Metamorphic Petrology, GEO 307
Block 5, 2019

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Office hours: By appointment or before/after class.

Textbooks: *An Introduction to Igneous and Metamorphic Petrology* by Winter (any edition should do)
highly recommended: *Introduction to Optical Mineralogy* by Nesse (again, any edition)
* Students must also purchase a hand lens of their own, available at the bookstore.

Course meeting times: M–F 9:00–11:00 am and 1:00–3:00 pm.
Course description: Tectonic origins, mineralogical and textural evolution of rocks that undergo changes in pressure, temperature and fluid-availability. Hand sample and microscopic study will provide insight into the processes and controlling influences of metamorphic change.
Prerequisites: GEO 212.

WHY take this course? Most people laugh when I say that this course is all about rocks… But it truly is. Petrology means the study of rocks—how and where and by what processes they were formed, and how they have been changed, mineralogically or texturally, since formation. What most people don't know is that rocks hold essential information about the *dynamic* history of the earth. Just by glancing at a rock—by noting the type of rock (mineral content) and texture (grain size, shape), you will soon be able to tell me all about the tectonic processes of earth that formed that rock. It is a very powerful tool. Much of what we have pieced together over time about earth's history comes from the study of rocks, and this course will give you the basic tools you need to understand the language of metamorphic rocks.

Course objectives:
1) Students will learn to observe and describe, in detail, the physical characteristics of metamorphic rocks in both hand sample and thin section. *(Knowledge, Inquiry, Communication, Vocation)*
2) Students will be able to apply the theory and methodology of metamorphic petrology to analyze metamorphic samples in hand sample and thin section. *(Knowledge, Inquiry, Reasoning, Communication)*
3) Students will be able to discuss the linkages between plate tectonics and metamorphism. *(Knowledge, Inquiry, Reasoning, Communication)*
4) Students will be able to interpret the geological history of a rock based on available data (e.g., hand sample, thin section, elemental, isotopic) and will be able to justify their interpretation (orally or in writing) using the supporting evidence. *(Knowledge, Inquiry, Reasoning, Communication)*
**This course supports the Educational Priorities and Outcomes of Cornell College with emphases on knowledge, inquiry, reasoning, and communication.*

Course information:
Responsibility:
As students at a liberal arts college, you are responsible for your own engagement in the academic conversation. This means being a prepared, active, and respectful participant. This includes reading the syllabus and all the assigned material, but more importantly, this means thinking critically, asking questions, coming to class having formulated your own ideas and responses to the course material, and engaging in dialogue with others. If you do not understand a topic of discussion, an assignment, a grade, or if you have any other questions or concerns, please come and talk with me.

Technology Policy
There may be certain times during class that it would be helpful to use a laptop, tablet, or smart phone. I expect you to use these devices only for class related purposes. If I believe that you are misusing technology, I will issue you a warning—after that I may ask you to leave class and other repercussions may follow.

Late Work:
I will **not** accept late assignments for a grade, but I will look at them for you to make sure you're on the right track. Missed reading questions or quizzes may not be made up without prior approval or evidence of a serious emergency. If you need an extension, please see me before the assignment deadline.

Course Accommodations:
College Policy regarding students with disabilities: Students who need accommodations for learning disabilities must provide documentation from a professional qualified to diagnose learning disabilities. Students requesting services should schedule a meeting with the disabilities services coordinator as early as possible to discuss their needs and develop an individualized accommodation plan. Ideally, this meeting would take place well before the start of classes. The student must notify the instructor of a new course of any accommodations needed within the first three days of the term. Additional information is available at: http://cornellcollege.edu/academic_affairs/disabilities/.

Academic Honesty:
College Policy: Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is their work unless the citation of another specific source is included. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Compass, our student handbook, under the heading "Academic Policies – Honesty in Academic Work."

Cheating, plagiarism, and other forms of academic dishonesty will not be tolerated. Any student in this course who is involved in academic dishonesty (portraying another person's work or ideas as their own, submitting the same or similar papers in more than one course without permission from the course instructors, facilitating plagiarism, etc.) will not earn credit for the relevant assignments, may be formally charged with academic dishonesty, and may receive an F in the course.

