

Spring 2022 | GEOL 1004 | Igneous and Metamorphic Petrology

Professor: Ryan Kerrigan

Office: Krebs 227A

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Class time: Tuesday & Thursday 9:30-10:50 PM

Lab time: Thursday 2:00-4:50 PM

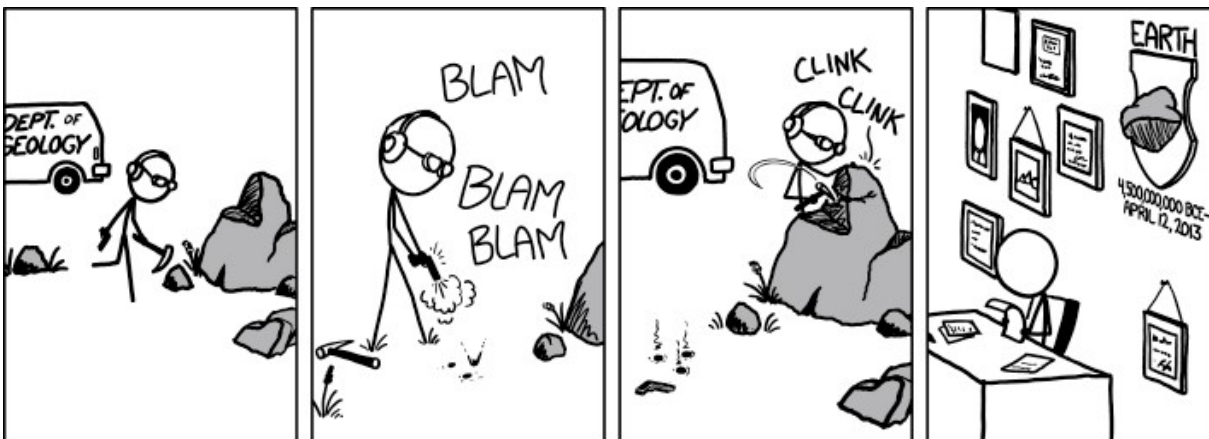
Office Hours: Tues 1:00-3:00 PM or by appointment

Office Phone: (814) 269-2942

Class Room: Krebs B52

Lab Room: Krebs B53

Welcome to Igneous and Metamorphic Petrology!



COURSE DESCRIPTION:

This course provides an introduction to the petrology of igneous and metamorphic rocks. Topics include generation of igneous and metamorphic rocks in various plate tectonic settings, introduction to thermodynamics, binary and ternary phase diagrams, textures and occurrence of igneous and metamorphic rocks.

Prereq: GEOL 1000 Mineralogy or consent of instructor

GOALS

- The primary purpose of this class is to help you conceptualize the principles of igneous and metamorphic rock formation and genesis as well as hone your identification skills. Goals include:
 - Be able to determine the diagnostic properties of igneous and metamorphic rocks
 - Be able to identify igneous and metamorphic rocks as well as characteristic structures and textures
 - Understand the processes and environments which create igneous and metamorphic rocks
 - Be able to interpret geochemical data in rock analysis
 - Understand chemical equilibria and thermodynamics as it applies to igneous and metamorphic systems

Required Textbook:

Principles of Igneous and Metamorphic Petrology by John Winter, 2nd edition, 2009, Prentice Hall, ISBN-13: 978-0321592576 ISBN-10: 0321592573 (~\$170 new, ~\$90 used). The textbook will also be available on Reserve at the library.

Other required materials:

Hand Lenses are available at the bookstore but you might be better off getting it online. I recommend a 10X Triplet Hand Lens, those are good quality without getting crazy expensive. Here is a guide to hand lenses that is helpful: <https://extension.psu.edu/a-brief-guide-to-hand-lenses>

Suggested materials:

Minerals in Thin Section (2nd Edition) by Dexter Perkins and Kevin R. Henke, 2003, Prentice Hall, ISBN-10: 0131420151, ISBN-13: 978-0131420151, (~\$73 new, ~\$58 used). Very important resource for anyone going into petrology.

Web-material: Most (not all) class materials (schedule, power points, problem sets, study guides, etc.) will be posted on CourseWeb for your convenience.

Electronics: Electronics are PROHIBITED in lectures; no computers, ipads, phones, music players, beepers, pagers, watches, etc. Please turn them off and put them away. Please do not make me remind you.

Clean-up: Please don't make a mess, but if you choose to make a mess, please clean up after yourself.

Safety: Use your brain, do not do anything that would endanger yourself or your classmates.

