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Necessary: Field notebook similar to “Rite in the Rain” all-weather Geological Field Book No.,  
540F J.L. Darling Corporation  

Other required materials: refer to checklists.  

Recommended Texts: Compton, Geology in the Field or similar  

Introduction  

This is a rigorous course in field geology and a capstone experience in the Geological  
Sciences undergraduate program at SDSU. Students are responsible for all the skills and  
knowledge they have acquired in previous courses, and are required to apply it in  
geologic investigations. This year we will conduct field work in three areas: (1) southern  
Death Valley region of eastern California (2) the California Coast Ranges and, (3) the  
White-Inyo Mountain region of eastern California.  

This course is physically demanding. Students should be in good health, capable of  
strenuous hiking on rugged terrain while carrying daypack and field gear.  

The emphasis of Geol 508 is field mapping and map interpretation. The entire  
physical and historical basis of geology as an intellectual discipline is derived from  
spatial (map) data. Evidence comes from the distribution and relationships of rock types  
in the field. The goal of Geol 508 is to provide students with experience constructing  
coherent sets of field observations, producing detailed outcrop maps, and writing clear  
and informative geological field reports. Students are required to describe and explain  
surface features and underground structure based on observation and inference. The  
ability to correctly infer is a central goal in field training because competence as a  
geologist is measured by the ability to draw reasonable conclusions from observed  
phenomena.  

Geologic mapping requires synthesis of knowledge and skills from every aspect of  
geology. Mapping is intellectually and physically challenging, but steady progress and  
the occasional epiphany in the course of mapping can be tremendously rewarding. It is  
also occasionally frustrating as well. Exercise patience as you develop and refine your  
geologic intuition and field mapping skills. This class provides ample time for instructor-  
student contact; ask questions and ask for comments on your map and notes in the field,  
or any other help you might need. Take your time, be careful in your note taking and
mapping, and think about the geology you are mapping. Plan your traverses to answer questions and solve problems as they develop in the field. You will consult with the instructor and/or TA at the beginning of each field mapping day to review your progress and go over your plan for the day.

Learning Outcomes

- Identify and classify basic geologic materials, including minerals, rocks, fossils, structures, and landforms, and know their basic material/mechanical characteristics and/or biological properties.
- Create basic types of geologic maps with standard geology symbols, using standard field measurement techniques and equipment.
- Visualize and comprehend geological materials or structures in 3-D based on 2-D data sets.
- Perform basic types of geologic analysis which includes taking field notes, making lithostratigraphic and biostratigraphic correlations, map construction, and cross-section construction.
- Communicate the major geologic events in an area based on notes, map and stratigraphic data you collect in the field.

Geol 508 learning outcomes are scaffolded in the SDSU curriculum through lecture and laboratory components of core courses including mineralogy & petrology, stratigraphy & sedimentation, structural geology and geophysics. Geol 508 is the chance to hone these skills and independently apply them to field-based problem-solving.

Philosophy of Curriculum and Instruction

The philosophy of curriculum and instruction in Geol 508 has several major tenants:
- Learning should be active, cooperative, and demanding.
- The student is best served by a curriculum that includes a diversity of field experiences.
- You learn best in a setting that minimizes travel and logistics and maximizes time in the field.
- You learn more effectively by working with fellow students in groups.
- Understanding the regional geologic context helps you to organize knowledge in ways that facilitate retrieval and application. This approach, which involves “intellectual preparation” for each project, helps you leave this course with knowledge you can use, not just facts or techniques that you accumulate.

Field areas

The Death Valley region is a premier natural laboratory for the geological sciences. Revolutionary concepts in structural geology were developed here based on field work i.e., low angle detachment faults associated with Basin and Range crustal extension. The area is also characterized by some of the thickest, best preserved and most intensively studied Neoproterozoic and lower Paleozoic strata anywhere on earth. Evidence for low-latitude glacial epochs in the Neoproterozoic strata of the Rodinia supercontinent led to the proposal of ‘snowball earth’, a controversial heavily debated topic. The Precambrian-
Cambrian transition records one of the most important intervals in the history of life. The Wood Canyon Formation includes the Precambrian-Cambrian boundary and we will map in this unit at Emigrant Pass in the Nopah Range near the California-Nevada border.

