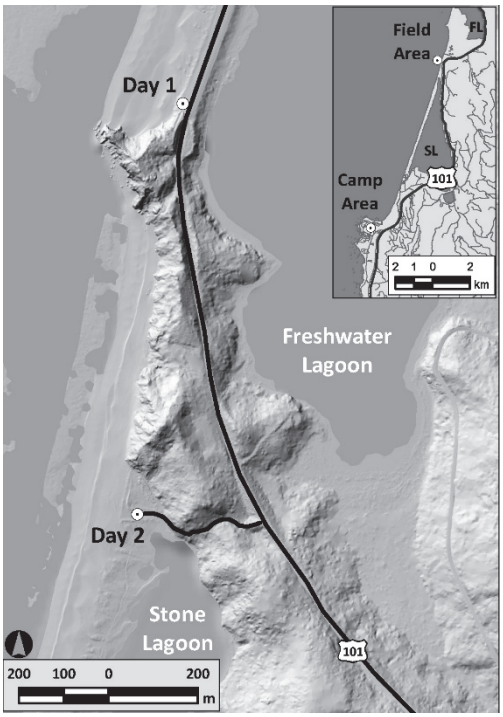
GEOL 335 Field Methods II
Spring 2016

Field Exercise #2:

Geologic Mapping and Lithologic Descriptions at Stone Lagoon



Field Trip Objectives:

1. Identify planar and linear structures in a field setting, measure their orientations with a Brunton compass, and represent their orientations accurately on a map.
2. Observe, classify, and describe rocks and geologic deposits through accurate descriptions and annotated sketches.
3. Represent geologic relations accurately through construction of a geologic map.

Location:

Bluffs north of Stone Lagoon and south of Freshwater Lagoon, Patrick's Point State Park.

Equipment Needed:

- Brunton pocket transit
- Hand lens
- Protractor-ruler
- Pencils/pens
- **Field Notebook**
- **Textbook**
- Colored Pencils

Materials Provided:

- 1:1,200 scale LiDAR map (day 1)
- 1:2,400 scale LiDAR map (day 2)

Tide information:

•	Sat 08:08 AM	6.75	H
•	Sat 03:10 PM	0.05	L
•	Sat 09:44 PM	5.7	H
•	Sun 03:04 AM	2.57	L
•	Sun 09:02 AM	7.1	H
•	Sun 03:53 PM	-0.33	L

The purpose of this field project is to make a geologic map of the coastal region between Stone Lagoon and Freshwater Lagoon. The first day will be spent in reconnaissance work to get a general impression of the rock units in the area, the nature of the contacts between units, the broad structural patterns in the area, and to learn the lay of the land and decide where to focus more detailed study. The second day will be spent completing a geologic map of the study area.

You will be most efficient if you identify and describe each of the principal geologic units as you encounter it. Then locate the contacts between units and follow the contacts across the map area. Record contact locations and relevant observations (rock types, orientation of bedding and/or foliation, presence of folds, shear zones, etc.) as you make your way around the study area. Pay particular attention to observations that may help you to identify the nature of each contact (conformable depositional contact? unconformity? intrusive contact? fault?). This information should be recorded in your field notes and identified on outcrop sketches. Be detailed in your notes and recognize that we have a limited time to cover a large area (you will be generalizing to some degree, just like exercise 1).

Field work schedule:

We will start work at the south end of Freshwater Lagoon. The goal for Saturday morning is to identify and carefully describe the three different geologic units present, to describe the small scale structures, and to start recording information on your geologic map. The class will divide into three groups and each group will work with one instructor/TA and will stay together for the day. The Instructor and the TAs will switch back and forth between groups.

At around noon, we'll drive to the picnic area at the north end of Freshwater Lagoon for a lunch break. There are picnic tables, restrooms, and a covered area. This is a good place to eat lunch and then discuss mapping progress and develop a field work plan for the rest of the day.

On Sunday, we'll do geologic mapping of the coastal exposures between Stone Lagoon and Gyon Bluffs (the headland between Stone Lagoon and Freshwater Lagoon). We will continue mapping in the same groups on Sunday; each group will follow its mapping plan in order to cover the whole area and complete their mapping by midafternoon. Be back to the vehicles by 4:30 for a wrap-up discussion and for a departure no later than 5:00. Plan to have a completed field map on the 1:2,400 scale base map by the end of field work on Sunday. If you prefer to show more detail, and if you have time, you may also make a geologic map on the 1:1,200 scale base map.

Field sketching and description of units

Assign a station number to each place that you stop and identify the rock or measure the orientation of a feature. Write descriptions of the main geologic units (see the list below). For each station, describe the rocks and structures (bedding, foliation, folds, etc.) and record the descriptions and orientations in your notes. See chapter 3, Coe (2011).

Locate each station on your map while you are at the station. Use the safety pins to mark the station locations on the map and label the pin holes on the back side of the field map. Use your protractor to plot orientations of bedding or other structures that you measure. Use a colored pencil (erasable colored pencil is the best) to show rock type at each station.

Where you cross from one geologic unit to another, look for evidence that indicates the nature of the contact (is it a conformable depositional contact? an unconformity? an intrusive contact? a fault?), and record the evidence in your field notebook. Draw the location of each contact on the map.

In your notebook, make a sketch of a representative exposure of each rock or sediment unit that you show on your map. The sketch should be approximately to scale and should include a scale bar, notation

of the direction you were facing when you made your sketch or the orientation of the exposure, labels for rock types and features shown, and a one-sentence interpretation/summary of what is shown.

Write a complete description of each rock unit or sediment unit that you show on your map. Start with a description of each unit at one exposure, following the outline below. As you see more of a unit while you are mapping, record additional descriptive information in your notes. In your final report, merge characteristics reported at different outcrops to make a complete description of the unit.

Rock descriptions should include:

- Type of rock or sediment – give it a rock name (e.g. "rhyolite" or "gneiss")!
- Overall color (on a fresh surface and on a weathered surface) and appearance
- Particle/grain size. Use standard grain size terms (e.g. "very fine sand" or measurements e.g. "phenocrysts 1-3mm long")
- Texture (e.g. phaneritic, porphyritic, foliated, clastic, etc.). If it is a sediment or sedimentary rock, record grain size, rounding, sorting, sedimentary structures (laminated, cross laminated, massive, etc.). See Appendix A6, Coe (2010).
- Degree of weathering. How hard is the rock? Is it friable? What does it break down to if it is weathered?
- Composition / mineralogy: What minerals can you see? If it is a conglomerate, what are the compositions of the clasts?
- Fossils?
- Metamorphic features. Is the rock metamorphosed? Is there foliation or lineation? What defines the foliation (How do you recognize it)?
- Folds. Are layers folded? What is the amplitude and wavelength of folds? See Chapter 8, Coe (2010).
- Bedding characteristics. Is there bedding? Bed thickness (or range of thicknesses)? What is the orientation of bedding?
- Joints, faults, fractures. Is the rock jointed? Fractured? Sheared? Describe joint, fracture or shear surfaces, and the spacing between surfaces. Record dominant direction of joints or shears.
- Veins. Describe their composition, thickness, and occurrence (do they fill joints? do they run parallel to foliation?)
- If you can determine thickness, how thick is the unit?
- If you can see contacts, what kind of contact separates the unit from units above or below?

Geologic map

Determine the location of each station on the map and record the rock type and other appropriate information. Compile all information on the 1:2,400 scale map. If you find that it is easier to use the 1:1,200 scale map for part of your work, you are welcome to compile information on this map as well.

Plot representative examples of bedding, foliation, fold hinges, etc. on your map. Use pencil and make the symbols small. You should ink the symbols on your final map, but it's more convenient to work in pencil on your field map. The base maps are all on the website. Feel free to use illustration software for your final map, but the instructor can provide a fresh copy if you want to do a hard-copy final map. See the table of map symbols in Coe (2010) for map symbols (Appendix A-10).

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Map the contacts between units and attempt to determine the nature of each contact (depositional contact, unconformity, intrusive contact, fault, etc.). Look for and record information that will help identify the type of contact mapped. For example, measurements of bedding orientations on either side of a contact might show whether it is a conformable depositional contact or some other type of contact, such as an angular unconformity or a fault.

You will not have time to follow individual contacts away from the best-exposed areas. In some cases contacts can be sketched on the basis of topographic expression, vegetation, soil color, or other features. Where you have sketched in the approximate location of a contact, use a dashed line to distinguish this part of your mapping from the contacts that are clearly exposed.

Extent of exposures, the inefficiency of access from two separate ends of the study area, and the relatively short time we will spend at Stone Lagoon / Freshwater Lagoon will limit the level of detail of your map and the extent of the area you can cover. Make as complete a map as possible. Keep in mind that reconnaissance mapping does not mean sloppy nor inaccurate mapping! An accurate map of a smaller area is preferable to an inaccurate map of a larger area.

What you will need to turn in at the end of the field trip on Sunday

1. **Field copy of your geologic map.** Include the stations numbered and marked, strike and dip symbols plotted, and rock units identified. I'll return this map to you no later than Friday March 11 by 4 p.m. I will place your maps into a box in the HSU Dept. of Geology office.

What you will need to turn in no later than 4 p.m. on Friday, March 25.

1. **A readable hard-copy of your field notes and sketches.** See Coe (2010) chapters 4, 6, 11.
2. **Field copy of your geologic map.** Include the stations numbered and marked, strike and dip symbols plotted, and rock units identified (same one that you turned in before).
3. **Neatly inked and colored final hard-copy of your geologic map.** The map should be neatly drafted, contacts drawn in ink (depositional contacts and intrusive contacts drawn with a thin line, fault contacts drawn with a thicker line), geologic units clearly labeled, strike and dip measurements plotted accurately, and explanation of map units written next to or accompanying the map. Coe (2010) chapter 10 and p. 309. Feel free to do this map electronically (illustration or GIS software).
4. **Hard-copy of the evaluation sheet on the following page.**
5. **Typed description of rock units.** This will be included as a section in your digital report (the methods section). For each of the units shown on your map, give the unit name (e.g. "ultramafic rocks") and include two well-written paragraphs that summarize all of your observations of this unit, (1) describing the hand sample-scale and (2) describing the outcrop-scale characteristics of the unit.
6. **A digital report that describes what you did**. This will include information about how you collected your data, the observations you made, a general description of the geologic units mapped (#4), and at least one page including your interpretation of the geology mapped (a narrative). The report needs to have at least one figure and a figure caption. The paper will be at least 5 pages long and formatted like in exercise #1. Include a table that lists representative structural data and include an interpretation of these structural data in your report.

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Grading Rubric for Field Exercise #2 **Name: _____**

Item	Points
Field Notebook and Field Map: Organization, detail, illustrations, completeness, and relevant detail; each rock unit described; annotated sketches; stations labeled; structural data plotted (unit strike & dip, fold or foliation trend & plunge).	_____/100
Final Map (general information): unit identification, abundance of orientation data, map explanation (includes all symbols and units shown), area covered, presentation (labels, neatness, detail).	_____/50
Final Map (units and contacts): contact location accuracy, contact type and evidence supporting your interpretation of contact type, correct symbols	_____/50
Final Map (structural information): strike & dip measurements and trend & plunge measurements reported in field notes are shown on map, representative orientations chosen, accurately plotted, and correct symbols used	_____/25
Lithology descriptions (typed summaries): completeness, accuracy, proper terms used, measurements (e.g. bedding thickness) included where appropriate, presentation (same sequence used for each description, accessibility)	_____/75
Geologic Report (text 100, figure 25, table 25)	_____/150

TOTAL ____/500