

Instructor: Dr. Sean Regan, REIC 330, sregan5@alaska.edu
Class Time: Tues 09:00-12:00PM Spencer Library
Office Hours: TTh; 1:00 – 3:00 PM; open door policy

Textbooks:

- Philpotts and Ague, 2009, **Principles of Igneous and Metamorphic Petrology**, 2nd edition, Cambridge University Press

Lectures:

This course deals with the origin and evolution of igneous and metamorphic rocks. Attention is focused upon the chemical aspects of rock systems, e.g. equilibria between minerals and melts. Another suitable name for this course is: modern problems in petrology. This course will not only provide freedom for each of you to explore your own research interests, but also help read and critically evaluate



peer-reviewed literature in your field by in-depth class discussions. Instead of looking at processes in isolated settings, we will explore the myriad interactions of petrologic processes, and try to better ascertain a dynamic understanding of global tectonics and how it is manifested in a petrologic system.

One meeting a week will be held for three hours. However, I'd like to limit lecturing as much as possible to leave room for discussions and application-based exercises. In addition to text book reading, you will be responsible for paper readings and discussions for each class (available on blackboard). In addition, each of you will prepare a Project Summary describing a petrologic hypothesis, and how you would test it (*More details in class*). Lastly, each student will prepare a 10 minutes presentation on applying thermodynamic datasets and forward modelling to a petrologic problem of their interest. Hopefully, this will lead to an in-depth discussion as to the advantages and short comings of such programs.

Project 1: Apply a thermodynamic dataset to your petrologic system of interest and report your findings with some discussion focused on why things did or did not work, and what else you might do.

Project 2: An NSF-style project summary proposing a hypothesis, and how you will test it. This is to be 1 page, single spaced, and will hopefully include several techniques or concepts learned in class.

Grades: •Participation (25%) •Project I (25%) •Project II (25%) •In class assignments (25%)

Academic Dishonesty/Accommodations Policy

- Please review the University's academic dishonesty policy. Cheating, fraud, and plagiarism are not allowed and will result in academic censure through appropriate University procedures.
- I will do anything within my power, that is legal, to help you succeed and thrive. If you have any type of learning disadvantage, consider meeting with Student Support Services staff to figure out the best actions to take.



Field photographs from the Athabasca granulite terrane, one of Earth's largest contiguous exposures of lower continental crust. Left: Dark areas are dismembered and partially melted dikes that intruded ca. 3.4 Ga tonalitic gneisses. Melting and strain occurred at 1.9 Ga, and as dikes partially melted, they were weakened and strained, which facilitated the mobilization of melt to higher structural levels. This mix between igneous and metamorphic processes is common, and will help us understand the differentiation of continental crust. Right: Partial melting of a hbl + plag mafic dike to a product assemblage of grt (solid) + plag (Liquid) + quartz (Liquid). This is an excellent way to make tonalite!

Jan 14: No Class (Reschedule) – Hf isotope excursion

Jan 22: Intro – Global Tectonics and petro review (PandA; Ch. 1; Frost and Frost, 2008; Koteas et al., 2010)

Jan 29-Feb 5: Thermodynamics – classic thermobarometry (PandA; Ch. 7-11)

Feb 12-19: Forward Modelling (ex. Melts, Theriak-Domino; See blackboard and program documentation)

Feb 26: Migmatites (hand outs – see blackboard)

Mar 5: Magma Transport (PandA, Ch. 2-3; hand outs- see blackboard)

Mar 12: Closed vs open systems (Kiglapait Intrusion literature)

Mar 26 – Apr 2: Chemical and Isotope methods – untangling the web (PandA: Ch. 13; Blackboard)

Apr 9 - 16: Timing Petrologic Processes – Petrochronology (MSA volume – see blackboard)

Apr 23: Presentations – final discussion
(PandA – Philpotts and Ague textbook)