

Geology 260
Spring 2020

Introductory Field Mapping

Instructor: Dr. Scott McCoy
LME 411
scottmccoy@unr.edu

TA: Nate Delgado
LMR 377
ndelgado@nevada.unr.edu

Student Learning Objectives: Upon completion of this course, students will be able to (1) locate themselves on a map and utilize a compass, tape measure and Schmidt Hammer to make geological measurements, (2) describe rocks in the field, and (3) identify and map geological units in the field. Students will complete a geologic mapping project over Spring Break. More specifically, the skills you will have acquired by the end of this class are:

1. Map location
2. Basic rock description and geologic unit description
3. Use of a Brunton compass
4. Geologic mapping
5. Constructing a geologic cross section
6. Constructing a stratigraphic column
7. Cartographic skills (introductory); drafting a geologic map
8. Rock mass classification using RMR and Schmidt Hammer (ASTM standard D5873-14)
9. Collect data in a team setting
10. Synthesize data and analysis into a concise report

Relationship of Course SLOs to ABET Student Learning Outcomes			
ABET Student Learning Outcomes	Corresponding Course SLOs	ABET Student Learning Outcomes	Corresponding Course SLOs
a) Fundamental Background - an ability to apply knowledge of mathematics, science, and engineering	1 to 8	g) Communication - an ability to communicate effectively	9, 10
b) Experimental Design / Data Analysis - an ability to design and conduct experiments, as well as to analyze and interpret data	5,6,8	h) Broad Education - the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
c) System and Process Design - an ability to design a system, component, or process to meet desired needs within realistic constraints		i) Continuing Education - a recognition of the need for, and an ability to engage in life-long learning	
d) Teamwork - an ability to function on multidisciplinary teams	9	j) Social Awareness - a knowledge of contemporary issues	8,10
e) Problem Solving - an ability to identify, formulate, and solve engineering problems	8	k) Competency - an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	4,5,7,8,10
f) Ethics - an understanding of professional and ethical responsibility		l) Field Competency- the application of geologic field proficiency to engineering practice	1,2,3,4,8,9

To prepare you for the mapping exercise, we will meet on selected Fridays from 2:00-4:30 prior to and after the field trip to complete exercises in rock description, use of a Brunton compass, cross-section drafting, and rock mass classification.

Field Area: We will be camping at Red Rock Canyon State Park, CA for four days during spring break. Our map area will be a 1+ square mile area within the park that exposes volcanic and sedimentary rocks of Miocene age. Red Rock Canyon is a desert area with rugged terrain. We will be doing extensive hiking and climbing on some steep slopes. It is imperative that you have a good pair of hiking boots with sufficient ankle support. High-top sneakers will not be sufficient. In late March, temperatures average from the 70s during the day to 40s and 50s at night. Prepare for a wide range of temperatures and bring a sleeping bag that is rated to at least 30 degrees. High winds are common at the park. Be sure your tent is low profile and wind resistant. Red Rock has running water (faucets), pit toilets, and picnic tables. You will need to bring your own camping gear, cooking gear, and food for the entire trip.

Required Materials: See attached list of required field equipment and supplies. It is important that you do not skimp on these items. They should last you for many years to come.

Text resources:

Freeman, Procedures in field Geology - *See Lacey for copies \$15*
Coe, Geological Field Techniques - *Relatively inexpensive copies (and an online PDF)*
Compton, Manual of field Geology

Grading:

No plus/minus grading will be used.

100%-90% = **A**; 89%-80% = **B**; 79%-65% = **C**; 64%-51% = **D**; 50% or below = **F**

Homework and class attendance: 20%

Geologic map and final report: 60%

Effort, attitude, teamwork (professional conduct): 20%

Teamwork:

You are strongly encouraged to choose your own field partner for this exercise. Groups of two are recommended. Partners should share skills and knowledge while together in the field, but not in camp, home, nor any place else. Reports and illustrations must be done alone. The reason for working with a partner in the field is for two reasons; first to learn from your partner and second, for safety reasons. Choose someone who has similar outdoor abilities to yours, that is, someone who will not always be either ahead of or behind you. You do not have the option of working alone for this class.

