

Spring 2024 | 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

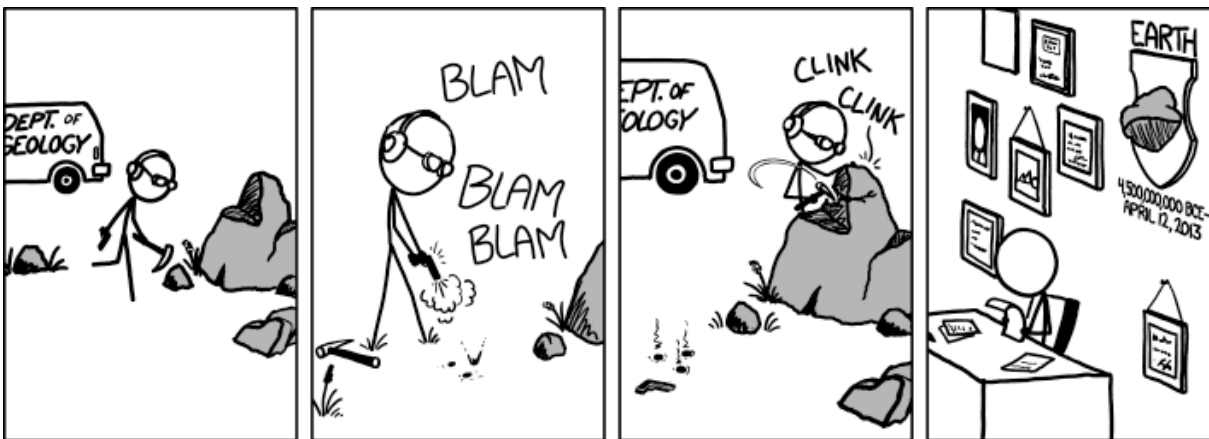
Office Hours: Tues 1:00-3:00 PM or by appointment

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. The author has made the textbook freely available to all! Nice. Go to this link and download it. You will need it.

https://www.whitman.edu/geology/winter/Winter_Principles%20of%20Igneous%20and%20Metamorphic%20Petrology%20by%20JOHN%20D.%20WINTER-1.pdf

Other required materials:

Hand Lenses 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. There will be some quizzes

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:

- 40% **Lecture Exams**, which is subdivided into three parts:
 - 12% Exam I
 - 12% Exam II
 - 16% Cumulative Final Exam (Thursday, April 25th, 2024, 8:00 AM–10:00 AM).
- 20% **Laboratory Exercises**
- 20% **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 26th, 2024 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 state 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. Please take care in preparing lab reports, since your grade will in part depend on the presentation of your reports. Write clearly, draw clearly and carefully what you see, and annotate captions with strings of words that make sense. If you feel your handwriting will be a hindrance to the professionalism of your reports,

