



## Geology 375: Petrology

Concord University, Department of Physical Sciences  
Program in Environmental Geosciences  
<http://www.concord.edu/physci/node/3>

This syllabus is subject to change based on the needs of the class. Changes may be announced in class, by e-mail, or online.

**Semester Taught:** Spring 2019  
**Credit Hours:** 4 credits  
**Course Sections & CRNs:** Lecture: section 1, CRN 20261 Lab: section 1A CRN 20262 (Note: Students must register for both.)  
**Course Place & Time:** Lecture: Science 308 MWF 1:00-1:50 pm Lab: Science 307 F 2:00-4:50 pm  
**Course Prerequisites:** Geol 369 Earth Materials and Minerals

**Professor:** Dr. Stephen C. Kuehn (Steve), Associate Professor of Geology  
**Office:** Science, Room 106 (the Electron Microprobe Lab)  
**Office Hours:** M 12-1, Tu 11-12, W 11-12 Any changes to these hours will be announced in class and/or posted next to my office door. Additionally, you may make an appointment or just stop by. I'm typically on campus 8a-6p. You may also contact me by e-mail, and I will typically reply within 48 hours or less.  
**E-mail, Phone, & FAX:** [skuehn@concord.edu](mailto:skuehn@concord.edu) 304-384-6322 office 304-384-6022 FAX **Twitter:** @CUGeology

**Catalog Description:** Description, classification, and geochemistry of rocks in hand sample and thin section. Includes study of the origin of rock bodies within various tectonic environments.

**Rationale, Purpose, and Overview of this Course:** Petrology is the study of rocks as tools for understanding geologic processes and geologic history. Rocks can tell us about the origin of the crust and mantle, the tectonic development of mountain ranges, the eruptive history and inner workings of volcanoes, and the formation of mineral resources. Because nearly all rocks are aggregates of minerals, this course builds directly upon mineralogy. In Petrology you will learn to recognize, describe, and classify many rocks both in hand sample and in thin section. Furthermore, you will learn to connect rock textures, mineralogy, bulk chemical composition, and mineral compositions with rock origin, including the physical and chemical processes involved and the tectonic setting. In other words, you will learn to deduce petrogenesis and geologic history from rock characteristics and associations. Lab work is a major focus of the course and will commonly require individual work outside of the scheduled lab sessions. You will make repeated use of petrographic microscopes and the electron microprobe. You will engage in authentic course-based research. You will also learn to communicate the results of your work and your research experiences through reports, presentations, blogs, and social media.

**Course material system:** <http://moodle.concord.edu> Log in to Moodle using your MyCU username and password. Notify your instructor if you have difficulty accessing Moodle materials.

**Hardware/Software needed:** Computer with internet access; MS Office suite or similar for documents, presentations, & spreadsheets

**Required Text, Etc.:** J.D. Winter, 2009, Principles of Igneous and Metamorphic Petrology, Pearson, ISBN 9780321592576; A.R. Philpotts, 2003, Petrography of Igneous and Metamorphic Rocks, Waveland, ISBN 1577662954  
A bound lab/field notebook  
Other readings/materials will be provided on Moodle (e.g. selected journal articles) or via hand-outs.  
Also useful (copies may be available in S307/308): Petrology: Igneous, Sedimentary, and Metamorphic by Blatt, Tracy, and Owens; Petrography Laboratory Manual by Raymond; Using Geochemical Data by Rollinson; Manual of Field Geology by Compton; an optical mineralogy text (e.g. Nesse); an atlas of igneous rocks (e.g. McKenzie, Donaldson, Guilford); an atlas of minerals/rocks in thin section (e.g. MacKenzie and Guilford or Perkins and Henke).

**CU Educational Goals and Mission:** The mission of Concord University is to provide quality, liberal arts based education, to foster scholarly and creative activities, and to serve the regional community. The educational programs of Concord University are designed to foster skills, knowledge, and attitudes. A detailed description of the Concord mission and goals may be found on the catalog home page: <http://catalog.concord.edu>; Note: Not all CU goals are specifically relevant to this course. As an upper-level core course for majors, Geol 375 addresses aspects of the following educational goals: Skills (1-7), Knowledge (2, 3, 4, 5, 7), and Attitudes (3, 6, 7).

