EARTH MATERIALS, GEO416K, FALL 2010

Lecture: MWF 10-11A, JGB 2.218; Lab: JGB3.114
Class Unique Numbers: 26710, 26715, 26720, 26725, 26730, 26735, 26740, 26745

"I knock at the stone's front door./"It's only me, let me come in."/ "I don't have a door," says the stone." Conversation with a Stone, Wislawa Szymborska

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Table of Contents

1. Rationale……1
2.Course Aims and Objectives……..1
2.1. Aims…….1
2.2.Learning Objectives…….....1
3. Format and Procedures…….……2
4. My Assumptions…….....2
5. Course Requirements…….....2
5.1. Attendance, participation..2
5.2. Course Readings……2
5.3. Blackboard……3
6. Assignments, Assessment, Evaluation…….....3
7. Undergraduate Award……..…3
8. Critical Dates……4
9. Academic Integrity……4
10. Other University Notices…....4
10.1. Q Drop Policy……4
10.2. Documented Disability…...4
10.3. Behavior Concerns…….....5
10.4. Use of E-mail……..5
10.5. Religious Holy Days……..5
10.6. Emergency Evacuation…..5
11. Tentative Course Schedule.....5

1. Rationale

This course is geared towards introducing you to minerals, mineral study techniques, igneous and metamorphic rocks, ore deposits, and ore formation processes. Minerals are the fundamental building blocks of all rocks, and consequently the Earth and other planets. Mineralogy combines elements of physics, chemistry, math, and geology and is a descriptive, analytical, and experimental science. Mineralogists try to understand the physical properties, chemical composition, crystal structure, occurrence, and distribution of minerals, and the physical and chemical processes that lead to the formation and destruction of minerals in nature. Knowledge of mineralogy is the basis for the understanding of geological processes, including the formation and alteration of the Earth and other planets as a function of time. Many minerals influence the economy and play a meaningful role in political decision-making. This course will **focus primarily on igneous and metamorphic rocks** (as opposed to sedimentary rocks), and **ore deposits**. Minerals stimulate the development of important technological materials (metals, semiconductors, building materials, glasses, ceramics). Many modern analytical methods and instruments were developed so that mineralogical and geochemical problems could be solved.

2. Course Aims and Objectives

2.1. Aims

The goal of this course is to improve your understanding the physical, chemical, crystallographic and structural properties of rocks and minerals. You will identify a range of minerals, and also igneous and metamorphic rocks. You will learn why these substances are important in our day-to-day lives.

2.2. Specific Learning Objectives

By the end of this course, students will:

- Develop an understanding of the history of the field of mineralogy and petrography, identify common rocks and minerals, learn about instruments used to study rocks and minerals, independently operate an optical microscope to identify minerals and textures in rock thin sections, associate mineral properties with their chemistry, develop an understanding of symmetry and its role in mineral classification, and learn about the origin of mineral properties (magnetism, color, radioactivity). Students will also learn to identify and begin to understand the origin of common igneous and metamorphic rocks. Students will be able to classify rock types, understand their formation, and learn why they could be important in our day-to-day lives.

- Complete lab assignments geared towards increasing skills they would use in the field and laboratory as geoscientists. Many rocks and minerals are identified based on their physical and optical properties, so students will learn to use an optical microscope and begin to identify specific textures within igneous and metamorphic rocks.
- Students will also complete a Wikipedia.com entry regarding an unusual mineral that is currently missing from the on-line dictionary. The entry will be developed throughout the semester as different topics regarding mineral properties are discussed.

3. Format and Procedures

The course consists of **3 lecture hours and 4 laboratory hours** a week for one semester. During the lecture, we will discuss specific topics related to the course. You are expected to attend each lecture, take notes, and actively participate. **Labs in this class are required** and run 2 hours twice a week. During lab time, you will be expected to work on and complete a set of practical exercises that will help you understand the concepts presented in lecture. Come to lab on time and prepared.

Collaborate with your classmates to complete the lab exercises for this class. Asking each other questions, discussing samples, etc., are absolutely necessary to successfully complete the work. However, it is unacceptable to turn in any work that is not your own.

4. My Assumptions

Prerequisites for the course include GEO401, 303, or 312K with a grade of at least *C,* CHEM301 with a grade of at least *C,* and credit with a grade of at least *C* or registration for CHEM302. Based on these prerequisites, I assume that you may be able to identify a few common rocks and minerals and understand the basics of plate tectonics and chemistry. I assume you understand this class may involve chemistry, physics, and math, despite the fact that it is a geology course.

5. Course Requirements

5.1. Class attendance and participation policy

Attend all scheduled classes and arrive on time. Late arrivals and early departures are disruptive. While there is no point penalty specified for class absences, experience has shown a correlation between poor class attendance and low grades.

