

Aug-06

SAN DIEGO STATE UNIVERSITY

Geol 324: *Petrology*

Lecture: Mondays and Wednesdays from 10:00-10:50 AM in CSL-425

Lab: Mondays and Wednesdays from 2:00-4:40 PM in CSL-425

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OFFICE: GMCS-227

OFFICE HOURS: Mondays from 11:00 AM-1:00 PM

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TEACHING ASSISTANT: Jenny Duncan

T.A. OFFICE HOURS:

PETROLOGY is defined as the study of rocks, and especially, the study of the geological processes that create igneous, sedimentary, and metamorphic rocks. The goal of this course is to introduce undergraduate students to the fundamental principles of modern petrology. Although sedimentary petrology will be discussed in this course, we will focus primarily on igneous and metamorphic petrology (you will learn much more about sedimentary petrology in Geol 536: Sedimentology and Lithostratigraphy!). Unlike sedimentary rocks, the formation of both igneous and metamorphic rocks is governed by geological processes that occur at relatively high temperature and pressure within the Earth. These processes cannot be directly observed. The origin of these rocks must be deciphered through indirect observations: their structure and texture, mineralogy, and chemical and isotopic compositions. Because of this, chemical equilibrium and thermodynamics are the "rules" that govern the igneous and metamorphic petrology "game". Thus, you will need a firm background in chemistry, preferably at the college level, to be successful in this course. Physics and calculus will also be helpful, but are not required.

REQUIRED TEXTS:

Assigned reading will come primarily from the textbook *"An Introduction to Igneous and Metamorphic Petrology"* by Winter, which is available for purchase at the SDSU Bookstore. You are expected to complete each reading assignment by the next class meeting (i.e., reading assigned on Monday should be completed by Wednesday). I will ask questions or lead discussions in class assuming that you have done the reading. *You will be responsible for understanding all material in the assigned reading from Winter's book, even if I don't mention it specifically during lecture. Conversely, you will be responsible for understanding all lecture material even if it is not mentioned in Winter's book.* The textbook *"Minerals in Thin Section"* by Perkins and Henke will be used as a reference for the laboratory portion of this course. In addition, selected reading from the scientific literature may be assigned.

REQUIRED SUPPLIES:

Besides the normal items you need for a college-level science course (a pencil and eraser, a pen, a notebook, a calculator, and your brain), you will also need the following items for this course: a hand lens, colored pencils, and a ruler.

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FORMAT and POLICIES:

We will meet twice per week. Attendance is mandatory and **class participation** is an important component of the final grade (see below). **Lectures** will provide the necessary background material and an opportunity for active discussion of the reading assignments. **Laboratory exercises** will be used to supplement the lecture portion of the course. These exercises will focus on the identification, classification, and interpretation of igneous, sedimentary, and metamorphic rocks in hand specimen and thin section (using the petrographic microscope), but will also include a range of other activities (field trips, analysis and interpretation of petrologic data, panel discussions of controversial topics in petrology, and other activities). You should expect to spend ~3-6 hours per week in the lab outside of normal class time in order to perfect your lab exercises and observational skills. **Lab write-ups** are due at the start of class on the same day of the following week unless you are instructed otherwise. The requirements for each write-up will be described at the start of the lab. Five **exams** will be given during the semester: two mid-term exams and a comprehensive final exam based on the lecture portion of the course, and one mid-term exam and a comprehensive final exam based on the laboratory portion of the course. The exams may include short-answer, multiple choice, and essay questions and mathematical problems and calculations. You do *not* need to memorize any equations that we discuss in class or lab, but you need to understand how to use them! Finally, we will take a one-day required **field trip** to Los Pinos Pluton! The date of the field trip is listed on the schedule—make sure you get that day off from work!

No late assignments will be accepted without prior approval. Group work on the problem sets and laboratory exercises is encouraged, but cheating and plagiarism will not be tolerated under any circumstances. If you work with others on assignments, make sure to use your own words! Furthermore, you must use full citations for any facts or ideas that are not your own!

