Field Geology of Plate Boundaries: Death Valley Trip

Credits: 3.0
CRN:
Prerequisite: GEOL 242 (Mineralogy) or ESCI 215 (Earth Materials)

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Required Textbook: *Rite in the Rain Geology Field Note Book.* You can find them online at http://www.amazon.com/gp/product/B0011DGJSC, ISBN 978-1-932149-35-7.

Optional Textbooks:

If you anticipate field work in your future, I recommend purchasing a copy of *Geology in the Field*, by Robert Compton (John Wiley and Sons, 1985; ISBN: 0-471-82902-1). This text provides a wealth of standard approaches to geologic data description and collection.

Geology Underfoot in Death Valley and Owens Valley, by Robert P. Sharp and Allan Glazner, Mountain Press Publishing Company, Missoula; 1997; ISBN 0-87842-362-1, provides general geologic background on many of the sites we will visit.

GEOL 343 Course Description

This course provides the opportunity for students to apply their in class theory to a field study experience. Students will record geologic observations in field notes and sketches; create maps and geologic cross sections; and present summaries of field investigations. Topic, site, and instructor may change upon each offering. Prior trips have visited the active plate margin in the western US, near Palm Springs in southern CA, and Death Valley National Park in eastern CA. The cost of the trip will vary based upon location. May be repeated for up to 9 s.h.

Field Trip Summary

This field course examines the geology and geomorphology in a continental rift setting (Death Valley) in eastern California. The nearly two miles of relief expose spectacular outcrops of rocks ranging from pre-Cambrian to the present. The region presents a rich diversity of landscapes, and includes sand dunes, playas, alluvial fans, gorges, high mountains, exposed fault surfaces, volcanic craters, and large landslides. Students will investigate how the valley formed. They will also decipher connections between modern depositional processes and environments and sedimentary structures that are preserved in the rock record. A minimum of 9 students is needed for the trip to run. Costs will not exceed $1200 per student including air fare, food, lodging,

transportation, and tuition. Students will stay in campgrounds. Students must be a major in Earth & Atmospheric Sciences or Environmental Science.

Course Justification

There is a persistent need for trained geoscientists with experience in geologic field investigation. This course will expose students in Geology, Environmental Sciences—Earth Science, and Water Resources to an active plate tectonic boundary in southern California, also known as Death Valley National Park (DVNP). DVNP provides extraordinary learning opportunities for students, exposing numerous faults and folds, a spectrum of rocks including clastic and chemical sedimentary rocks, explosive and effusive volcanic rocks, intrusive igneous rocks and metamorphic rocks. In addition, desert springs associated with groundwater flow, topography, and faults provide superb examples of hydrology. The landscapes in the area exhibit premier examples of arid region landscape processes and geomorphology, including uplifting mountains, huge landslides, dunes, playas, alluvial fans, and desert pavement. This field course builds on prior course work in lecture and labs and integrates that material with superb field settings. The nearly 100% exposure of rocks and structures in the area offers a view into Earth's processes and the geologic record of past environments. In addition, the close juxtaposition of eroding mountains, and modern depositional settings for clastic and chemical sediments permits field based projects which couple stratigraphy with processes in a very direct way. Field exercises will require students to identify rocks, characterize processes, and develop skills in collecting and analyzing spatial and geologic information. This course will be a profound learning experience.

The course will take place mostly on the field trip, which will run in January, with scheduled weekly meetings during Spring semester. After returning, students will generate finished maps and cross sections, geologic descriptions, stratigraphic sections, stereonets, reports, and the like. Such items are routinely required for any geologic field investigation.

Specific course objectives

Students will:

- develop skills in recording geologic observations in field settings;
- learn how to relate sedimentary features and structures to depositional environments and surface processes;
- learn how to map rock units;
- learn how to identify and map faults and folds;
- develop skills in graphical presentations of geologic data, including cross sections and map views; and
- recognize relationships between tectonic activity and landscape form

Student Learning Outcomes

Student Learning Outcomes for the Geology Major addressed by this course:

- Students will demonstrate their ability to describe and identify geologic materials. (GEOL-SLO #1)
- Students will demonstrate their understanding of how rocks, sediments, and soils form. (GEOL-SLO #2)