**Overarching Course Learning Goals & Themes for the Semester** By the end of this course, successful students should be able to:

1. Demonstrate mastery of key concepts related to topics in course schedule below, including the physical and chemical Earth processes which generate igneous and metamorphic rocks
2. Safely utilize laboratory equipment including rock saws, petrographic microscopes, and the electron microprobe to prepare samples and collect data
3. Record work progress and scientific observations using written descriptions and sketches in laboratory notebooks and on blank forms
4. Interpret mineralogical, textural, and geochemical data in context
5. Describe in detail and classify igneous and metamorphic rocks using hand samples, thin sections, and geochemical data
6. Communicate scientific research outcomes to both specialists and non-specialists
  - a. Prepare a research poster and present it to a non-specialist audience
  - b. Prepare a journal-format research paper which includes an abstract, introduction, methods, results, figures, data tables, and references
  - c. Demonstrate an understanding of successful science communication practices and how to tailor science communication to different audiences

**Grading:** Your grade will be based on laboratory work & lab notes, problem sets, short quizzes, exams (two short exams during class time plus a cumulative final), research reports (written paper & poster presentation), science communication assignments, and participation. Several of these items are described further in sections below. Grades are calculated from the total points earned relative to points possible. Lecture exams and quizzes constitute about 40% of the available points, the lab practical ~10%, research report ~15%, research poster presentation ~10%, and the labs and other assignments ~25%.

Scale: A 90-100% B 80-89% C 70-79% D 60-80% F less than 60%

**Make-Up Policy:** Arrangements must be made in advance to schedule an alternate time if you anticipate missing a scheduled exam for any reason. No make-ups are needed for the small quizzes as it is possible to earn full credit on the small quizzes even with limited absences. Assignments will normally be expected to be completed and turned in on time as late work can disrupt the class experience for you and for others. Assignment may be accepted late in some circumstances, but you must consult with me for pre-approval prior to the deadline, and reduced credit will apply (loss of 20% per week).

**Daily Preparation:** You will find concepts easier to grasp in class and lab, and you will find your class time to be more productive if you come prepared via readings, related introductory work, etc. and have a positive attitude toward learning. Know that learning is achieved and good grades are earned through careful preparation, dedication, focused work, and perseverance. It is recommended that you make *hand-written* notes while reading, during class, etc. Petrology can be challenging, but it is a powerful and rewarding tool for deciphering earth and planetary processes and is therefore well worth the effort.

**Labs and Problem Sets:** Labs will consist primarily of practical work. This will include detailed description of hand samples, examination and description of thin sections, and development of petrologic interpretations. Lab will also include a hands-on experience with equipment and instruments including sample preparation equipment, microscopes, scanners, and the electron microprobe. Most labs will be due one or two weeks after they are assigned. Be aware that some scheduled time outside of regular class hours will be necessary for everyone to have sufficient access to equipment like thin section machines and the electron microprobe. Some of your Friday lab hours may be banked for this purpose. In addition to the sample-based labs, you will complete a few problem sets. These will include working with geochemical data, phase diagrams, etc. When working in the lab and on your research project, you will be expected to record your activity (date, time, purpose, notes, questions, etc.) in your bound notebook. Notebooks will be collected periodically.

**IUSE Research Project and Science Communication:** This course is part of a multi-semester research sequence and science communication training curriculum. Thus, this course will integrate with the research work that you have completed in Geol 205 and Geol 369 and have or will complete in Geol 385 and Geol 404 Field Geology.

You will continue working on your research questions and continue developing your laboratory research skills. To practice communication aimed at other scientists, you will finish preparing a journal-style manuscript describing and interpreting the results of your research from this and prior semesters. You will also prepare and present a poster at Undergraduate Research Day. There will also be activities designed to practice science communication designed for the public.

**Exams:** Lecture exams and quizzes will include a mixture of question types (e.g. multiple-choice, drawing & labeling, fill-in, short answer, essay, and practical application). Study questions will be provided to aid in your preparation. You may also bring a single, hand-written 3x5 index card to exams 1 & 2. You may use a hand-written 4x6 card for the final. During lecture/final exams, backpacks and electronic devices placed in silent mode (cell phone, iPod, tablet, portable computer, iWatch, etc.) will be left at the front of the room. The presence in your possession of such a device during a lecture/final exam is considered academic dishonesty, independent of whether it was used or not and will result in a grade of F for the exam or course. The laboratory practical exam will focus on hand sample and thin section description materials. You may use reference books and similar materials as needed during the lab practical. Further clarification of appropriate materials for the lab practical will be discussed in class.