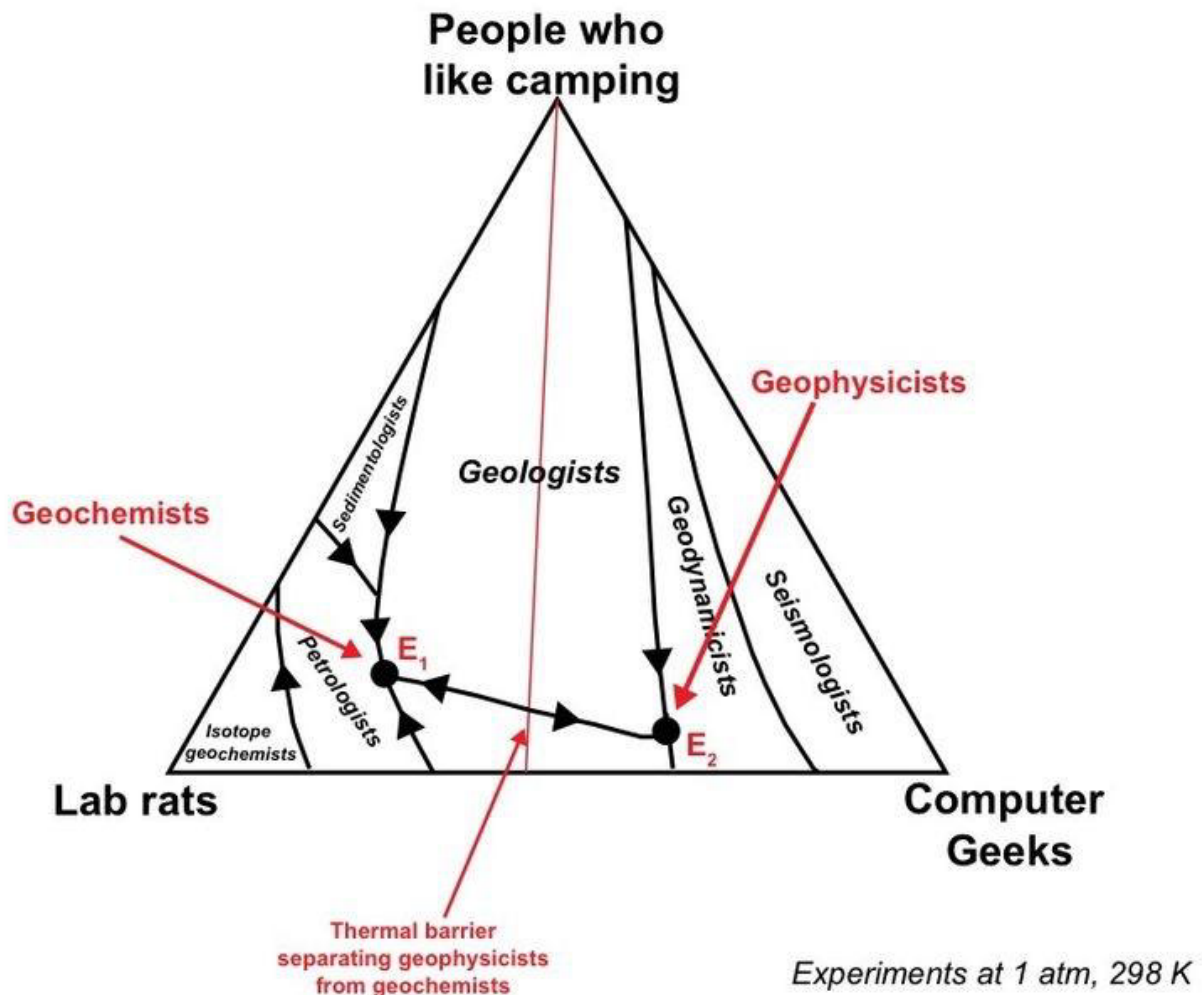
type. Please, thoroughly read the questions posed so that you answer all that is being asked of you. Labs are due at the start of lab the following week after they are assigned, unless stated otherwise. Late assignments will lose 10% each day of its tardiness.

FINAL PROJECT:

You will be given a rock to examine for your term project. Each sample will have some geographical and geologic context. You will examine the hand sample and report your finding. You will also make a thin section of the rock and report on your finding. Additionally, rocks will be analyzed for major element concentrations. All analyses will be synthesized into a final report to be presented to the class. Your final report should include (but not be limited to) the following: positive identification of your rock with data to support your conclusion; a history of the rock and geologic group it belongs to; uses and occurrences (geologically and geographically); a discussion of the genesis and thermodynamic and how those factors contributed to the physical characteristics of your rock. Your final product should include an 8-10-page paper on your mineral and a 10-minute presentation to be given in the last week of class. More information will be provided as the semester progresses.

FIELD TRIP:

There will be one weekend-long camping field trip to eastern Pennsylvania/Maryland. The field trip will be held **Saturday, April 12th and Sunday April 13th 2024**. This field trip is mandatory, if you have any conflicts on these dates, please let me know as soon as possible.



Schedule of Events

Week	Tuesday (Lec)	Thursday (Lec)	Thursday (Lab)
1	<u>January 9, 2024</u> Intro to Petrology and Igneous Rocks <i>Chapt. 1 (2-22)</i>	<u>January 11, 2024</u> Classification of Igneous Rocks <i>Chapt. 2 (23-33)</i>	<u>January 11, 2024</u> <i>Intro to Optical</i>
2	<u>January 16, 2024</u> Class. & Text. Of Ig. Rocks <i>Chapt. 3 (34-53)</i> Problem Set I Due	<u>January 18, 2024</u> Igneous Structures and Field Relationships <i>Chapt. 4 (54-82)</i>	<u>January 18, 2024</u> <i>Granites and Related Rocks</i>
3	<u>January 23, 2024</u> Igneous Structures and Field Relationships	<u>January 25, 2024</u> An Introduction to Thermodynamics <i>Chapt. 5 (83-92)</i>	<u>January 25, 2024</u> <i>Making Thin Sections</i>
4	<u>January 30, 2024</u> Phase Rule & 1-2 systems <i>Chapt. 6 (93-112)</i> Problem Set II Due	<u>February 1, 2024</u> Binary Eutectic Systems	<u>February 1, 2024</u> <i>Making Thin Sections II</i>
5	<u>February 6, 2024</u> Binary Peritectic Systems	<u>February 8, 2024</u> EXAM I	<u>February 8, 2024</u> <i>Project Work</i>
6	<u>February 13, 2024</u> Ternary Systems <i>Chapt. 7 (113-134)</i>	<u>February 15, 2024</u> Chemical Petrology I: Major and Minor Elements <i>Chapt. 8 (135-157)</i>	<u>February 15, 2024</u> <i>Felsic & Interm. Volcanics</i>
7	<u>February 20, 2024</u> Trace Elements and Isotopes <i>Chapt. 9 (158-182)</i> Problem Set III Due	<u>February 22, 2024</u> Generation & Diversity of Magmas <i>Chapt. 10-11 (183-221)</i>	<u>February 22, 2024</u> <i>Mafic Volcanics & Plutonics</i>
8	<u>February 27, 2024</u> Layered Mafic Intrusions <i>Chapt. 12 (222-243)</i> Problem Set IV Due	<u>February 29, 2024</u> Lunar Petrology & MOR <i>Chapt. 13 (244-269)</i>	<u>February 29, 2024</u> <i>Lunar Rocks</i>

Schedule of Events			
Week	Tuesday (Lec)	Thursday (Lec)	Thursday (Lab)
9	<u>March 5, 2024</u> EXAM II	<u>March 7, 2024</u> <i>No Lecture</i> WORK ON YOUR PROJECTS!!!!	<u>March 7, 2024</u> <i>No Lab</i> WORK ON YOUR PROJECTS!!!!
10	<u>March 12, 2024</u> NO CLASS SPRING BREAK	<u>March 14, 2024</u> NO CLASS SPRING BREAK	<u>March 14, 2024</u> NO CLASS SPRING BREAK
11	<u>March 19, 2024</u> Intro to Metamorphism <i>Chapt. 22 (470-476)</i>	<u>March 21, 2024</u> Intro to Metamorphism	<u>March 21, 2024</u> <i>Metamorphic Minerals</i>
12	<u>March 26, 2024</u> Structures and Textures of Metamorphic Rocks (477-517) Problem Set V Due	<u>March 28, 2024</u> Stable Mineral Assemblages <i>Chapt. 24 (518-536)</i>	<u>March 28, 2024</u> <i>Metamorphic Textures</i>
13	<u>April 2, 2024</u> Facies and Metamorphism of Mafic Rocks (537-557) Problem Set VI Due	<u>April 4, 2024</u> Facies and Metamorphism of Mafic Rocks	<u>April 4, 2024</u> <i>Schreinemakers</i>
14	<u>April 9, 2024</u> Metamorphic Reactions & Thermodynamics <i>Chapt. 27 (558-606)</i>	<u>April 11, 2024</u> Metamorphism of Pelitic Rocks <i>Chapt. 28(607-634)</i>	<u>April 11, 2024</u> <i>Subduction-related Rocks</i>
15	<u>April 16, 2024</u> Meta of Calc & Ultramafics <i>Chapt. 29 (635-654)</i> Problem Set VII Due	<u>April 18, 2024</u> PRESENTATIONS	<u>April 18, 2024</u> <i>Metapelites and AFM Diagrams</i>
16	Thursday April 25th 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.