

Overview:

This course introduces the physical and chemical properties of minerals within their context as the fundamental building blocks of rocks. Particular emphasis will be given to learning the association of minerals with the rock types they typically occur in, as well as a basic introduction to the petrologic processes that form them. Skills to be learned include mineral observation and identification techniques in hand samples and thin section, as well as an introduction to quantitative analytical techniques such as SEM and XRD, and how to use the data produced by each technique.

Instructors:

Prof. Kari Cooper, kmcooper@ucdavis.edu, Room 3127 Earth & Physical Sciences Building

Lecture TA: Kate Hewitt, kchewitt@ucdavis.edu

Lab TA's: Tyler Schlieder, tdschlied@ucdavis.edu; Elizabeth Grant, ergrant@ucdavis.edu

Office Hours:

Cooper: TBA

Hewitt: TBA

Schlieder: M 1-3 pm (zoom link on Canvas)

Grant: TBA

Meeting Times/Locations:

Lectures:

MWF: 10:00-10:50 am, zoom lectures (will be a combination of live and pre-recorded)

Lab sections:

A01: M 4:10-7:00 pm, EPS 1316

A02: W 1:10-4:00 pm, EPS 1316

Important Dates:

1. Labs begin: Mon-Weds, **October 5-7** (in EPS 1316)
2. Veteran's Day Holiday: Wednesday **Nov. 11**: no labs this week for either lab section
3. Thanksgiving Day Holiday: Thursday-Friday **Nov. 26-27**: no class (but note that labs still run M-W Nov 23-25!)

Textbook:

Required text:

Earth Materials: Introduction to Mineralogy and Petrology, Klein & Philpotts, Cambridge University Press. Any edition is ok (1st Edition (2013), 2nd edition (2016)).

Optional/recommended:

An Introduction to the Rock-forming Minerals, 3rd Edition, Deere, Howie, and Zussman, Mineralogical Society, London, 2013.

Introduction to Optical Mineralogy, Nesse, W.D., Oxford University Press, 2004.

Course format

Class Lectures:

This year due to Covid-19 the lectures will be in an entirely online format. I will be using a hybrid approach with a combination of asynchronous (pre-recorded) and synchronous (live) material. I will be using an Active Learning model where students read and/or watch pre-recorded content prior to lecture times in order to get basic concepts, and then most of the time in live lectures will be devoted to questions from students about the material, additional explanations, and practicing applying the concepts with in-class assignments and small group work. **This means that it is very important that you come to class having finished the pre-assigned readings/videos, and be prepared to participate in class!** Education research shows that active learning strategies increase student learning and retention of material (Deslauriers, L., Schelew, E. & Wieman, C., 2011, *Science* 332, 862- 864) and has a particularly beneficial effect for underrepresented groups (Theobald et al. 2020, *Proc. Nat. Acad. Sci.* 117, 6476–6483). Plus, it's a lot more interesting and fun than just being lectured at!

Labs:

Labs this year will include both an in-person component and an online component. We took the decision about whether to offer GEL60 labs in person very seriously, and took into consideration the learning objectives of the course and how it fits into the major, the impact on TAs, the safety of students and instructors, and the potential impacts on majors' ability to complete the degree on time. We decided to run some components of the labs to be in person because there are some skills and some essential information that can't be taught online. However, in order to minimize time spent in person and therefore exposure for all concerned, we are cutting the in-person component down to the minimum necessary. The labs will now consist of three parts: 1) pre-lab reading, videos, and online content. 2) in-person labs with access to samples and microscopes. 3) Post-lab online content and questions building on concepts and skills learned during the hands-on part of the labs. The in-person part of the labs will be during the regularly-scheduled lab period and must be completed during that three-hour lab period – **there will be no access to microscopes or samples outside of the scheduled labs.** The in-person part of the labs will be supplemented with online material both before (pre-lab part) and after (post-lab part) scheduled lab periods. In order to make the most of the limited time with hand samples and microscopes, **you must complete the pre-lab assignments before arriving** to the scheduled lab.

Hand Lens: A 10x hand lens is required for this course. If you are a geology major and do not own one, now is the time to buy one. The bookstore should carry them or you can get them through other sources such as Amazon.com. If you have any questions about the type or quality of hand lens necessary, please talk to one of the TAs.

