

GEOL 465 Maymester field course

A Tectonic Transect Across the US Cordillera: May 2021

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Introduction

Field-based observation is an essential part of the Earth Sciences, and forms the basis for much continuing geological research. This field-based Maymester course on the Tectonics of the US Cordillera will provide undergraduates with an integrative geological field experience that will allow them to apply their knowledge to a set of research problems involving most aspects of the Earth Sciences. As such it will help them place the various courses they have taken in context with each other, and to think in an interdisciplinary and creative fashion.

Course outline

The course will consist of three parts.

Part A will comprise a set of 6 preparatory seminars at USC centered around the geological problems posed by the complex pattern of mountains forming the Cordillera in the western US. These seminars will take place on-line during the second half of the Spring semester, 2021.

Part B consists of a 13-day field trip visiting key localities from the central California coast east to the Mojave Desert near Las Vegas. The trip will be held in the period May 16 to 30, and will include a variety of geological exercises, which will be completed and graded during the course of the trip.

Part C consists of the preparation of a term paper about an aspect of the research carried out in the field. This phase will be supported by a set of discussion sessions held during the field course, and must be submitted by June 15, 2020.

Instruction will be carried out by Drs John Platt and Ellen Platzman, of the Department of Earth Sciences at USC, and by a graduate teaching assistants from the department.

Course details

Part A. Seminar sessions. These will be held during the Spring Semester preceding the field course. Participation in the seminars will include verbal presentations and the submission of written summaries: assessment will be provided in time for the following seminar. The seminars will be based on published literature relating to the topics listed below. Reading lists will be provided in advance of each seminar.

- Geological background: the tectonic evolution of the US Cordillera
- The Mesozoic plate boundary: an Arc - Forearc Basin - Accretionary Complex system
- The Basin and Range Province: a continental rift within the Cordilleran thrust belt
- Cordilleran metamorphic core complexes: windows into the deep crust of the Cordillera
- The Sevier and Laramide thrust belts: thin and thick-skinned foreland fold-and-thrust belts
- The Neogene tectonic revolution and the creation of the San Andreas Transform system

Part B. The field program. This will last 13 days in the period May 16 to 30, including travel time to and from USC, and within the field area in California. A series of field exercises will be carried out during the course; these will be completed during the evening of each day, and assessed while the course is in progress. A provisional plan follows.

Day 1. Wheeler Gorge (Ojai, California). Sedimentary structures in an abyssal plain turbidite sequence.

Day 2. Point Sal. The Coast Range ophiolite.
Assessed exercise: Reconstructing the oceanic crustal sequence from an obducted ophiolite.

Day 3. San Simeon. Classic Franciscan melange on the California coast
Assessed exercise: Sedimentary and tectonic analysis of melange with tectonic blocks.

Day 4. Transect east across the arc and forearc basin to the San Andreas transform
Assessed exercise: measurement of slip rate on the San Andreas fault.

Day 5. Lake Isabella, southern Sierra Nevada. Granites and roof pendants in the Mesozoic magmatic arc.

Day 6. Tectonics and magmatism in the Eastern California Shear Zone.
Assessed exercise: Relationships between strike-slip faulting, normal faulting, and magmatism in the Neogene Eastern California Shear Zone.

Day 7. Bishop Field Center. Work up exercises

Day 8. Owens Valley to Death Valley: a transect across Basin and Range structures and the Eastern California Shear Zone

Day 9. Monarch Canyon, Funeral Mountains (east rim of Death Valley). Metamorphic core complex in variably metamorphosed Proterozoic to Early Cambrian rocks.

Assessed exercise: A structural transect through a metamorphic core complex with multiple detachments.

Day 10. Beatty, Nevada. Algal mud mound in fossiliferous Ordovician limestones.

Assessed exercise: Stratigraphic analysis of an algal mud mound in the miogeoclinal wedge.

Day 11. Clark Mountains (Pachalka Spring), eastern Mojave Desert: Sevier fold and thrust belt. Mapping exercise in folded low-grade metamorphic Early Cambrian sequence

Assessed exercise: Geologic mapping in folded and thrust metasediments.

Day 12. The Mescal Range, eastern Mojave Desert: Sevier fold and thrust belt. Fold and thrust structures in unmetamorphosed Late Cambrian-Jurassic shelf sequences and Cretaceous volcanics.

Assessed exercise: A structural profile through part of the thrust belt.

Day 13. Return to USC

Part C. Discussion sessions. These will take place during the evening of each field day, and a final discussion and debriefing will be held on the afternoon of the last field day. These discussions will be designed to assist the students in the preparation of a term paper researching some aspect of the geological evolution of the area. The students will have a choice of topics, and will submit the term paper electronically by the official end date of the program (June 15).

Grading Structure

2 assessed seminar presentations prior to the field trip	15%
8 assessed exercises during the field trip	65%
term paper	20%

Recommended Preparation:

Introductory Earth Science course (e.g., GEOL105)

GEOL 315L Minerals and Earth Systems.

One or more of GEOL 316L Petrologic Systems; GEOL 320L Surficial Processes and Stratigraphic Systems; GEOL 321L Structural Geology and Tectonics.

Teaching/study load

Contact hours for this course consist of 6 2-hour seminars at USC, and approximately 90 hours of contact time in the field, including evening sessions for discussion and working up assessed exercises. The total commitment of 102 contact hours is equivalent to a 4-unit semester course with 7 contact hours per week.

Logistics

Students and instructors will camp during the trip; the department will provide tents, camping tables and chairs, and cooking equipment. Students will need to bring sleeping bags and mats, and appropriate clothing. Transportation will be in departmental field vehicles. To ensure safety in the field, students will always work in a group together with the instructor, and there will always be more than one vehicle available for transportation. Students will need to be in good health, physically fit, and able to walk in the field for distances up to several miles.

Student matters

The course will need a minimum of 5 students to be viable. It will be of benefit to both junior and senior undergraduates who have taken some essential courses in the Earth Sciences, as well as graduate students. Participants will be selected by the Undergraduate Advisor in consultation with the instructor.

Covid-19

This course will only run if we have permission from University authorities. We assume that there may still be issues related to the pandemic in any event, and the way the trip is run may have to be modified to take account of these. It is likely that we will require participants to be tested, or to quarantine (or both) prior to the trip. During the trip we will minimize interactions with non-participants – many of our camping sites and field areas are very isolated, in off-road locations, which will facilitate this.