Academic Integrity: Although there will be opportunities for group work in this course, all students are responsible for understanding the material and should indicate with whom they collaborated on any assignment. Group work does not mean that one person does all the work and everyone else puts their name on it...this is considered cheating. Students **should not:** claim other's ideas as their own, turn in other's work as their own, copy sources without proper citation (plagiarism), allow others to take their work or ideas, or pass off past projects as original work. If you have questions about academic honesty, see the instructor or refer to the document "Academic Integrity at the University of Pittsburgh at Johnstown." (<https://www.johnstown.pitt.edu/sites/default/files/landing-images/upj-academics-integrityguidelines.pdf>). Anyone found to be in violation of the Pitt-Johnstown standards for academic integrity will fail the course.

Student Accommodations: If you have requesting accommodations, you are encouraged to contact both the instructor and the Office of Health and Wellness (G-10 Student Union Building, 814-269-7119) to schedule an appointment as early as possible in the term. The Office of Health and Wellness will verify your disability and determine reasonable accommodations for this course.

Diversity and Inclusion: Our classroom will be one of acceptance and inclusion. Any form of discrimination, bullying, etc. will not be tolerated. Please review the university's statement of Equity and Inclusion, if you are unfamiliar: <https://www.johnstown.pitt.edu/about/office-president/equity-and-inclusion>

Late Work: Any work not received by the due date and time will have points deducted, except when pre-excused by the instructor (which will require documentation). Up to 10% of the total possible points will be deducted each day late (this includes weekends and holidays). No work will be accepted after the last day of classes.

Outside Resources: Perhaps there are questions that I cannot answer, or issues you feel you cannot discuss with me, UPJ has outlets these issues. Kara Bernard, the Natural Sciences division administrative assistant, is a wealth of knowledge about random stuff. If you have a problem me or a problem you don't feel comfortable talking to me about please see: Steve Stern, Chair of the Natural Science Division; he is my boss.

Evaluation of the Course

Exercises and other course material will be included in classes that are not part of the reading. It will be hard to "make up" missed classes. Readings and assignments are designed to give more detail on many topics than time allows for in class presentation. These additional assignments are an important part of the course and do not just reiterate lecture material. Some topics in the reading and assignments will not necessarily be covered in class but will appear on exams. The points of individual labs, quizzes, and exams may vary. However, your points will be weighted and calculated as follows:

- 35% **Lecture Exams**, which is subdivided into three parts:
 - 10% Exam I
 - 10% Exam II
 - 15% Cumulative Final Exam (Thursday, April 28th, 2022, 8:00 AM–10:00 AM).
- 20% **Laboratory Exercises**
- 10% **Laboratory Final Exam**
- 10% **Assignments**
- 15% **Final Project**
- 5% **Field Trip**

This is a tentative rubric for grade calculation, hopefully it will hold true but there might be slight adjustments.

EXAMS

The best way to study for the exams will be discussed in class. All students are expected to take exams at the scheduled time unless they have a medical excuse signed by the Assistant Vice President for Academic Affairs, Dr. Stephen Kilpatrick. **I must be notified prior to** any exam being missed in order for a makeup to be offered. The final exam is scheduled for **Thursday, April 28th, 2022 at 8:00 AM**. Please do not ask for extra credit or extra assignments to get extra credit. The answer is no.

ASSIGNMENTS:

Homework assignments and occasional take-home exercises will be assigned on a regular basis. Exercises will be a combination of assigned reading and problem sets. Problem sets will be handed out and students will have one week to complete them. There will be seven problem sets due throughout the semester that will focus on current material as well as preparing you for upcoming material. Problem set due dates will be clearly stated on the top of the first page of the assignment but they due dates are also listed on the Course Schedule. Material handed in late will be deducted 10% for each day it is late, this includes weekend days.

LABS:

Labs are designed such that a student who is current with the class material and focuses should be able to complete the lab in the time allotted. However, some labs will at times be more difficult and require work outside of class time. Lab exercises will focus on mineral and rock identification, however, some labs will be designed to aid in your term project and other labs will reinforce phase equilibria and thermodynamics of natural systems. Lab topics will parallel those covered in concurrent lectures as closely as possible, but there may not always be a perfect overlap. At times, materials will be made available for use. Out of courtesy to others, please do not remove any materials from the lab!

You are expected to use all of the resources at your disposal, including your wits, the internet, each other (when acceptable), as well as the instructor. You are responsible for turning in *your own* work. Working with other students is encouraged, however, blatantly copying another student's work is unacceptable.

FINAL PROJECT:

FIELD TRIP:

People who like camping

Lab rats

Computer Geeks

Geochemists

Geophysicists

Geologists

Sedimentologists

Geodynamics

Seismologists

Isotope geochemists

Petrologists

E_1

E_2

Thermal barrier separating geophysicists from geochemists

Experiments at 1 atm, 298 K

Schedule of Events

Week	Tuesday (Lec)	Thursday (Lec)	Thursday (Lab)
1	<u>January 11, 2022</u> Intro to Petrology and Igneous Rocks <i>Chapt. 1 (2-22)</i>	<u>January 13, 2022</u> Classification of Igneous Rocks <i>Chapt. 2 (23-33)</i>	<u>January 13, 2022</u> <i>Intro to Optical</i>
2	<u>January 18, 2022</u> Class. & Text. Of Ig. Rocks <i>Chapt. 3 (34-53)</i> Problem Set I Due	<u>January 20, 2022</u> Igneous Structures and Field Relationships <i>Chapt. 4 (54-82)</i>	<u>January 20, 2022</u> <i>Granites and Related Rocks</i>
3	<u>January 25, 2022</u> Igneous Structures and Field Relationships	<u>January 27, 2022</u> An Introduction to Thermodynamics <i>Chapt. 5 (83-92)</i>	<u>January 27, 2022</u> <i>Making Thin Sections</i>
4	<u>February 1, 2022</u> Phase Rule & 1-2 systems <i>Chapt. 6 (93-112)</i> Problem Set II Due	<u>February 3, 2022</u> Binary Eutectic Systems	<u>February 3, 2022</u> <i>Making Thin Sections II</i>
5	<u>February 8, 2022</u> Binary Peritectic Systems	<u>February 10, 2022</u> EXAM I	<u>February 10, 2022</u> <i>Felsic & Interm. Volcanics</i>
6	<u>February 15, 2022</u> Ternary Systems <i>Chapt. 7 (113-134)</i>	<u>February 17, 2022</u> Chemical Petrology I: Major and Minor Elements <i>Chapt. 8 (135-157)</i>	<u>February 17, 2022</u> <i>Mafic Volcanics & Plutonics</i>
7	<u>February 22, 2022</u> Trace Elements and Isotopes <i>Chapt. 9 (158-182)</i> Problem Set III Due	<u>February 24, 2022</u> Generation & Diversity of Magmas <i>Chapt. 10-11 (183-221)</i>	<u>February 24, 2022</u> <i>Project Samples & Posters</i>
8	<u>March 1, 2022</u> Layered Mafic Intrusions <i>Chapt. 12 (222-243)</i>	<u>March 3, 2022</u> Lunar Petrology & MOR <i>Chapt. 13 (244-269)</i> Problem Set IV Due	<u>March 3, 2022</u> <i>Lunar Rocks</i>

Schedule of Events			
Week	Tuesday (Lec)	Thursday (Lec)	Thursday (Lab)
9	<u>March 8, 2022</u> NO CLASS OR LAB SPRING BREAK	<u>March 10, 2022</u> 	<u>March 10, 2022</u>
10	<u>March 15, 2022</u> MOR, OIB, CFB & Arcs <i>Chapt. 14-17 (270-376)</i>	<u>March 17, 2022</u> EXAM II	<u>March 17, 2022</u> <i>Metamorphic Minerals</i>
11	<u>March 22, 2022</u> NO CLASS NE GSA	<u>March 24, 2022</u> Intro to Metamorphism <i>Chapt. 22 (470-476)</i>	<u>March 24, 2022</u> <i>Metamorphic Textures</i>
12	<u>March 29, 2022</u> Structures and Textures of Metamorphic Rocks (477-517) Problem Set V Due	<u>March 31, 2022</u> Stable Mineral Assemblages <i>Chapt. 24 (518-536)</i>	<u>March 31, 2022</u> <i>Classification and Deformational Histories</i>
13	<u>April 5, 2022</u> Facies and Metamorphism of Mafic Rocks (537-557) Problem Set VI Due	<u>April 7, 2022</u> Facies and Metamorphism of Mafic Rocks	<u>April 7, 2022</u> <i>Metapelites and AFM Diagrams</i>
14	<u>April 12, 2022</u> Metamorphic Reactions & Thermodynamics <i>Chapt. 27 (558-606)</i>	<u>April 14, 2022</u> Metamorphism of Pelitic Rocks <i>Chapt. 28(607-634)</i>	<u>April 14, 2022</u> <i>Schreinemakers</i>
15	<u>April 19, 2022</u> Meta of Calc & Ultramafics <i>Chapt. 29 (635-654)</i> Problem Set VII Due	<u>April 21, 2022</u> PRESENTATIONS	<u>April 21, 2022</u> LAB PRACTICAL
16	Thursday April 28th 8:00 AM - 10:00 PM FINAL EXAM		

*This schedule will be fluid at times to adjust for the pace and comprehension of the class.