
GEOS 280

Mineralogy

Fall 2016
MWF 12:30 – 1:30 Lecture
T 8:30-11:20 Lab

Instructor: Jim Mills

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Office: Julian 214

Office Hours: MWF 11:00-12:00

Overview

Mineralogy is the study of naturally occurring crystalline substances; i.e., how, where, and why minerals form, their composition, and external and internal structure.

Lab Fee

A \$15.00 lab fee will be used to offset costs associated with a crystal growing project.

Goals

In this course you will learn, in part:

- To identify 100-110 minerals through the use of their physical properties.
- To identify minerals through an optical microscope using grain mounts and thin sections.
- To determine the symmetry of crystals and how this can be used to classify minerals, and, determine their internal structure.
- The composition, and variation in composition, of minerals and why this occurs.
- The methods of mineral analysis.
- The various geologic environments minerals form in.

Logistics

Attendance and Etiquette

Regular attendance is required for all lectures and laboratories. Unexcused absences of more than two weeks (consecutive or non-consecutive) will cause me to drop you from the course. This will be a fast-paced course and it is critical to your understanding of the material that you be present at all times.

Please be on time for the beginning of class and unless it is an emergency, please do not walk out during class time – this is very distracting to your peers and me.

Also, please be sure your cell phones are turned off, put away, and not used during class.

Materials

Textbook:
Introduction to Mineralogy, 2012, Nesse, W.D., Oxford University Press, 480 p.

Handlens (10x)
Protractor,
Compass (for drawing circles)
Colored pencils
Ruler
Calculator

Milestones

In the 20th century, the demand for metals and minerals in the United States grew from a little over 160 million tons to about 3.3 billion tons; the ratio of renewable to non-renewable materials used declined from 40:60 to about 10:90 during the century. (USGS, 2000)

1916 – Sheetrock (gypsum wallboard) was first produced. (USGS, 2000)

Homework and Projects

A series of homework and project assignments will be given during the course of the semester. **No late assignments will be accepted.**

Examinations

Three one-hour exams are scheduled during the semester. See the attached lecture syllabus for the appropriate dates. **NO MAKE-UP EXAMS WILL BE GIVEN EXCEPT FOR DOCUMENTED EMERGENCIES.** The final exam will be given on the scheduled date and will be **COMPREHENSIVE.** The final exam **MAY NOT** be taken at any other time than what is officially scheduled.

Grading

Grades will be determined based on the criteria listed below:

One-hour exams	45%	(15% /exam)
Final exam	15%	
Homework/projects	10%	
Laboratory Work and Lab Quizzes	30%	

Grade Scale

A	100-93%	C+	79-77%
A-	92-90%	C	76-74%
B+	89-87%	C-	73-70%
B	86-84%	D+	69-67%
B-	83-80%	D	66-64%
		D-	63-60%
		F	<60%

Academic Honesty

Any act that places a student in unfair advantage with respect to the rest of the class will be treated according to the University procedures outlined in the Student Handbook.

Important Dates

August 24 th – 31 st	Adjustment Period (Add/Drop)
October 10 th	Midterm Grades
October 28 th	Last day to withdraw from a course with grade of W, change from P/F to grade, change from grade to P/F
FINAL EXAM	Monday, December 14th, 8:30-11:30 am

1940 - Tantalum capacitors had been perfected, and consumption of tantalum increased sharply with the introduction of radar and military radio communications during World War II. Sintered-plate nickel-cadmium battery was commercially produced. The Kroll process to produce titanium was patented. The invention of the crystal diode sparked germanium production.

(USGS, 2000)

1947 - First separation of rare earths by ion exchange was reported. Scientists at Bell Laboratories invented the transistor, originally made from germanium, but later made from silicon.

(USGS, 2000)

1958 - Aluminum beverage can was introduced. The laser was invented. Large sedimentary deposits containing zeolites were discovered.

(USGS, 2000)

American Disabilities Act Information

DePauw University is committed to providing equal access to academic programs and university administered activities with reasonable accommodations to students with disabilities, in compliance with the Americans With Disabilities Act and Amendments (ADAAA). Any student who feels she or he may need an accommodation based on the impact of a disability or learning challenge is strongly encouraged to contact:

Julianne Miranda, Interim Director of Student Disability Services and ADA Compliance for further information on how to receive accommodations and support.

Contact information:

Student Disability Services: 408 S. Locust Street, Suite 200, in The Memorial Student Union Building (765-658-6267).

Student Responsibilities:

It is the responsibility of the student to share the letter of accommodation with faculty and staff members. Accommodations will not be implemented until the faculty or staff member has received the official letter. Accommodations are not retroactive. It is the responsibility of the student to discuss implementation of accommodations with each faculty and staff member receiving the letter.

Prof. Jim Mills <i>Dept. of Geosciences</i> Fall, 2016 Office: Julian 214 Phone: 658-4669 E-mail: jmills@depauw.edu					
	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 – 9:00		Geos 280 Lab 12:40-3:30			
9:10 – 10:10		Lab			
10:20 – 11:20	Office Hour 11:00-12:00	Lab	Office Hour 11:00-12:00		Office Hour 11:00-12:00
11:30 - 12:30					
12:30 – 1:30	Geos 280 12:30-1:30		Geos 280 12:30-1:30		Geos 280 12:30-1:30
1:40 – 2:40					
2:50 – 3:50					
4:00 – 5:00	Dept./Faculty Meeting	Faculty Development			
5:00 – 6:00	Dept./Faculty Meeting	Committee Meeting			
7:00-8:30		Geos 450 7-8:30		Geos 450 7-8:30	

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1969 - A bertrandite mine was established in Utah providing the first significant U.S. beryllium raw materials source. Strontium replaced barium in color television faceplate glass to block X-ray emissions. The United States accomplished the world's first manned moon landing.

