Geology 321 | # GEOCHEMISTRY | **Spring 2019**

NW Arizona, landscape shaped by super eruption of the Peach Spring Tuff

Instructor:

Dr. Tamara Carley
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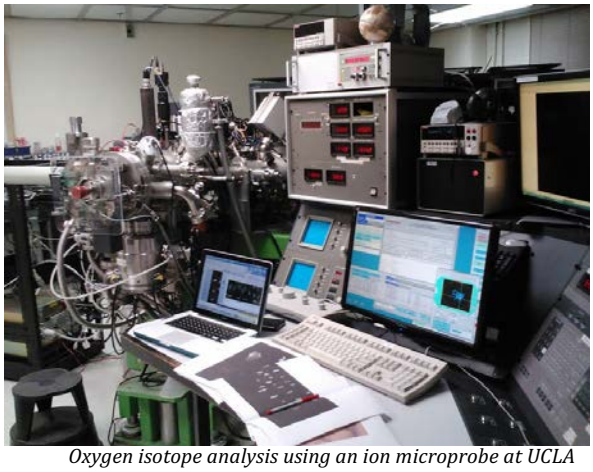
Office: Van Wickle 101c
Research Lab: Van Wickle 1c
Office Hours:
Monday: by appointment
Friday: 10:00 am to noon
Friday: 1:30 to 3:00 pm



Oxygen isotope analysis using an ion microprobe at UCLA

Place and Time:

Van Wickle Hall, Room 15
Lecture: Tuesday-Thursday, 11:00-12:15
Lab: Thursday 1:15-4:00

Textbook: Geochemistry by William M. White (Wiley-Blackwell); ISBN-13: 978-0470656686

Course Description: Our dynamic planet, and our lived experience as humans on this Earth, is shaped by complex interactions between the geosphere, hydrosphere, atmosphere, and biosphere. This semester we will explore the geochemical aspects of these interconnected Earth spheres using a "source to sink" mentality. First, we will consider the generation, evolution, and destabilization of a large body of magma. We will then examine the impacts of a supersized eruption on climate, water systems, and soil fertility, as well as the fate of volcanic ash in aqueous environments. Finally, we will consider the formation, composition, and properties of Earth materials extracted from these systems and for economic purposes. Geochemical concepts learned during our progression from "source" (magma) to "sink" (clay and ore deposits) will include: solid-earth equilibria (igneous, metamorphic, sedimentary, and weathering reactions), isotope geochemistry, oxidation-reduction reactions, natural aqueous solutions, and solid-aqueous equilibria, and more.

Learning Outcomes:

- Identify the environment of formation for important rock types and explain formation as related to broad scale earth processes (e.g., plate tectonics, petrogenesis, weathering, etc.).
- Understand major events and rates of change through geologic history and describe methodologies used to determine age relationships between Earth materials.
- Understand that the Earth is a complex system of interacting rock, water, air, and life.
- Know how to acquire, interpret, and access sound scientific data and information.

Teaching Philosophy and Course Design: I am a strong proponent of "active learning," and "challenge-based learning." Each week, we will craft a driving question (e.g., "what happens to global climate following a super eruption, and why?") and use lecture material, textbook concepts, and scientific articles to uncover answers. In parallel, you will identify one question that you find personally motivating (relevant to local ash deposits and major course themes). Throughout the semester, you will develop a detailed research plan designed to help find the answer to your question. You will present your plan to your peers and a panel of judges in the form of a grant proposal at the end of the semester. Your proposal will be supported by data acquired using locally-collected ash samples and a suite of analytical instruments (XRD, SEM, XRD). The success of this course will require your participation, cooperation, enthusiasm, and preparation. Thank you in advance.

Geothermal springs: Satsuma Iwo Jima

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 approval 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., analytical instruments, data reduction software, Excel, etc.) during our time together. You will need a computer (either your own laptop or a computer lab machine) to successfully complete most assignments. However, there is a time and a place for everything, and I will be very clear about times when laptops and phones (or similar) may be used. Please consider our classroom to be a *screen free zone* during lectures and class discussions. 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 discus appropriate accommodations that you may require to be successful in this course. I ask that you contact the ATTIC (attic@lafayette.edu, 610-330-5098) and involve them in 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 Thursday morning at 11:00 am (electronic uploads to Moodle and paper copies of reading reflection to class).
- Work submitted by midnight on Tuesdays (via Moodle) will earn a 5 point early incentive bonus (exceptions to this policy will be 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 class. Extra credit will be assessed at the end of the term.