Keep all class and lab-work in a jumbo 3-ring binder. Periodically, the TAs and I may check to make sure that you are staying organized. Think of this class as a job: I expect you to show up on time, work hard, and make every effort to learn.

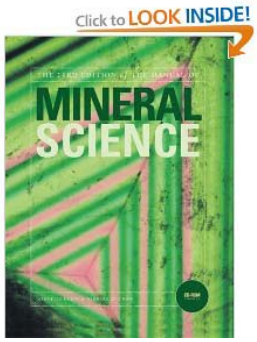
The expectation for all students in this course is that complete integrity will be demonstrated at all times. Violations of academic dishonesty will be reported for administrative action. Although I encourage you to discuss the lab problems with each other and me, your answers should be written only by you.

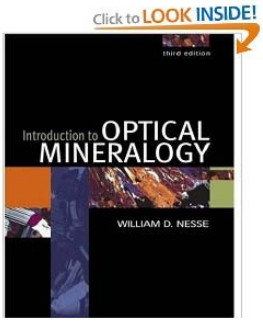
5.2. Course Readings/Materials

Required Textbook: Klein, C., Dutrow, B. (2007) Manual of Mineral Science (Manual of Mineralogy), 23rd edition, Wiley Publisher, 716 pages, ISBN-10: 0471721573, ISBN-13: 978-0471721574. (earlier editions are fine)

Recommended Textbook: Nesse, W.D. (2004) Introduction to Optical Mineralogy, 3rd edition, Oxford University Press, 370 pages, ISBN-10: 0195149106 , ISBN-13: 978-0195149104. (earlier editions are fine)

Course packet: Purchase and download additional readings and laboratory exercises for the course from University Readers (http://www.universityreaders.com/). The course packet will be sent to you as a 3-hole punched in shrink wrap, and 20% of the reader should be available for immediate download. Purchase a binder to place the course packet in, and add some additional paper for questions you may need to answer during the laboratory.





Supplies needed: Bring a pencil to complete the laboratory exercises. Some labs require colored pencils. We have hand lenses available, but you may like your own (10x magnification). Bring your required textbook to lab.

Library Reserves: Copies of the required and recommended textbooks are available in the Geology Library JGB4.202 for a loan period of 24 hours.

5.3. Use of Blackboard in Class

In this class I use Blackboard—a Web-based course management system with password-protected access at http://courses.utexas.edu —to distribute course materials, to communicate and collaborate online, to post grades, to submit Wikipedia project assignments, and to provide you practice lecture exams. You can find support in using Blackboard at the ITS Help Desk at 475-9400, Monday through Friday, 8 a.m. to 6 p.m.

I will post PowerPoint slides on Blackboard prior to each lecture and they will be available throughout the semester to help you study. You are welcome to bring your laptop to class and access these during lecture. Recent studies indicate that students who bring laptops to class perform worse (on average) than their non-laptop using peers, and are much less likely to pay attention in class. Some students, however, have disabilities that require their use or find that it is their learning style. Laptops can be a distraction for other students. If you use your laptop in class, do not be a distraction to other students or to me. You may also decide not to come to lecture if the PowerPoint slides are available on Blackboard. This is not recommended my slides are largely figures in your textbook.

6. Assignments, Assessment, and Evaluation

Grades in this course will be based on:

- Lecture Exam 1 (15%) multiple choice, graded by Dr. Catlos
- Lecture Exam 2 (15%) multiple choice, based on material since lecture exam 1, graded by Dr. Catlos
- Lecture Final Exam (20%) multiple choice, cumulative, graded by Dr. Catlos
- Lab Exercises (10%) short answer, graded by your TA
- Lab Exam 1 (15%) Labs 1-7 only, short answer, graded by your TA
- Lab Final Exam (15%) Labs 8-15 only, short answer, graded by your TA, based on material since Lab Exam 1
- Wikipedia project (10%) short answer, graded by Dr. Catlos

Policy concerning laboratory exercises. Laboratory exercises should be completed and turned in during lab time. Some labs may take more than one period (2 hours), but no more than 2 (4 hours). Each question for the lab exercises has a clear point value; some labs are worth more points than others. We recommend that you read the labs and their assigned readings prior to your lab time. **Due to the nature and intense preparation involved in setting up these lab assignments, if you miss a one, you may NOT be able to make it up completely.** If you know you will miss a lab exercise, you should inform your TA at least 1 week prior to missing that day. We can make an effort to accommodate you in another lab time, but it cannot occur on a regular basis, as samples are limited and large class sizes are not ideal. Unexcused (and lame excused) late lab exercises will be docked 75% of the total possible points if they are turned in within 1 week. Excused late lab exercises must be made up in a timely fashion (determined by the instructor and TA), or else will also be docked 75%.

