

Spring 2-1-2018

GEO 305.01: Igneous & Metamorphic Petrology

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Geo 305: Igneous and Metamorphic Petrology

Syllabus, Spring 2018

Lecture MW 3:00 - 4:20 PM (CHCB 348)
Lab: Th 11:00 AM - 12:50 PM (CHCB 348 or 110)
Office Hours: MW 11:00 AM - 12:00 PM, or by appointment.
Instructor: Dr. Julie Baldwin
email: julie.baldwin@umontana.edu
Office: CHCB 307; Phone: 243-5778

Course website

We will utilize Moodle for this course (<https://moodle.umt.edu>). Course announcements, lecture notes, problem sets, and lab assignments will be posted here. You can also keep track of your grades here.

Textbooks

Required

- Principles of Igneous and Metamorphic Petrology (2nd ed), J.D. Winter (ISBN: 978-0321592576)

Optional (will be available in lab as reference)

- Minerals in Thin Section (2nd ed), D. Perkins (ISBN: 978-0131420151)
- An Introduction to the Rock-Forming Minerals (3rd ed), Deer, Howie, and Zussman (ISBN: 978-0903056274)

Prerequisites

The prerequisites for this course are a C- or better in GEO 225 (Earth Materials) and completion of two semesters of college chemistry. You may take this class concurrently with CHMY 143 or CHMY 123.

Description of Course

Petrology is the study of rocks - in this case igneous and metamorphic rocks. Because rocks are aggregates of minerals, this course is a natural continuation of mineralogy. In this course, you will learn to recognize, describe, and classify many igneous and metamorphic rocks in hand specimen, thin section, and in the field. Your skills at hand specimen and optical mineralogy will improve during the semester. In addition, you will learn about textures, process, occurrences, and principles that will allow you to interpret the rocks that you encounter. Lab work, principally the study of rock specimens in hand sample and thin section, is a major focus of the course.

Learning Outcomes

1. You will understand the processes that are responsible for forming igneous and metamorphic rocks and the tectonic settings where they occur.
2. You will understand how the composition, structure, and textures of igneous and metamorphic rocks can be used to interpret past geologic processes and the geologic history of an area.
3. You will be able to describe and identify igneous and metamorphic rocks in both hand sample and using the petrographic microscope.
4. You will learn how to obtain, use, and interpret geochemical data using web databases, computer programs, and spreadsheets.

Lab

Please bring a hand lens and colored pencils to ALL lab sessions. No food or drink is allowed in the microscope room (CHCB 110). A water bottle with a lid is fine.

Field Trip

There is a required field trip for this class. Details regarding the timing of this trip will be discussed in class.

Grading

40% Exams
30% Labs
20% Problem Sets
10% Field Trip

Final grade: over 90% = A, 80-89% = B, 70-79% = C, 60-69% = D, 59% or below = F

No extra credit will be given. No incompletes will be given for grades except in extenuating circumstances.

Exams

This class will have two exams (midterm and final exam). They are not cumulative. The final exam will only cover the metamorphic portion of the class. If you miss an exam due to an *extraordinary* circumstance (such as a serious illness or a medical or family emergency), you must have official documentation available for me to verify those circumstances, and you must supply that documentation within 24 hours of the exam date.

Policies

1. Regular class attendance and active participation are expected; while they are not factored into your final grade the best way to succeed in this class is to *actively* attend every class. If you miss a class, go to Moodle and download the notes for that day and talk to your classmates about what you missed.
2. Office hours are listed above. If you cannot meet during office hours, please email me and we can set up a different time to meet.
3. No late work will be accepted or graded for feedback. I am extremely strict about this policy. An assignment is considered 'late' whether it is turned in one minute or one hour after a deadline. Labs are generally due one or two weeks after they are handed out (due at the beginning of class the day a new lab is assigned – see syllabus). Problem sets are due one week after they are handed out. All assignments are due at the beginning of class or lab. If there are extenuating circumstances preventing the on-time completion of work, please talk to me about alternative arrangements.
4. No makeup exams will be given.
5. All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://www.umt.edu/vpsa/policies/student_conduct.php

Schedule (subject to change)

| Date | Topic | Reading | Lab/Assignments |
|-------|-------|--|---|
| Jan | 22 | Introduction/Earth Structure | Ch. 1 |
| | 24 | Igneous rock classification <i>Problem Set 1: Geotherms</i> | Ch. 2 & 8 <i>Lab 1: Igneous rock classification</i> |
| | 29 | Igneous rock classification | Ch. 2 & 8 |
| | 31 | Igneous rock textures <i>Problem Set 2: Viscosity</i> | Ch. 3 <i>Lab 2: Igneous textures</i> |
| Feb | 5 | Igneous structures | Ch. 4 |
| | 7 | Igneous structures <i>Problem Set 3: Norms</i> | Ch. 4 <i>Lab 3: Volcanoes</i> |
| | 12 | Intro to Thermodynamics | Ch. 5 <i>Volcanoes (cont'd)</i> |
| | 14 | Binary Igneous Phase Diagrams <i>Problem Set 4: Phase diagrams</i> | Ch. 6 |
| | 21 | Binary Igneous phase diagrams | Ch. 6 <i>Lab 4: M&M magma chamber</i> |
| | 26 | Ternary Igneous Phase Diagrams | Ch. 7 |
| | 28 | Mantle Melting | Ch. 10 <i>Lab 5: Stillwater Complex suite</i> |
| Mar | 5 | Magma diversity | Ch. 11 |
| | 7 | Igneous rock associations - oceanic <i>Problem Set 5: MELTS</i> | Ch. 13&14 <i>Stillwater (cont'd)</i> |
| | 12 | Igneous rock associations - convergent | Ch. 16-18 |
| | 14 | Igneous rock associations - other | Ch. 15,19-20 <i>Lab 6: Granites</i> |
| Mar | 19 | Midterm Exam (Igneous Petrology) | |
| | 21 | Introduction to Metamorphism | Ch. 21 <i>Lab 7: Metamorphic rock classification</i> |
| April | 2 | Metamorphic Classification | Ch. 22 |
| | 4 | Metamorphic Textures <i>Problem Set 6: Metamorphic phase diagrams</i> | Ch. 23 <i>Lab 8: Metamorphism of mafic rocks</i> |
| | 9 | Metamorphic Phase Diagrams | Ch. 24 |
| | 11 | Metamorphic Phase Diagrams | Ch. 24 <i>Metamorphism of mafic rocks (cont'd)</i> |
| | 16 | Metamorphic Facies & Mafic Rocks | Ch. 25 |
| | 18 | Metamorphic Facies & Mafic Rocks <i>Problem Set 7: Geothermobarometry</i> | Ch. 25 <i>Lab 9: SW Montana suite</i> |
| | 23 | Thermobarometry | Ch. 26&27 |
| | 25 | Metamorphism of Pelites | Ch. 28 <i>SW Montana suite (cont'd)</i> |
| | 30 | Metamorphism of Pelites | Ch. 28 |
| May | 2 | Metacarbonates | Ch. 29 <i>SW Montana suite (cont'd)</i> |
| | 10 | Final Exam (Metamorphic Petrology) 3:20-5:20 pm | |