

PHYSICAL GEOLOGY COURSE OUTLINE

Geol 110 Sec. 01, Sched #14371
Lect: TTH 11:00 - 12:15, TH618
Lab: TU 2:10 - 5:00, TH618
appntmt
No CR/NC option
Spring 2008`

Dr. David Mustart
My office: TH620; Phone: 338-7729
Office Hrs: Tu Th 9:30-10:00; Tu 12:30-1:30 or by
My website: mustart.wikispaces.com
My email: mustart@sfsu.edu (But I prefer the phone)
Secretary: TH509; Phone: 338-2061

The Earth: An Introduction to Physical Geology (with vertical Sierra cliff face on cover) **7th Edition** (2002), Tarbuck & Lutgens (\$35.10 -Used only, at our Bookstore). **Bring the text to class every day** so we can discuss reading, maps and diagrams. **At Amazon.com, search : books > textbooks > ISBN#0130920258.** (Used from ~ \$5 includes shipping)

Laboratory Manual in Physical Geology (7th Edition) (with woman in blue shorts hiking up layered red rocks on cover) **Spiral bound** (2006), Busch: AGI (Amer Geol Inst)/NAGT (Natl Assoc GeoTeachers) (Bookstore: New \$74.40; Used \$58.05).

At Amazon.com, search : books > textbooks > ISBN#0131497456. Used from ~ \$37 with shipping)

Geology of the San Francisco Bay Region (1st Edition) (2006) Doris Sloan (new \$17.95; used \$14.00) U C Press California Natural History Guide Series #79
Will be essential in understanding geology of S.F. Bay Area for our field trips. **At Amazon.com, search : Geology of the San Francisco Bay Region by Doris Sloan** (Used from ~ \$14 with shipping)

Rocks and Geology in the San Francisco Bay Region (2002) Stoffer (Free download)

U.S.G.S. Bulletin 2195. Only available free on-line (with free Adobe Reader) at:
<http://geopubs.wr.usgs.gov/bulletin/b2195/>

Download this 63-page report as a PDF document -15.2 MB.
Will be essential in understanding Bay Area geology.

Simplified Geologic Map of California, Map Sheet 57, California Geological Survey.
Given out free in class.

Clear Front Report Cover - for submission of your field project. (\$0.89) Get the type with **clear front, opaque back with 3 prongs for 3-hole-punched report**. Located on Aisle 7B, 2nd shelf from top. Reports will **not be accepted or significantly penalized, in other "cheesy" types of report covers**. If you have problems ask at supply counter for item with SKU #1808199.

Hand lens Power 10X Loupe lens (\$10.95) Shelved with lab supplies at back end of aisle 3.
Ask at supply counter if you can't find them. (10% discount with this syllabus)

Pocket Knife – Swiss Army Spartan Model or similar recommended (\$19) Ask at supply counter for salesperson to get knife from stock. For problems, page Amber Wilson. 10% discount with this syllabus. (Virtually any pocket knife will work fine.)

Camera - Everyone in class must have a camera to take **color photos** for your field project. The photos are the chief evidence for outcrop identification. Each student must take the photos themselves, so you cannot use photos taken by other students in the class. Disposable cameras are acceptable, but cell phone cameras are too low quality for use.

3-Ring Binder- Essential for carrying the many handouts I give you.

Note: For the following lab supplies –acid bottle, hand lens & pocket knife- you will get a 10% discount at cash register if you show this note in syllabus to cashier; if any problems arise, page Amber Wilson, the supply manager who agreed to this discount. (Don't let the cashiers discourage you from seeking the discount).

OPTIONAL TEXT & MATERIALS:

Dictionary of Geological Terms, (1984), Third Edition, Amer. Geol. Institute (\$17 new; \$13 used)

Small Magnet with hole in center- Available at Radio Shack (~ \$2) A magnet is essential for testing for the mineral magnetite. The hole allows you to tie a string to the magnet.