**The California Coast Ranges and Southern San Joaquin Valley** displays world-class geology within a subduction-related Mesozoic magmatic arc setting. It is part of the great chain of Cordilleran batholiths-subduction systems extending from the tip of south America to Alaska and beyond. Our focus here will geologic history and landscape evolution within the context of petroleum geology resources.

**The Poleta folds** of eastern California has been studied and mapped by literally thousands of UC and CSU students over the past 40 years. This area afford opportunity to do stratigraphic analysis and mapping in classic Cordilleran orogen fold-thrust belt geology which is an archetypal collisional mountain belt formed by converging oceanic and continental plates. The fold-thrust belt here is part of a series of continuous contractional structures extending north-south through western North America Cordillera from Canada to southeastern California. It is characterized by thin-skinned tectonics, as opposed to thick-skinned deformation that characterized the Laramide province farther inboard. Cordillera fold-thrust belt structures are generally east vergent, which means that thrust sheets appear to have moved from the west (hinterland) relative to the stable continental craton onto which the thrust sheets moved (foreland). Thrust belts commonly mark the outer edge of collision mountain ranges such as the Andes, Alps and Himalayas, and of course the North American Cordillera. Thrusts in this situation don't just appear on their own but in herds and can interact to make wonderfully complicated cross-sections. Understanding the regional context and significance of the rocks we’re mapping is an important learning goal. Oil companies have a keen interest in this type of geology.

**Logistics and timing**

**Southern Death Valley** - 7 field days before the start of classes (Jan 12-18) - mapping in classic Neoprotrozoic-Paleozoic stratigraphy at Emigrant Pass in the southern Nopah Range. We will stay at the California State University Zzyzx field station – Desert Studies Center near Baker California and commute each day to the map area. Cost for food & lodging per person at Zzyzx will be ~$225.

**California Geology** – 5 days overlapping Spring recess (March 25-30)

**White Mountains** – 10 days at Poleta folds (May 23-June 2) - mapping classic Neoprotrozoic-Paleozoic stratigraphy above Deep Springs Valley plus a short exercise on Cenozoic volcanism and glacial geology in the Owens Valley. This part of the class starts the day after commencement ceremonies for Geological Sciences.....we will camp in a forest service campground near the top of Westgard Pass (Grandview Campground). We will organize food groups and do our own cooking. Final maps, cross-sections, field notes, and interpretations for the Poleta folds will be due one week after return from eastern California.
GEOL 508 GRADING CRITERIA

The Death Valley and White Mtn parts of the class will count for ~80% of your course grade and is broken down for each part approximately as follows:

Map & cross-section 60%
Field notes 10%
Stratigraphic column 10%
Geologic report 10%
Participation 10%

Map:
- Data recording and density: sufficient and appropriate for field conditions and structural complexity in the area under investigation
- Contacts and units are accurate and defensible – free of major unexplained thickness changes and consistent with all measurements and observations. Rule of V’s observed. Location and detail/subtlety evaluated.
- Structure as mapped and interpreted is shown by standard geologic symbols and supported by data and observations. Map is internally consistent.
- Complete legend/map explanation for all symbols and units. North arrow and scale included.

Cross Section:
- Consistent with all major structural features present map and mechanically correct in all aspects.

Stereonet:
- Plot fold measurements as poles and determine profile plane and axial bearing and plunge of folds.

Reports:
- Organized, complete and concise; speaks specifically to the field area and map data. Reflects knowledgeable application of structure and stratigraphic concepts and terminology.

Field notes:
- Mechanics: includes date & field location at top of each page, legibility, completeness (coherent descriptions you could understand after 10 days or more), and consistency and interconnectedness.
- Drawings and Sketches: scale and orientation, usefulness and relevance, active model testing by visual representation.
- Evidence of Scientific Thought: frequent making and testing of predictions evident, uncertainty is acknowledged and dealt with, and general evidence of active and responsive thought.