Safety:

Rendezvous points will be announced at the beginning of each field day. You must be at rendezvous point at the appointed time. If you are not back at the appointed time, search parties will be organized to find you. Failure to meet at the assigned time may jeopardize the safety of others in the class who participate in search parties. If necessary, searches will generally take place only during daylight hours.

Schedule:

January 24	Introductory meeting
January 31	no class (Do required reading)
February 7	no class (Do required reading)
February 14	Topo map exercise
February 21	Brunton exercise on Quad
February 28	Field descriptions of clastic rocks
March 6	Field descriptions of volcanic rocks
March 13	Rock mass classification, pre-trip meeting, <i>equipment check</i>
March 16-20*	Mapping exercise, Red Rock Canyon State Park, California

Itinerary:

Depart Monday March 16, at 9:30.

Tuesday - Intro to Red Rock units

Wednesday - Mapping

Thursday - Mapping

Friday until noon - Mapping

Return to Reno Friday evening (probably around 7 pm)

*Note that in case of weather, we may leave on the weekend before or delay leaving Reno for one or more days, so don't plan any critical life events during this spring break. Normally, we end up following the schedule, but occasionally that doesn't work out and we have to do the trip later during spring break week.

March 27	Unit descriptions due. Cross section and stratigraphic column construction
April 3	Cross-section, strat column, and rock mass classification report due Open forum for any remaining questions
April 10	Final map project due

Late work

It is crucial that ALL assignments be handed in on time, so that (1) you're prepared to discuss them in class, (2) we can grade them promptly, and (3) you don't fall behind. Therefore, I will deduct 10% per day that papers are late.

Statement on Academic Dishonesty

Cheating, plagiarism or otherwise obtaining grades under false pretenses constitute academic dishonesty according to the code of this university. Academic dishonesty will not be tolerated and penalties can include filing a final grade of "F"; reducing the student's final course grade one or two full grade points; awarding a failing mark on the coursework in question; or requiring the student to retake or resubmit the coursework. For more details, see the [University of Nevada, Reno General Catalog](#).

Statement of Disability Services

Any student with a disability needing academic adjustments or accommodations is requested to speak with me or the [Disability Resource Center](#) (Pennington Achievement Center Suite 230) as soon as possible to arrange for appropriate accommodations. This course may leverage 3rd party web/multimedia content, if you experience any issues accessing this content, please notify your

instructor.

Statement on Audio and Video Recording

Surreptitious or covert video-taping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may be recorded.

Statement for Academic Success Services

Your student fees cover usage of the [Math Center](#) (775) 784-4433, [Tutoring Center](#) (775) 784-6801, and [University Writing Center](#) (775) 784-6030. These centers support your classroom learning; it is your responsibility to take advantage of their services. Keep in mind that seeking help outside of class is the sign of a responsible and successful student.

The University of Nevada, Reno is committed to providing a safe learning and work environment for all. If you believe you have experienced discrimination, sexual harassment, sexual assault, domestic/dating violence, or stalking, whether on or off campus, or need information related to immigration concerns, please contact the University's Equal Opportunity & Title IX office at 775-784-1547. Resources and interim measures are available to assist you. For more information, please visit the [Equal Opportunity and Title IX](#) page.

EQUIPMENT CHECKLIST FOR GEOLOGY 260

Miscellaneous field equipment:

(All items are **required**, unless specified)

- ___ wristwatch
- ___ two field notebooks (water resistant pages)
- ___ hand lens on a cord (10x or 14x)
- ___ mechanical pencils 2 to 4H
- ___ drafting pens
- ___ colored pencils (Col-erase best; wax-type too dark and cannot be erased, will not take ink!)
- ___ canteen or water bottles (3 quarts/day)
- ___ hat with sun protection
- ___ sunglasses
- ___ sunblock
- ___ chapstick
- ___ Brunton compass (issued by department)
- ___ mm/inch scale
- ___ 6 inch plastic scales: 1/10 inch and 1/20 inch
- ___ protractor
- ___ field case/pouch to carry notebook, pens, map scales, protractor
- ___ sturdy belt to hold brunton and field case/pouch
- ___ day pack
- ___ plastic acid bottle
- ___ rock color chart (one per group)
- ___ grain size card
- ___ pocket knife
- ___ textbooks and class notes; sed/strat, mineralogy, Compton's (optional)
- ___ map board with overlay protection for map (clear hard plastic)
- ___ safety pin or diaper pin

