

Course Syllabus

ESS322H1 – Igneous and Metamorphic petrology - 2016

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About this course

The goal of this course is to introduce you to advanced concepts in igneous and metamorphic petrology. These will allow you to understand the key physical-chemical processes involved in the genesis of these types of rocks at various levels in the Earth's crust and upper mantle. As a result, you will be able to interpret the mineralogy, texture and fabric of igneous and metamorphic rocks in unison with geochemical data, and therefore, you will be prepared to generate a more comprehensive understanding of various terrains on our planet that include these types of rocks. The labs include petrographic microscopy, the recognition of rocks in hand samples and various numerical exercises.

Provisional Course Schedule (*the content is subject to adjustments during the semester*)

Lectures at 9-11 am on Wednesdays, labs at 13-16 pm on Thursdays in ES 2101

Sept. 14th: Lecture 1 – Introduction to thermodynamics and igneous phase diagrams

Sept. 15th: Lab 1- Thermodynamics and phase diagram exercises

Sept. 21st: Lecture 2 - Mantle petrology and magma genesis I.

Sept. 22nd: Lab 2 – Ultramafic rocks - 3 hours of microscopy and hand samples

Sept. 28th: Lecture 3: Magma genesis II. and the most important radiogenic isotope systems

Sept. 29th: Lab 3: Model calculations of partial melting, isotope exercises

Oct. 5th: Lecture 4 - Mafic magmatism

Oct. 6th: Lab 4 - **Term test I** – material covered in Lab 1 and 3 and Lecture 1-3 (1 hour) + After the test: Mafic to intermediate magmatic rocks – intrusive and extrusive – microscopy and hand samples (2 hours)

Oct. 12th: Lecture 5 - Physical processes during magma evolution and migration and the role of volatiles in magmas

Oct. 13th: Lab 5 - 2 hours microscopy (mafic to intermediate continued) + 1 hour calculations: trace elements during crystallization

Oct. 19th: Lecture 6 - The evolution of arc magmas

Oct. 20th: Lab 6 - Microscopy, more focus on felsic rocks (2 hours) + calculation of mineral formulae (1 hour)

Oct. 26th: Lecture 7 - Alkaline magmatism, carbonatites and kimberlites

Oct. 27th: Lab 7 - Microscopy – felsic and alkaline magmatic rocks (2 hours), short intro to the software MELTS (1 hour)

Nov 2nd: Lecture 8 - Thermobarometry and the kinetics of magmatic and metamorphic processes

Nov. 3rd: Lab 8: Geothermobarometry and kinetics calculations

Nov. 9th: Lecture 9 - Overview of metamorphic environments, thermodynamics of metamorphic reactions, petrogenetic grids and pseudosections

Nov. 10th: Lab 9 - **Term test II.** – Microscopy of igneous and mantle rocks + Lab 5, 6, 8 calculations (1.5 hours), after the test: thermodynamic and petrogenetic grid exercises (1.5 hours)

Nov. 16th: Lecture 10 - Metamorphic textures and fabrics, fluids during metamorphism

Nov. 17th: Lab 10 - Metamorphic rocks I. (microscopy, hand samples)

Nov. 23rd: Lecture 11 - Metamorphism of pelites and carbonate rocks

Nov. 24th: Lab 11 - Metamorphic rocks II. (microscopy, hand samples)

Nov. 30th: Lecture 12 - Metamorphism of igneous rocks

Dec. 1st: Lab12 - **Term test III.** – Microscopy and hand samples – both igneous and metamorphic

Marking scheme

Term test I. – 15% of total mark

Term test II. – 15% of total mark

Term test III. – 20% of total mark

Lab assignments – 15% of total mark

Final exam – 35% of total mark

Trivia tests – they will take place in the first 5 minutes of Lab 2 to Lab 11 and you can lose up to 8% of your total mark for the course on these. Required material will be provided in advance. You can only lose and not gain marks on these.

Lab assignments are due at 4:30 pm on Thursday the week after the particular lab took place unless otherwise agreed during the lab. Submit at the Earth Sciences reception desk. Make sure to get it stamped.

Resources:

- Lecture slides will be uploaded as a pdf on Blackboard the night before the lecture
- Several labs will have handouts
- There is no specific textbook for the course, however, the following books are good resources for the course and also for the future:
 1. Principles of Igneous and Metamorphic Petrology (by Philpotts A.R. and Ague J.J.)
 2. Igneous Petrology (by Best M.G. and Christiansen E.H.)
 3. Metamorphic Phase Equilibria and Pressure –Temperature-Time Paths (by Spears F.S.)
 4. Thermodynamics of Natural Systems (by Greg Anderson) - *both editions are very good, the second one has more information*

Policy on Missed Tests or Lab Exercises and Missed Assignment Deadlines

1. There are no makeup exams for mid-term examinations.
2. Late submissions will not be marked and default to grade of 0. The deciding date is the date stamp when the assignment is received by the front desk.

Missed tests, missed lab exercises and missed assignment deadlines will only be excused for cases in which the absence was entirely beyond the student's control (e.g., medical reasons, personal affliction), and only if the proper documentation is submitted.

If your petition is accepted you will be pro-rated on the missed assignment/test (i.e., you will be given a mark which is equal to your average course mark).

To request that your test/assignment is being pro-rated, please register your petition by [clicking on this link](#)

We will consider all requests which are received within 5 business days of the missed assignment (the University is open during Reading Week).

Note, that reasons involving personal commitments such as vacation travel arrangements are not considered legitimate grounds for missing tests and that we reserve to the right request further documentation (e.g., a doctor's note etc).

If your petition is successful, you (and your instructor) will be informed by e-mail.

Note on academic misconduct

Academic misconduct may take a number of forms, for example cheating on tests, plagiarism, or submission of identical homework. Such offences lead to erosion of trust between the instructor, the offending students, and the other students in the course and can therefore not be tolerated.

For further information, visit: <http://www.artsci.utoronto.ca/osai/The-rules/what-is-academic-misconduct>