

ERTH2104 Winter 2019

Igneous Systems, Geochemistry and Processes

Instructor: Brian Cousens

Igneous Petrology is the study of processes that produce melts (magmas) within the Earth, how these melts then rise towards the surface, the chemical and mineralogical changes that occur as they cool and crystallize, how magmas interact with crustal rocks through which they pass, and how different rock formations are produced during eruption or emplacement of magmas. We will discuss how the chemistry of igneous rocks depends on the composition of the source material that is melting, and how this primary melt composition can change as a result of the many processes that occur after this melt separates from its source and ascends through the Earth's mantle and/or crust. Note that the best approach to understanding igneous rocks involves field, chemical, and textural analysis. We will also further investigate the links between igneous rocks and tectonic setting that were introduced in EARTH1006. The Rock Assignment is a comparative petrographic and geochemical study of two suites of volcanic rocks that simulates a real-world research project.

**Lecture:** Monday and Wednesday 11:30 AM-1:00 PM

**Labs:** Wednesday 2:30 – 5:30PM OR Thursday 8:30-11:30AM

**Grading Scheme:**

<b>Lecture</b>	Mid-term Exam	10%
	Final Exam	25%
<b>Rock Assignment</b>		25%
<b>Lab</b>	Lab Quizzes (weekly)	15%
	Final Lab exam	25%

**Textbook:** Winter, JD, 2010. Principles of Igneous and Metamorphic Petrology, 2<sup>nd</sup> Edition. Prentice Hall. Available in the Bookstore, and is worth the investment.

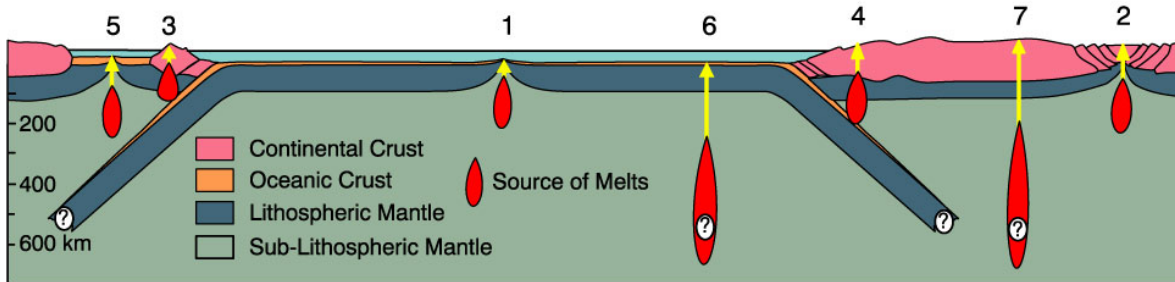
**Office Hours:** whenever my office door is open or by appointment.

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## **Topics To be Covered:**

The Earth and Magma Generation  
Igneous Rock Names and Textures  
Field Relationships  
Thermodynamics and Phase Diagrams  
Geochemistry of Igneous Rocks  
Igneous Rocks and Plate Tectonics  
Mantle Melting and Basaltic Rocks  
Evolution of Magmas  
Layered Intrusions and Anorthosites  
Oceanic Volcanism  
Large Igneous Provinces  
Convergent Margin Magmatism  
Granitoids  
Alkaline Rock Suites, Kimberlites and Carbonatites

**cuLearn:** Lecture slides, and other materials, will be posted on cuLearn.



## **ERTH2104 Learning Outcomes:**

By the end of the semester, each successful student will acquire the following skills and knowledge sets in the lecture and laboratory sessions:

- an integrated understanding of the field characteristics, chemical and mineralogical composition, and petrogenesis of the major igneous rock groups and deduce their plate tectonic association and mode of origin.

- understand the various mechanisms by which Earth materials melt to form magmas, and describe processes that modify those magmas as they pass through the lithosphere.
- become familiar with the key skills used to aid the interpretation of igneous rocks using geochemical diagrams, in particular igneous phase diagrams.
- identify the common rock forming minerals of igneous rocks in both hand specimen and thin-section through practical experience using a transmitted light microscope.
- identify key textural features of igneous rocks in both hand specimen and thin-section, and appreciate the significance of such features with regard to geological processes that have operated.
- assign a name to an igneous rock on the basis of its mineralogical and textural characteristics, and appreciate the environment(s) of formation.
- ability to make detailed and annotated petrographic sketches from thin-section observation and to summarise and interpret the salient features.
- synthesize petrographic and geochemical information to determine the origin of rock suites, in a class “rock project” involving both individual and group work.

## **STUDENT ACCOMMODATIONS**

### **Examinations and Assignments**

Students with conflicts for any examination must have a note from an employer or a medical certificate (see below) in order to **write the exam** at another date. Unless caused by illness, all conflicts **MUST** be reported to the instructor **PRIOR** to the exam date. If a lab is missed, a student may make it up along with the lab quiz in another lab section during that week without requiring a medical certificate. In the case of a less serious illness (cold, flu), I require a medical note within one week after the exam date in order for a deferred exam to be written. In the case of a serious illness, see <http://carleton.ca/registrar/special-requests/deferral/> for the rules concerning deferral of an exam or assignment, and contact me as soon as possible.

### **Requests for Academic Accommodation**

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

#### **Pregnancy obligation**

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: [carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](http://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

### **Religious obligation**

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: [carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

### **Academic Accommodations for Students with Disabilities**

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. [carleton.ca/pmc](https://carleton.ca/pmc)

### **Survivors of Sexual Violence**

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and its survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: [carleton.ca/sexual-violence-support](https://carleton.ca/sexual-violence-support)

### **Accommodation for Student Activities**

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: [students.carleton.ca/course-outline](https://students.carleton.ca/course-outline)

### **Medical Certificates**

Please note, that in this course, on all occasions that call for a medical certificate you must use (or furnish the information demanded in): [http://carleton.ca/registrar/wp-content/uploads/med\\_cert.pdf](http://carleton.ca/registrar/wp-content/uploads/med_cert.pdf)

## **PLAGIARISM**

The University's Senate defines plagiarism in the regulations on instructional offences as: "to use and pass off as one's own idea or product work of another without expressly giving credit to

another". *This includes copying of material from websites or other publications that is incorporated into assignments, reports, or other submissions for grading.* Borrowing someone else's answers, unauthorized possession of tests or answers to tests, or possession of material designed in answering exam questions, are all subject to university policy regarding instructional offences.

For this course (and all other courses at Carleton), it is extremely important to understand that you cannot copy and paste material from websites or publications into assignments. This is plagiarism, and it is easy to spot during grading of weekly assignments. When formulating an answer to an assignment question, be sure to reword the material from websites or publications into your own words, then type that into your assignment. Identification of copied material in an assignment answer will result in an automatic zero points for that section of an assignment<sup>2</sup>.

I encourage students to work together on assignments. HOWEVER, each student must submit answers to questions in *their own words*, not the words used by another student that you are working with. *Be sure that you and your co-worker word your submitted answers differently.* If the answers submitted by one student for an assignment are identical to those submitted by another student, both students will be assigned a grade of zero for the question.

Details regarding the Carleton University Academic Integrity policy can be found at: <http://carleton.ca/senate/wp-content/uploads/Academic-Integrity-Policy1.pdf>