**Group work, individual work, and academic integrity:** You are encouraged to discuss questions, ideas, and principles with each other as you work in lab, prepare reports and presentations, and prepare for exams. However, except for any explicitly-assigned group assignments/exercises where you are instructed otherwise, the ultimate product that you turn in must be your own work in your own words. In addition, you are not to use materials produced by students in previous semesters of this course, nor are you to provide any similar materials future students to see or use. See also the CU Academic Dishonesty and Honor Code statements below.

**Attendance and participation:** Regular attendance is essential to performing well in this course. Since the class is small, I will notice if you are late or absent frequently. While in class, you are expected to be engaged with the course activity of the day and behave in a manner that allows all students in the classroom to fully participate and learn. Lecture or lab classes cancelled for any reason will be accommodated via Moodle or substitute work. Since electronic devices are distractions to other students in the classroom and have been scientifically shown to hinder student learning during class time, their use is not permitted during class without prior permission. Please turn them off and put them away prior to the start of class.

**Summary Course Schedule:**

Weeks 1-2	Course Introduction Fundamental concepts in petrology Minerals in Igneous Rocks; Review of rock-forming minerals Introduction to igneous textures Research project planning
Weeks 3-4	Igneous textures and their origin; Rock classification and nomenclature Science Communication and Social Media Begin research activity
Weeks 5-6	Science Communication and Social Media Properties of magmas Exam 1 (February 18)
Weeks 7-8	Properties of magmas; Volcanism and Intrusion Thermodynamics and Phase Diagrams
Week 9	Spring Break
Weeks 10-11	Thermodynamics and Phase Diagrams Magma generation; Magma crystallization and mixing
Weeks 12-13	Geochemistry – major/minor elements, trace elements, isotopes
Weeks 14-15	Exam 2 (April 15) Introduction to metamorphism and metamorphic rocks Metamorphic reactions, assemblages, facies, pressure & temperature Undergraduate Research Day
Weeks 16-17	Course wrap-up Lab practical (Friday, May 3) Research papers due May 6 by 5 pm Final exam (Friday, May 10 11:30 am -1:45 pm)

*The most current schedule, readings, assignment dates, and exam dates may be found on Moodle.*

In the event of campus closure (e.g. due to snow), check Moodle for schedule and assignment changes.

In the case of inclement weather, the lecture start time is changed from 1:00 to 1:45.

**Privacy Information :** Concord follows the federal Family Educational Rights and Privacy Act (FERPA) in regard to student academic records. The CU Moodle learning management system and the LMS administrators follow industry recommendations to keep your personal information private. The Moodle privacy policy is described here: <https://moodle.org/mod/page/view.php?id=8148> Photos from this course may occasionally be posted to Concord geology program Twitter and FaceBook accounts. Please also be advised that e-mail is not a secure form of communication. To best protect your confidential educational information, face-to-face communication is recommended. If you initiate a request via your official Concord e-mail address, I will interpret this as constituting your permission to release the requested information to you via reply to the same address.

**Free Tutoring:** Free tutoring is available both on campus on online for many courses. Contact the Academic Success Center ([asc@concord.edu](mailto:asc@concord.edu); 304-384-6074 <http://hub.concord.edu/academicsuccess/>) for more information.

**Quick reference teaching schedule:**

Dr. Steve Kuehn - Spring 2019 Course Schedule					
	Monday	Tuesday	Wednesday	Thursday	Friday
8:00					
9:00					
10:00					
11:00		Office Hour	Office Hour		
12:00	Office Hour		occasional Faculty Meetings		
1:00	Geol 375 CRN 20261 Petrology in Science 309 1:00-1:50 pm		Geol 375 CRN 20261 Petrology in Science 309 1:00-1:50 pm		Geol 375 CRN 20261 Petrology in Science 309 1:00-1:50 pm
2:00					Geol 375 Lab CRN 20262 Petrology in Science 306/307/308 2:00-4:50 pm
3:00	Faculty Meeting 2nd & 4th Mondays each month				
4:00					
5:00					

Other commitments not listed: Student research times; Microprobe lab workers and projects; Classes/labs using microprobe; Other meetings

