

**GEOL 3400: MINERALOGY AND PETROLOGY
FALL 2008
TR 9:30 - 10:45, Lab R or F 2:00 – 4:50**

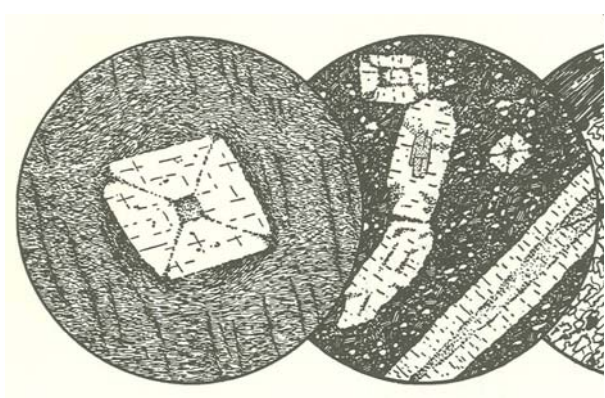
Description and interpretation of origins and environments of igneous, metamorphic, and sedimentary rocks. Description includes minerals and textures visible in hand sample and under the petrographic microscope. Includes a field trip project. Prerequisite: GEOL 1401 or 1402

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Andalusite porphyroblasts in slates from Bavaria, Germany and Sierra Nevada Mtns, CA viewed under a petrographic microscope (Williams and others, 1954). In this class you will view thin-sections from a ductile shear zone in the Sand Springs Range, NV that contain andalusite

Office hours: Monday, Wednesday: 8:00 – 9:00 am, 10:00 – 11:00 am
Tuesday: 8:00 – 9:30 am, 1:00 – 3:00 pm
Thursday: 8:00 – 9:30 am
Friday: 8:00 – 9:00 am
(or call, or ask in lab, to set up a good time to meet)

Texts: (Required)

- Blatt, H.W., Tracy, R.J., and Owens, B.E., 2006, *Petrology, Igneous, Sedimentary, and Metamorphic, Third Edition*: W.H. Freeman and Co., 530 p.
- Perkins, D., and Henke, K.R., 2004, *Minerals in Thin Section, Second Edition*: Pearson Education, 163 p.

Other text used in lecture, lab (not required!)

- Compton, R.R., 1985, *Geology in the Field*: John Wiley & Sons, 398 p.

Grading:

- 2 exams over lecture and lab topics: 15% each
- 1 comprehensive final exam, 15%
- 9 graded lab projects, including 2 field trip projects, 3.5% each (20% total)
- 3 one-page summaries of petrology papers from the geologic literature (after completing, we'll have group discussions), 8% each
- Extra credit project: Researching graduate school programs in geosciences

Student Learning Outcomes

1) To study in more detail topics introduced in Physical and Historical Geology, such as: rock types erupted from volcanoes (for example Davis Mountains trachytes, Big Bend pyroclastic flow deposits), the plate-tectonic significance of different sandstone types (graywacke, arkose, and quartz arenite), and the pressure - temperature conditions at which different facies of metamorphic rocks form.

- 2) To get hands-on experience in describing and interpreting rocks so that you will have a solid background you could use when taking summer field camp, a 5-week field course (GEOL 3600), when working on your own research project (GEOL 4391), and when taking geology courses in graduate school. My ultimate goal is that you have a good working knowledge of how to describe and interpret whatever rocks you encounter at any university or anywhere in the world. I will emphasize what can be done with outcrops and hand samples in the field and thin sections in the lab. I will neglect many theoretical or specialized lab aspects, such as thermodynamics of metamorphic rock reactions or chemical compositions of igneous rocks.
- 3) To practice using the basic terms of igneous, metamorphic, and sedimentary rocks so that you can compete well and work with Geology Majors at other schools at field camp or in graduate school.
- 4) To integrate lecture and lab portions of the course into a single way of learning petrology. The ideal strived for is that lectures will be purely introduction to lab projects.
- 5) To learn how to use geology tools in the field and the lab. In the field we'll use Brunton compasses to make geologic maps and cross-sections. In the lab we'll use polarizing microscopes to identify minerals and textures (see last page)

Course Webpages

<http://blackboard.angelo.edu> will contain lecture outlines, practice problems, web links to scenic areas mentioned in class and lab, answers to lab assignments and class projects, and your official grades.

