

SIO 100 Geological Field Methods

Winter 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. The whole class will be virtual, with a series of exercises where you have to collect data (virtually) 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:

Richard D. Norris:

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Teaching Assistants:

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Office hours	Contact (Zoom ID)	Time & Day
Richard Norris	https://ucsd.zoom.us/j/94886623324 Meeting ID: 948 8662 3324	Thursday 1-2 pm
Emily Chin	https://ucsd.zoom.us/j/97311983516 Meeting ID: 973 1198 3516	Monday 5-6 pm
Kendall Mahony	https://ucsd.zoom.us/j/5565983669 Meeting ID: 556 598 3669	Monday 4-5 pm
Sean Curran	https://ucsd.zoom.us/j/94474913992 Meeting ID: 944 7491 3992	Friday 10-11 am

Requirements:

This class will meet Wednesday (12-12:50) and Friday Afternoon (12-2:50 pm) over Zoom. 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.

Class structure:

In general, Wednesdays will be devoted to a ~1 hr lecture on relevant material.

Fridays 12-2:50 pm will be devoted to “lab” exercises.

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 3 question quizzes. You will have a week to do the quiz material which will be based on the readings.

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: Orthophotoquads, & 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
- 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	W Jan 6	Course Intro; History of Mapping (RN) The Tapestry of Time & Terrain: Broad Overview of North American Geology (EC)	Baldridge Ch 1 & 2
	F Jan 8	Using Google Earth (GE), topo sheets and LiDAR (RN)	Intro to Google Earth, Topographic maps & LiDAR
Week 2	Jan 13	Linking GE to regional geologic features (EC)	Baldridge Ch 8
	Jan 15	Reading geologic maps and making map overlays in GE (RN)	First Quizlet on Baldridge Interpreting Geology of Yellowstone NP and Making Overlays in GE
Week 3	Jan 20	Rock and outcrop descriptions & field notes: sediments (RN)	Baldridge Ch 3; Stow Ch 2 & 13 Compton Ch 3.
	Jan 22	Rock and outcrop descriptions & field notes: igneous & metamorphic rocks (EC)	Making outcrop and regional field sketches
Week 4	Jan 27	Strike and Dip, Stereonets Calculating	Compton Ch 11, Baldridge Ch 4.

		true dip from apparent dip (EC)	Quiz on Baldridge Ch 3 & 4 (<u>due Feb 5</u>)
	Jan 29	Field observations using "Field Move Clino" (RN)	Strike and Dip exercise True dip from apparent dip
Week 5	Feb 3	Thickness Column for Mud Hills (EC)	Stow, Ch 3-6; Compton Ch 11
	Feb 5	Drawing a measured Section (RN)	Stratigraphic section of Mud Hills
Week 6	Feb 10	Identifying Faults and Structure in GE and on the ground (EC)	Compton Ch 12, Baldridge Ch 5, <i>Optional Blakey Ch 6</i>
	Feb 12	Mapping using Marker Beds (RN)	Mapping structure of Mud Hills
Week 7	Feb 17	Lecture on cross sections (RN)	Baldridge Ch 6, 7 Quiz on Ch 6, 7 (<u>due Feb 26</u>) <i>Optional Blakey Ch 7,8,9</i>
	Feb 19	Intro to Illustrator (EC)	Cross section of Mud Hills
Week 8	Feb 24	Intro to Rainbow Basin – strat column (RN)	
	Feb 26	Faults and Folds at Rainbow Basin (EC)	Draft map of Rainbow Basin geology
Week 9	Mar 3	Mojave & San Andreas Neotectonics (EC)	
	Mar 5	Rainbow Basin continued—focus on Structure (RN)	Final Rainbow Basin Map
Week 10	Mar 10	Map Overlays of Rainbow Basin (RN)	
	Mar 12	Drawing faults on a Cross section (EC)	Rainbow Basin Cross Section

Field Work?

As a field class in the time of COVID-19, this course will be entirely virtual. Ordinarily, we teach this class in the Fall, but we hoped, against hope, that by delaying into the Winter we could have some part of the class in person. Such is, sadly, not to be. Consequentially, there is no requirement that you visit any of the sites we will visit virtually, although all are accessible if you have transportation and are in the San Diego area. If you can go and see the sites, we are sure you will find the experience illuminating, but owing to social distancing issues with the pandemic we cannot give you extra credit or show favoritism for your field efforts, much as we would like to. Still, we have field equipment you can check out, and we can provide detailed instructions on where to go should you want to do your own exploration.

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
- Adobe has a Student version for \$20.99/month with a 7 day free trial.
https://www.adobe.com/products/illustrator/free-trial-download.html?sdid=JRSIH&mv=search&ef_id=CjwKCAiAouD_BRBIEiwALhJH6Hw4RITEOTMQGo60rD00Ky-iEVOVZxGnx-2c4pQJyZJsewluRdAedxoCsRYQAvD_BwE:G:s&s_kwcid=AL!3085!3!356518782149!e!!g!!adobe%20illustrator%20price&gclid=CjwKCAiAouD_BRBIEiwALhJH6Hw4RITEOTMQGo60rD00Ky-iEVOVZxGnx-2c4pQJyZJsewluRdAedxoCsRYQAvD_BwE#mini-plans-web-cta-illustrator-card

Other useful materials:

- Protractor,
- ruler,
- colored pencils,
- pencils
- 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/B00I4W95CK/ref=sr_1_1?dchild=1&keywords=Harbin+compass&qid=1609548999&sr=8-1 (\$52.00)

Optional Reference Books:

- Baldridge, 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)