- Students will demonstrate comprehension of the role of deep time in Earth history. (GEOL-SLO #3)
- Students will demonstrate understanding of processes that occur on and within the Earth and interactions among Earth's systems. (GEOL-SLO #5)
- Students will demonstrate their ability to collect and analyze geologic information in field and laboratory settings. (GEOL-SLO #6)
- Students will demonstrate their ability to apply scientific reasoning and technology to solve geologic problems. (GEOL-SLO #8)
- Students will demonstrate their ability to work collaboratively to solve geologic problems (GEOL-SLO #9)
- Students will utilize scientific methods to design and execute research projects that include collection, analysis and interpretation of data. (GEOL-SLO #10)
- Students will demonstrate their ability to communicate scientific and technical information effectively through appropriate oral, visual and written presentation. (GEOL-SLO #11)

Student Learning Outcomes for the Earth Science Major addressed by this course:

- Students will demonstrate understanding of the governing concepts related to all components of the Earth system (meteorology, geology, oceanography, astronomy) and the relationships that link them. (ES-SLO #1)
- Students will demonstrate understanding of the structure of Earth's interior and the processes that operate within and on the Earth's surface, including a working knowledge of plate tectonics and natural hazards. (ES-SLO #4)
- Students will demonstrate their ability to describe and identify geologic materials and interpret the processes by which these materials form. (ES-SLO #5)
- Students will utilize scientific methods to design and execute research projects or solve problems that include collection, analysis and interpretation of data. (ES-SLO #7)
- Students will demonstrate their ability to communicate scientific and technical information effectively through appropriate oral, visual and written presentation. (ES-SLO #8)

Grades

Students will be evaluated based on **participation** (**5%**) on the field trip, **field notes (25%), maps (25%)**, **geologic cross sections (%15)**, **stereonets (%15)**, and **Fusion table** (**15%**).
Participation on the field trip, which includes asking questions in the field, assisting with tent set-up and tear down, doing dishes at the camp, helping with food preparation, cleaning up the camping area, and assisting with packing up camping gear.
Field notes must include a record for each stop, including date, time, location (GPS location), purpose for stop, verbal descriptions, sketches, discussion, discoveries and comments on key themes at the stop.
Geologic maps portray the kinds of rocks and nature of geologic structures at a location. Each map must have a descriptive title with place and content of map, author, date, scale, north indicator, and lithologic legend. The finished geologic map (the desk copy) should have lithologic contacts, folds, faults, and rock orientation symbols clearly delineated. Lithologic units must be color-coded in the map and on the legend (desk copy only). The legend must include a description of the rock unit. Unconformities must be noted. Rock units in the legend must be in correct stratigraphic order, with youngest on top. Students are encouraged to transfer their map

data to a GIS format, but paper maps with legible writing and neatly drawn features will not receive less credit.

Geologic cross sections are created from geologic maps, and portray the three-dimensional character of rock relationships. The geologic cross sections must have a descriptive title, author, date, vertical exaggeration, horizontal and vertical scales, topography, labeled ends of cross section that are keyed to a cross section line on the map, correctly located fold axes and faults, neatly sketched (or computed) bedding surfaces and formation contacts, if present.

Stereonets provide an ensemble view of how structures are aligned. Each stereonet will need a descriptive title, date, and author.

Google Fusion tables are spatial databases that provide map views, filters, and diagrams, and allow easy sharing of your data to the world. The Fusion table is built on GPS locations for your strike dip data, and can also render contacts (that is, it can plot points, lines, and areas). You will learn how to link your pictures and images of stereonets to locations in a map, with a clickable pop up windows with information about the site.

Late work will be marked down exponentially, with a decay rate of -0.25 per day, up to a limit of 5 days, at which point your grade ceases to decay, but the damage is done, so to speak. The equation is: $G(t) = G_0 e^{\lambda t}$, where $G(t)$ is your grade after it has decayed over time, G_0 is your grade if you submit your work on time, λ is the decay rate, e is Napier's constant ($\approx$2.71828), and t is time in days. For example the table below shows the value of a report up to five days past due:

Days Late	Value of report
0	100%
1.0	78%
2.0	61%
3.0	47%
4.0	37%
5.0	29%

Note even if you are 5 days or more late, you will still get something for the exercise, and this is often the difference between a passing or failing mark for the course. **Do the work in the time allotted! You won't regret it! If you don't make the deadline, it's still worth it to hand them in.**

Rubrics for Course Exercises

A rubric identifies key parts of an exercise which will be evaluated, or ranked, based on a scale from 0 = no credit to 4 = excellent. What does each rank mean? This will vary based on what is being evaluated. In general:

0 = **No Credit**. This applies to an effort that would not receive a passing mark (below D-). There might be information provided, but the information is seriously flawed and the method of portraying that information (graphs, charts, maps, etc) obscures the true nature of the subject material.

