

Geology 110 (Introductory Geology)

Making a composite stratigraphic section of southeastern Minnesota

This field project includes three afternoon field trips to exposures in the Northfield., MN area and a one-day trip to exposures in Taylors' Falls MN, north of St. Paul. Handouts for the three afternoon field trips are included in this .pdf file. Lab reports for each of the three labs include stratigraphic sections (as described in each section below). Part of the final project for the class is organizing these individual sections into a single composite section and then using that section to explore aspects of the geologic history of southeastern Minnesota.

Lab period 1:

During today's lab, we are going to visit a number of outcrops east of Northfield. Our goals are to:

1. Recognize and describe major stratigraphic units.
2. Determine the thicknesses of these units.
3. Determine elevations and nature of contacts between units.
4. Determine the orientation of stratigraphic units.
5. Reconstruct a complete stratigraphic section, including all the units.
6. Observe internal features (fossils, structures, etc.) of the rock units.
7. Collect fossils from the site at Wangs Corner. (These will be identified and analyzed in a later lab).
8. Create some hypotheses about the environments of deposition of the rocks.

It will be particularly important today to keep track of your locations and elevations. I will have the topographic maps in the vans for you to locate yourself. Here are the **approximate** elevations of the places we may visit.

1. Stanton Quarry, elevation 1030-1040 ft.
2. Highway 56 roadcut near Stanton, elevation 960-970 ft.
3. Sogn roadcut, elevation 960-990 ft.
4. Wangs corner, elevation 1070-1100 ft.
5. Sogn quarry, elevation 1120 ft.

Special note about the Sogn roadcut: This is a dangerous roadcut because of overhanging rocks. Please don't climb on the overhangs and be sure to wear your hardhats.

At each outcrop, you will want to locate and describe the different rock units. Pay particular attention to the thicknesses of the units and the internal structures. Refer to your earlier lab handouts on rock description in hand specimen and at outcrops. It is important to take good, complete notes at each location.

Assignment: Based on your observations, prepare a composite stratigraphic section, including observations made at all the stops. A composite section shows the entire stratigraphy and identifies the portions seen at each stop as well as gaps where there are no outcrops. This stratigraphic section should use conventional symbols for structures and patterns for different rock types. Also, make a complete description of every rock unit we see.

Lab periods 2 and 3: Field Trips to Red Wing

Red Wing is located at the confluence of the Cannon River and the Mississippi River. Red Wing is named for a local Native American leader of the early nineteenth century. There is still a Native American settlement on Prairie Island, along with a Northern States Power nuclear power facility. Red Wing is about a 45 minute drive from campus. Because of the driving time, we will be leaving at **1 p.m. sharp** for these labs, so groups should convene at 12:30 - 12:45. Meet in the lab and make sure that your group has a hammer, a map board, a tape and a compass.

Week 1:

Stop 1: Base of the water tower, across from the golf course. Locate yourself on the map and note the elevation of this exposure. Estimate the age of the rocks, compared to those we have seen around Northfield and in Taylors Falls.

We'll start at **the upper part of the exposure** :

We will start by closely examining and then discussing the "sedimentary structures" in this exposure - internal structures within sedimentary beds that are produced by a variety of processes. There is a tiny amount of information in the text (p. 166-167) about these features; by the end of the afternoon, we'll know a whole lot more!

Estimate the total thickness of rocks exposed here. Examine the rocks closely, and compile your observations into a schematic stratigraphic section of the whole exposure, a detailed stratigraphic section of at least a meter's thickness of the rocks and a detailed description of the rock type. Things to look for and describe include: thickness of beds; nature of cross-bedding; range of rock types; fossils or trace fossils (burrows, feeding tracks, etc.); other sedimentary structures; grain sizes, shapes, and sorting; color; other distinguishing features. Look at your outcrop observation handout for more details.

Measure as many paleocurrent directions (from cross-beds) as you can. Count the number of measurements within each 20° group (0-20, 20-40, etc.). It is important to gather as many measurements as possible without repeating measurements of the same cross-bed. We will compile the results at the end of this stop or in class tomorrow on a rose diagram. Is there a dominant current direction? Two? None? As you interpret these data, remember that this region may not have been in its present orientation when the rocks were deposited. Also, remember the type of current that may have been involved - wind, ocean currents, river flow, etc. And recall that wind directions change with latitude, so if this area was at a different latitude in the past, prevailing wind directions might have been different.

At the base of the exposure :

Describe the rock and estimate its thickness. Try to draw some 3D sketches of some of these exposures and measure the current directions shown by the axes of the trough cross-bedding.

The unit exposed at the water tower, the Jordan sandstone, is the principal aquifer (water-bearing unit) for southeastern Minnesota. What is the evidence of water flow through the rock?

Stop 2: Exposures on Highway 19 near Red Wing turnoff We will stop at one of a series of similar exposures along Highway 19 to examine another unit in the Paleozoic section near

Northfield. This is a unit that you will want to describe in detail, both from up close and at a distance from the exposure. Complete a detailed stratigraphic section of at least a meter's thickness of the rocks and make note of any other features found in the exposure (look at your outcrop observation handout for more details.)

Assignment for next lab: Complete your stratigraphic sections from the water tower site and the Highway 19 site. Hand these in along with detailed descriptions of the rock types and short interpretations of the environments and mechanisms of deposition, based on your observations of sedimentary structures.

Week 2:

You'll need a hard hat this week, in addition to the hammer, map board, tape and compasses

Stop 1. Base of Barn Bluff.

Again, examine the topographic map and determine the elevation. How does the elevation compare to the water tower site? We will first look at rocks along Highway 61 and then climb up to another exposure on the bluff. Be particularly careful along Highway 61 because of the possibility of loose rocks coming down.

Highway 61:

Describe the rocks at this site and try to correlate them with units you have seen elsewhere. See your notes from last week and your outcrop observation handout - by this point in the course, you should be an expert at describing all kinds of sedimentary rocks!

West end of Barn Bluff:

You will also want to make a sketch of the exposure at the west end of the bluff, describe the rock types present here and determine the age relationships and geologic history .

Stop 2: Walk up Barn Bluff

We'll park and walk up the trail that starts at the east end of the bluff. The exposures we see will help fit the rocks from lower on the bluff together with the others we've described closer to Northfield. But the real reason to climb up the bluff is to look at the Mississippi River, its confluence with the Cannon River, the location of Prairie Island, and to make some hypotheses about the evolution of the river system.

Assignment for next lab:

The write-up for this lab is a composite stratigraphic section showing all of the rock units we have seen in southeastern Minnesota, including those at Red Wing and Taylor's Falls. I encourage you to meet with your group to go over your notes very soon. You'll want to incorporate your observations into your preparations for the discussion on the geology of southeastern Minnesota.