GEOS 280

Mineralogy

Fall 2018
MWF 8:00 – 9:00 Lecture
T 8:30-11:20 Lab

Instructor: Jim Mills

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Office Hours: MWF 9:30-10:30

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 $10.00 lab fee will be used to offset costs associated with replacing mineral specimens and supplies for mineral testing and thin section preparation.

Goals

In this course you will learn, in part:

- To identify 100-110 minerals based upon 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 compositional variation of minerals and why this occurs.
- About 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 (including exam periods).

Materials

Textbook: **Introduction to Mineralogy**, 3rd ed., *2017, Nesse, W.D., Oxford University Press, 495 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

Homework and Projects

A series of homework and project assignments will be given over the course of the semester. **Late assignments will NOT be accepted**.

Examinations

Two 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	40%	(20% /exam)
Final exam	20%	
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 22rd – 29th	Adjustment Period (Add/Drop)
October 8th	Midterm Grades Due
October 26th	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	**Wednesday, December 12th, 8:30-11:30 am**

wallboard) was first produced. (USGS, 2000)

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)

1969 - A bertrandite mine was

American Disabilities Act Information

It is the policy and practice of DePauw University to provide reasonable accommodations for students with properly documented disabilities. Written notification from Student Disability Services is required. If you are eligible to receive an accommodation and would like to request it for this course, please contact Student Disability Services. Allow one-week advance notice to ensure enough time for reasonable accommodations to be made. Otherwise, it is not guaranteed that the accommodation can be provided on a timely basis. Accommodations are not retroactive. Students who have questions about Student Disability Services or who have, or think they may have, a disability (psychiatric, attentional, learning, vision, hearing, physical, medical, etc.) are invited to contact Student Disability Services for a confidential discussion in Union Building Suite 200 or by phone at 658-6267.

Resources for Students of Color and Underrepresented Students in STEM:

Students of Color in STEM (SoCiS) is a student organization founded by Brittany Davis in 2017 in order to provide community and support for STEM students who identify as students of color and members of diverse underrepresented identities on campus. This organization provides these students with a network of students in or interested in a similar major that could be a support system for them academically (tutoring), and socially (mentoring). Often times, students of color enter campus feeling isolated, overwhelmed, or less welcomed than their peers. Though it is common knowledge that STEM careers are in high demand, people of color are still underrepresented in many STEM fields. This organization serves as a tool to help students of color narrow down and choose their future STEM profession, and stay with their major/career interest for the entirety of their academic career at DePauw by having consistent exposure to diverse STEM interests. Programming for this student organization will come in the form of talks led by alumni professionals of color, scholarship and fellowship workshops, networking opportunities for underrepresented students in STEM, opportunities to travel to diversity in STEM conferences (i.e SACNAS, ABRCMS), and many more opportunities to grow as a professional in STEM. Please consider joining this exciting organization and feel free to reach out to executive members Brittany Davis, Antoinette Gibson, or faculty advisor Bridget Gourley (Biochemistry & Chemistry) with questions and to also join their e-mail list at: (brittanydavis_2020@depauw.edu). Reach out to them at the student academics fair on August 25th from 6:00pm to 8:30pm.

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)

Prof. Jim Mills

Dept. of Geosciences

Fall, 2018

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	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 – 9:00	Geos 280 8:00-9:00	Geos 280 Lab 8:30-11:20	Geos 280 8:00-9:00	Campus Farm House	Geos 280 8:00-9:00
9:00 – 10:00	Office Hour 9:30-10:30		Office Hour 9:30-10:30	CFH	Office Hour 9:30-10:30
10:00 – 11:00				CFH	
11:00 - 12:00				CFH	
12:00 – 1:00				**SM Liaison Meetings**	
1:00 – 2:00		**Campus Farm House Meeting**		CFH	**Campus Farm House Meeting**
2:00 – 3:00				CFH	
3:00 – 4:00				CFH	
4:00 – 6:00	Dept./Faculty Meeting			CFH	
7:00-8:30					

Geos 280 – Mineralogy – Julian 226

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)

Geos 280 -- MINERALOGY Fall, 2018 WEEKLY LECTURE SYLLABUS			
Month	**Week**	**Topic**	**Readings**
August	**22**	Introduction, Historical Background Mineral Classification, symmetry Elements – Lattices and Unit Cells	1- All 2- pgs. 12-18 5 – pgs. 114-119 11 – Skim…
	27	Symmetry, Indexing Planes – Miller Indices	2 – pgs. 19-26
Sept.	**3**	Axial Ratios, Forms, Zones Atoms and Atomic Structure	2 – pgs. 27-46 3 – pgs. 50-57
	10	Crystal Chemistry: Atoms, Ions, Atomic Structure, Elemental Abundance, Bonding	3 – pgs. 58-69
	17	Crystal Structure and Growth	4 – All (pgs. 71-88)
	24	Crystal Growth Introduction to Mineral Optics	5 – All (pgs. 89-119) 7 – pgs. 142-149
Oct.	**1**	***Monday, Oct. 1nt - Exam 1***	
	1	Mineral Optics: Refractive Index, Interference Colors (***No Class Oct. 3rd and 5th***)	7 – pgs. 149-155 7 – pgs. 181-186
	8	Uniaxial Minerals: Refraction, Extinction, Optic Sign	7 – pgs. 158-165 7 – pgs. 165-172
	15	***Oct. 13th - 21st - Fall Break***	
	22	Uniaxial Minerals: Refraction, Extinction, Optic Sign, Biaxial Mineral Optics	7 – pgs. 158-165 7 – pgs. 165-172
	29	Biaxial Mineral Optics: Interference Figures, Optic Sign, 2V Determination, Dispersion	7 – pgs.162-164 7 – pgs. 172-181
Nov.	**5**	Mineral Analysis	8 – All (pgs. 190-209) 9 – All
	12	Non-silicate Minerals	17 - 20
	12	***Monday, Nov. 12th - Exam 2***	
	19	Non-silicate Minerals	17 - 20
		Nov. 21st - 25th - Thanksgiving Break	
	26	Non-silicate Minerals	17 – 20
Dec.	**3**	Wrap-up	
		Final Exam (Wednesday, Dec. 12th, 8:30-11:30)	

GEOS 280 -- MINERALOGY
Fall, 2018
LABORATORY SYLLABUS

The laboratory portion of this course is critical to your understanding of physical and optical mineralogy. *Therefore, 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.***

Month	*Day*	*Topic*	*Mineral Unknowns Specimen Numbers:*
Aug.	**21**	**No Lab**	
	28	Interfacial Angles, Symmetry	1-10
Sept.	**4**	Crystal Classes, Symmetry	11-20
	11	Crystal Forms, Miller Indices	21-30
	18	Stereonets	31-40
	25	Twins and Pseudomorphs	41-50
Oct.	**2**	Thin Section Preparation	51-60
	9	The Polarizing Microscope	61-70
	16	**No Lab - Fall Break**	
	23	Isotropic Minerals, Refractive Index	71-80
Oct/Nov.	**30**	Uniaxial Minerals	81-90
	6	Biaxial Minerals	91-100
	13	Biaxial Minerals	101-110
	20	Biaxial Minerals	
	27	Mineral Identification in Rocks	
Dec.	**4**	Lab Practical	

JOURNALS

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