(USGS, 2000)

1972 - Federal Insecticide, Fungicide, Rodenticide Act (FIFRA) banned many pesticides containing mercury. Federal Water Pollution Control Act authorized EPA to regulate mercury discharges into waterways. Cyanide heap leaching technology to extract gold began in Nevada.

(USGS, 2000)

1973 - Start of Organization of Petroleum Exporting Countries (OPEC) oil embargo. Lead in paint was banned under Federal Hazardous Substances Act. Phase-out of lead in gasoline began under the Clean Air Act.

(USGS, 2000)

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 WEEKLY LECTURE SYLLABUS

Month	Week	Topic	Readings
August	24	Introduction, Historical Background Mineral Classification, symmetry Elements – Lattices and Unit Cells	1- All 2- Pgs. 11-18
	29	Symmetry, Indexing Planes – Miller Indices	2 – pgs. 18-26 2 – pgs. 26-30
Sept.	5	Axial Ratios, Forms, Zones Atoms and Atomic Structure	2 – pgs. 30-46 3 – pgs. 48-54
	12	Crystal Chemistry: Atoms, Ions, Atomic Structure, Elemental Abundance, Bonding	3 – pgs. 54-66
		<i>Wednesday, Sept. 21st - Exam 1</i>	
	19	Crystal Structure and Growth (Wednesday, Sept. 28th, NO CLASS)	4 - All
	26	Crystal Growth Introduction to Mineral Optics	5 – All 7 – pgs. 136-138
Oct.	3	Mineral Optics: Refractive Index, Interference Colors	7 – pgs. 138-152 7 – pgs. 175-180
	10	Uniaxial Minerals: Refraction, Extinction, Optic Sign	
	17	<i>Oct. 15-22nd - Fall Break Southern Colorado – Northern New Mexico</i>	
	24	<i>Friday, Oct. 28th - Exam 2</i>	
	31	Biaxial Mineral Optics: Interference Figures, Optic Sign, 2V Determination, Dispersion	7 – pgs. 156-182
Nov.	7	Mineral Analysis	8 – All 9 – All
	14	The Silicate Minerals	11 – All
	21	<i>Monday, Nov. 21st - Exam 3</i>	
		<i>Nov. 23-27th - Thanksgiving Break</i>	
	28	Non-silicate Minerals	17 – 20
Dec.	5	Wrap-up	
		<i>Final Exam (Monday, Dec. 14th, 8:30-11:30)</i>	

1980 - Gold price peaked at an historic daily high of \$850 per ounce on January 21. New steelmaking technologies began to lower manganese needs. Record-high silver price of \$49.45 per ounce was recorded. Comprehensive, Environmental Response, Compensation, and Liability Act (CERCLA) established Superfund to clean toxic waste sites, including some from old mining operations.

(USGS, 2000)

1991 - The Soviet Union was dissolved, and the United States became the market for many metals and minerals produced or stockpiled there. Last “natural ore” (direct-shipping iron ore) mine in the Lake Superior District halted production. Open-hearth furnace steel production ended. Phosphate mining ended in Tennessee. Clumping bentonite cat litter was introduced.

(USGS, 2000)

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LABORATORY SYLLABUS

The laboratory portion of this course is critical to your understanding of physical and optical mineralogy. *Thus it is expected that you will attend all labs and be in lab during the assigned lab time.* We will use the lab time to go over new lab assignments and review the previous weeks' assignment. Most, if not all of the labs will require a significant amount of outside work on your part. There will be a lab practical during the last lab period of the semester. ***Failure to turn in three or more completed labs will result in a course grade of 'F' regardless of your performance in other portions of the course.***

<i>Month</i>	<i>Day</i>	<i>Topic</i>	<i>Mineral Unknowns Specimen Numbers:</i>
Aug.	30	Interfacial Angles, Symmetry	1-10
Sept.	6	Crystal Classes, Symmetry	11-20
	13	Crystal Forms, Miller Indices	21-30
	20	Stereonet	31-40
	27	Twins and Pseudomorphs	41-50
Oct.	4	Thin Section Preparation	51-60
	11	The Polarizing Microscope	61-70
		Fall Break	
	25	Isotropic Minerals, Refractive Index	71-80
Nov.	1	Uniaxial Minerals	81-90
	8	Biaxial Minerals	91-100
	15	Biaxial Minerals	101-110
	22	Unknowns I	
	29	Unknowns II	
Dec.	6	Lab Practical	

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JOURNALS

<i>American Mineralogist</i>	A very technical journal covering all aspects of mineral formation, thermodynamics and equilibrium.
<i>Canadian Mineralogist</i>	Written in the same style as American Mineralogist.
<i>Contributions to Mineralogy and Petrology</i>	A very technical journal covering mostly igneous rocks, but occasionally an article on minerals.
<i>Economic Geology</i>	A technical journal on ore deposits and their associated minerals.
<i>Mineralogical Record</i>	A laymen's journal on specific minerals and their occurrence. The photos and drawings of mineral specimens are beautiful.
<i>Rocks and Minerals</i>	A laymen's magazine on popular minerals and how and where to collect them.

OUTSIDE READING MATERIALS

At times, reading the textbook discussion of a particular topic will be difficult to understand. There are many other books available on mineralogy, crystallography, and optical mineralogy in the Prevo library that may help you to better understand a particular topic. Reading another author's description of the topic can, in some cases, better clarify the material. I strongly encourage you to use these texts.