Stratigraphic column:
- Graphic section – provide title at top, show names, ages and thicknesses of units.
- Correct use of lithologic symbols – distinguish between main units.
- Thicknesses – is total thickness of section reasonable?
- Lithologic descriptions – emphasis on key identifying characteristics of units; organization, consistency, detail, accuracy
GEOL 508 FIELD EQUIPMENT CHECKLIST

**Essential Field Gear**
- [ ] Hand lens (10x)
- [ ] Rock hammer
- [ ] Field notebook
- [ ] Map board
- [ ] Two mechanical pencils (0.5 mm)
- [ ] Erasers – a clean good eraser is your best friend!
- [ ] assorted color pencils
- [ ] Plastic rulers/protractor
- [ ] Brunton compass (or Silva)
- [ ] 10% HCl available from storeroom for $1.50 - refills are free!
- [ ] Grain size card
- [ ] Field pack
- [ ] water bottles, canteen or a camelback (two liter minimum capacity)
- [ ] Windbreaker
- [ ] Beanie (cold weather hat)
- [ ] Sturdy hiking boots – break these in before camp!
- [ ] Sun hat
- [ ] Sun glasses
- [ ] Sun screen (SPF 30 or greater)

**Recommended Field Gear**
- [ ] Wrist watch
- [ ] Calculator w/ trig functions
- [ ] Small pair of binoculars
- [ ] Camera
- [ ] Beltpack for field equipment
- [ ] Leather gloves
- [ ] Tupperware lunch container
- [ ] Snacks
Southern Death Valley - mapping in classic Neoproterozoic-Paleozoic stratigraphy at Emigrant Pass in the southern Nopah Range. We will stay at the California State University Zzyzx field station – Desert Studies Center near Baker California and commute each day to the map area. Cost for food & lodging per person at Zzyzx will be ~$267 payable as check to “Associated Geology Students” before trip departure.

**Schedule**

**Jan 12**
Depart SDSU 1 pm for Desert Studies Center (our home for the week) accessed by Zzyzx Road just south of the town of Baker on I-15. Arrive around 5pm, check in, dinner that evening at DSC followed by mandatory orientation meeting. [http://en.wikipedia.org/wiki/Zzyzx,_California](http://en.wikipedia.org/wiki/Zzyzx,_California)

**Jan 13**
Geologic orientation trip reviewing the stratigraphy of southern Death Valley; stops at Saratoga Springs, Sperry Wash, Shoshone, Tecopa Lake beds, Alexander Hills. Mandatory meeting after dinner.

**Jan 14**
Measuring stratigraphic section and mapping at Emigrant Pass in the southern Nopah Range. Mandatory meeting after dinner to construct stratigraphic section.

**Jan 15**
Geologic excursion to the floor of Death Valley via Hwy 178 to see cinder cone split by Death Valley fault zone, detachment faults, Mormon Point, turtlebacks, Badwater (lowest elevation in North America at 282 feet below sea level), Devil’s Golf Course, Zabriski Point and other possible stops.

**Jan 16**
Mapping at Emigrant Pass

**Jan 17**
Mapping at Emigrant Pass

**Jan 18**
Return to San Diego via the Mojave National Preserve and Kelso Dunes
Schedule

May 23  Depart SDSU 9 am for Westgard Pass Group campsite (el. 7313 ft / 2229 m) which will be our base of operations …arrive ~5-6 pm

May 24  Geologic orientation from “Sierra View” on White Mtn Road, then proceed to Poleta folds to measure a stratigraphic section. Compile section back at camp into a 1 page “reference section” you’ll use for mapping.

May 25-26 Two day map exercise at “Little Poleta”. This will entail individual mapping in a small area.

May 27  Turn in “Little Poleta” map and cross-section. Volcanology/Quaternary geology field trip to see Long Valley caldera and Bishop Tuff. If possible we’ll take the chairlift to top of Mammoth Mtn for a panoramic view of LVC and the eastern Sierras…bring $ for this. We will also try to access a section of the Bishop tuff in Owens River gorge as well as several other stops; if there’s time we’ll construct a stratigraphic section through the Bishop Tuff welded ignimbrite sheet. Arrive back at camp late… we’ll eat out for dinner this night.

