



Above: Askja caldera, Iceland. Below, dikes and sills exposed at Pico do Arieiro, Madeira

## Instructor:

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## Place and Time:

Van Wickle Hall, Room 15  
Lecture: Tuesday and Thursday, 9:30-10:45 am  
Lab: Tuesday 1:15-4:00 pm  
Office Hours: Thursday 1:15-4:00 pm or by appointment



## Course Objectives:

Petrology is the study of rocks: their origins and evolution. In this course, you will thoroughly investigate the lifecycle of igneous and metamorphic rocks using many converging lines of evidence. You will ask, and learn to answer, questions like: What type of rock is this? What is its composition? What minerals are present and in what relative abundances? What textures are visible in the rock? What are its macro- and microscopic characteristics? How did it form? Where did this rock originally form and where was it ultimately found? How has the rock changed since its formation? Where else on earth do we find rocks with similar characteristics? Throughout it all, ask “why, Why, *WHY!*” and “how do we know?” and “could there be another explanation?”

## Learning outcomes:

- Describe, explain, and differentiate the compositional and physical layers of the Earth
- Identify basic minerals; understand relationships between their chemistry and occurrence
- Know basic igneous and metamorphic rock processes and types
- Relate rock processes to plate tectonics or other broad-scale earth processes
- Explain where, why and how specific igneous and metamorphic rock types are produced
- Skillfully acquire, interpret and access sound scientific data and information about the Earth

**The way I teach:** I am a strong proponent of “active learning,” and “challenge-based learning.” Things “stick” best when you learn by doing. There will be frequent opportunities to exercise agency and identify subtopics and examples that you find to be particularly interesting and relevant. This approach to teaching and learning has huge benefits, but it requires a great deal of participation, cooperation, enthusiasm, and preparation on your part. I thank you in advance.

**Textbook:** Principles of Igneous and Metamorphic Petrology (2<sup>nd</sup> Edition) by John D. Winter (Prentice-Hall). Watch for Walla Walla references!

*Photo: Columbia River Basalt at Palouse Falls, WA*



**Talkin' rocks:** I'm very happy to discuss the course, assignments, grades, your classroom experience, and this crazy planet of ours. Come see me any time during my office hours—I'll either be in my office or downstairs in my research lab (check my door for a note!). You are welcome drop in at other times when my door is open. I'm also happy to communicate via email. I'm not big on formality, but I do ask for a salutation, a sign-off, and a response in all of our email exchanges. I will strive to respond to your emails promptly, but please know that I may wait until morning (or Monday) to respond to emails received after I leave Van Wickle for the evening. Plan ahead!

**Attendance:** Come to class. Come to lab. Attend fieldtrips. I will gladly accept Dean-approved absences. Otherwise, you must be present (and participating!) in class and lab. Violation of this policy will negatively impact your "Daily Notecard" grade (see final page for details). Exams cannot be rescheduled without a notice from the Dean.

**Class cancelation:** It is the policy of Lafayette College and Geology and Environmental Geosciences to hold classes every day they are scheduled (no snow days!). If a rare circumstance emerges that makes class cancelation unavoidable (dangerous conditions, extreme illness, required research travel), the missed class time will be made up with an alternative arrangement on a case-by-case basis (e.g., rescheduled class, mandatory attendance at a relevant campus event, etc.).

**Technology during lab:** It's not the Stone Age anymore. We live in an amazing technological era, and we will make frequent use of many electronic resources (e.g., Google Earth, MELTS, Excel, Moodle, Leica, etc.) during our time together. You will need access to a computer to successfully complete most labs (either your own laptop or a computer lab machine). You will also frequently need to use the petrographic microscope camera app (on your cellphone, tablet, or laptop). Please come to lab with a technology plan in place (e.g., bring your laptop or be ready to visit the computer lab). Please contact me if this becomes a problem and we will find a solution (no problem!).

