Instructor: Professor David L. Kimbrough  
email: dkimbrough@geology.sdsu.edu, Phone: 594-1385  
Office: GMCS-229A; Office hours: MW 1200-1300; or by appointment  
Teaching Assistant: Matt Dorsey  

**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 Mecca Hills segment of the San Andreas Fault zone 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/sketching 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.

**Mecca Hills** - The 2017 edition of Geol 508 will include a 5 day Spring break trip to investigate the geology of the San Andreas Fault zone on the eastern side of the Salton Trough. The SAF is a major transform fault characterized by shallow earthquakes and brittle failure at and near the surface. Static stress faults adjacent to faults drive rock deformation and measurement of structures in the rocks provide a means for interpreting paleostress directions. The southern segment of the San Andreas Fault where we’ll be working is statistically ‘overdue’ for a major earthquake.

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 7-13) - 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 ~$225.

**Mecca Hills** – 5 days overlapping Spring recess (March 25-29)

**White Mountains** – 11 days at Poleta folds (May 15-28) - mapping classic Neoproterozoic-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:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map &amp; cross-section</td>
<td>60%</td>
</tr>
<tr>
<td>Field notes</td>
<td>5%</td>
</tr>
<tr>
<td>Stratigraphic column</td>
<td>5%</td>
</tr>
<tr>
<td>Geologic report</td>
<td>20%</td>
</tr>
<tr>
<td>Participation</td>
<td>10%</td>
</tr>
</tbody>
</table>

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
_____ Handlens (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 theCalifornia 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
Location & Directions

The 2017 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.

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.

Inyo National Forest 760 873-2503 group campsite reservations

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 Westgard Pass group campsite is ~ 7300 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.

Medical Services

Northern Inyo County Local Hospital District
150 Pioneer Lane
Bishop, CA 93514
(760) 873-5811

Northern Inyo Hospital is a full service critical access hospital including 24-hour emergency care services.

Field gear

- See list below.

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 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.
# SDSU Geol 508 Field Camp
## White Mountains, California
### Summer 2017 (May 15-28)

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 15</td>
<td>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</td>
</tr>
<tr>
<td>May 16</td>
<td>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.</td>
</tr>
<tr>
<td>May 17</td>
<td>Map exercise at “Little Poleta”. This will entail <em>individual mapping</em> in a small area.</td>
</tr>
<tr>
<td>May 18</td>
<td>Map exercise at “Little Poleta”. <em>individual mapping</em></td>
</tr>
<tr>
<td>May 19</td>
<td>Geothermal/ 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. Arrive back at camp late… we’ll eat out for dinner this night.</td>
</tr>
<tr>
<td>May 20</td>
<td>Finish up Little Poleta mapping &amp; turn in “Little Poleta” map and cross-section.</td>
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<tr>
<td>May 21</td>
<td>Big Poleta mapping – in <em>teams of two</em> each day</td>
</tr>
<tr>
<td>May 22</td>
<td>Big Poleta mapping</td>
</tr>
<tr>
<td>May 23</td>
<td>Big Poleta mapping</td>
</tr>
<tr>
<td>May 24</td>
<td>Quaternary geology exercise</td>
</tr>
<tr>
<td>May 25</td>
<td>Quaternary geology exercise</td>
</tr>
<tr>
<td>May 26</td>
<td>Big Poleta mapping</td>
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<tr>
<td>May 27</td>
<td>Big Poleta mapping &amp; resolution of cross-section problems</td>
</tr>
<tr>
<td>May 28</td>
<td>Break camp and return to San Diego 7:30 am departure from camp each day; finish mapping @ 4:30 pm</td>
</tr>
</tbody>
</table>

## The Rules
- No one leaves camp or the field area without checking with Kimbrough, Heather or Matt 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.
WHITE MOUNTAINS FIELD CAMP EQUIPMENT LIST

**Camping equipment**
- Tent, sleeping bag, pad, pillow, ground cloth
- Raingear
- Flashlight, headlamp is best, spare batteries
- Lantern (optional, share)
- Folding chair
- Cup, bowl, plate
- Warm jacket & hat & gloves

**Field equipment**
- Boots
- Plenty of socks
- Daypack
- Warm weather clothing (light fabrics that keep the sun off your skin)
- Sun hat, sunglasses
- Sunscreen and chapstick
- Water bottle (at least 3 liters) - Camelbak or equivalent works
- Equipment belt, optional but recommended
- Map board, Compass & Protractor
- Handlens
- Hammer
- Mechanical pencils (.5mm recommended)
- Eraser
- Colored pencils
- Black drafting pens (Staedtler – Office Depot)

**Personal and Other**
- Toilet kit, Baby wipes
- Swimsuit & towel
- Watch/travel clock with alarm
- Shoes/sandals for evenings
- Clothes for warm and cold weather (use layers)
- Extra money for dinner out one or two nights
- Snack food you can’t live without
BIG POLETA FOLDS REPORT

Due ___

Brunton Compass – if you haven’t already turned it in….

Big Poleta field map
Big Poleta final map
Cross-section A-A’
Stratigraphic column – 1 page
Report – not to exceed 5 pages double spaced that includes:
  Geologic History of the White-Inyo Mountains (~1 page)
  Poleta Formation stratigraphy (~1 page, text linked to strat column)
  Structural Geology (~2 or 2.5 pages – text linked to map)
  Summary of Geology History (0.5-1 page)

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

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

Stratigraphic column:
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