SRSU GEOLOGY 4601 – Field Geology -- SUMMER I, 2026 -- Course Syllabus

Instructors: Jesse M. Kelsch, Ph.D. for Part One; Thomas A. Shiller, Ph.D. for Part Two;
Office: Same campsite as you
TA: Ryan Smith
Camp Steward: Carissa Chambers

Sul Ross State University 2026 GEOL 4601:

Schedule for Part One (May 27-June 12)

Schedule for Part Two (June 13-July 1)

Date	week-day	Daytime activity	Night spent at campsite:	project	cell	toilet	shower	laundry
27-May	Wed	**drive** to Valley of Fires (6 hrs). Set up camp. Evening 2 hour project before dinner	Valley of Fires group shelter 2	flow directions & report	no	yes	yes	no
28-May	Thur	**drive** to Sandia Crest (3 hrs). Then to Paliza group redtail campground (2 hrs).	Paliza redtail group campground	field, map, xsec, stereonet, report	no	vault	no	no
29-May	Fri	NM Map 1 Day 1						
30-May	Sat	NM Map 1. Day 2						
31-May	Sun	NM Map 1 Day 3						
1-Jun	Mon	NM Map 1 Day 4: half day in field, work in camp after lunch						
2-Jun	Tue	**drive** Highway 4: caldera, Los Alamos museum; rift margin; p.m. arrive camp and showers	Abiquiu group shelter 2		yes	vault	yes	no
3-Jun	Wed	in camp all day: finish Map 1 project & turn all components in						
4-Jun	Thur	**drive** to SF campground (2 hrs); start Map 2	Santa Fe Treehouse Camp & Wilderness Preserve	field, map, xsec, stereonet, report	yes	yes	yes	no
5-Jun	Fri	NM Map 2 Day 2						
6-Jun	Sat	NM Map 2 Day 3						
7-Jun	Sun	in camp all day: work on Map 2 project & turn in all components						
8-Jun	Mon	**drive** to Jacks Creek or other (1.5 hr)	Forest Service campsite near Pecos river headwaters TBD (no reservations)	field, project deliverables, group presentations in camp	no	vault	no	no
9-Jun	Tue	NM hydro project						
10-Jun	Wed	finish & give hydro presentations at camp						
11-Jun	Thur	**drive** to guads/ pine springs (6hr); dinner in carlsbad	Pine Springs 16 and GS1		no	vault	no	no
12-Jun	Fri	**drive** to Alpine (3 hr) & release	Alpine					
13-Jun	Sat	day off	Alpine					
14-Jun	Sun	PART TWO BEGINS						

The schedule for Part Two will be delivered to students on June 14

Outline of course points for Field Camp Part One:

Location:	Project:	Points:
Valley of Fires, NM	Brunton review; Recording lava flow direction	30
Near Paliza Campground, NM	Geologic map, cross section, report	150
Near Paliza Campground, NM	Small (half-day) geologic map: "postage stamp"	50
Near Santa Fe, NM	Geologic map, cross section, report	120
Near Jacks Creek, NM	Hydrology study	100
Teamwork, cooperation, campsite participation		50
South Rim/Big Bend Loop Report		100
Dawson Mapping Project		100
Christmas Mountains Project		100
Croton Spring Project		100
Horseshoe Canyon Project		100
Total points for the NM (Part One) half of GEOL 4601		500
Total points for the Big Bend (Part Two) half of GEOL 4601 (project schedule and grade value to be delivered at the start of Part Two)		500
Comprehensive Final Exam		100
Total points for course		1100

The standard grading scheme will be used to determine your final grade (90.0 to 100% = A; 80.0 to 89.9% = B; 70.0 to 79.9% = C; 60.0 to 69.9% = D; below 60.0% = F)

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Everything You Ever Wanted to Know About Field Camp*

*But Were Afraid to Ask!

General Information

Q. What's Field Camp all about?
A. Glad you asked… you see, in most Geology classes you've taken so far you've just learned *about* Geology; in Field Camp you learn how to *do* geology! Field work is the foundation of geologic research and inquiry. It is the means by which you gather the data upon which hypotheses are developed and theories are proved. Everybody, by now, is familiar with secondary research; that is to say, looking up information that someone else has developed in a book or journal and then regurgitating it as a report or as exam answers. Field work is primary research: it is developing ideas on your own and testing these ideas based on the data that you personally gathered. The organization of this data is expressed as both a geologic map and a geologic cross section; the ideas you develop form the geologic report.

Q. What do I need to have already learned prior to Field Camp?
A. The prerequisites for this class are Structural Geology and Stratigraphy / Sedimentation. A petrology background is also useful. In other words, you need to know how to describe and identify rocks in detail, how to identify and describe geologic structures (and, thus, be proficient in the use of a Brunton Compass), how to recognize the sequence of events that created the rocks and structures, how to create a map using data you collect, and how to interpret others' geologic maps (which includes knowledge of geologic map symbols). Additionally, knowledge in how to camp, how to survive in the desert, and how to orient yourself and read a map are crucial! If you lack one or more of these skills, you're about experience one heck of a crash course!

Q. Is field Camp going to be tough?
A. Yes.

Q. What is expected of me?
A. As far as work goes, there will be several mapping projects, each of which will require you to prepare a completed Geologic Map; one will also require a Geologic Report. The format for these will be discussed later. There will also be a few non-mapping projects, which will be elaborated on as the project approaches.

Information Concerning Behavior, Camping, etc.

When camping we will be near other groups of people. You are expected to be reasonably non-disruptive. Remember that we are representatives of a higher education institution; we want to project the right image.

Everywhere we go we need to be very sensitive about litter. Never leave anything in the field; if you don't want to bring it back, don't take it in the first place. Always check to make sure that nothing has fallen out of the vans, which tend to accumulate clutter. Keep up with the trash while at camp and always make sure that our camp is especially clean when we leave it – even if there was pre-existing trash there. This includes organic material; just because something is biodegradable does not mean we can leave it behind! A big, sprouted onion will, indeed, soon decay and return to nature. In the meanwhile, however, it's just going to look like another out-of-place piece of garbage. Be especially careful about cigarette butts. Dispose of them safely somewhere other than on the ground. There will be no smoking in the vans or near the food preparation area.

Q. How much stuff can I take with me?
A. You will be requested to bring the minimum amount of stuff you need for reasonable comfort, the amount of which will vary from person to person. If too many people start bringing too much stuff, extraneous items will be left behind! In general, bring one duffle-bag's worth of clothes, toiletries, and what other trappings of civilization you may need, one backpack or so's worth of field equipment, one small- to medium-sized box worth of "dry" food goods, and all the water containers and toilet paper you care to bring.

Q. What do I NOT need to take?
A. Sul Ross is supplying all cooking gear, several lanterns, enough water for all trips. You are requested to fill your

personal water bottles before we leave a water source.
Q. What about food?
A. We will organize a group food cooking system with the help of our food boss. You will be required to contribute to this effort. You can also bring a reasonable amount of your own snacks, beverages, etc. We will provide water, Gatorade, and morning coffee.

Q. Can I smoke?
A. If you're not referring to tobacco, you know the answer. If tobacco is the herb in question, then the answer is yes, no, and conditionally. There is absolutely no smoking in the university vans. There will be no smoking allowed anywhere near the food preparation and eating areas, near the group work area, nor near any communal area. If you choose to smoke at roadside stops or at camp, keep up with your butts and do not litter. If you choose to smoke while doing field work, pack all of your butts out and absolutely do not litter – **and be aware of fire danger**! Several of the campsites and indeed entire US Forest Service districts have a no-smoking-at-all policy right now. New Mexico has suffered from large wildfires in recent years. It is your responsibility to be completely perfectly totally careful and sensible with ANY flame or ember.

Q. Will there be "facilities" available?
A. Toilets of varying degrees of sophistication will be available at all campgrounds. If nature calls while you're out doing field work, you're completely on your own. You are well advised to pack toilet paper into the field. Always remember to dig a hole *first* and pack out all toilet paper. After you've finished, cover the waste and re-fill the hole.

Showers will not be available at all campsites. For this reason, we have to spend some time at the KOA in between our more picturesque campgrounds. The KOA has showers, laundry facilities and even a pool.

Q. Can I use my rock hammer?
A. You can use your rock hammer at road cuts and on BLM and USFS land, but **absolutely not** in Big Bend National Park or Guadalupe National Park. When you take a sample with your hammer, do not smash away at scenic spots; hammer blows can really blight a nice location. Rather, collect your sample in the out of the way and "behind the scenes" places where eyes are not naturally going to wander. Even in places where the rock hammer cannot be used for its main purpose, however, you might consider taking it; it makes a pretty handy make shift shovel (see previous question).

Field Camp Desert Survival Basics

Water

Drink lots of water. **Carry lots of water**. If you find yourself running low on water, return to the vans to get more water. While you're there, drink more water. We cannot emphasize this enough. Because of the heat, you will need to consume about a gallon of water per day. Do this: in the morning, for breakfast, drink your fill of water (or juice--but no cranberry juice). If you drink coffee, tea, or Dr. Pepper for breakfast then drink an equivalent amount of water on top of everything. After your thirst has been more than satisfied, fill your canteens completely. *Important Note*: Fill up all of your canteens and other assorted water containers whenever we are at a water source! Do not wait until we get to the work area and fill up from the jugs; it is very important that we haul as much water as possible into the field.

You need to carry with you no fewer than five (5) quarts of water. When, during the course of field work, you find yourself down to about a half a quart, work your way back to the vans to get more. Repeat as necessary.

When you stop to relieve yourself during the course of the day, check the color and odor of your urine. This can be done easily without being disgusting. A more yellow appearance and stronger odor indicates that you are dehydrating; drink more water! And always try to drink water before you are thirsty.

Clothing

Always wear a hat. Always wear a hat. Always wear a hat. Something with a wide brim all the way around that breathes. Handkerchiefs and do-rags may look cool, but you're basically just strapping on a brain sauna. If you don't think you need a hat, just go a few hours without one while carrying your four quartz of water plus field gear. After we drag your heat-exhausted carcass in from the field, you just might reconsider. Plus, points WILL be taken off if you are not heeding this rule.

Always wear hiking boots. You will be scrambling over rocks and trekking through thorns. You need tough, waterproof boots with good, thick soles and ankle support. Tennis shoes will guarantee you at least one twisted ankle this summer.

Your instructor's advice is this: Always wear long pants out into the field; it protects against plants, animals, dehydration, and other bad things. After one hot day of long pants, though, you might switch to shorts for comfort. This is up to you. The trade-off is scratched legs, but hey: scratched legs are a field geology badge of honor! It shows that you actually spent the day in motion, and DID go the extra 50 feet to check that other outcrop!

Partner

At each project, you will have an assigned partner or partners. During the course of the work day you are to **never** separate from your partner. Although it may seem more efficient to "spread out so you can cover more ground", it won't seem that way when you are lying in an arroyo dying of dehydration and blood loss. If it's your partner that is knocking on death's door, then you are in trouble! If your partner is too slow for you, deal with it. If you are found without your partner or partners, you will lose a letter grade. If you want to ditch your partner because he or she is a lazy cretin who doesn't want to do any work, just tell us, but don't separate from him or her during the field day.

The Importance of an Early Start

The mornings are the best time to get any field work done. It may still be hot, but it is not nearly as hot as it is going to get. To make it during field camp, make your mornings your most productive time. Besides, the earlier we start, the earlier we can get back to camp! Start the mornings by mapping the stream cuts and lowlands; in the afternoons these become the hottest places; get them out of the way. In the early afternoon, make your way up to the high points where there will be less reflection and more breeze. When we get into the field, start mapping right away and don't stop until lunch... which brings up the next section:

Breakfast and Lunch

Eat a good breakfast. Not only will this provide much-needed energy for morning work, it will also prevent you from taking lunch too early. Chances are, you will be least productive after you've woofed down some lunch under some scant shade. Especially for lunch, try to avoid foods that are too sugary. Salty foods are okay in moderation. Besides lunch, take snacks with you (granola bars, etc.) to stave off hunger so you can delay lunch until an appropriate time. Of course, eat before you get weak from hunger!

Don't Get Lost

Since you will be mapping, you will be keeping a close eye on your topo map. In addition to recording data points, trace out your traverses between stops. This will not only keep you knowing were you are, it will also help you become familiar with the mapping area. If you do become disoriented, make your way to a place that shows up prominently on a topo map, such as a bend in a stream, a high point, or a saddle between high points. From these places you should be able to locate yourself and re-plan your traverses. When you encounter another group, confer with the map to make sure that both groups think that you are in the same place.

Watch Out for Critters!

If you see any "dangerous" critters over the span of the next five weeks, chances are it will be a rattlesnake. Generally speaking, rattlesnakes, being much smarter than the average human, avoid the heat of the day. Keep a careful eye out for them sunning on rocks in the morning and hiding in the shadows after it starts to get warm, especially in rocky areas and under bushes and logs and rock ledges. Watch where you put your hands. The best thing about rattlesnakes is this: they give you fair warning. Unless you step on them before they notice you, of course. If you hear a rattle, don't run or jump away; you might run into the snake! Instead, stop and carefully look around until you spot the snake, then back away slowly and take a good, stiff drink (of water). Remember, if you see one snake, then there may be others lurking in the same general vicinity!

Other possible critters you might encounter are Mexican black bears and mountain lions. Chances are, you won't; in fact, you can count yourself lucky if you do. Should you meet up with one of these animals, hold your ground, make yourself look big, and make noise. By all means, resist the temptation to run; you will appear to the animal to be a big, frightened rabbit. The difference being, rabbits can hide down holes and you can't. To avoid menacing critters, make a bit of noise as you do your work; if they hear you first, they'll probably get out of the way. If you sneak up on them, you might be in trouble. Also, to keep them out of camp, make sure the food and trash is locked away at night and don't camp near it!

The smallest critters, though, are the ones that you need to be most wary of. Scorpions and spiders won't kill you, but they can ruin your week. Shake out your boots and clothes every morning before you put them on, especially if they were laying out overnight. Before you pick up a rock laying on the ground, knock it over with your boot or rock hammer to see if anyone's living underneath it. When you put up your tent and ground cloth, be careful of critters hanging out

underneath and give your tent and tarp a shake before putting them up. Finally, if you spill fruit juice on your bare leg, clean it off thoroughly; otherwise it makes your leg a more attractive snack to all sorts of biting critters.

Sunburn

Your biggest enemy in the desert isn't wildlife; it is the sun. In addition to the aforementioned effects of dehydration, the desert sun can be menacing. If you go with shorts and short-sleeved shirts, like many of you will, make sure you always wear and carry sunscreen! (but don't wear it on your forehead or the sweat will just bead up and roll right into your eves!). Count on your hat to protect your forehead from sunburn. You will always be wearing a wide-brimmed hat.

Remember: Avoid trouble! Dress right, eat well, and drink plenty of water. Keep track of where you are, keep an eye out for your partner, and keep an eye out for other groups. If you start to feel the effects of dehydration or heat sickness, go to the vans to take care of it immediately! Map the lower areas in the morning and the higher areas later in the day; stay out of the excessively hot places in the afternoon. Oh... and did I mention to drink and carry plenty of water?

Mapping Hints n' Tips

(Adapted from: Basic Methods of Structural Geology (1988) by Stephen Marshak- and Gautam Mitra and from Manual of Field Geology (1962) by Robert R. Compton.)

1. First thing out, get a feel for the mapping area. If you can, traverse the boundaries of the mapping area. At your first, best opportunity, climb a high point to survey the area. Try to get a feel for the quality of exposure, the types of rocks present, and the general distribution of lithologies and structures. Even though you are doing an initial survey, make your map as you go! Never say, "I'll just come back here and map this later." Be constantly mapping, even if you are just mapping the contacts at the boundaries, in the streambed, etc. It's -a good start and will help you plan traverses. If you blindly start mapping in an area, -you may quickly become frustrated because the outcrops that you stumble across cannot be viewed in any rational context. That is why reconnaissance is an important first step. Using the information gained from your reconnaissance, start mapping in areas where you can understand the structures and recognize the stratigraphy.

2. Based on your survey, make an initial choice of the type of mapping that is best suited to the area. There are three basic types:
(a) Outcrop Mapping: The positions and shapes of discrete outcrops are located on the base map. At each outcrop the unit is identified, and appropriate measurements are made. This method is suitable for regions in which there is little continuity between outcrops. It is often used in metamorphic terranes or in regions with a lot of cover.
(b) Station Mapping: Pinpricks or x's are marked on a map at points where measurements are made, and each point is assigned a station number. The number and the measurements are recorded in a notebook. Some of the measurements are then plotted on the map. This method is suitable for regions where there is a lot more structural detail at a locality than the geologist can plot on the map.
(c) Traverse Mapping: Using this method, a geologist walks out traverses and plots structural measurements (contacts, structures, bed attitudes, etc.) directly on the base map as s/he goes along. The map of the area covered each day is complete at the end of that day. Traverses are commonly planned so that a given contact or structure is traced across the countryside.

Projects in this field camp are all in areas with good to reasonable outcrop exposure. It is recommended that you practice Traverse Mapping, augmented by Station Mapping. Plan and map your traverses as you go along; recording data at stations along your traverse which you can incorporate into your map and your report when you get back to camp (e.g., thickness of bed, nature of contact, attitude of bed or structure, cleavage, foliation, primary structures, description of lithology, etc.).

Do not delay putting measurements on your field map. Do not just record measurements in your field notebook and plan to put them on in the evening. By not plotting measurements, you are eliminating the possibility of using your map to guide your traverse or to create or modify working hypotheses.

3. Early in your work, begin to employ the method of multiple working hypotheses. You should be constantly developing ideas that will be proven or disproven by the next step in your traverse. Plan your traverses around the problems to be solved, not vice versa. By doing this, the process of mapping becomes the process of problem solving and therefore becomes more interesting. Needless to say, your hypotheses will evolve as your work progresses. New ones develop and old ones die. Constantly be aware of where you are on your field map, and be thinking about your hypotheses – even when walking back to the vans for more water.

4. Early in your work, sensitize your eyes to recognize variations in lithology. You may find at first that all rocks in your map area look the same, but as you work, you will find that different units become more distinctive. Pay special attention to weathering patterns, bedding thicknesses, grain size and shape, and unique mineral assemblages. These features help you to identify a unit. Don't worry if it takes you a while to acclimate to your field area; there is always a period of muddling around before you can really make progress.

5. Use marker horizons (very distinctive beds) to find and identify structures.

6. The truth is always right! Be sure to record data even if they seem anomalous, even if they don't fit any of your working hypotheses. **Never** select data so that they fit your favored hypothesis—this is bad science. You may, however, select representative data for plotting on your map if you have only limited space. Make sure that the observations you

record are correct—this is part of your capstone course: identifying geologic features. Be clear on the difference between observations and interpretations.

7. Use your notebook to make sketches of the three-dimensional ideas forming in your mind as you map. Make rough cross sections. Don't wait for the end of mapping to sit down at camp and start to try to envision the subsurface: This should be part of your mapping. Remember the three-point problem? You can use that to fine-tune your field cross sections: As you are mapping contacts and measuring bedding orientations and fault-plane data, you can use the three-point problem to make sure your hypothesis fits both the map and the cross section. Always remember that the topographic surface you are walking around upon is a temporary shaving-off of the larger, three-dimensional geologic structure that these rocks make up.

8. If you come across an outcrop that seems especially difficult and confusing, don't spend too much time there trying to figure it out. Just say what you can and any guesses you may have in your field notebook and move on. With continued exploration in the area, the nature of the complex outcrop will probably come to light as you test your hypotheses. If an outcrop seems especially complex, it probably is. However, don't chalk all of the outcrops up to this: Use Occam's Razor, which states that the simplest solution is probably the right one.

Field Studies as a Scientific Method

Because the geologist is continuously observing relations and making interpretations in the field, their general methods may be compared with the classical scientific method. In its conventional form, the scientific method consists of several steps. The investigator first observes and collects data. He then formulates a hypothesis to explain this data. Next, he tests the hypothesis in all possible ways, particularly by studying additional relations that can be predicted on its basis. If the hypothesis survives all tests, it is considered tentatively verified; if not, another hypothesis must be formulated and tested.

In geologic studies, it is often most effective to consider all possible hypotheses together. If only one hypothesis is utilized, or if one is adopted too quickly, there may be a tendency to overlook evidence that would disprove it. Another reason why multiple hypotheses should be considered in the field is that outcrops cannot be revisited to test every new idea. Furthermore, different kinds of data may be so interrelated that all must be studied together to be understood.

General Objectives: Each student will develop:
1. Knowledge of field techniques used in the geological sciences
2. Knowledge of proper conduct in the field
3. Practical skills in wilderness first aid and survival
4. Knowledge of reporting observations made in the field
5. Skills in processing data collected in the field

Student Learning Objectives: Each student will demonstrate the ability to:
1. Identify rocks and geologic features in the field
2. Measure geologic structures using a Brunton compass
3. Construct detailed geologic maps and cross sections

Geology BS marketable skills:
1. Student will be able to conduct field work.
2. Student will be able to use field equipment.
3. Student will be able to use lab equipment.
4. Student will be able to use library resources.
5. Student will be able to communicate in written and oral format.

Geology BS SLO's:
1. The student will be able to apply a diverse body of Geologic information in the area of Earth history.
2. The student will be able to apply a diverse body of Geologic information in the area of mineralogy and petrology.
3. The student will be able to apply a diverse body of Geologic information in the area of structural geology and tectonics.

4. The student will be able to apply a diverse body of Geologic information in the area of stratigraphy.
5. The student will be able to apply a diverse body of Geologic information in the area of field techniques.

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