I have attached the SDSU policy on plagiarism and cheating. In addition, I have attached a short description of "What is plagiarism?". My own policy on plagiarism and cheating is as follows: *Any student that commits plagiarism or cheats will receive a grade of "F" for the course and will be reported to the SDSU Office of Judiciary Procedures for disciplinary action.*

Your work will be weighted as follows:

Class participation & field trip	5%
Lab write-ups	25%
Mid-term exams	30%
Final exams	40%

Your final grade will be based on a percentage of the total available points:

A (90% or above), **B** (89-80%), **C** (79-70%), **D** (69-60%), **F** (59% or below).

The good news! You will be graded relative to the performance of your fellow students, rather than an arbitrary point scale. However, I will hold you to the highest standards and evaluate your performance rigorously. There will be no grade inflation!

SCHEDULE:

Jan. 18

Lecture: Introduction to Igneous Petrology
Lab 1: Classification of Rocks

Jan. 23

Lecture: Introduction to Igneous Petrology
Lab 2: Classification of Sedimentary Rocks

Jan. 25

Lecture: Crystal Nucleation & Growth
Lab 3: Classification of Metamorphic Rocks

Jan. 30

Lecture: Properties of Magmas
Lab 4: Classification of Igneous Rocks

Feb. 1

Lecture: Properties of Magmas
Lab 5: Viscosity Experiments

Feb. 6

Lecture: Introduction to Thermodynamics
Lab 6: Mineral Identification Review Part I

Feb. 8

Lecture: Introduction to Thermodynamics
Lab 6: Mineral Identification Review Part I
Lab 7: Mineral Identification Review Part II

Feb. 13

Lecture: Phase Diagrams
Lab 7: Mineral Identification Review Part II

Feb. 15

Lecture: Phase Diagrams
Lab 8: Binary Phase Diagrams

Feb. 20

Lecture: Phase Diagrams
Lab 8: Binary Phase Diagrams

Feb. 22

Lecture: Phase Diagrams
Lab 9: Ternary Phase Diagrams

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Feb. 27

Lecture: Chemical Petrology (Analytical Techniques and Data Presentation)
Lab 9: Ternary Phase Diagrams

Mar. 1

LECTURE MID-TERM EXAM #1!

Lab 10: Igneous Petrography

Mar. 6

Lecture: Chemical Petrology (Major and Minor Elements)
Lab 10: Igneous Petrography

Mar. 8

Lecture: Chemical Petrology (Diversification of Magma)
Lab 11: M&M Magma Chamber

Mar. 13-15

SPRING BREAK!

Mar. 20

Lecture: Chemical Petrology (Trace Elements and Isotopes)
LAB MID-TERM EXAM!

Mar. 22

Lecture: Chemical Petrology (Trace Elements and Isotopes)
Lab 12: Stillwater Complex

Mar. 27

Lecture: Mantle Melting
Lab 12: Stillwater Complex

Mar. 29

Lecture: Mantle Melting
Lab 13: Hawaiian Lavas

Apr. 3

Lecture: Mid-ocean Ridge Basalt Magmatism
Lab 13: Hawaiian Lavas

Apr. 5

Lecture: Mid-ocean Ridge Basalt Magmatism
Lab 14: Yosemite

Apr. 10

Lecture: Continental Flood Basalt Magmatism
Lab 14: Yosemite

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Apr. 12

LECTURE MID-TERM EXAM #2!

Lab 15: Los Pinos

Apr. 17

Lecture: Ocean Island Basalt Magmatism

Lab 15: Los Pinos

Apr. 19

Lecture: Ocean Island Basalt Magmatism

Lab 16: Lunar Rocks and Meteorites

Apr. 22 (Saturday)

FIELD TRIP TO LOS PINOS!

Apr. 24

Lecture: Arc Magmatism

Lab 17: Metamorphic Minerals

Apr. 26

Lecture: Granitoid Magmatism

Lab 17: Metamorphic Minerals

May 1

Lecture: Introduction to Metamorphic Petrology

Lab 17: Metamorphic Minerals

May 3

Lecture: Metamorphic Reactions

Lab 17: Metamorphic Minerals

May 8

Lecture: Metamorphic Facies

Lab 17: Metamorphic Minerals

May 10

Lecture: Metamorphism of Mafic, Pelitic, Calcareous & Ultramafic Rocks

LAB FINAL EXAM!