INTRODUCTORY IGNEOUS AND METAMORPHIC PETROLOGY

GEOL 308 - Spring 2025

Syllabus for Lecture and Laboratory

Course INFO

Lecture and Laboratory room: Exploratory Hall L505
Lecture time: MW, 1:30-2:45 PM **- Lab time:** M 3:00 – 5:30 PM
Instructor: G. Mattietti, PhD
E-mail: gkysar@gmu.edu
Office Hours: Wednesday 3:30 to 5:30 PM
Instructional Material: John D. Winter, principles of igneous and metamorphic petrology. The textbook is available from: https://www.pearson.com/us/higher-education/program/Winter-Principles-of-Igneous-and-Metamorphic- Petrology-2nd-Edition/PGM146492.html
The textbook is out of print, so a used one and/or sharing the textbook is fine. Make sure you are buying the book by Winter, there are Petrology textbook with the same title but by other authors.
Laboratory: All material is provided in class. Handouts and other course materials distributed through Blackboard.

Course Objectives and Goals

This is a junior-level igneous and metamorphic petrology course, designed to give students the knowledge and skills for identifying and classifying igneous and metamorphic rocks, and interpreting their petrogenesis in the tectonics context.
By the end of this course, students who applied themselves to the study of Petrology should be able to:
• To understand the formation and evolution of igneous and metamorphic rocks and their relationship to their structures and tectonic context.
• To understand the general petrogenetic reactions and place these reactions in a PTX context.
• To identify and classify igneous and metamorphic rocks samples at macroscopic and microscopic and through geochemistry.
• To use petrochemistry databases to analyze and interpret analytical data in their tectonic context.

Course Prerequisites

This is an upper-level geology class for geology, chemistry, and chemical engineering majors. The topics discussed in this class require a basic solid knowledge of mineralogy and chemistry. The class covers a significant amount of material so you should not assume that topics will be reviewed starting at the basic level. A grade of C or higher in mineralogy is required. Students enrolled in this class MUST have already successfully taken a general chemistry course

Course Assessment

Course Assessment is based on the student's scores of lecture and laboratory components, so distributed:

LECTURE 75%; based on the following components: three 3 lecture exams (Exam 1=24%, exam 2=23%, exam 3= 22%), final chemical petrology project 6%. Penalty for exam make ups/late submissions: 15% of exam grade

LABORATORY 25% based on the following components: laboratory exercises are graded on completion and due at the end of the lab period = 10%; Lab exam 1=6%, Lab exam 2 = 4%, Course field trip = 5%

- Exams are taken only once. No lowest exam score dropped.
- No final curve, unless the end-of-semester final MEDIAN for the class falls below 80%
- Absence/fail to submit an exam will result in a 0 (zero) score for that exam. No make-ups granted unless evidence of extenuating circumstances is provided. Make ups of any graded element of the course carries a 15% penalty.
- The field trip can be exempted if proof of extenuating circumstances is submitted.
- No Extra-credit available under any circumstance. The course is intensive and content heavy, there is no time for extra credit.

Final grade is assigned based on the following scale, with no exceptions:

A+≥ 99%	94 ≥ A < 99%	90 ≥ A– < 94%;
87≥ B+ <90%	83 ≥ B < 87%	78 ≥ B– < 83%;
75≥ C+ <78%	74 ≥ C < 70%	70 ≥ C– < 65%;
50≥ D < 65%		
50< F		

Course Policies

By staying enrolled in this course, you agree to the following course policies:

• Attendance: not mandatory, but highly recommended if you want to do well.
• Cell phones policy during exams: Cell phones are NOT allowed during the taking of a lecture exam. Cell phones will be collected prior to starting the exam and returned to the students as soon as the exam is submitted. Use of a cell phone during a lecture exam is considered cheating.
• Communications: Email is the only official way of communicating with students. Any email from me will come from gkysar@gmu.edu or through Blackboard. In accordance with protection of privacy best practices, I will not respond to email sent from non-GMU email accounts. It is your responsibility to make sure that your GMU email is set up properly and to check your email regularly. Your email must have a subject line because emails without subject are filtered as spam mail.
• Class etiquette: All students in attendance have the right to a safe and quiet learning environment. Respect all rules and regulations established by GMU (see university policies below). Come to class on time and if you must leave earlier do so in a way that will not disturb the other people present in the room. During class, mute your cell phones. Class disruption of any sort will not be tolerated.
• Extenuating circumstances might occur that prevent you from taking an exam. If such circumstances can be justified, a make-up session with no penalty is available. NOTE CAREFULLY THE DAY OF THE EXAMS; if you realize that you cannot take an exam as scheduled, inform the professor immediately. As per GMU policy on religious festivities, you must inform the instructor at the beginning of the semester if you will be absent from an exam in order to schedule a make-up.

• Course materials: course material distributed to students is protected by U.S. copyright law and/or is intellectual property of the course instructor; you cannot repost this material on the web, on online study sites or distributed in any other format outside the class.
• Course assessment: course assessment is explained in this syllabus; assessment criteria and grading scale are non-negotiable.

GMU POLICIES that Apply to this and any course at GMU:

In accordance with Catalog Policy AP.2.5, the following apply to this Course:

Academic Standards

Academic Standards exist to promote authentic scholarship, support the institution's goal of maintaining standards of academic excellence, and encourage continued ethical behavior of faculty and students to cultivate an educational community that values integrity and produces graduates who carry this commitment forward into professional practice.
As members of the George Mason University community, we are committed to fostering an environment of trust, respect, and scholarly excellence. Our academic standards are the foundation of this commitment, guiding our behavior and interactions within this academic community. The practices for implementing these standards adapt to modern practices, disciplinary contexts, and technological advancements. Our standards are embodied in our courses, policies, and scholarship, and are upheld in the following principles:

- **Honesty**: Providing accurate information in all academic endeavors, including communications, assignments, and examinations.
- **Acknowledgement**: Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, coauthored pieces, and project reports.
- **Uniqueness of Work:** Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to written assignments, code, presentations, exams, and all other forms of academic work. Violations of these standards—including but not limited to plagiarism, fabrication, and cheating—are taken seriously and will be addressed in accordance with university policies. The process for reporting, investigating, and resolving violations is outlined in the university's procedures. Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community. The principles outlined in these academic standards reflect our collective commitment to upholding the highest standards of honesty, acknowledgement, and uniqueness of work. By adhering to these principles, we ensure the continued excellence and integrity of George Mason University's academic community.

Student responsibility: *Students are responsible for understanding how these general expectations regarding academic standards apply to each course, assignment, or exam they participate in; students should ask their instructor for clarification on any aspect that is not clear to them*.

Link to the GMU honor Code document

Accommodations for Students with Disabilities

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit https://ds.gmu.edu/ for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu. Phone: (703) 993-2474.

Student responsibility: *Students are responsible for registering with Disability Services and communicating about their approved accommodations with their instructor in advance of any relevant class meeting, assignment, or exam.*

FERPA and Use of GMU Email Addresses for Course Communication

The Family Educational Rights and Privacy Act (FERPA) governs the disclosure of education records for eligible students and is an essential aspect of any course. Students must use their GMU email account to receive important University information, including communications related to this class. Instructors will not respond to messages sent from or send messages regarding course content to a non-GMU email address.

Student responsibility: *Students are responsible for checking their GMU email regularly for course-related information, and/or ensuring that GMU email messages are forwarded to an account they do check.*

Title IX Resources and Required Reporting

As a part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environments for all members of the University community, the University does not discriminate based on sex or gender in any of its education or employment programs and activities. Accordingly, all non-confidential employees, including your faculty member, have a legal requirement to report to the Title IX Coordinator, all relevant details obtained directly or indirectly about any incident of Prohibited Conduct (such as sexual harassment, sexual assault, gender-based stalking, dating/domestic violence). Upon notifying the Title IX Coordinator of possible Prohibited Conduct, the Title IX Coordinator will assess the report and determine if outreach is required. If outreach is required, the individual the report is about (the "Complainant") will receive a communication, in the form of an email, offering that person the option to meet with a representative of the Title IX office. For more information about non-confidential employees, resources, and Prohibited Conduct, please see University Policy 1202: Sexual and Gender-Based Misconduct and Other Forms of Interpersonal Violence. Questions regarding Title IX can be directed to the Title IX Coordinator via email to TitleIX@gmu.edu, by phone at 703-993-8730, or in person on the Fairfax campus in Aquia 373.