**Mandatory Syllabus Statements Which Apply to All CU Courses:**

**Accessibility/Accommodations:**

Concord University is committed to responding to the needs of students with disabilities as defined by the Americans with Disabilities Act. Please inform your instructor at the beginning of the class semester if you have a disability and are requesting accommodations. It is your responsibility to self-disclose that you are requesting accommodations. The University and instructor will provide you with a reasonable accommodation. You should register with CU's Disability Services Office, located in the Athens campus Jerry and Jean Beasley Student Center, Bottom Floor, across from the Campus Post Office. The Disability Services Office phone is 304-384-6086 or you can email the Director, Nancy Ellison, at [nellison@concord.edu](mailto:nellison@concord.edu) for assistance. Website: <https://www.concord.edu/multicultural/node/13>

**Academic Dishonesty**

Academic dishonesty is morally unacceptable as well as destructive to the learning and teaching atmosphere. Academic dishonesty includes the giving or receiving of improper help on examinations or assignments, falsifying documents, and plagiarism (the act of stealing and using, as one's own, the ideas or the expression of the ideas of another). Such dishonesty can lead to a variety of penalties — including but not limited to failure of assignment, failure of course, loss of institutional privileges, or dismissal from the University. (See University Catalog Academic Policies and Procedures <http://catalog.concord.edu/content.php?catoid=5&navoid=243> )

**Concord University Honor Code**

A Concord University Honor Code was approved by students, staff, faculty, administration, and the CU Board of Governors. The Code states:

*"As a member of the Concord University Community I will act with honesty and integrity in accordance with our fundamental principles and I will respect myself and others while challenging them to do the same."*

The Honor Code is intended to unite the Concord community behind a culture of honesty, integrity, and civility.

**Class/Online Attendance Policy**

Regular class attendance is part of a student's academic obligation at Concord. Irregular attendance may affect academic performance adversely and is detrimental to the atmosphere of a class. (See University Catalog Academic Policies and Procedures.)

**Emergency Alert System**

In an effort to increase safety and security on our campus, Concord University encourages everyone to register for instant text message alerts. Alerts will only be used for security and safety notices. All students, faculty, and staff are eligible to receive text message alerts on their cell phones or email alerts. Please contact the IT Help Desk for further assistance (304-384-5291).

### **Emergency Information**

Emergency/courtesy telephones are located at the main entrance of each residence hall and at various other locations on campus. Emergency telephones can be identified by the flashing blue light and will provide the user with a direct link to Public Safety at the press of a button. To report an on-campus emergency, call 304-384-5357 or 911. The Office of Public Safety is located on the bottom floor of the Rahall Technology Center. For further emergency information go to: <http://www.concord.edu/administration/office-public-safety> .

### **Inclement Weather Policy**

As a general policy, the University will remain in normal operations during adverse weather conditions. In the event of severe weather conditions, the following may occur:

#### University Closure

No students or employees are to report.

#### Classes Cancelled

Students do NOT report BUT employees are expected to report to work at their normal time.

#### Operating on an Inclement Weather Delay

Under this schedule, all 8 a.m. classes will start at 10 a.m. Students and faculty will follow the Inclement Weather Schedule. (See <http://www.concord.edu/emergency-alerts> for Athens/Beckley Inclement Weather Schedules.)

*\*Announcements invoking the late schedule or other options referenced above are aired on area radio and television stations and are sent as text and email messages to those enrolled for this service.*

### **Student Conduct**

In classrooms, online, laboratories, and during any activities that are part of course requirements, students are expected to observe reasonable rules of conduct.

### **Sexual Harassment & Assault**

Federal law, Title IX, and Concord University policy prohibits discrimination, harassment, and violence based on sex and gender (Including sexual harassment, sexual assault, domestic/dating violence, stalking, sexual exploitation, and retaliation). If you or someone you know has been harassed or assaulted, you can receive confidential counseling support through the Concord University Counseling Center (304-384-5290). Alleged Violations can be reported non-confidentially to the Concord University Title IX Coordinator at 304-384-6327 or [titleix@concord.edu](mailto:titleix@concord.edu). Reports to Campus Security can be made at (304-384-5357). As an employee at Concord University, I am a mandatory reporter which means I must report any sexual misconduct I am made aware of. This includes verbal or written (such as in an assignment) disclosures of sexual harassment or sexual assault.

### **Technology Services**

Contact the CU Help Desk at extension 5291 from campus or 304-384-5291 off campus. You may also e-mail [cuhelpdesk@concord.edu](mailto:cuhelpdesk@concord.edu).