Grading:

Grading will be based 50% on lecture material and 50% on lab material, as follows:

Lecture quizzes, in-class assignments, and participation	20%
Problem sets	15%
Lecture Final Exam	15%

Lab exercises and quizzes	50%
---------------------------	-----

Quizzes, in-class assignments, and participation: There will be a short quiz due before most of the lectures, based on reading and/or videos assigned for the day. In addition, there will be short in-class assignments associated with most class meetings. These assignments must be submitted during class and there is no make-up for them. The points for participation will be tracked partly through the in-class assignments and partly through how actively you are participating during discussions.

Problem sets: There will be seven problem sets due throughout the quarter. They will usually be due one week after being posted. You are welcome to turn in your problem set early; **however, no credit will be given for problem sets turned in late.** Solution keys will not be posted, though every effort will be made to grade and hand them back before the next problem set is assigned. I highly recommend you take advantage of office hours to review the problem sets after they have been graded. These will build on lectures and reading by giving you some experience working through problems and calculations related to the course material, as well as having some questions that are similar to exam questions. They will be posted approximately one week before each due date.

Lecture Final Exam: The final exam for the course is scheduled for Tue. Dec.15 at 1:00pm. The final exam for the course will be an online, asynchronous exam which will be open for approximately 24 hours during a time window that includes the scheduled exam time. More details will be provided closer to the end of the quarter.

Laboratory Exercises: The laboratory sessions meet once a week. **In-person attendance is mandatory.** These sessions are an integral part of this course and you are required to attend. Labs will typically consist of three parts: a pre-meeting assignment, in-lab hands-on exercises, and post-lab questions following up on skills that you develop during the in-person part, supplemented with online material. The pre-lab assignment is due before the lab period. The in-lab part is due at the end of your lab section. As with problem sets, **no credit will be given for labs turned in late.** Late labs, however, will be corrected by your TAs.

Lab quizzes: Pre-lab quizzes will be based on the reading and/or pre-recorded videos that prepare you for the hands-on exercises during the lab period. In addition, post-lab quizzes will assess the skills and concepts covered during the lab period.

COVID-19 Safety Protocols

Due to the ongoing Covid-19 pandemic, strict safety protocols will be in place for the in-person lab components. These are necessary in order to maintain health and safety of everyone involved in the lab. Any students who don't follow these protocols will be required to leave the lab. The following requirements apply to all faculty, staff and students while on campus (see full Campus Policy 290-01 at <https://campusready.ucdavis.edu/public-health-policies-requirements>)

1. Face coverings are required both indoors and outside.
2. Maintain six feet of physical distance from others whenever possible.

3. Wash or disinfect your hands frequently.
4. Monitor your symptoms, stay home if you're sick and report positive cases.
5. Disinfect your personal and shared spaces regularly.

Based on these requirements, the following specific rules will be strictly enforced:

- Each TA, instructor, and student entering the building will complete the [COVID-19 Symptom Survey](#). The results of this survey must be emailed to gel-survey@ucdavis.edu for record-keeping.
- Students will wait outside the north entrance to the EPS building (the door to the lobby and main stairwell) until the TA opens the building doors to let them in. Students will not be allowed in the building without showing the TA an email with the results of their UCD symptom survey.
- If students are feeling sick or have been in contact with known cases of COVID, they will be asked to stay home.
- Students and instructors must report any cases of COVID as per campus' reporting requirements (see <https://safetyservices.ucdavis.edu/coronavirus/reporting-concerns-confirmed-cases>)
- If any positive test results or suspected infections are reported, all attendees of that lab section will be notified and asked to isolate for the recommended time. Alternative assignments will be provided.
- All surfaces, microscopes, and samples will be cleaned and disinfected by Custodial Services and/or the TAs prior to each lab section.

During lab:

- Students will enter through a designated door and go straight to their assigned lab seat
- Students will stay at their microscope the whole time except to get wipes or gloves, or to go to the restroom
- Masks are required and everyone must maintain a distance of at least 6 feet from all others in the lab.
- Gloves are required when handling rock samples and microscopes
- TAs will answer questions using their microscope with a camera hooked up to a projector
- Students will exit through a designated door

Accessibility and accommodations:

If you have concerns about accessibility or need special accommodations for exams or lectures, first contact the UC Davis Student Disability Center, and if they determine that special accommodations are warranted, I will work with you to find a solution. Accommodations must be put in place *before* the lab sections or exams, and it is your responsibility to start the process early enough to allow enough time for this to happen.