Rock Hammer with nylon-vinyl grip by Estwing - Chisel-tip "soft-rock" 20 oz (\$28 "mason's hammer" @Home Depot, Metro Center across Hwy 280 from Serramonte Shopping Center- 992-9600)

COURSE OBJECTIVES:

The course is designed as a **rigorous introduction to the principles of physical geology**, emphasizing understanding of the natural processes that operate to shape our planet, both at the Earth's surface and deep within the interior. The two **over-arching goals** of the course are to **develop your skills in looking for evidence** for the changes that have shaped the Earth and continue to alter its surface every day, and at the same time, to **learn to question authority**. After this course, if you were **helicopter-dropped, blind-folded anywhere in the world**, within a few hours, you should be able to describe the basic geologic story of the site!

The course is designed to meet the University's General Education Segment II requirements for a **Physical Science course with a Lab/Field component**. The field aspect is met by participation in two required field trips. The course is the first step toward a major in Geology, but is designed both for majors and non-majors. Students are assumed to have no previous background in geology

ATTENDANCE & CLASS PROCEDURES:

I expect all students to consider that regular attendance is a serious and necessary part of completing the course. Always remember what Woody Allen said: "80 % of life is showing up". The class will begin at 11:00am and I consider it essential for everyone to have arrived by that time, or earlier. Drinking sodas, coffee, etc. is acceptable, but do not bring food to class. Headphones, Ipods, etc., are not permitted in class and **CELL PHONES AND BEEPERS MUST BE OFF**. Talking to your friends when class is in progress is extremely rude and annoying to others so **DON'T DO IT!**

An outline of the day's lecture and important announcements will be posted on the board before the start of class. Early arrival will give you time to record this outline before the lights go out. **Due to the disturbance caused by late arrivals, the classroom doors may be locked after class begins, so please be on time**. If, due to an emergency, you will be late for class, please phone me before class begins. If some urgent matter requires you to leave class early, please discuss this with me before class begins, or in an emergency, during class.

If missing a class is unavoidable due to sickness, etc., please phone me before class at 338-7729. If I'm not in my office, you may leave a message after the sixth ring. If you fail to contact me regarding a class absence, please **do not expect to get any class handouts** that may have been distributed. If you incur just one unexplained absence, or miss an exam, **you may be administratively withdrawn** from the course.

REQUIRED FIELD TRIPS:

1. **Sunday, March 16, 8:00 am - 6:30 pm Geology of Golden Gate National Recreation Area and Point Reyes National Seashore. How to classify and describe common rocks and minerals in the field.** Travel by car pools with cost of \$5/per person for gas and bridge toll. Meet at 8:00 am at 19th and Holloway at bus pullout under the metal shelters. Bring lunch, daypack, hand lens, clipboard, pens, pencils, any field trip handouts, and \$6 in small bills (No 10's or 20's). Dress warmly but in layers for rain, fog, wind and sun, and bring an umbrella.

2. **Saturday April 19 (or Sunday April 20 in case of rain) 8:00 am - 5:00 pm. Geology and Field Mapping from San Francisco to Montara Beach.** Meet at 8:00 am at 19th and Holloway at bus pullout under the metal shelters. Bring lunch, daypack, hand lens, clipboard, pens, pencils and any field trip handouts. Dress warmly but in layers for rain, fog, wind, sun and possible swimming. We will travel by car pool with cost of \$5. (Bring small bills, that is \$1's, to pay drivers (No 10's or 20's)

If you are unable to attend either of these field trips, you should not enroll in the course. **If you miss a trip for any reason**, other than the most serious and compelling emergency, **you will be required to withdraw from the course**. Unfortunately, no guests may attend field trips.

For the two required field trips, **you must sign a consent and release form at the first class.**

EXAM PROCEDURES:

The lecture portion of the course is divided into three segments with a one-hour exam following completion of each segment. Each exam will be out of 100-180 points, and will be approximately half objective (multiple choice and blank filling) and half subjective (short paragraph answers, maps and diagrams). There will not be a comprehensive final since each exam covers only the material in the preceding segment of the course, except for plate tectonics that will be covered on all exams.

No dictionaries or computers may be used during exams.

All exam questions are based on material covered in the review questions given out in class. Therefore a serious and complete mastery of the review questions is essential for satisfactory performance in the course. I allow time at the beginning of each lecture for you to ask review questions pertaining to the previous lecture, particularly if you made an effort to answer the questions on your own. As I want you to ask questions in class so that everyone can benefit from the discussion, outside of class I'll answer a maximum of 5 questions per student per exam. The deadline to ask 5 questions (a, b, c, d, e counts as 5) is by **voice mail** by 5pm the day prior to any exam. Call me at 338-7729, **record the entire question with the question number, leave your phone number** and I'll call you back by 12 midnight and leave answers on your recorder. (I don't type fast enough for e-mail.)

During exams, no student may leave the exam room under any circumstances. All restroom visits must be completed before the exam begins. If, once the exam has begun, you must leave to visit the restroom or for any other reason, you must turn in your exam and consider it completed at that time. All exams are to be returned to the instructor before leaving the classroom, a rule that applies both during the exam period, as well as after the exams have been graded. **No exams**

either graded or ungraded, are to leave the classroom. Study buddies must sit separately. For exams, no ear-covering hats or hooded sweat-shirts. **Cheating earns an F** and potential expulsion from SFSU.

If you are more than 40 minutes late for the exam, you will not be permitted to take the exam, and will receive a zero. No one will be allowed to leave the exam room before 40 minutes have elapsed. If you have an undependable vehicle or ride the Muni, be sure to have alternate transportation (e.g. cab) available on exam days.

There will be **NO MAKEUP EXAMS** except for the most serious and compelling emergencies, for which you will be required to provide written documentation. If an emergency arises, I will consider alternate options only if you contact me personally, and we discuss your situation before the exam is given. Call me at 338-7729.

NO INCOMPLETES ARE GIVEN IN THE COURSE.

PLAGIARISM:

With regard to field projects or any other work submitted, I want everyone to be very clear that plagiarism is unacceptable and will result in an automatic grade of "F". Plagiarism is defined as taking work, writing etc. from another and passing it off as one's own. Use your own words in any material submitted.

EXAM SCHEDULE & GRADE WEIGHTING:

Lecture Exams

- Exam #1: Thurs March 6-----33 1/3%
- Exam #2: Thurs April 10-----33 1/3%
- Exam #3: Tues May 20-----33 1/3% (11:00am-12:15pm, during exam week)

Lab Exams

- Mineral Exam: Tues Feb 12 (Lab #3)- 10% (**closed book**)
Formulas and Properties - (First 25 minutes of lab)
- Mineral Exam: Tues Feb 19 (Lab #4)-20% (**4 pages notes** - 1 side only)
Mineral Identification (First 1 1/2 hrs of lab)
- Field Quiz #1: Sun Mar 16 (At end of Field Trip #1)- 5% (**closed book**)
- Rock Exam: Tues Mar 18 (Lab #8) - 20% (**8 pages notes**-1 side only)
Rock Identification (First 1 1/2 hrs of lab)
- Field Quiz #2: Sat April 19 (or Sun April 20) (At end of Field Trip #2)- 5% (**closed book**)

Field Report: Field Report for Trip #2 due Thurs, May 15- 11:00 am - 20%
 Late field reports will be docked up to one full letter grade per week, and none will be accepted after noon Friday of finals week.
 Report must be typed, 3-hole punched, and submitted in a clear-front, opaque-back, 3-prong report cover. Projects not meeting the guidelines will not be accepted or will be penalized significantly

Map Exam: Thurs May 22 (Lab #16)- 20% (**8 pages notes**-1 side only + calculator)
 Structure, Topo & Geol Map Interp (1:30pm-3:00pm during exam week)
 (When notes are allowed during lab exams, the pages must be chosen before exam begins.)
 (Party follows exam + Prison Push-up Challenge!)

The course grade will be weighted 60% on lecture and 40% on lab.

NOTE: NO INCOMPLETES ARE GIVEN IN THE COURSE.

GRADE DISTRIBUTION:

For all exams, grades will be distributed as follows:

A- 88-91%	A 92-97%	A+ 98-100%
B- 70-74%	B 75-82%	B+ 83-87%
C- 55-59%	C 60-64%	C+ 65-69%
D- 25-39%	D 40-49%	D+ 50-54%
F 0-24%		

LECTURE SCHEDULE

In the reading assignments: “Ch” refers to Chapters in the text “Earth” by Tarbuck and Lutgens.
 “Ex” refers to Lab Exercises in Laboratory Manual by Busch.

<u>Segment I</u>	<u>Lecture (or Lab)</u>	<u>Reading</u>
1. Introduction	Lect#1	Ch 1
2. Atoms, Minerals & Rocks	Lect#1- 5; Lab#1,2,3	Ch 2; Ex 3, 4
3. Igneous Rocks	Lab#4	Ch 3; Ex 5
4. Sedimentary Rocks	Lab#5	Ch 6; Ex 6
5. Metamorphic Rocks	Lab#6	Ch 7; Ex 7
6. Geologic Time & Dating	Lect#6,7	Ch 8; Ex 8
7. Solar System & Early Earth History	Lect #8	Ch 22
8. Earth’s Surface & Inner Structure	Lect#9; Lab#5	Ch 17,1
9. Plate Tectonics & Mountain Building	Lect#10,11,12; Lab #6	Ch 19,20; Ex 2

Exam #1: Thurs, Mar 6**Lect#13****Segment II****Lecture (or Lab)****Reading**

1. Volcanism & Origin of Magma
2. Igneous & Hydrothermal Intrusions
3. Joints & Weathering
4. Geologic Structures, Folds & Faults
5. Geology Marin Hdinds to Pt Reyes

Lect#14-18; Lab#7,8,9
 Lect#19; Lab#9
 Lect#20,
 Lab #10.
 Field Trip

Ch 3, 4; Ex 2
 Ch 4; Ex
 Ch 5
 Ch 15,16; Ex10
 Field Trip Handouts

Exam #2: Thurs, Apr 10**Lect#21****Segment III****Lecture(or Lab)****Reading**

1. Geology SF to Montara Beach
2. Groundwater
3. Glaciers and Ice Ages
4. Deserts and Wind
5. Streams
6. Coastlines and Waves
7. Mass Wasting
8. Soils Geology
9. Earthquakes & Tsunamis

Field Trip
 Lect#22,23; Lab #11
 Lect#24; Lab #12
 Lect#25; Lab #13
 Lect#26; Lab #13
 Lect#27; Lab #14
 Lect#28
 Lect#29
 Lect# 30, 31

Field Trip Handouts
 Ch 11; Ex 12
 Ch 12; Ex 13
 Ch 13; Ex 14
 Ch 10; Ex 11
 Ch 14; Ex 15
 Ch 9
 Ch 5
 Ch 16

Exam #3: Tues, May 20**Lect#32****11:00- 12:15, during exam week****LAB SCHEDULE:**

Each Tuesday we will carry out lab exercises using the Lab Manual. Since each lab will involve the practical application of concepts outlined in the Manual, it will be necessary that you read the appropriate exercise carefully during the weekend before lab.

“()” indicates additional lecture topics to be covered during lab.

	<u>READING</u>
Lab #1 Introduction to Mineral Properties	Ex 3
Lab #2 Mineral Identification	Ex 3

Lab #3 Formulas and Properties Exam; Mineral Identification	Ex 3
Lab #4 Mineral Identification Exam; Igneous Rock Identification & Environments	Review Ex 3 Ex 4, 5
Lab #5 Sedimentary Rock Identification & Environments (Earth's Surface & Inner Structure)	Ex 6
Lab #6 Metamorphic Rock Identification & Environments (Plate Tectonics)	Ex 7
Lab #7 Final Review of all Rock Families (Volcanism)	Ex 4,5,6,7
Lab #8 Rock Identification Exam (Volcanism)	Review Ex 4,5,6,7
Lab #9 Topographic Maps & Survey Systems (Intrusions)	Ex 9
Lab #10 Geologic Structures & Geologic Maps	Ex 10
Lab #11 Groundwater	Ex 12
Lab #12 Glaciers	Ex 13
Lab #13 Deserts Streams	Ex 14 Ex 11
Lab#14 Coastlines	Ex 15
Lab #15 Identifying Landforms on Topographic Maps	Review Ex 9-15
Lab #16 Map Exam	Finals week- Thurs May 22, 1:30 – 3:00pm

INSTRUCTIONAL MATERIALS FEE:

All students in Geol 110 must pay a non-refundable "**Instructional Materials Fee**" of **\$10**, as indicated by the appropriate footnote in the class schedule. Be sure to get a "Lab Fees" form from the instructor and follow instructions at bottom of form. By the end of the 6th week

of instruction, Friday March 9, 2006, all students in the class must pay the fee, ensure that both copies of the form are stamped by the cashier, and **return the completed and stamped white copy to the Geosciences Department Office, TH509**. Failure to submit the required form by the indicated deadline will result in a hold on the student's records and a suspension of all university services. (Retain the yellow copy as your proof of payment.)