Camping gear:

- ___ warm sleeping bag (30°F)
- ___ foam pad
- ___ windproof tent
- ___ heavy ground tarp

Web sites of interest

Red Rock State Park:

www.desertusa.com/rrsp/rrsp.html
www.parks.ca.gov/?page_id=631

Magnetic declination:

ngdc.noaa.gov/geomag/declination.shtml

- ___ camp stove
- ___ lantern
- ___ fuel for stove/lantern
- ___ lawn chair (beach type works well)
- ___ clothesline/nylon rope
- ___ flashlights
- ___ matches
- ___ alarm clock
- ___ dishes, silverware, cooking utensils
- ___ lunch materials
- ___ food and drink for 5 days and 4 nights
- ___ soap, toiletries
- ___ towel
- ___ toilet paper
- ___ moleskin to prevent blisters
- ___ plastic basin (wash dishes and you), detergent, dishtowel
- ___ first aid kit (include scissors, tweezers, aspirin)
- ___ firewood (optional)

Clothing:

- ___ hiking boots (2 pair if you own them)
- ___ sneakers
- ___ winter hat
- ___ gloves
- ___ 4 pairs hiking socks
- ___ underwear for 5 days
- ___ bathing suit (optional)
- ___ 1 pair shorts
- ___ 1 pair long pants, lightweight
- ___ 4 T-shirts
- ___ long cotton shirt to cover arms from sun
- ___ long underwear or sweat pants
- ___ windbreaker with hood
- ___ rain jacket
- ___ polypropylene or thermax shirt (optional)
- ___ winter jacket (optional – watch weather)

Sources of field/drafting gear

Amazon.com

CGS Mule (cgsmule.com/): 680 E Glendale Ave, Sparks

Staples: 10350 N McCarran Blvd.

Nevada Fine Arts store: 1301 S Virginia St.

Final project:

Read this at least twice!

Your final product for this course will include 1) a geologic map, along with 2) a stratigraphic column, 3) a cross section, 4) rock descriptions, and 5) RMR rock mass classification for selected outcrops.

The first thing that is due will be the **rock descriptions**, due the week after your field work. These descriptions should be presented in a clear manner as a typewritten document, starting with the oldest rock units and progressing to the youngest. Two of the pre-field exercises will help you to develop this skill.

If you have had GEOL 202, then you have already constructed a **stratigraphic column**. Basically, a strat column is a graphic representation of the thickness and outcrop style of the rocks in the field area, coupled with an abbreviated description of each unit. A strat column occasionally accompanies a map, but more commonly is a standalone illustration in a paper or report. Some things to remember for your strat columns:

- Determine unit thickness by measuring the units on the cross section (so obviously, you have to carefully construct the cross-section first!)
- Show the weathering profile (different from what you might have done in 202)
- For units whose base or top is not exposed, show minimum thickness or greater
- Color the units to match the map
- Add lithologic patterns, following USGS standards
- Include a key or label each unit
- Leave a 1-inch margin around the edge of your page; strat column should fit on a single page
- Include a caption/description as if this were part of a report
- Exercise good draftsmanship
- Look at other figures of strat columns for suggestions on craft

In our first lab, we will construct a topographic profile. This profile will provide the basis for construction of a **geological cross-section** later in the semester. We will discuss construction of a cross-section when we are in the field, and again in the lab before it is due. It is important that a geologist can think in three dimensions (actually four, if one adds the time dimension), so understanding (and predicting) where the rocks are in the subsurface is a critical skill that is developed by drawing cross-sections. This cross-section will ultimately be included on your geologic map.

