

ES 3315b: Metamorphic Petrology

Winter, 2019

Course Instructor: Dr. Desmond Moser (office: B&GS 1070; e-mail: desmond.moser@uwo.ca)

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Lectures: Tuesdays, 9:30–10:30 PM, B&GS 1065;

Laboratory: Tuesdays 2:30 to 5:30, B&GS 1065

Office Hours: Thursday after class or by appointment

Prerequisite(s): Earth Sciences 2230A/B and Earth Sciences 3313A/B or permission of the Department.

Extra Information: 2 lecture hours, 3 laboratory hours.

Course description:

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 settings.

WHAT ARE THE PRINCIPAL OBJECTIVES OF THIS COURSE?

To understand how pressure, temperature and bulk chemical composition influence the metamorphic mineral assemblage and the geochemical cycles in the lithosphere.

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(!). The history of the lithosphere is recorded in those rocks and may be revealed by applying the techniques of metamorphic petrology.

Syllabus of Topics (order and coverage may vary)

- Introduction to Metamorphism, History of Metamorphic Petrology
- Contact Metamorphism and the Phase Rule
- Regional Metamorphism and Mineral Isograds, Metamorphic Reactions
- Chemographics
- Thermodynamics in Metamorphic Systems
- Fluid flow and Metamorphic Reactions/ Metasomatism
- Mineral Growth and Textures in Metamorphic Rocks
- Geochronology and Metamorphic Pathways
- Tectonics and Metamorphism
- Shock metamorphism

Learning Resources:

The required text for this course is *Igneous and Metamorphic Petrology* (2010), by John Winter. The cost is somewhat high for hard cover, less for e-text, but this textbook is also used in the course Earth Sciences 3313A/B – Igneous Petrology. There is a copy on 1-day 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. All labs are due at the end of the lab period. Each student is required to complete labs and assignments individually. Late labs will not be graded.

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

Assignments

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.

Evaluation

laboratory assignments.....	20%	Labs start Tues. Jan 15th
laboratory exam.....	20%	Lab exam Tues. April 9th
assignments	10%	
midterm.....	15%	Midterm in class, Thurs. Feb 14th
final exam.....	35%	TBD

Note that:

exam period is 11th - 30th April; exams are cumulative.

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

All lecture material, including handouts, is testable. Students are responsible for checking the OWL class site on a regular basis (prior to each lab at a minimum).

Statements on special circumstances:

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 Dean's office 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 from the Dean's Office immediately. 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 (located in the Dean's Office) for visits to Student Health Services. The form can be found here: https://studentservices.uwo.ca/secure/medical_document.pdf

Graduate Course Health and Wellness

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre. Numerous cultural events are offered throughout the year. For example, please check out the Faculty of Music web page <http://www.music.uwo.ca/>, and our own McIntosh Gallery <http://www.mcintoshgallery.ca/>. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>. Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html.