Academic honesty:

Academic misconduct such as cheating or plagiarism will be dealt with in accord with the Code of Academic Conduct. You must review this document before the course and confirm that you have reviewed it online (you will be prompted to do so by email and on MyUCDavis). An updated version can be found at <http://sja.ucdavis.edu/files/cac.pdf>. You must also confirm your participation in this course by following this link: participate.ucdavis.edu.

Academic Senate policy *requires* instructors to report any suspected cases of cheating or plagiarism to Student Judicial Affairs.

Schedule

GEL 60 2020: Earth and Planetary Materials						
Week	day	date	Lecture Topics	Lecture Reading	Lab Topics	Problem Sets
0	Wednesday	9/30/20	Introduction to Earth Materials course	Ch. 1-3, K&P	No lab	
	Friday	10/2/20	Mineral prop's and ID continued	Ch. 1-3, K&P		Problem set 1 posted
1	Monday	10/5/20	Basics of crystallography	Ch. 4-5, K&P	Hand sample ID	
	Wednesday	10/7/20	Crystallography 2	Ch. 4-5, K&P		
	Friday	10/9/20	Wrap up crystallography; intro to optical mineralogy	Ch. 6, K&P		Problem set 1 due; Problem set 2 posted
2	Monday	10/12/20	Optical microscopy 2	Ch. 6, K&P	Optical mineralogy 1	
	Wednesday	10/14/20	Optical microscopy 3	Ch. 6, K&P		
	Friday	10/16/20	optical 4	Ch. 6, K&P		Problem set 2 due
3	Monday	10/19/20	optical wrap-up and summary	Ch. 7, K&P	Optical 2	
	Wednesday	10/21/20	Igneous rock forming minerals	Ch. 7, K&P		
	Friday	10/23/20	More on igneous minerals	Ch. 7, K&P		Problem set 3 posted
4	Monday	10/26/20	Formation of igneous rocks, phase diagrams	Ch. 9, K&P	Igneous Minerals	
	Wednesday	10/28/20	igneous rock occurrence and classification	Ch. 9-10, K&P		
	Friday	10/30/20	Igneous rocks and their tectonic associations	Ch. 9-10, K&P		Problem set 3 due
5	Monday	11/2/20	Metamorphic rock-forming minerals; prograde vs. retrograde index minerals		Metamorphic Minerals 1	
	Wednesday	11/4/20	Intro to thermodynamics			
	Friday	11/6/20	thermodynamics, cont.	Ch. 14 (13), K&P		Problem set 4 posted
6	Monday	11/9/20	Metamorphic grade and facies	Ch. 8 (14), K&P	No lab	
	Wednesday	11/11/20	Veteran's day Holiday	Ch. 8 (14), K&P		
	Friday	11/13/20	Tectonic association of metamorphic rocks	Ch. 15 (14), K&P		Problem set 4 due; Problem set 5 posted
7	Monday	11/16/20	catch up day		Metamorphic Minerals 2	
	Wednesday	11/18/20	Ore minerals and economic geology			
	Friday	11/20/20	Ore minerals and economic geology	Ch. 15 (14), K&P		Problem set 5 due; Problem set 6 posted
8	Monday	11/23/20	Sedimentary rock-forming minerals	Ch. 16, K&P	Sedimentary Minerals	
	Wednesday	11/25/20	Sedimentary rock formation and processes, classification and association	Ch. 16 (15), K&P		
	Friday	11/27/20	Thanksgiving holiday			
9	Monday	11/30/20	reading exercise	Ch. 11-12, K&P	no lab	Problem set 6 due
	Wednesday	12/2/20	reading exercise	TBA		Problem set 7 posted
	Friday	12/4/20	Analytical methods: intro to X-ray diffraction			
10	Monday	12/7/20	XRD continued	TBA	no lab	
	Wednesday	12/9/20	intro to electron microbeam methods	TBA		
	Friday	12/11/20	Review for final exam			Problem set 7 due
Finals week	Monday	12/9/19	Final exam, 10:30-12:30			