1 = **Poor**. This applies to an effort that would receive a passing mark in the D range, and while passing, still has significant problems. *Some necessary information* is conveyed, but is missing pertinent details. The *method of portrayal* (graphs, charts, maps, etc.) is sloppy, and lacks definition and order. The *analysis of the data*, if one is asked for, is shallow and cursory.

2 = **Fair**. This applies to an effort that would receive a mark in the C range. The effort provides *necessary and sufficient content* to characterize the information, but it *lacks a thorough analysis* of the data, may not provide complete *background information* and needs improvement. *Organization and portrayal of the information* (graphs, charts, maps, etc.) could be improved.

3 = **Good**. This applies to an effort that would receive a mark in the B range. The effort provides *necessary content in a meaningful context*, an *adequate analysis in a clear fashion*, and a *useful portrayal* of information (graphs, charts, maps, etc.).

4 = **Excellent**. This applies to an effort that would receive a mark in the A range. The effort displays *clear, concise, accurate information* that is *organized and presented well*, *portrays the information clearly* (graphs, charts, maps, etc), and provides a *thorough and insightful analysis* of the results.

Rubric for Field Notes

Weight (%)	Criteria
10	Date, time, location (GPS coordinates)
20	Purpose and Description of stop
40	Detailed notes of observations
30	Sketches

Rubric for Geologic Maps

Weight (%)	Criteria
5	Lithologic contacts
5	Faults
40	Rock Orientation symbols, correctly plotted
15	Legend: Color-coded for lithologic units; all geologic symbols need a symbol (fault, strike-dip, contact, etc)
30	Verbal description of lithologic units in legend
5	Title, author, date, references for data sources, north arrow, scale

Rubric for Geologic Cross Sections

Weight (%)	Criteria
5	Title (Location and Content of Section), author, date
5	Properly labeled axes, with directional indicators, keyed to a map
70	Properly located folds and faults and layers
5	Properly labeled layers on the cross section
5	Statement of vertical exaggeration
5	Overall appearance and clarity of the cross section
5	Legend for layers

Rubric for Stereonets

Weight (%)	Criteria
5	Title (Location and Type of Feature), author, date
85	Plot of poles to planes
10	Identification of fold axes, compressive direction, general interpretation

Rubric for Fusion Table

Weight (%)	Criteria
5	Title (Location and Table Content), author, date, titles of visualizations
40	All strike-dips located for all field sites
40	Columns for rock type, strike, dip, latitude, longitude, formation name, bed thickness, fossils present, current indicators, sedimentary structures
5	Photos and stereonets linked to locations
5	Info window presents pertinent features only
5	Visualizations (additional tabs based on columnar data)

The rubric score will be re-scaled to the University curve according the following ranges: A: 100-87.5%, B: 87.5-62.5%, C: 62.5-37.5%, D: 37.5-8.3%, E: < 8.3%. The equation to rescale is $Grade_{university} = 0.3801 \times Grade_{rubric} + 56.386$, which yields a score as a percentage for the final grade assignments given by the standard University curve given below.