Work Return: You will be assigned a random 4 digit ID number to use on all work that you submit. Respect the anonymity of the number. You may pick up graded work 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. 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 is worth 0.25% extra credit. 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. 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. All extra credit will be assessed at the end of the semester.

Grade Distribution and Assignment Overview

Category	%	Description
Standard Coursework: 30%		
Daily Notecards	15	On a typical day, you will receive a notecard and use it to brainstorm ideas or respond to specific questions posed in class. Questions may relate to *the assigned reading for the week* (from the textbook or your article), content discussed in lecture, lab activities, field trips, guest lectures, your experiences in other classes or out in the world, etc. These notecards will be used to gauge understanding and to promote discussion. You will receive partial credit for participation and full credit for high-quality responses. In-class activities with a take-home component (rare) will be factored into this category and given the same weight as a notecard.
Weekly Reading Reflection	15	In the course of a typical week, you will be responsible for reading: (1) a short excerpt from your textbook; (2) one or more articles from an issue of Elements magazine; and (3) a scientific journal article of your choosing. Each Thursday you will submit two-page reading reflection in which you will: concisely bullet out the main points of the readings; identify specific examples of geochemical concepts and techniques; ask lingering questions about the content; explain the relevance to the "question of the week; and pose a discussion question for your classmates. You will receive a template to follow. Submit a digital copy of your reflection to Moodle before lecture, AND bring a printed copy (one page, front and back) to class.
Exams: 30%		
Midterm Exam	15	This exam will be written for a 75-minute class period. It may include short answer responses, labeling of figures, interpretation of graphs, calculations, and specimen work (identification, interpretation). Expect at least one open-ended questions about how to best approach a geochemical research question (e.g., which isotope system is appropriate for determining material of a certain age, what kind of analytical instrument is the best tool to use to help you meet your goals and why, etc.). You may complete the exam to the best of your ability using pencil before switching to pen, accessing a handwritten resource notecard, and making corrections for partial credit. Content through the end of the previous week is fair game.
Final Exam	15	The final exam will follow the same format and guidelines as the midterm exam. It will be approximately twice the length of a typical lecture exam. The final will be cumulative, and will consist of ~50% concepts introduced before Exam 1 and ~50% new content.
Grant Proposal: 40%		
Preliminary Data	15	Lab periods will typically be dedicated to collecting, processing, and analyzing samples of bentonite (altered volcanic ash). Following each lab activity, you will write a concise, well-illustrated report of your methods and results, and you will respond to a specific research question (e.g., does bulk geochemistry suggest these samples are all from the same eruption?). These preliminary data reports will accompany your final grant proposal in an appendix.
Grant Proposal Checkpoints	5	There will be occasional checkpoints to ensure that you are on track for your grant proposal (e.g., pitch your top three proposal ideas; outline the specific details of your proposal). These will be announced in advance, and will often be completed during a scheduled lab period.
Peer Support	5	Research is a collaborative endeavor. You will often be called upon to assist your classmates, be it in the field, in lab, or in the peer-review process. Your participation in the collaborative process will be factored into your final grade.
Submitted Proposal (written)	10	Your final grant proposal will include an abstract, a clear and well-defined project statement, background context, supporting preliminary data, a plan of attack, and a statement about the significance of the work. The writing must be persuasive. The text of the proposal will be 2 pages (abstract, figures, references, and your data appendix not included).
Proposal Presentation	5	You will present your proposal to your peers and a panel of judges on the final day of class. You must persuade your audience that—in a competitive funding environment—your project is good investment (i.e., well-reasoned, achievable, impactful).

Important Dates:

02/07	Field trip: Whitehall Quarry (weather dependent)	05/07	Submit grant presentation and abstract
02/21	Field trip: Whitehall Quarry (weather backup)	05/09	Present grant proposal to review panel
03/14	Midterm Exam	05/10	Submit final grant proposal
03/28	Guest Speaker: Scott Samson	TBA	Final Exam details announced by Registrar

Weekly details (themes, readings, etc.) will be available on Moodle and updated regularly. Minor deadlines and grant proposal checkpoints will be announced in class at least one week in advance.