Student opportunity: *If you prefer to speak to someone confidentially, please contact one of Mason's confidential employees in Student Support and Advocacy (SSAC), Counseling and Psychological Services (CAPS), Student Health Services (SHS), and/or the Office of the University Ombudsperson*

Spring 2025 Course Calendar*

Date	Lecture topic		Laboratory
Jan. 22	**Part 1: Chemical Petrology. Magma genesis and evolution**	Phase diagrams, eutectic, peritectic and solvus.	
Jan. 27		Ternary and multi-component systems	Lab 1: Classification of igneous rocks. Intrusive - Modal classification
Jan. 29		Chemical Petrology of major element oxides and data representation: TAS, Harker and Fenner Diagrams.	
Feb. 3		Chemical petrology of trace elements, Goldschmidt rules; Variation diagrams	Lab 2: classification of igneous rocks: Volcanic rocks – CIPW
Feb. 5		Chemical petrology of Isotopes	
Feb. 10		Conditions of pressure and temperature of partial melting and magma genesis	Lab 3: Ultramafic and mafic Intrusive rocks in thin section
Feb.12		Processes of magma evolution/differentiation	
Feb. 17		Magmatic structures and products of cooling magmas	Lab 4: Ultramafic and Mafic extrusive rocks in thin section
Feb. 19		Summary of part 1	
Feb. 24	**LECTURE EXAM 1 – 90 minutes**		Lab 5: Intermediate and Felsic intrusive rocks in thin section
Feb. 26	**Part 2: Igneous lithospheric environments**	Intro to part 2 of the course: lithospheric environments. Presentation of course project. IGPET software.	
Mar. 3		Igneous environments of the oceanic lithosphere: Ridges, Rises. Komatiites and Ophiolites	Lab 6: Intermediate and felsic volcanic rocks in thin sections
Mar. 5		Igneous environments of the oceanic lithosphere: mantle plumes, hot spots and seamounts.	
Mar. 17		Convergent plates environments: types of evolution of magmatism	Lab 7: pyroclastic rocks in thin section
Mar. 19		Continental lithospheric environments: hot spots' case studies: CRB and Yellowstone	

Date	Lecture topic		Laboratory
Mar. 24		Continental lithospheric environments: Kimberlites, Carbonatites, layered Mafic Intrusions	**LAB EXAM 1**
Mar. 26		Granitoids classification - summary of part 2 of the course.	
Mar. 31	**LECTURE EXAM 2 – 90 minutes**		Time for working at petrology project
Apr. 2	**Part 3: Metamorphic lithospheric environments**	The PTX domain for metamorphism – phase diagrams. Degrees and facies	
Apr. 7		Geothermobarometers	Lab 8: metamorphic minerals in thin section
Apr. 9		Metamorphism of ultramafic and mafic rocks	
Apr. 14		Metamorphism of pelitic rocks	Lab 9: Metamorphic textures
Apr. 16		Metamorphism of Carbonates	
Apr. 21		Role of fluids in metamorphic environments; metasomatic processes	Lab 10: selection of metamorphic rocks for analysis in hand sample and thin section
Apr. 23		**FIELD TRIP PRESENTATION**	
Apr. 25-26		**FIELD TRIP**	
Apr. 28		Metamorphic associations – PT-t diagrams	Lab 10 – Continued. One on one time for project feedback
Apr. 30		Summary of course part 3	
May 5		Study day	**LAB EXAM 2**
May 7	**LECTURE EXAM 3 – 90 minutes**		

* Instructor reserves the right to change lecture topic and order to fit class needs and learning objectives.