**Technology during lecture:** There is a time and a place for everything. Please consider our classroom to be a *screen free zone* during lecture periods. I will be very clear about times when laptops and phones (or similar) may be used. Otherwise, come to class ready to participate in discussions and activities without the distraction of a tool with a power button. Violation of this policy will negatively impact your "Daily Notecard" grade (see final page for details).

**Moodle:** We will use Moodle frequently—for communication, daily reading assignments, resource distribution, surveys and polls, assignment submissions, grade reporting, etc. Please familiarize yourself with Moodle, and please let me know if you have any questions or concerns.

**Moodle Disclaimer:** Moodle contains student information that is protected by the Family Educational Right to Privacy Act (FERPA). Disclosure to unauthorized parties violates federal privacy laws. Courses using Moodle will make student information visible to other students in this class. Please remember that this information is protected by these federal privacy laws and must not be shared with anyone outside the class.

**Academic Honesty:** Integrity is of paramount importance, and I hold it in the highest regard. It's okay (even encouraged, and often required!) to struggle as you grapple with new concepts. It's not okay (never, ever) to compromise your academic integrity. Any work you submit must be your own creation. The ideas you put forth in discussion and the answers you provide on homework or exams must be your original thoughts; otherwise, credit must be given where credit is due (citing published work, or acknowledging your peers for their intellectual contributions). Any perceived breach of academic integrity will be reported to the chair of Geology and Environmental Geosciences and to the Dean of Students. Consult the Student Handbook for further information.

**Academic Accommodation:** I am happy to discuss appropriate accommodations that you may require to be successful in this course. I ask that you contact the ATTIC ([attic@lafayette.edu](mailto:attic@lafayette.edu), 610-330-5098) and involve them in determining and facilitating an action plan *as soon as possible*.

**Work Submission:**

- The standard due date for all work, unless explicitly stated otherwise, is Monday by the end of business hours (5:00 pm via Moodle or to Dr. Carley's office).
- Work submitted by the end of business hours on Friday (5:00 pm via Moodle or to Dr. Carley's office) will earn a 5 point early incentive bonus (exceptions explicitly stated)
- Late work will be accepted until graded work is returned to your classmates: 5% penalty if late on deadline day, 20% penalty if submitted more than one day late.
- Extra credit write-ups can be submitted via Moodle at any time before midnight on the last day of the semester (05/08/2020). Extra credit will be assessed at the end of the term.

**Protected Privacy:** You will be assigned a random 4 digit ID number to use on all paper submissions of work (exams, printed labs, etc.). Respect the anonymity of the number.

**Work Return:** You may pick up graded work (lab rubrics, exam and quiz scores, etc.) from the hanging files outside my office door, in a folder labeled with your anonymous ID number. You can view your graded exams in office hours (typically available one week after you take the exam).

**Grade Communication:** You are responsible for keeping track of your grades throughout the course of the semester. The value of each assignment is available in the "Assignment Overview and Grade Distribution" section of this syllabus. You may inquire about your grade in office hours at any point in the semester. Grades are not negotiable—take advantage of extra credit opportunities!

**Grading policy and a breakdown of the numbers:**

Above and beyond expectations		Good, high-quality work			Sufficient; baseline expectations met			Room for improvement		
A	A-	B+	B	B-	C+	C	C-	D+	D	D-
94%	90%	87%	84%	80%	77%	74%	70%	67%	64%	60%
These numbers indicate the minimum score that must be earned for each corresponding letter grade. Grades are firm (no rounding!) and non-negotiable. Take advantage of extra credit and opportunities to redo work for partial credit.										

**Extra Credit:** You may add a maximum of 5% extra credit towards your final grade (this is significant—take advantage!). All extra credit will be assessed and factored into your final grade at the end of the semester. The most common way to earn extra credit is to attend Geology seminars and other campus events (on a case-by-case basis). Attendance and appropriate participation will add 0.25% extra credit to your final grade. A short write up (2 pages, 1 inch margins, 1.5 spacing, size 11 font) can be submitted for a maximum of 0.75% extra credit towards your final grade. The write up must contain: (1) a summary of the lecture; (2) an overview of issues you found particularly interesting; and (3) questions you have related to the content of the lecture. Write-ups are due via Moodle by midnight on the last day of class.

**Course schedule:** This schedule is subject to change—be it slow and steady (uniformitarianism!) or in fits of drastic upheaval (catastrophism!). Check Moodle frequently for up-to-date information.

Week	General topic	Significant dates and deadlines
01/27	Introduction to igneous petrology	
02/03	Intrusive and extrusive processes and products	
02/10	The mantle	
02/17	Magmatic evolution and differentiation (Part 1)	
02/24	Magmatic evolution and differentiation (Part 2)	
03/02	Transition week: Principles to application	<i>Lego Lab due (Mon.); Exam 1 (Thurs.)</i>
03/09	Mid-ocean ridges	
03/16	Spring Break	
03/23	Ocean islands	
03/30	Convergent margins (Igneous)	
04/06	Transition week: Igneous to metamorphic	<i>Igneous World Tour due (Mon.); Exam 2 (Thurs.)</i>
04/13	Introduction to metamorphic petrology	
04/20	Metamorphic facies, metamorphism of mafic rocks	
04/27	Metamorphic zones, metamorphism of pelitic rocks	
05/04	Metamorphic wrap-up and final reflections	<i>Metamorphic Adopt-a-Rock due (Thurs.)</i>
Finals	Exam date determined by the Registrar	

### Grade Distribution and Assignment Overview

Category	%	Description
Daily Notecards	20	During lecture, you will brainstorm ideas or respond to specific questions. Questions may relate to <i>the assigned reading for the week</i> , content discussed in lecture, lab activities, rock or mineral specimens, etc. These notecards will be used to gauge understanding and to promote discussion. You will receive partial credit for participation and full credit for quality responses.
Exam 1	12	This exam will be written for a 75-minute class period. It may include short answer responses, labeling of figures and graphs, calculations, phase diagram and geochemical plot interpretation, and specimen work (identification, interpretation). You may complete the exam to the best of your ability using pencil before switching to pen and making corrections for partial credit using a handwritten notecard. Exam 1 will include content through compatibility and partitioning.
Exam 2	12	Exam 2 will follow the format and guidelines specified above, and will include ~40% concepts from Exam 1, ~60% new content.
Final Exam	15	The final exam will follow the same format and guidelines as Exams 1 and 2. It will be approximately twice the length of a typical lecture exam. The final will be cumulative, and will consist of ~40% igneous concepts and ~60% metamorphic concepts.
Lego Lab	6	You will explore chemical differentiation using Legos to simulate a crystallizing magma body. This exercise will help you build necessary skills for the “Igneous World Tour.” You will: classify rocks and magma using bulk rock chemistry and mineral assemblages; use Excel to calculate changing chemistry and to generate geochemical plots; analyze and interpret geochemical plots; find and document hand samples that correspond to the rocks and minerals in your simulation. You will summarize your results in a concise but well-illustrated report.
Igneous World Tour Website	15	Together, as a class, we will explore mid-ocean ridges. You will then take personal responsibility for unique volcanic systems in (1) an ocean island setting, and (2) a subduction zone. You and a partner will compare your findings for your unique settings. This project will be the culmination of several labs and lectures in the igneous petrology unit of the class. You will present your results and interpretations in a well-illustrated WordPress website.
Metamorphic Adopt-a-Rock	10	When we transition from igneous to metamorphic rocks, you will find a rock to “adopt.” You will describe the rock in hand sample, make and characterize a thin section, and make your best attempt to tell the full life-story of the rock, from the formation of its protolith to its current state (using evidence like texture, mineral assemblages). You will summarize your work and your interpretations in a well-illustrated, data-rich presentation.
General lab and lecture	10	Standard lab tasks (weekly) and in-class activities with a take-home component (rare) will be weighted equally and factored into this category.