GEOL 3400: MINERALOGY AND PETROLOGY, FALL 2017
Lecture: MWF 11:00; Lab: T 2:00

Description, classification, and interpretation of igneous and metamorphic rocks, including identifying common minerals. Interpretations include tectonic setting, processes of formation, and pressure-temperature conditions. Laboratory work consists of hand sample description, examination of thin sections under a petrographic microscope, and field trips. Prereq.: GEOL 1401 or 1402.

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Office hours: Monday: 8:00 – 10:00 am, 2:00 – 3:00 pm
Tuesday: 9:00 – 11:00 am
Wednesday: 8:00 – 9:00 am
Thursday: 8:00 – 11:00 am
Friday: 8:00 – 9:00 am

Required Texts:

Grading:
• 2 exams over lecture, text, and project topics: 13% each
• 1 comprehensive final exam, 16%
• 1 hand sample quiz: rock and mineral identification, 10%
• 10 graded lab projects, including one required weekend field trip project: 40% (4% each)
• 1 summary and discussion of a scientific paper, 8%

Course Webpages
http://blackboard.angelo.edu contains lecture slides, practice problems, web links to scenic areas mentioned in class and lab, answers to lab assignments and class projects, and your official grades.
Here are a couple of sites that have useful thin-section photos of rocks and minerals:
http://jm-derochette.be/
http://leggeo.unc.edu/Petunia/IgMetAtlas/mainmenu.html

Lab and Field Equipment Needed

1. Hand lens, 10x Hastings Triplet recommended
2. Geology field book (We will place an order for all interested and get a bulk rate)
3. Set of colored pencils (Buy good ones at Hobby Lobby or Michaels)
Field Trips

You will get a chance to apply concepts discussed in class to describe and interpret outcrops of igneous and metamorphic rocks. You will attend at least one of two required weekend field trips. You can go on both! The field trip project will be your Lab 10. Our tentative schedule:

1) **Friday – Sunday, October 13 - 15:** Davis Mountains Volcanic Field. We will explore areas containing Tertiary lava flows, pyroclastic flows, and intrusive igneous rocks. We will camp at Davis Mountains State Park. Look forward to an informal star party Saturday night led by ASU Planetarium Director Dr. Kenneth Carrell!

2) **Saturday, September 16:** Climb to summit of Enchanted Rock, examine strange, possibly cross-bedded schlieren, collect Llanite from the most famous locality, and eat Coopers barbeque for dinner!

Course objectives

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) 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. The ultimate goal is that you have a good working knowledge of how to describe and interpret whatever igneous and metamorphic rocks you encounter anywhere in the world. We will emphasize what can be done with outcrops and hand samples in the field and thin sections in the lab.

3) To practice using the basic terms of igneous and metamorphic rocks so that you can compete well and work with Geology Majors at other schools at field camp or in graduate school.

4) To learn how to use geology tools in the field and the lab. In the field we will use hand lenses, maps, and aerial photos. In the lab we'll use polarizing microscopes to identify minerals and textures (see last page for a detailed look at our microscopes)

Learning objectives will be evaluated by grades on exams, lab projects, lab quizzes, and homework assignments.
<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture/Discussion topics</th>
<th>Lab Projects</th>
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<tbody>
<tr>
<td>I: 8/28, 8/30, 9/1</td>
<td>Igneous Minerals (Lab Manual) Basic petrographic microscope techniques (Lab Manual)</td>
<td>1- Igneous Minerals in Hand Sample (mostly review)</td>
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<td>II: 9/6, 9/8</td>
<td>A Few Fundamental Concepts (Ch 1)</td>
<td>No lab meetings! (Monday is Labor Day Holiday)</td>
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<td>III: 9/11, 9/13, 9/15</td>
<td>Igneous Rock Classification and nomenclature (Ch 2) Classification Project</td>
<td>2- Identifying felsic igneous minerals in thin-section Group work ethics discussion</td>
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<td>IV: 9/18, 9/20, 9/22</td>
<td>9/19, 9/21: Textures of Igneous Rocks (Ch 3) Igneous structures and field relations (Ch 4)</td>
<td>3- M&amp;M magma chamber modeling</td>
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<td>V: 9/25, 9/27, 9/29</td>
<td>Paper on Davis Mountains volcanic field assigned Pluton types, pluton emplacement mechanisms (Ch 4)</td>
<td>Complete Lab 3</td>
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<td>VI: 10/2, 10/4, 10/6</td>
<td>Solitario cross-section project Volcanic Rocks (Ch 4)</td>
<td>4- Mafic Minerals in thin section and Intro to the Petrographic Microscope</td>
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<td>VII: 10/9, 10/11, 10/13</td>
<td>Pyroclastic Rocks and Calderas (Ch 4) 10/11: EXAM 1 - IGNEOUS ROCKS The Phase Rule and two-component systems (Ch 6)</td>
<td>5- More Petrographic Microscope Techniques: determining plagioclase composition, uniaxial and biaxial interference figures, optic signs, 2V</td>
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<td>VIII: 10/16, 10/18, 10/20</td>
<td>Phase Rule Continued (Ch 6) Phase Diagrams 10/20: Discuss Davis Mtns volcanic field paper</td>
<td>6- Intrusive igneous rocks in hand sample and thin section</td>
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<td>IX: 10/27</td>
<td>10/23 – 10/25, Geological Society of America Meeting Work Phase Diagram Problems</td>
<td>No formal lab meeting Continue work on Lab 6</td>
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<tr>
<td>X: 10/30, 11/1, 11/3</td>
<td>An Introduction to Metamorphism (Ch 21) Play-do Deformation project A Classification of Metamorphic Rocks (Ch 22)</td>
<td>7- W Nevada Extrusive Igneous rocks in hand sample and thin section</td>
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<td>XI: 11/6, 11/8, 11/10</td>
<td>Interpreting shear sense from mylonites (Ch 23) Textures of contact and regional orogenic metamorphism (Ch 23) Metamorphic rocks in hand sample project</td>
<td>8- Metamorphic Minerals in thin-section</td>
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<td>XII: 11/13, 11/15, 11/17</td>
<td>Interpreting histories of metamorphism and deformation (Ch 23)</td>
<td>9- Metamorphic rocks in thin section and hand sample</td>
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<td>XIII: 11/20</td>
<td>Events timing project Hand samples of metamorphic minerals (lab topic)</td>
<td>No formal lab meeting. Lab open Thanksgiving Holidays 11/23 – 11/27</td>
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<td>XV: 12/4, 12/6, 12/8</td>
<td>12/4: Review all hand samples Final Exam Review: phase diagrams, shear sense indicators in mylonites</td>
<td>HAND SAMPLE QUIZ: IGNEOUS AND METAMORPHIC ROCKS AND MINERALS</td>
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<td>XVI: 12/11</td>
<td>12/12, 10:30 – 12:30: FINAL EXAM</td>
<td>Note: Lab 10 is the Field Trip Project</td>
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Notes

Turn in your lab on time!

1) Lab projects submitted after the due date will receive a 10-point deduction!
2) Work turned in after graded work is returned to others will not be graded. This is a professional ethics issue.
3) If you score below a 50 on a lab project you may request an opportunity to correct or redo a portion of your work. You must make this request within one week of receiving your graded lab.

Know the 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.

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence.
Parts of our 12 recently refurbished Nikon Labophot petrographic microscopes (we will also use 2 almost new Leica DM750P scopes and 1 new Nikon Eclipse E200MV POL scope!)