Percent	Grade	Percent	Grade	Percent	Grade	Percent	Grade
93-100	A	87-89.9	B+	77-79.9	C+	67-69.9	D+
90-92.9	A-	83-86.9	B	73-76.9	C	63-66.9	D
< 60	E	80-82.9	B-	70-72.9	C-	60-62.9	D-

Death Valley Field Trip Schedule

Date		Day	Location	Campground	Activity
1/3/2014	Fri	Day 1	Travel/Resting Springs Tuff/Lake Tecopa	Shoshone Village	Recon
1/4/2014	Sat	Day 2	Split Cone/Mormon Pt/Badwater Arch/ Devil GC/Artists Palette	Furnace Creek	Recon
1/5/2014	Sun	Day 3	Gower Gulch	Furnace Creek	Map
1/6/2014	Mon	Day 4	Gower Gulch	Furnace Creek	Map
1/7/2014	Tue	Day 5	Golden Cyn	Furnace Creek	Map
1/8/2014	Wed	Day 6	Hole in the Wall	Furnace Creek	Map
1/9/2014	Thu	Day 7	Mosaic Cyn/Mesquite Dunes Desert Pup fish	Furnace Creek	Recon
1/10/2014	Fri	Day 8	Marble Cyn	Stovepipe	Recon/Map
1/11/2014	Sat	Day 9	Ubehebe	Stovepipe	Recon/Map
1/12/2014	Sun	Day 10	Racetrack	Stovepipe	Recon
1/13/2014	Mon	Day 11	Fall Cyn/Titus Cyn	Stovepipe	Recon
1/14/2014	Tue	Day 12	Dante's View/Travel		Recon/travel

On Campus Schedule

Week	Mon	Wed
Jan 15-17		Field Notes DUE!!
Jan 22-24	Transfer GPS to GIS	
Jan 29-31	Add strike-dips to GIS	
Feb 3-5	Add contacts to GIS	
Feb 10-12	Finish Maps	Maps DUE!!
Feb 17-19	**Spring Break**	
Feb 24-26	Extract topographic profiles	
Mar 3-5	Add contacts to cross section	
Mar 10-12	Work on cross sections	
Mar 17-19	Work on cross sections	
Mar 24-26		Cross Sections DUE!!
Mar 31-Apr 2	**Spring Break**	
Apr 7-9	Read strike dips into Stereonets	
Apr 14-16	Interpret stereonets	
Apr 21-23	Create Fusion table	
Apr 28-30	Add photos to Fusion table	
May 5-7		Fusion table due
May 12-14	Course Wrap-up: Show and Tell	

College Calendar Spring 2014

January 12-14	Sunday-Tuesday	New Student Arrival & Orientation
January 15	Wednesday	Classes Begin
February 14	Friday	College Closes After Last Class
February 24	Monday	Classes Resume
March 28	Friday	College Closes After Last Class
April 7	Monday	Classes Resume
May 7	Wednesday	Study Day

May 8-14	Thursday-Wednesday	Finals
May 17	Saturday	Commencement

Emergency Evacuation/Shelter-in-Place Procedures In the event of an emergency evacuation (i.e. fire or other emergency), classes meeting in Science I are directed to reassemble at Chase Gymnasium so that all persons can be accounted for. Complete details of the College's emergency evacuation, shelter-in-place, and other emergency procedures can be found at http://www.oneonta.edu/security .

Course Guidelines and Expectations for Students

The following list provides a baseline of what is expected from students in this course (quoted section from the list of *Student Responsibilities* approved by SUNY Oneonta).

"In class responsibilities

Students will:

- Attend all classes and arrive punctually.
- If unavoidably late for a class, enter quietly and unobtrusively, and behave in other required ways to minimize distraction.
- Remain alert and attentive during lectures, discussions, and other class/lab activities.
- Avoid unnecessary conversation during lectures, discussions, and other class/lab activities.
- Contribute to class experiences by asking relevant questions, offering relevant examples or views, adequately answering questions posed by others, engaging in critical and independent thought, and challenging both the instructor and the curriculum materials assigned for the course.
- Demonstrate courtesy and respect in dealing with instructors and classmates.
- Recognize and seek to understand diverse points-of-view."

In the field responsibilities

Students will:

- Assemble all materials they need to conduct field investigations and bring these items with them (this list will be supplied at the start of the semester)
- Participate in group camping activities, such as setting up and taking down tents, preparing food and cleaning up after meals
- Be respectful of fellow students on the trip and of other campers in the campground
- Maintain quiet time from 10 pm to 6 am in the campground (or according to the local campground guidelines)
- Obey all state, federal and local laws pertaining to drug and alcohol use, trespassing, and social behavior.
- Any student violating the above principles will be dismissed from the field trip. The student assumes all costs associated with travel back to campus upon dismissal from the trip.