

SIO 100 Geological Field Methods

Fall 2021

Overview: This class will introduce you to geologic methods. These include strategies for research design, data reduction, geological inference and use of basic instruments. The class will feature specific exercises in mapping, measuring sections, working with imagery and topographic maps, and cross-sections. In addition to field exercises most Fridays and parts of three weekends, the course features a series of exercises where you have to collect data and interpret it to make measured sections, cross-sections, field maps and structural interpretations. In addition to the practical aspects of the class, we will learn about the general geology and tectonics of the American Southwest, where many of the exercises are based. We will also touch on field safety as well as the identification of sources of published and informal geological data, the integration of field data with other data sources (such as making overlay maps) and LIDAR data. The class is designed so that you will come away confident in your ability to lead your own field projects.

Instructors:

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Teaching Assistants:

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Class Meeting Times and Requirements:

Wednesdays (1-2 p.m. in Eckart 225) - short in-class exercises or lectures
Fridays (12-3 p.m. in Eckart 225) - weekly project/exercise (sometimes in the field)

This class will meet Wednesday (1-2) and Friday Afternoon (12-3 pm) in Eckart 225. We will not have exams. Grades will, instead, be based **entirely** on weekly exercises (each worth 10-15% of the grade) and short in-class exercises (whose score is incorporated in the weekly assignment grade). You will typically have a week between the assignment of a project/exercise and when it is due. Late work will not be graded without prior agreement of the instructors.

Office Hours:

Wednesdays (2-3 p.m. in Eckart room TBD or via Zoom)
Thursdays (10-11 a.m., 2-3 p.m. via Zoom)
Fridays (10-11 a.m. via Zoom)

Class structure:

In general, Wednesdays will be devoted to a ~1 hr lecture on relevant material. Fridays 12-3 pm will be devoted to "lab" exercises. We plan to have three field trips. Two are Saturday trips: **Oct 23**—Salton Sea (Mud Hills) and **November 20**, Joshua Tree National Park. One is an overnight trip to Rainbow Basin. To maximize our time in the field the plan is to depart after dinner on Friday, **November 5**, and return in the early evening on Sunday, **November 7**. Please mark these trips on your calendar as we will not have makeup times. If you cannot go on the trips, you can still do most of the work using our virtual data sets. However, the actual field experience is the soul of the class, so we urge you to make every effort to attend the trips.

Your grade will depend upon: (1) graphical work—cross-sections, maps, stereonet plots; these will be graded on accuracy, appropriate use of geological terminology and symbols, quality of presentation including neatness and artistic merits, (2) Written reports where you will be graded

on the accuracy of your geological interpretation/presentation; quality of your writing and (where appropriate) your suitable use of references/citations and (3) the Wednesday in-class exercises.

Course Learning Objectives:

- **Learn how to read and understand information in geologic maps**
- **Learn basic geologic history and context of Western North America and SW US**
- **Use of different Data types:** Digital elevation models (like LiDAR and drone-image based DEMs)
- **Overlay various map types on Google Earth**
- **Learn basic field mapping skills:** Compasses, Abney Levels, Jacob’s Staff and Electronic mapping programs (“Clino” and “Field Move”, “Google Earth”, “Rockd”) and graphics packages: Illustrator, Affinity Designer, or Inkscape.
- **How to measure a stratigraphic section and describe rock sequences**
- **Mapping geologic features**
- **Use of graphics programs to make professional maps**
- **Making cross sections from a geologic map**

Course Syllabus

	Date	Topic	Reading/lab
Week 1	F Sept 24	Pace & Compass Traverse	
Week 2	W Sept 29	Strike & Dip, Stereonets	
	F Oct 1	Stonehenge Exercise	
Week 3	W Oct 6	Outcrop Drawing, Tourmaline Beach geology	Stow Ch 2 & 13 Compton Ch 3.
	F Oct 8	Tourmaline Beach Outcrop Drawing	Making outcrop and regional field sketches
Week 4	W Oct 13	Lithologic description	Compton Ch 11
	F Oct 15	Black’s Beach Measured Section	
Week 5	W Oct 20	GE Structure X-sections	Stow, Ch 3-6; Compton Ch 11
	F Oct 22	Geology background of Mud Hills; GE Interpretation of Mud Hills	Saturday Oct 23: Field Trip: Mud Hills
Week 6	W Oct 27	Drawing X-sections	Compton Ch 12
	F Oct 29	Drawing Mud Hills Cross Section	Mapping structure of Mud Hills
Week 7	W Nov 3	Intro to Rainbow Basin	
	F Nov 5	GE Interpretation of Rainbow Basin	Friday evening- Sunday Evening, Nov 5-7: Full Weekend trip: Rainbow Basin

Week 8	W Nov 10	Drawing a map of Rainbow Basin	
	F Nov 12	Map & X section of Rainbow Basin	Draft map of Rainbow Basin geology
Week 9	W Nov 17	Mojave & San Andreas Neotectonics	
	F Nov 19	Rainbow Basin X-section	Nov 20: Saturday Field Trip: Joshua Tree
Week 10	W Dec 1	LIDAR & GE Map Overlays	
	F Dec 3	GE & LIDAR Maps	

Field Work?

As a field class in the time of COVID-19, we expect the class to have field trips, but we are prepared in case these are not possible. In the event we cannot get to the field, we have virtual data sets from these field locations that we can present to you.

Required Materials:

- A computer with internet,
- Google Earth--a free download: <http://www.google.com/earth/download/ge/>
- Field move (for tablets) or Field Move Clino (for phones)--an e-mapping program; <https://www.petex.com/products/move-suite/digital-field-mapping/>
- Adobe Illustrator, Affinity Designer, or Inkscape,

Other useful materials: protractor, ruler, colored pencils, clipboard, field notebook, Brunton compass. We anticipate that we will be able to provide all of these materials for you but if you have any of these items that you can bring that would be good. If you would like to purchase your own compass or a write-in-the-rain field notebook you can find these items at the following links.

- Field book such as Write-in-the-Rain books: <https://www.ascscientific.com/geology-field-equipment/field-books/geology-field-book/> (\$18.50, with scale and ruler in a pocket in the back); A cheaper field book without the back pocket is: <https://www.amazon.com/Elan-Publishing-Company-E64-4x4-Surveying/dp/B071GNK2XB> (\$10.95, also comes in yellow covers)
- A "Brunton" Compass: [this is a Chinese knockoff, but surprisingly good quality. I bought one; I also reviewed this compass on the Amazon website] https://www.amazon.com/Geological-Compass-Harbin-DQL-8/dp/B0014W95CK/ref=sr_1_1?dchild=1&keywords=Harbin+compass&qid=1609548999&sr=8-1 (\$52.00)

Optional Reference Books:

- Baldrige, Geology of the American Southwest. Can be rented online for \$12.77 for three months; used copies available for ~\$20
- Blakey, R.C., and Ranney, W.D., 2018. Ancient landscapes of Western North America, Springer. 228 pp. (\$20.99)
- Compton, R., 2017. Geology in the Field. CreateSpace Independent Publishing Platform **SBN-10:** 1547118776; **ISBN-13:** 978-1547118779 (\$16.95)
- Lisle, R.J., Brabham, P. & Barnes, J., Basic Geological Mapping, 5th Edition, The Geological Field Guide Series, 2011. (\$34)

- Stow, D. A.V., 2005. Sedimentary rocks in the field. CRC Press 320 pp. (\$34 used from Amazon)