Policy concerning make-up exams. If you know you will miss an exam, you should inform Dr. Catlos and your TA at least 1 week prior to missing that day if possible. Documentation for why you will be missing that exam is required, and we will reschedule the makeup exam as soon as possible.

Preliminary information on Wikipedia project. As part of this course, you will be working towards creating a Wikipedia.com entry for an unusual mineral, for which Wikipedia has no entry. This project is worth 10% of your final grade. The project has due dates throughout the semester, and the final project will be due on November 29.

Subject-to-change notice. This syllabus represents the current plans and objectives of the course. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.

7. **Undergraduate Award**

The student with the highest grade in this class will be nominated for the Mineralogical Society of America's American Mineralogist Undergraduate (AMU). This Award recognizes outstanding students who have shown an interest and ability in the discipline of mineralogy. The student will be presented with a certificate at the department's Spring awards ceremony and receive a *Reviews in Mineralogy and Geochemistry* or *Monograph* volume chosen by the student. See: www.minsocam.org/MSA/Awards/UnderGrad_Award.html.

8. List of Critical Dates for Class Administration

- **August 25** Wednesday: Classes begin.
- **August 30** Monday: Last day of the official add/drop period; after this date, changes in registration require the approval of the department chair and usually the student's dean.
- **September 6** Monday: Labor Day holiday. No Laboratory Hours
- **September 7** Tuesday: No Laboratory Hours
- **September 8** Wednesday: Guest Lecture by Geology (Walter) Librarian, Lecture about Wikipedia Project
- **September 10** Friday: Twelfth class day; this is the date the official enrollment count is taken. Last day an undergraduate student may add a class except for rare and extenuating circumstances. Last day to drop a class for a possible refund.
- **September 22** Wednesday: Last day to drop a class without a possible academic penalty.
- **October 4-8** Monday-Friday: Dr. Catlos will be in Turkey for a geological conference.
- **October 8** Friday: Lecture Exam 1 (15%) multiple choice
- **October 11, 12** Monday, Tuesday: Lab Exam 1 (15%), short answer
- **October 20** Wednesday: Last day an undergraduate student may, with the dean's approval, withdraw from the University or drop a class except for urgent and substantiated, nonacademic reasons. Last day a student may change registration in a class to or from the pass/fail or credit/no credit basis.
- **November 1-3** Monday-Wednesday: Geological Society of America Conference.
- **November 15** Monday: Lecture Exam 2 (15%) multiple choice
- **November 24, 25** Wednesday, Thursday: No Laboratory Hours.
- **November 25-27** Thursday-Saturday: Thanksgiving holidays.
- **November 29** Monday: Wikipedia Project Due
- **December 1, 2** Wednesday, Thursday: Lab Final Exam (15%), short answer
- **December 3** Friday: Last class day.
- **December 8** Wednesday: 2:00-5:00 pm, Lecture Final Exam.

9. Academic Integrity

University of Texas Honor Code. The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community.

Each student in this course is expected to abide by the University of Texas Honor Code. Any work submitted by a student in this course for academic credit will be the student's own work. Collaboration is allowed to complete the laboratory exercises, but it is unacceptable to turn in any work that is not your own. Answers for the questions must be written in your own words. You are encouraged to study together and to discuss information and concepts covered in lecture and lab with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an email, an email attachment, a disk, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Code can also be extended to include failure of the course and University disciplinary action. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

10. Other University Notices and Policies

10.1. Q drop Policy. The State of Texas has enacted a law that limits the number of course drops for academic reasons to six (6). As stated in Senate Bill 1231: "Beginning with the fall 2007 academic term, an institution of higher education may not permit an undergraduate student a total of more than six dropped courses, including any course a transfer student has dropped at another institution of higher education, unless the student shows good cause for dropping more than that number."

10.2. Documented Disability Statement. Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities (SSD) at (512) 471-6259 (voice) or 1-866-329-3986 (video phone). Faculty are not required to provide accommodations without an official accommodation letter from SSD. Please notify me as quickly as possible if the material being presented in class is not accessible (e.g., instructional videos need captioning, course packets are not readable for proper alternative text conversion, etc.).

10.3. Behavior Concerns Advice Line (BCAL). If you are worried about someone who is acting differently, you may use the Behavior Concerns Advice Line to discuss by phone your concerns about another individual's behavior. This service is provided through a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance Program (EAP), and The University of Texas Police Department (UTPD). Call 512-232-5050 or visit http://www.utexas.edu/safety/bcal.

10.4. Use of E-mail for Official Correspondence to Students. It is the student's responsibility to keep the University informed as to changes in his or her e-mail address. Students are expected to check e-mail on a frequent and regular basis in order to stay current with University-related communications, recognizing that certain communications may be time-critical. It is recommended that e-mail be checked daily, but at a minimum, twice per week. The complete text of this policy and instructions for updating your e-mail address are available at http://www.utexas.edu/its/policies/emailnotify.html.

10.5. Religious Holy Days. By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, I will give you an opportunity to complete the missed work within a reasonable time after the absence.

10.6. Emergency Evacuation Policy. Occupants of buildings on the UT Austin campus are required to evacuate and assemble outside when a fire alarm is activated or an announcement is made. Familiarize yourself with all exit doors of the classroom and the building. Remember that the nearest exit door may not be the one you used when you entered the building. If you require assistance to evacuate, inform me in writing during the first week of class. In the event of an evacuation, follow my instructions or those of class instructors. Do not re-enter a building unless you're given instructions by the Austin Fire Department, the UT Austin Police Department, or the Fire Prevention Services office.

11. Tentative Course Schedule

This syllabus represents my current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.

Week/Dates	Main Topics	Readings	Laboratory Topic
Week 1			
8/25	Intro Course Outline & Details	Chp.1	No Lab
8/27	History of Mineralogy; Mineral Properties	Nickel & Grice (1998)	
Week 2			
8/30	Mineral Identification in Hand Specimen	Chp. 2	Lab 1. Mineral Properties
9/1	Review of Plate Tectonics, Elements, Bonding, Simple Structures	Chp. 3	Puffer (1980)
9/3	Ionic Radii , Ion & bonding; Coordination and Crystal Structure		
Week 3			
9/6	**HOLIDAY**		
9/8	Guest lecture, Dennis Trombatore, Geology Librarian, Wikipedia Project Details		No Lab Mon or Tues; Lab 2. Classification (Wed. & Thurs.)
9/10	Concept of a Lattice and Description of Crystal Structures	Chp. 4	
Week 4			
9/13	Coordination & Crystal Structure, Structures and Pauling's Rules		Lab 3. Igneous Rocks & Minerals
9/15	Pauling's Rules, cont. Isomorphism,	Winter (2001) Chps. 2 & 3	

	Polymorphism, Crystalline Effects		
9/17	Isomorphism, Polymorphism, Crystalline Effects, cont.		
Week 5			
9/20	Composition of the Earth; Mineral Compositions	Chp. 5	Lab 4. Igneous Rocks in Hand Sample
9/22	Igneous Rocks & Minerals	Chp. 21	
9/24	Igneous Minerals		
Week 6			
9/27	Metamorphic Rocks		Lab 5. Metamorphic Minerals
9/29	Metamorphic Minerals	Spear (1995) Chps. 1 & 2 Bucher and Frey (1994) Chps. 1 & 2	
			Lab 6. Metamorphic Rocks & Minerals
10/1	Substitution Mechanisms, Origin of Color and Mineral Defects	Chp. 10	
Week 7			
10/4	Twinning; Magnetism		Lab 7. Economic Rocks and Minerals
10/6	Lecture Exam Review		Lab review (Wed. & Thurs.)
10/8	**LECTURE EXAM 1**		
Week 8			
10/11	Introduction to Crystallography; Symmetry	Chp. 6	**LAB EXAM 1**, Oct. 11 or 12
10/13	Symmetry Elements and Crystal Systems		Lab 8. Introduction to Symmetry (Computer Lab)
10/15	Symmetry Elements and Crystal Systems		
Week 9			
10/18	Notation		Lab 9. Symmetry with Blocks
10/20	Translation and Dimensional Order	Chp. 7	Lab 10. Microscope Introduction
10/22	Lattices and Motifs		Nesse (2004) Chp. 2
Week 10			
10/25	Space Groups and Point Groups	Chp. 9	Lab 11. Basic Microscope Observations
10/27	Microscopic Identification of Minerals		
10/29	Nature of Light	Chp. 13	
Week 11			
11/1	Isotropic vs. Anisotropic Minerals		Lab 12. Interference Colors
11/3	Uniaxial Crystals		Nesse (2004) Chp. 5 & 6
11/5	Uniaxial Crystals		
Week 12			
11/8	Biaxial Crystals		Lab 13. Minerals in Thin Section
11/10	Biaxial Crystals		
11/12	Lecture Exam Review		
Week 13			
11/15	**LECTURE EXAM 2**		Lab 14.Igneous Rocks in Thin Section
11/17	Mineral Stability and Phase Diagrams	Chp. 11	Lab 15. Meta. Rocks in Thin Section
11/19	Introductory Thermodynamics		
Week 14			
11/22	Post Crystallization Processes	Chp. 12	
11/24	Post Crystallization Processes		No Lab Wed. &Thurs.
11/26		**HOLIDAY**	
Week 15			
11/29	Gems	Chp. 20	Lab review (Nov, 29 and 30) **Wikipedia Project Due**
12/1	Other Analytical Techniques	Chp. 14	**LAB EXAM 2,** Dec. 1 or 2
12/3	Final Exam Review		
12/8	**FINAL EXAM**		