Field Trips

On field trips you will get a chance to apply concepts discussed in class to describe and interpret outcrops of rocks and fossils. Tentative schedule:

- 1) Spillway Hill, Twin Buttes area, San Angelo: October trip during lab time to measure section of Permian and Cretaceous? Rocks, describe sedimentary rock types, and interpret significance of sedimentary structures.
- 2) Saturday, October 18: Famous rock exposures in the Llano uplift: We will meet early in the morning and return late in the evening. Activities will include collecting fossils, sketching faults and folds, describing the oldest rocks in Texas, and cliff-jumping into the Devils Waterhole, Inks Lake State Park (if you dare). Leaders: Drs. Joe Satterfield, A.K. Stewart
- 3) Friday – Sunday, November 7 – 9: Required Mineralogy and Petrology trip to the Davis Mountains Volcanic Field. We will explore areas containing Tertiary Period lava flows, pyroclastic flows, and intrusive igneous rocks We will camp at Balmorhea State Park and attend at Star Party at McDonald Observatory Saturday night. Leaders: Drs. Joe Satterfield, A.K. Stewart, and Mark Sonntag
- 4) Tuesday – Saturday, January 6 – 10 [Tentative]: Big Bend region mapping project, Slaughter Ranch: One or two students can work as field assistants and possibly earn GEOL 4191 credit on this ASU research project. A grant may pay for most expenses! If interested, talk to Dr. Joe.

Week	Lecture/Discussion topics	Lab
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8/26, 8/28	Igneous minerals (Ch 2) Polarizing microscope techniques (Perkins and Henke)	1*- Review of minerals in igneous rocks in hand sample, introduction to a few new ones (* = graded lab)
9/2, 9/4	Igneous rock classification (Ch 2, 3)	2- How to use the petrographic microscope LAB 1 DUE
9/9, 9/11	Igneous structures and field relations (Ch 1) Pluton types, emplacement mechanisms (Ch 1) Solitario cross-section project	3*- Identifying minerals in thin section
9/16, 9/18	Fractional Crystallization of magma (Ch 6)	4*- M&M magma chamber modeling LAB 3 DUE
9/23, 9/25	Volcanic rocks and field relations (Ch 4) 9/25: SUMMARY OF PAPER 1 DUE 9/25: Discuss pluton emplacement papers	5: Volcanic rocks in hand sample and thin section LAB 4 DUE
9/30, 10/2	How to use a Brunton Compass Sandstone classifications (Ch 13)	6*- Intrusive igneous rocks in hand sample and thin section
10/7, 10/9	10/7: EXAM 1: IGNEOUS ROCKS Geological Society of America Annual Meeting, Houston (Dr. Joe and Dr. Stewart are giving talks; www.geosociety.org)	6*- Concluded
10/14, 10/16	Sedimentary structures, including soft sediment deformation (Ch 13) Interpreting basin setting, plate tectonic setting (provenance) from composition (Ch 11, 13)	7*- Sandstones in hand sample and thin section LAB 6 DUE
10/21, 10/23	Limestone and dolostone classifications (Ch 15)	8*- Grain size analysis with sieves
10/28, 10/30	Carbonate environments, especially reefs (Ch 15) 10/30: SUMMARY OF PAPER 2 DUE 10/30: Discuss Capitan Reef papers	LAB 8 DUE 9*- Spillway Hill Field Trip during lab time: Measuring a stratigraphic section
11/4, 11/6	Chert, evaporates, ironstones, coal (Ch 16)	10*- Preparation for Davis Mtns Field Trip Lab (11/7-9) LAB 9 DUE
11/11, 11/13	Metamorphic minerals (Ch 18)	11- Carbonate rocks hand sample and thin section LAB 10 DUE
11/18, 11/20	11/18: EXAM 2 - SEDIMENTARY ROCKS Interpreting metamorphic textures (Ch 18)	12- Chert, evaporates, ironstones, and coal in hand sample
11/25	Field observations of metamorphic rocks (Ch 18) Fault zone metamorphism and interpreting shear sense of mylonites	Thanksgiving Holiday: No lab!
12/2, 12/4	Interpreting Pressure – Temperature (P-T) conditions from metamorphic facies (Ch 17) 12/4: SUMMARY OF PAPER 3 DUE, 12/4: Discuss metamorphic petrology papers	13*- Metamorphic rocks in hand sample and thin section

12/11	FINAL EXAM: METAMORPHIC ROCKS PLUS REVIEW QUESTIONS ON IGNEOUS and SEDIMENTARY ROCKS	LAB 13 DUE
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Note about schedule

Lab and homework assignments cannot be turned in after graded assignments are returned and answers are posted!

Know the ASU Honor Code

Angelo State University expects its students to maintain complete honesty and integrity in their academic pursuits. Students are responsible for understanding the Academic Honor Code, which is contained in print and web versions of the Student Handbook.

Persons with disabilities which may warrant academic accommodations must contact the Student Life Office, Room 112 University Center, in order to request such accommodations prior to any accommodations being implemented. You are encouraged to make this request early in the semester so that appropriate arrangements can be made.

Parts of our Nikon Labophot Petrographic Microscopes:

