

# Geology 161: Physical Geology

## What is Physical Geology?

Physical geology is simply the study (logos) of the earth (geo)! In this class we will begin to understand the forces behind such phenomena as volcanic eruptions, earthquakes and tsunamis. We will discover what the world is made of, and touch rocks that were formed billions of years ago. We will learn how crystals are formed, how glaciers carve solid rock, and how rivers cut canyons. By the time this course is over, you will have a new perspective every time you go outdoors. Our world is a rich and mysterious place, and the science of physical geology is the place to discover it.

## Contact the Instructor

**Instructor:** Garry Hayes – Science Community Center 336

**Phone and Voice Mail:** 575-6294

**Office hours:** TTh 8:15-8:45; 11:45-12:45, 5:30--6:30

**E-mail:** hayesg@yosemite.edu

**Web Page:** <http://hayesg.faculty.mjc.edu/>

**The Geoblog:** <http://geotripper.blogspot.com/>



## What books do I need?

### Required Texts:

*Physical Geology: Exploring the Earth*, Carlson, Plummer and Hammersly

*Physical Geology Lab Manual*, Garry Hayes

## How will my grade be determined? (Tentative)

Task	Points Possible	Percentage of Grade
Quizzes (best 10)	200	25%
Laboratory	300	37%
Midterm	100	13%
Final	200	25%
Total	800	100%

A: 800-720

B: 720-640

C: 640 -560

D: 560 - 480

F: Less than 480

Quizzes will generally be given after each chapter and will consist of fill-in, true/false, and short answer essay questions. Ten of the quizzes will count (There will be 11 or 12 quizzes). **NOTE: Quizzes cannot be made up for any reason, unless arrangements have been made in advance with the instructor.** The midterms and the final will consist of multiple choice questions. **The final examination will be comprehensive.** If you have special needs in relation to testing, let me know as soon as possible.

Extra credit can be earned by completing at least 10 “Testing Your Knowledge” assignments at 5 points apiece (the essay questions). Up to 50 points can be earned. **You are strongly encouraged to do these assignments.** The chapter review assignments are due at the time of each quiz and **will not be accepted** if they are late. You may get extra credit for attending certain community events on campus. Watch your MJC e-mail account for announcements.

**When does it all happen? (This schedule is very tentative)**

## Tentative Schedule

Week	Date	Topics	Reading
1	Jan 14-16	Introducing Geology; Origin of the Earth	Chap. 1 & 23
2	Jan 21-23	Minerals	Chap. 2
3	Jan 28-30	Igneous Rocks and Intrusive Activity	Chap. 3
4	Feb 4-6	Volcanism	Chap. 4
5	Feb 11-13	Volcanism	Chap. 4
6	Feb 18-20	Weathering and Sedimentary Rocks	Chap. 5 & 6
7	Feb 25-27	Metamorphic Rocks - MIDTERM #1	Chap. 7
8	March 3-5	Geologic Structures and Earthquakes	Chap. 15-16
9	March 10-12	The Interior of the Earth - Sea Floor	Chap. 17 & 18
10	March 17-19	Plate Tectonics and Continents	Chaps. 19 & 20
11	March 24-26	Mass Wasting	Chap. 9
12	March 31-April 2	Running Water	Chap. 10
13	April 7-9	Groundwater	Chap. 11
14	April 14-16	Glaciers	Chap. 12
15	April 21-23	Work of Wind and Deserts, Shorelines	Chap. 13-14
16	Final Examination	Tuesday, April 28 10-12:50 AM	

**“After sleeping through a hundred million centuries we have finally opened our eyes on a sumptuous planet, sparkling with color, bountiful with life. Within decades we must close our eyes again. Isn’t it a noble, an enlightened way of spending our brief time in the sun, to work at understanding the universe and how we have come to wake up in it? This is how I answer when I am asked—as I am surprisingly often—why I bother to get up in the mornings.”**

**Richard Dawkins**

Are you the kind of person who ignores handouts? Don't do that: **Read all of this!**

**Surviving Physical Geology**

**ALWAYS ATTEND CLASS** - This shouldn't have to be said, but it is truer for science courses than for many others: You will miss a tremendous amount of information if you aren't there. If you **have** to miss a class, you are **still responsible for all that occurs, including test and quiz announcements**. Call me or get notes from someone else in the class. Be aware that three (3) consecutive absences will be considered sufficient grounds for dropping you from the course.

**READ THE TEXT BEFORE THE LECTURE** - Read the text after the lecture. And read it before tests. Do the practice quizzes at the end of the chapters. Books are required for a reason. I've found some of the best ones available; make use of them.

**ALWAYS TAKE COMPLETE NOTES** - and rewrite them after referring to your text. You will remember only 10% of what you hear, 20% of what you write, but more than 40% of what you hear and rewrite. Practice your drawing skills; a picture may truly be worth a thousand words.

**SCORE CARD:**

**Quizzes:**

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**Chapter Review:**

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**Midterm and Final:**

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**Every student is unique with different strengths and weaknesses.** Some of you may find this to be a difficult course, while others may find it to be relatively easy. The most important point to know is that you **can pass this course!** It may, however, be necessary to change some of your study habits and learning strategies, especially if you are just beginning your college education.

**There is no substitute for effort.** Do not come to my office two weeks before the end of the course asking how you can pass the class. You will know long before then that you are in trouble.

**Academic Dishonesty:** Your integrity is vital to your success in college and in life. Your classmates expect a fair and just learning environment. I personally consider academic dishonesty to be one of the most egregious offenses in the college environment. Consequently, anyone found cheating in this course will be dealt with as firmly as college policies will allow. At the very minimum, your assignment will be recorded as a 0 and documentation of the incident will be placed in a student discipline file with your name on it. Additional consequences may include suspension or expulsion from the college.

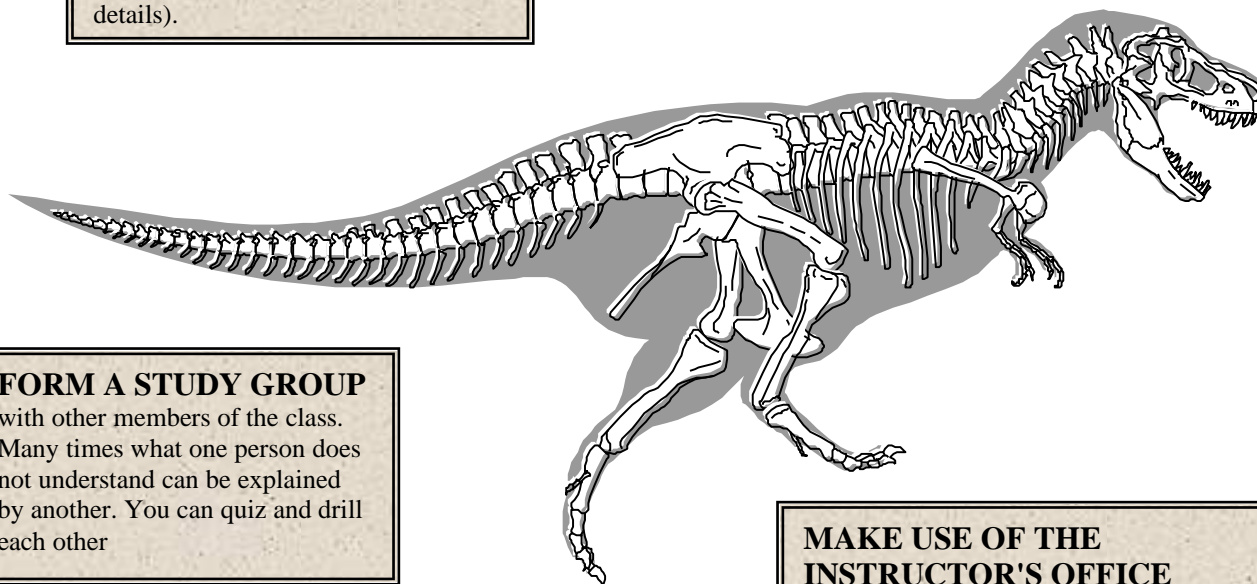
## Class got you unnerved? Need ideas to survive this course?

### GET THE HELP OF A TUTOR OR LAB ASSISTANT.

Too few students take advantage of the tutoring program here at MJC. The tutors are students who received 'A's when they took the course, and students who have received tutoring have had marked increases in their test scores. This service is free (see me for details).

### USE THE WEB PAGE RESOURCES AND COMPUTER TUTORIALS

available in the geology lab. Explore the department web page to see what resources are available there:  
<http://hayesg.faculty.mjc.edu/Geology161.html>.



### FORM A STUDY GROUP

with other members of the class. Many times what one person does not understand can be explained by another. You can quiz and drill each other

### SET ASIDE STRICT STUDY HOURS.

Students often rebel at the concept of study time outside the classroom (at least I did while in school!) This is unfortunate, since most learning occurs during study time. Make it a habit to give 2 hours of study for every hour of class lecture. If you are working, it may be harder to schedule study time, and yet all the more critical. Don't neglect lunch hours for study time (I got my degree while selling shoes at a department store!).

### MAKE USE OF THE INSTRUCTOR'S OFFICE

**HOURS:** I am available and happy to help you in any way I can. If you can't make it during regular office hours, call me and make an appointment. If you can't call me, then e-mail me ([hayesg@yosemite.edu](mailto:hayesg@yosemite.edu)).

**THE PARTING SHOT:** If you successfully read all of the above, you have earned the right to some extra credit points! Visit the Geology 161 website (you can access it at <http://hayesg.faculty.mjc.edu/Geology161.html>). Note the location at which the picture was taken, and **e-mail** me before the second class meeting to receive 5 extra points (handwritten notes don't count).

**USE 3X5 FLASH CARDS** to help memorize terms. Much difficulty in this course results from not learning the language of science. Put the term on the front, and the definition on the back. Carry a few in your pocket or purse, and glance at them when you are standing in line, or during commercials.

# Physical Geology Laboratory

## "DOING" SCIENCE:

Contrary to the view of many people, most scientific research is not done by the lonely and slightly mad research genius working in an isolated castle. It is a communal effort of many people working together, trying to solve a common problem or puzzle.

In the lab, we will also work in groups. Your grade points will be evenly split between your individual efforts and those of your group. Each group should have 3-4 people and will be selected during the first lab period. If anyone is not doing their part in the group, they will not be given the credit for the group's work. Please see the instructor if there are any problems. If you work better on your own, you may feel free to do so.

## THE PRELAB ASSIGNMENT:

**The first page or two of each lab assignment should be read and completed prior to lab each week.** These prelab assignments will be graded when your notebooks are collected mid-semester, and again at the end of the semester. There are some occasional surprises. **Don't forget to check the pre-lab assignments every week!**

## THE LAB:

The lab is done in Room 326 of the Science Community Center on West Campus. Each week a new exercise will be assigned. Unless otherwise noted, the lab exercises will be due at the beginning of the following week. Although each individual will complete the assignment in their own lab manuals, most weeks the group will submit a single copy of the assignment with everyone's signature. **Twice during the semester, the lab notebooks will be collected and graded for individual credit.** Pop quizzes will be given a number of times during the semester (groups will work together on these). **The midterm and final will be individual efforts.**

## LAB EXIT QUIZZES

You can leave the lab as soon as you are done with the day's assignment. For attendance purposes, and as a source of learning outcome feedback, you are requested to take the **lab exit quiz**, a series of four questions or problems on the subject of the day. You are to answer the questions by yourself, without the help of books or notes. To get credit, you must get the four questions correct. You may make three attempts to pass, but you must go to the end of the line each time. Take the completed lab to the instructor or laboratory assistant to receive your grade. The quizzes are worth two points each, and cannot be made up at a later time.

## EQUIPMENT AND TEXT:

*Physical Geology Lab Manual* by Garry Hayes (Required)

10 power handlens (available at Bookstore, Great Valley Museum or NASCO West)

Colored Pencils

## Group Exercises

Assignment																	
Score																	
Exit Exam																	

## Tentative Schedule

Week	Date	Topics	Reading
1	Jan 14-16	Physical properties of minerals	Chap. 2
2	Jan 21-23	Rock-forming minerals	Chap. 2
3	Jan 28-30	Sedimentary, metamorphic and ore minerals	Chap. 2
4	Feb 4-6	Plutonic and Volcanic rocks	Chap.3-4
5	Feb 11-13	TBA	Chap. 6
6	Feb 18-20	Sedimentary Rocks	
7	Feb 25-27	Metamorphic Rocks	Chap. 7
8	March 3-5	Topographic maps and Volcanoes <b>(Midterm exam)</b>	Appendix
9	March 10-12	Structural geology - faults and folds	Chap. 15
10	March 17-19	Geologic maps I	Chap. 15
11	March 24-26	Geologic maps II	Chap. 15
12	March 31-April 2	Streams and rivers	Chap. 10
13	April 7-9	Glaciers	Chap. 12
14	April 14-16	Del Puerto Canyon Field Trip	
15	April 21-23	Coastal Landforms and <b>Laboratory Final</b>	Chap. 14

# Geology Department Field Studies Spring 2020



## **Geology 187: Death Valley (5156) - 2 units** **Thursday, February 13 (4:00pm) to Monday,** **February 17 (6:00pm)**

Death Valley is one of the most desolate places on our planet. Receiving less than two inches of rain a year, the Valley is the hottest and driest place on the North American Continent. The resulting lack of vegetation allows geologists to see evidence of the earliest history of our land, for within the monument are rocks ranging in age from more than 2 billion years to less than 1,000 years. Active faults, evidence of 900-foot-deep lakes, fish, salt flats, sand dunes, and shark teeth and dolphin bones are all part of this trip. **This is a rigorous trip** with long drives and rugged camping conditions. Geology wimps not recommended! (Fee: \$90.00)

## **Geology 176: California** **Mother Lode (5500)- 1/2 unit** **Sat., March 14 (7:30am - 7:30pm)**

Mineral hunting (pyrite, mariposite, quartz crystals and more) highlight this trip which will explore the southern Mother Lode between Mariposa and Jamestown. Other sights include ghost towns, old mines, ancient lava flows, and the California State Mineral **Exhibition (Fee \$18.00)**.

## **Geology 172: Yosemite Valley** **(5499)- 1/2 unit FRIDAY, April** **10 (7:30am - 7:00pm)**

One of the world's most famous works of nature, Yosemite Valley is a perfect locale for understanding the work of glaciers, streams, landslides, and the processes producing granite. Stops include the lower Merced River valley, Bridalveil Falls, Yosemite Falls and Inspiration Point, and if possible, a look at flood and landslide damage (Fee \$18.00)

## **Geology 191: Geology of the Colorado Plateau** **Summer Field Studies: May 21-31, 2020**

It's the adventure of a lifetime! The Colorado Plateau is one of the most dramatic landscapes in North America: it is a region that preserves nearly two billion years of Earth history in spectacular fashion. On this trip we will explore the parks and monuments of New Mexico and Colorado, including Mesa Verde, Black Canyon of the Gunnison, Great Sand Dunes, and Chaco Canyon national parks, and numerous state parks and national monuments. We'll meet in Albuquerque and travel a large loop to the north. Details on next page.

## Important Details!

Each of these field trips is a separate course for academic credit. To enroll, you will need an add card from the instructor. When you apply, a per-credit fee and trip fee will be charged in the admissions/business office. You are expected to take notes and complete a worksheet for each field trip you attend.

**For day trips**, bring a sack lunch, canteen (or small ice chest), notebook, and coat or rain protection if the weather threatens. Rock hammers and cameras are optional. Transportation is provided by the school (private vehicles are not allowed on trips). We will meet in front of the Science Community Center (north side) on West Campus at 7:30 AM. We generally expect to return about 7:30 PM. More information at <http://hayesg.faculty.mjc.edu/geology171x.html>.

**The extended trip** to Death Valley involves camping out in fairly rugged conditions which necessitates additional planning and preparation. We will have **an organizational meeting** prior to the trip (**Thursday, January 30 at 5:30 PM in Science Community Center Room 326 on West Campus**), and you will need to prepare some written materials. **Attendance at the meeting is mandatory**. More information at [http://hayesg.faculty.mjc.edu/Death\\_Valley\\_Field\\_Studies.html](http://hayesg.faculty.mjc.edu/Death_Valley_Field_Studies.html).

### Looking ahead:

**Geology and Anthropology of the Colorado Plateau- June 26-July 10, 2019** (Geology 191 and Anthropology 191 – 6 units): It's the adventure of a lifetime! The Colorado Plateau is one of the most dramatic landscapes in North America: it is a region that preserves nearly two billion years of Earth history in spectacular fashion. On this trip we will explore the parks and monuments of New Mexico and Colorado, including Mesa Verde, Black Canyon of the Gunnison, Great Sand Dunes, El Morro, Bandelier, and Chaco Canyon. Along the way we'll explore one of the largest volcanic complexes in North America, the Valles Caldera, and the one of the world's great mountain ranges, the Rockies. We'll meet in Albuquerque and travel a large loop to the north. The geology class will be held jointly with the Anthropology 191 Field Studies Course, which will provide an in-depth human history of the region, including the Ancestral Puebloan people, and present-day Native American communities.

Cost (includes transportation, hotels, and entrance fees): approximately \$1,600. Students will be responsible for getting to Albuquerque, New Mexico for the start of the trip.

We will have several organizational meetings, the first of which will be on **Wednesday, January 22, at 7:00 at MJC in Science Community Center Room 326 (West Campus)**. Previous experience in geology or earth science is recommended, but not required. For more info, check out:

[http://hayesg.faculty.mjc.edu/Geology\\_191\\_Colorado\\_Plateau.html](http://hayesg.faculty.mjc.edu/Geology_191_Colorado_Plateau.html)



**What will you know when you finish this course? What new skills will you have? The following items are the Course Learning Outcomes (CLO's) for Physical Geology. Upon successful completion of the course, you will be able to:**

- A. **Analyze the elements of the scientific method and explain how these principles apply to the study of the earth.** All sciences share a common methodology of attaining knowledge that seeks to eliminate bias and prejudice in research. You will know the difference between a hypothesis and a theory (and it may very well not be what you think!).
- B. **Explain the geologic processes of tectonism, erosion, and mineral and rock formation.** You live in one of the most diverse landscapes in the world: there are few places where you can start driving in a hot desert, go up and ski for a few hours, and then go to the beach to work on your tan. Almost every important geologic process has an example taking place in this state, and you will understand how they work. Not to knock pop culture, but you will know more about geology than literally any television or newspaper reporter. You will be criticizing and critiquing the news regularly, especially when they make mistakes about earthquakes and volcanoes.
- C. **Use the basic geologic principle of uniformitarianism and the examples of present-day geologic processes to explain the formation and evolution of the features of the earth.** Many people are surprised that a geologist can look at a few rocks in a roadcut or mountainside and then immediately tell a complete story of how those rocks came about. In this class, you will learn the set of principles that geologists use to tell the story of the rocks. You will have the ability to interpret the story in the rocks yourself, either in pictures and diagrams, or by visiting the localities yourself.
- D. **Assess and evaluate competing hypotheses regarding the concept of geologic time, the origin of the earth and solar system, and plate tectonics.** Geologists are still arguing about geological processes. This is how science is meant to work, so we will be learning how controversies and arguments are settled in geologic research.
- E. **Explain the necessary role of the geologist in the modern technological society in areas such as urban planning, the search for new energy resources, and environmental research.** Can we drill offshore of California and bring back \$2/gallon gas? Are politicians correct when they say global warming is not real? Do we have enough water for the population of the state? Should we be covering the agricultural soils of the Central Valley and building cities? Geologists have a lot to say about these issues, and you will understand how scientists approach these problems.
- F. **Test for the physical and chemical properties of minerals, and identify the most common minerals and igneous, sedimentary and metamorphic rocks.** The nuts and bolts of geology is the ability to identify the most common rocks and minerals. You will know fully 95% of all the minerals and rocks anyone will ever ask you about!
- G. **Interpret geologic features and landforms from aerial photographs and topographic maps.** You will learn how to read maps and identify geological features on aerial and satellite imagery. You will never have to feel ignorant when you are outdoors with this skill. And, it is more fun than it sounds (check out GoogleEarth sometime...).
- H. **Distinguish three-dimensional rock structures and faults from geologic maps.** You will be exercising your mind in this class; thinking in three dimensions is a rare and valuable skill that has many applications outside geology as well. And everyone should know their faults (literally).