- Use no vertical exaggeration (otherwise, units will be skewed and thicknesses wrong)
- Typically done perpendicular (or nearly so) to the strike of map units
- Done at the same scale as your final map (you might want to consider doing one at 2x scale to make it easier to measure thicknesses)
- Color and label units the same as with the map
- OK to exaggerate thin units a bit for clarity

In our last lab before heading to the field we will introduce the basics of how geological engineers classify rock masses. In particular, we will learn how to use the most popular and general rock mass classification system, the rock mass rating system or RMR. A brief typewritten report describing your rock mass classification should include:

- A concise description of your methods used to calculate RMR
- Background for each outcrop summarizing important aspects of its geology and structure

- A sketch map with a scale or an annotated photograph of the outcrop, indicating the position of your traverse (line survey) for joint spacing measurements and the positions of the joints recorded, if visible
- Presentation of your results for each classification parameter and your final RMR rating
- Table of joint observations, measurements and characteristics
- Table of Schmidt Hammer measurements used to calculate the uniaxial compressive strength
- A concise discussion of the relative contributions of the various factors that entered into your RMR rating and of the implications of this rating

The **geologic map** should be a *professional* product, that is, it should look like a published map, and include everything that a published map includes, and nothing else (this means my name should not be on the map, nor should it indicate this is a class project). Therefore, as part of your learning process, you should look at a number of geologic maps to gain an understanding of what should be included (there are many hanging on walls around here). If you have any questions about this, please see me well prior to the day before this is due. On the following page is the basic layout that you should use for your final map. Everything should fit on an 11x17 piece of paper. Your final map must include:

- Title – include your name and date
- N arrow, scale, magnetic declination
- Make sure all map blobs are labeled, even if they are colored
- Cross-section MUST match the map in terms of both topography and geology
- Legend – appropriately placed and labeled with short rock descriptions (use present tense, since the rocks are still there)
- Legend should include ALL symbology that is used on the map
- Look at published maps for examples

A few words about drafting. You may choose to draft your map in a drawing program, such as Adobe Illustrator; if you choose to do so, we can provide a digital topographic base for you. Just as acceptable is drafting your map and other figures by hand, provided they are VERY NEATLY DONE. This might include hand-coloring (but it better not look like a 6-year-old did it) and hand-lettering (for the map only, the legend should be typed). Remember that we are expecting a professional-quality output and anything less is not acceptable and will be reflected in your final grade. If you have ANY concerns about the quality of your work, we encourage you to discuss them with us well prior to the due dates.

Your final grade will be based on the following:

Map accuracy (35 points) – placement of contacts, S&D data – we expect you to hand in your field maps along with the final map for comparison, and expect to see everything that shows up on the final map, also show up on your field maps (otherwise, my conclusion is that you made up a bunch of stuff after returning from the field)

Rock descriptions (15 points) – descriptions of 7 geological units in the area

Cross-section (10 points) – accuracy of topography and geology

Stratigraphic column (10 points) – summary rock descriptions, including thickness)

Craft (10 points) – quality of final product in terms of drafting – look at a published geologic map for guidance (things like S&D symbols, unit labels, clear black boundary lines)

RMR report (20 points) – as outlined above

Grading sheet for GEOL 260 maps

Name_____

- _____(1) Title
- _____(1) Name
- _____(1) Date
- _____(1) N arrow
- _____(1) Scale
- _____(1) Magnetic declination
- _____(2) Legend contains all symbology (contacts, faults, S&D)
- _____(1) Contact lines clear (black)
- _____(2) Strike/dip data sufficient & correct
- _____(2) All map areas labeled
- _____(5) Rock descriptions
- _____(4) Ts1-Tt contact
- _____(4) Tt-Ts2 contact
- _____(4) Ts2-Tb contact
- _____(4) Tb-Ts3 contact
- _____(4) Qu contacts
- _____(4) Qal contacts
- _____(2) Cross-section topo correct
- _____(1) Units labeled
- _____(2) Geology agrees with map geology
- _____(5) Cross section geology correct
- _____(2) Strat column weathering profile
- _____(3) Strat column thickness correct
- _____(2) Colors match map & section
- _____(2) Key/explanation on strat column
- _____(1) Caption/title to column
- _____(10) Drafting & appearance

_____ Total (72 possible)

_____ Percentage