May 28  Big Poleta mapping – in teams of two each day

May 29  Big Poleta mapping

May 30  Big Poleta mapping

May 31  Big Poleta mapping – prepare draft of cross-section

June 1  Big Poleta mapping & resolution of cross-section problems

June 2  Break camp and return to San Diego

7:30 am departure from camp each day; finish mapping @ 4:30 pm

The Rules

- No one leaves camp or the field area without checking with Kimbrough first – the only exception to this is if you must leave to seek emergency medical attention; even in this case try to make sure someone knows where you’re going and who’s with you.

- Quiet hours in camp: 10 pm until wake-up. Our Westgard Pass base of operations is a public campground and it’s very important that we don’t disturb anyone else’s stay here. [http://www.forestcamping.com/dow/pacifcsw/inycmp.htm#grandview](http://www.forestcamping.com/dow/pacifcsw/inycmp.htm#grandview)

- No alcohol in State vehicles.
**Location & Directions**

The 2011 Geol 508 Advanced Field Geology White Mtn segment of the course will headquarter at a US Forest Service campsite at Westgard Pass in the White-Inyo Range of eastern California (37.278, -118.154).

The route to the camp is: north on I-15 to Victorville where you will take Hwy 395 across the Mojave Desert and up the Owens Valley to the north end of the small town of Big Pine. From Big Pine turn right onto State Hwy 168 and 12.4 toward Westgard Pass where you turn left into the group campsite area. If you come to the White Mountain Pass Road YOU HAVE GONE TOO FAR…turn around and go back 0.4 miles.

![Map](image)

**Environment**

The US Forest Service group campsite is a dry camp, meaning that we bring our own water and use pit toilets. Everyone will need to pitch in $10 for camping. It’s a beautiful spot convenient to the Owens River for afternoon swimming.

Bring firewood for fire and a chair for comfort. If you have a telescope or binocs for astronomy…your are welcome to bring them! The campground will likely be warm during the day and cool at night. But it can also be wet, windy and cold, it could even snow on us, so rain gear, a waterproof tent, and warm jackets are a must. Be aware that Grandview is ~ 8500 feet high, so altitude can be a problem, especially for the first few days of class. Be prepared to drink lots of fluids and stay well-protected from the sun. Hat and sunblock are necessities! Bring a bathing suite for swimming in the Owens River. Mosquitoes are not likely to be a problem, but biting flies, rattlesnakes and scorpions are not uncommon. Insect repellent, flashlights, and well-sealed tents are the solutions.
The Poleta Fold Belt, where we’ll be mapping, is located on the north side of Westgard Pass at the south end of Deep Springs Valley which, incidentally, is the site of one of the nation’s most elite colleges: http://www.guppylake.com/nsb/DS-SeattleTimes.pdf

The Poleta Folds are mostly between 5400 and 6200 feet elevation. At this time of year we are likely to be graced with mid-day temperatures in the 75-90 degree range…but it can get much hotter, or colder.

**Field gear**

- Same as for Emigrant Pass.

**Intellectual Preparation**

There will be reading and map interpretation assignments prior to the southern Death Valley and White Mtn segments of the course.

For the White Mountains:

- Read “Geologic History of the White-Inyo Range” which I will post as a pdf in Blackboard. Make sure to print this out and bring it to camp with you. You will be required to read this before you arrive at Camp. This will give you many advantages including familiarity with terms, events, concepts and places introduced in the first few days of field camp and thus give you a head start in being able to put it all together in your head and on your maps.
- Study the White-Inyo strat column - I suggest that you make a reduced copy and paste it somewhere in your field notebook for easy reference.
- Look over the handout on “folding” I will post…. bring a textbook on Structural Geology if you have one.
- Look over the “carbonate handout”.
- Start getting familiar with “your future best dead friends” as my colleague Hilde Schwartz at UCSC calls them, namely trilobites, archaeocyathids, helicoplacoids and the trace fossils Planolites and Skolithos.