

Geology 110 (Introductory Geology)

Geologic Mapping in the Cannon River Wilderness Park

This week's lab has two purposes: to examine the rock section in another part of the Northfield area and to make a geologic map and cross-section of a small area of the Cannon River Wilderness Park. Our geologic map and cross-section of the Wilderness Park will help us further understand the shape and orientation of the rock units in the Northfield area.

So far, we have examined exposures in road cuts and quarries, where there is essentially 100% exposure of all the sedimentary beds. In most places, however, exposure is much more limited and geologists have to extrapolate between isolated exposures to interpret the geology. This process is used to create a geologic map, which shows the distribution of rock units on the surface of the earth. Perhaps you remember working with the Soudan quadrangle (MN) geologic map at the beginning of the term. A copy of this geologic map is posted in the lab. Look at the key to determine how much of the rocks are actually exposed and how much of the geologic map is extrapolated on the basis of those exposures. A geologic cross-section is an interpretation of the geology of a vertical slice through an area. At the bottom of the Soudan quadrangle is a cross-section through that area.

Bring to lab: this handout, a handlens, notebook and pencil, ruler/protractor, at least five colored pencils. Also bring your notes on making outcrop and rock observations. Each group will also need a hammer, an acid bottle and at least one map board. If it's a warm day, you'll also want a bottle of water. Insect repellent and sunscreen will also be advisable. Check for ticks after we return.

We will make the geologic map on a **topographic** base. A topographic map is a projection of the earth's surface onto a piece of paper. In order to represent hills and valleys, lines of equal elevation (contour lines) are drawn on the map. A flat surface has no contour lines (it is all at the same elevation). A smooth slope has parallel, evenly spaced contour lines. Valleys and ridges make bends in the contour lines. The topographic map of the area you are to map is attached. Note the scale at the bottom of the map. The scale will help you determine how large the area is. We have an excellent TASA CD resource to help you learn about topographic maps, which you've seen already. It definitely is worth the time to work through some of the sections on contouring and making topographic cross-sections.

The first step in making a geologic map is finding some exposures. I've marked several good places to look for rocks on maps that I'll distribute to each group. Visit these spots first and then look around for other exposures. Determine where you think you need more information to refine your map and go to those places. Gullies (small stream valleys) are particularly good candidates for places to find rocks. Be sure you know your location on the map and on the ground at the rock outcrops you find! You also want to be careful to distinguish rock outcrops in place (these are the ones you want to locate) and rocks that have been moved by erosion from their original locations (what kind of information can you get from rocks that have been moved?)

When you find some rocks in place, figure out what they are and describe them. Divide them into units, record the thicknesses and describe the contacts. Locate the contacts between the units on your topographic map. It will be helpful to color each unit in a different color to prevent confusion. Put a patch of color on the area of the map where the rock unit is exposed. Be sure to label your notes and map so that you can tell which notes go with which outcrop. After you have described, located and mapped your first outcrop, go find another outcrop. Are the rocks here the same as the rocks at the first outcrop? Again, locate contacts on the map and color in the same units. If you have new rocks, then define new units. Be sure to look carefully at the rocks to see if there is anything new you can add to your description of the units and their contacts.

After you've visited the first two outcrops, you will see that part of the problem of geologic mapping is that there aren't rocks everywhere. The orientation of the beds and contacts help geologists extrapolate

units. For instance, if the beds and contacts are vertical, the contacts will make straight lines across the contour lines. If they are horizontal, the contacts will parallel the contour lines. Do as much extrapolating as you can in the field, by penciling in contacts and lightly coloring areas that you think might possibly be underlain by particular rock types.

The Cannon River Wilderness Park also has some interesting landforms, which are studied in another course called Geomorphology.

When you return to the labs, you will want to make a final copy of the map and draw a cross section on line A-A'. The final copy of the map should show your best interpretation of the geology of the whole area. That means the whole map should be colored in, showing your best guess at what rocks are where. Use a darker shade of a particular color to show the locations of the outcrops you mapped and a lighter shade to show the extrapolation. Use a solid line for contacts that you could place to within a few meters vertically, and a dashed line for inferred contacts that couldn't be placed so closely. Use the same colors on the map and on the cross section. You should include a key that describes what each color stands for, including a short description of each unit. Also, draw and label line A-A' on your map.

To construct a cross section, first make a topographic profile along A-A'. This is most easily done by laying the long edge of a piece of graph paper along A-A' and marking the location of each contour line. Draw a vertical line along the short edge of the graph paper and mark off elevations, according to the scale of the map. Using the elevations of the contours, mark off where the slope crosses each contour then connect the dots. Transfer the location of each geologic contact to the cross section and then extrapolate the units below the surface in their proper orientation. The lab assistants are experts at making cross sections and there are also some posted instructions to help you. The TASA CD on Topographic maps has a particularly helpful section on topographic profiles.

Assignment: Each group should turn in a final geologic map, a cross section, and a brief (1-2 p.) interpretation of the geologic history of the area, considering climate and ocean processes.

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