EARTH SCIENCES 3315B 2014 - METAMORPHIC PETROLOGY

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Pre-requisites: ES 2230A/B Introduction to Geochemistry
ES 3313A/B Igneous Petrology

Anti-requisites: former ES 312a

Schedule

Lectures: Tuesdays & Thursdays: 9:30-10:30, WSC-240

Labs: Monday 2:30-5:30 and Wednesday 6:00-9:00, B&GS-1065

CALENDAR DESCRIPTION OF EARTH SCIENCES 3313A/B

METAMORPHIC PETROLOGY

Study of metamorphic processes using rock and thin section descriptions (petrography). Discussion of factors that control the mineralogy and physical attributes of different metamorphic rocks (e.g., temperature, pressure, composition, fluids). Use of phase equilibria and geochronology to understand metamorphic histories. Association of different rock types with plate tectonic setting.

WHAT ARE THE PRINCIPAL OBJECTIVES OF THIS COURSE?

To understand how pressure, temperature and bulk chemical composition influence the metamorphic mineral assemblage. Thermodynamics and phase equilibria will be used to constrain these parameters. To examine mineral growth and determine how this growth records different deformation events. Selected topics such as fluid flow and metasomatism will be examined. The laboratory involves the interpretation of hand specimens and thin sections of metamorphic rocks.

WHY STUDY METAMORPHIC PETROLOGY?

Metamorphic rocks make up the bulk of the Earth's crust. The history of the crust is recorded in those rocks and may be revealed by applying the techniques of metamorphic petrology.

LEARNING RESOURCES

The **required text** for this course is Igneous and Metamorphic Petrology (2010), by John Winter, The cost is somewhat high, ~$140, or $70 for e-text, but this textbook is also used in the course Earth Sciences 3313A/B – Igneous Petrology. There is a copy on reserve in the library. For additional information and colour copies of the figures, see

http://www.whitman.edu/geology/winter/ (the website also has a list of errata).

There are several other excellent textbooks on Metamorphic Petrology in the library. These include:

Philpotts, A.R. & Ague, J.J. (2010) Principles of Igneous and Metamorphic Petrology QE461.P572.

Bucher, K. & Grapes, R. (2011) Petrogenesis of Metamorphic Rocks.

Dickin, A.P. (2005) Radiogenic Isotope Geology QE501.4.N9D53

Other useful books:

Mason, R. (1978) Petrology of Metamorphic Rocks, G. Allen & Unwin.

Nordstrom, D.K. & Munoz, J.L. (1994) Geochemical Thermodynamics, Blackwell.

Spear, F.S. (1995) Metamorphic Phase Equilibria and Pressure-Temperature-Time Paths, Mineralogical Society of America Monograph.

Spry, A., Metamorphic Textures. Pergamon.

Wood, B.J., & Fraser, D.G. (1976) Elementary Thermodynamics for Geologists.

Yardley, B.W.D. (1989) An Introduction to Metamorphic Petrology. Longman.

LABORATORIES

The laboratory is required. Material will be uploaded to the OWL website before the lab. Students are responsible for printing each assignment and lab. All labs are due at the end of the lab period.

Each student is required to complete labs and assignments individually (see academic integrity below). Labs must be handed in at the end of the lab period. Late labs will not be graded. Assignments are normally marked and returned one week after they are due (they are normally due one week after they are handed out). Late assignments are penalized 10% (absolute) per day for each day they are late and a mark of zero percent is given if the assignment is not submitted before corrected assignments are returned.

An **optical mineralogy text is also required**, e.g., Nesse (2003) Introduction to Optical Mineralogy. Oxford. 3rd Ed. or Deer, Howie and Zussman (1992) An Introduction to Rock-Forming Minerals. Longman.

A useful textbook for the lab is:
Philpotts , A.R. (1989) Petrography of igneous and metamorphic rocks, QE461.P56

MARKING SCHEME

lab	**20%**	due at the end of the lab, labs start week of 20th January
lab exam	**15%**	open book, penultimate week of the semester
assignments	**10%**	4 assignments, due one week after assigned
midterm	**15%**	**Tuesday 25th February**, 50 minutes, in class
final exam	**40%**	exam period is 11th - 30th April; exams are **cumulative**.

Note: for the midterm and final exams students should bring a calculator and a ruler. Both may include multiple choice, fill in the blank and short answer questions and problems.

All lecture material, including handouts, is testable. Although there is a course text and most of the material comes from this text, material from other sources is also discussed during lectures. Any additional material will be posted on the OWL web site for the course. Students are responsible for checking the OWL class site on a regular basis (prior to each lecture or lab at a minimum).

SYLLABUS

(some topics may not be covered)

1) Introduction to metamorphic petrology
2) Crystal growth and metamorphic textures
3) Thermodynamics
4) Stable mineral assemblages – phase rule, graphical representation
5) Facies and Metabasites
6) Metamorphic Reactions
7) Metamorphism of Pelites
8) Metamorphism of Calcareous & Ultramafic Rocks
9) Age dating and *P-T-t* paths
10) Metasomatism and skarn deposits

GENERAL INFORMATION

Statement on Academic Offences: Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:
http://www.uwo.ca/univsec/handbook/appeals/scholoff.pdf

Student's responsibilities in the event of a medical issue: If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Academic Counselling Unit as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained immediately from the Academic Counselling Unit. For further information please see:
http://www.uwo.ca/univsec/handbook/appeals/medical.pdf

A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form for visits to Student Health Services. The form can be found here:
https://studentservices.uwo.ca/secure/medical_document.pdf

Accessibility Statement
Please contact the course instructor if you require any arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x.82147 with any specific question regarding an accommodation.