15-Day Drop:
To drop on the 15th day, you may have no more than 2 *excused* absences; you must have completed all your work, and you must have participated in class. I reserve the right to decide which excuses are valid and to determine whether you have been participating actively in class.

Graded Work:

Grading:	20% Weekly assignments, labs	20% First exam
	20% Final exam	40% Final project

Assignments, Labs: Practice makes perfect. You will get a lot of practice looking at rocks both in hand sample and under the microscope this block. I will also try to keep you supplied with assignments and/or readings that will help you understand and learn the concepts introduced during lecture. I will not accept late assignments for a grade, but I will correct them for you to make sure you're on the right track.

Exams: There will be two exams; both will incorporate lab and lecture material.

Fieldtrip: I hope to take a fieldtrip to the University of Iowa to use some of their useful toys. More about this in class.

Final project: You will all choose a pet rock to analyze throughout the course of the block. This final project will have both an individual component (analysis and interpretation of your pet rock within the context of the larger geological history of the area) and a group component (research and presentation of the geological history of the area from which your pet rock originates). More information to come.

Course schedule:
The following is a tentative course schedule—I may change the order of, add or cull subject material depending on course progress. Chapters and page numbers for Winter (2nd edition).

Week 1:
Monday, January 14
9 am — Course intro; Agents of metamorphism (covers *Ch. 21 446–452, Ch.22* in Winter)
1 pm — *Lab 1* Metamorphic minerals under the microscope
Assignments — Types of metamorphism presentations; *Ch. 21 (453–465), Ch. 25 (537–542)*

Tuesday, January 15
9 am — Protolith & metamorphic facies; Types of metamorphism presentations
1 pm — Continued; Lab time
Assignments — Article 1; Finish *Lab 1* (due 1/16)

Wednesday, January 16
9 am — Neocrystallization and mineral assemblage; begin *Lab 2*
1 pm — *Lab 2* Metamorphic facies & presentations (due 1/17)
Assignment — *Ch. 23;* Pet rock work

Thursday, January 17
9 am — Interpreting thin section textures
1 pm — Continued; *Lab 3* Textures
Assignment — *Lab 3;* Pet rock work

Friday, January 18
9 am — Textures, continued; Lab time
1 pm — Lab time
Assignment — TBA

Week 2:
Monday, January 21
9 am — Pet rock thin section analysis
1 pm — Continued lab time
Assignment — Study for midterm

Tuesday, January 22
9 am — Midterm
1 pm — Lab time
Assignment — *Ch. 24*

Wednesday, January 23
9 am — Mineral assemblages and phase diagrams
1 pm — Continued; ID peak mineral assemblages for pet rocks
Assignment — *Ch. 26;* HW

Thursday, January 24
9 am — Mineral reactions & diffusion
1 pm — Continued; *Lab 4* element maps
Assignment — HW

Friday, January 25
9 am — Thermometers & barometers
1 pm — Continued; EMP transects
Assignment — TBA

Week 3:
Monday, January 28
9 am — Field trip to University of Iowa?
1 pm — Continued
Assignment — TBA

Tuesday, January 29
9 am — Thermobarometry equations: mole fraction and activity
1 pm — Continued; *Lab 5* EMP data
Assignment — *Ch. 27*

Wednesday, January 30
9 am — Thermobarometry; *Lab 5* continued
1 pm — Lab time
Assignment — TBA

Thursday, January 31
9 am — Pressure–temperature paths & tectonics
1 pm — Continued; Research time
Assignment — Pet rock research

Friday, February 1
9 am — Adding in the time: geochronology
1 pm — Continued; Research time
Assignment — TBA

Week 4:
Monday, February 4
9 am — TBA
1 pm — Work time
Assignment — Finalize pet rock presentations & write-up

Tuesday, February 5
9 am — Pet rock presentations
1 pm — Pet rock presentations

Wednesday, February 6
9 am **— Final exam**