MANDATORY ADVISING

For students pursuing a Geology Major, you must see a Geology advisor at least once per semester and no later than Advising Day. Be sure to get an Advising Form from the department office, TH509, and follow instructions at bottom of form. Failure to complete advising, will result in you being dropped from subsequent Majors courses. In addition to course planning at the advising meeting, you and your advisor will discuss your graduation assessment portfolio.

Distinguished Speaker Series for Spring 2007

The Geosciences Department's Distinguished Speaker Series will continue in Spring Semester 2008 with presentations usually on Tuesday or Thursday from 1:00-2:00 in TH 618. Students in Geology courses are encouraged to attend.

IMPORTANT DATES:

Deadline to drop course:	Wednesday, Feb 20
Spring Break:	Monday, Mar 24 – Sunday, Mar 30
Cesar Chavez Holiday:	Monday, Mar 31 (classes cancelled)
Deadline to withdraw:	Thursday, April 24
Last day of classes:	Thursday, May 15
Final exam period:	Saturday, May 17 - Friday, May 23
Grades available on line:	Tuesday, June 3

**The Sixth International Hutton Symposium on
The Origin of Granites and Related Rocks
Stellenbosch University, Stellenbosch, South Africa,
July 1 - 6, 2007**

**Hydrothermal Pipes in Eight Granitic Plutons in California:
Evidence for Evolution and Migration of a Magmatic Volatile
Phase in Epizonal Silicic Intrusions**

David Mustart and Matthew Horrigan

Department of Geosciences, San Francisco State University mustart@sfsu.edu

Hydrothermal pipes occurring in granitic intrusions provide significant insights into the genesis and migration of a magmatic volatile phase which evolves at late stages of crystallization of silicic plutons. At this point, we have located more than 600 pipes in plutons in California. We have carried out our most detailed investigations on the Tuolumne Intrusive Suite in the Sierra Nevada Batholith and have located more than 400 pipes within the three most silicic members of this nested intrusive suite. Although our mapping is not complete, the preliminary distribution pattern of pipes is as follows: Half Dome Granodiorite (366 pipes), Cathedral Peak Granodiorite (44 pipes) and Johnson Granite Porphyry (6 pipes). The majority of pipes (62%) occur either directly centered on, or within one meter of a pegmatite or pegmatite-aplite dike.

Most pipes display concentric zoning with an outer rind enriched in quartz, potassium feldspar and muscovite, and a core composed primarily of internally nucleated albite and epidote, with intercrystalline spaces partially filled with fine-grained chlorite displaying a radial to spherulitic habit. Evidence that a fluid phase has streamed through the pipes is suggested by the presence in the pipe core of a finely-milled microbreccia of epidote, quartz and plagioclase enclosed in a matrix of spherulitic chlorite. The abundance of hydrothermal pipes in the shallowly emplaced Tuolumne Intrusive Suite suggests to us that such conduits are a common feature of epizonal silicic plutons, and have originated in large part by upward migration of a magmatic volatile phase released from the associated pegmatites. This hydrothermal fluid has subsequently streamed upward through a partially solidified host, leaving a characteristic pipe-shaped track. This inference has been partially confirmed by the close association of pipes and pegmatite dikes in the petrologically similar and shallowly-emplaced Paradise-Whitney Intrusive Suite, located 120 km south-east of the better known Tuolumne Suite.

The zonal mineralogy frequently leads to differential weathering of the pipes producing a recessed core and a protruding rind. The resultant similarity of surface expression to potholes, weathering pans and miarolitic cavities, may explain why hydrothermal pipes in granitic intrusions have apparently been overlooked by previous workers.