help you to identify the important course information, study for the quizzes and exams, prepare you for the field trip and to keep on top of the material.

Final Examination:

The final examination is cumulative and will be scheduled by the University and held during the December examination period. The exam will contain multiple choice, true and false and short answer questions. Figures, movies and animations are examinable, as are in-class participation/lab type exercises. The exam will be more heavily focused on post-midterm material. The assigned readings are examinable, the material covered in lecture is weighted more heavily than the readings.

Library Service:

Research Help: University of Toronto Scarborough Library

Staff at the UTSC Library will be happy to help you find the resources you need for your assignments, and learn the research skills you will need for success at university.

Research help is available by phone, e-mail, chat, or in-person in the Library.

For more information, please see the Library's Help Guide for UTSC Students: http://guides.library.utoronto.ca/utsc_help

Quercus:

Lecture and lab material will be posted on and Online Quizzes will be done through quercus. Please check daily for updates. Link: q.utoronto.ca

Academic Integrity Statement:

Academic integrity is one of the cornerstones of the University of Toronto. It is critically and important both to maintain our community which honours the values of honesty, trust, respect, fairness and responsibility and to protect you, the students within this community, and the value of the degree towards which you are all working so diligently. According to Section B of the University of Toronto's Code of Behaviour on Academic Matters, which all students are expected to know and respect, it is an offence for students:

- to use someone else's **ideas or words** in their own work without acknowledging that those ideas/words are not their own with a citation and quotation marks, i.e. to commit plagiarism.
- to include false, misleading or concocted **citations** in their work.
- to obtain **unauthorized assistance** on any assignment. **This includes i-clickers!**
- to provide **unauthorized assistance** to another student. This includes showing another student completed work.
- to submit their own work for credit in **more than one course** without the permission of the instructor.
- to falsify or alter any **documentation** required by the University. This includes, but is not limited to, doctor's notes.
- to use or possess an **unauthorized aid** in any test or exam.

There are other offences covered under the Code, but these are by far the most common. Please respect these rules and the values, which they protect. It is your responsibility to ensure that your work maintains academic integrity. If you have any concerns please see the instructor before a potential problem arises. Please familiarize yourself with the Code (http://www.governingcouncil.utoronto.ca/policies/behaveac.htm) and also with the handout "How not to plagiarize", available in the Course Documents section on BB. At the University of Toronto academic dishonesty can result in a *mark of zero, a reduction in final grades, denial of privileges, a monetary fine, failure in the course, suspension, permanent record, a recalling of degrees/diplomas and certificates, or expulsion.*

Accessibility Needs:

The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom or course materials, please contact Accessibility Services as soon as possible: UTSC campus AccessAbility http://www.utsc.utoronto.ca/~ability/ or St. George Campus Dis*Ability* *d*isability.services@utoronto.ca or http://studentlife.utoronto.ca/accessibility.