GEOL 3000
Lab 4B: Constructing Cross-Sections of Flat-lying Strata, Fillmore County, MN
(12 pts)

**Background**
As we discussed in the first lab exercise looking at the 3-D topographic image of the Upper Midwest, the dendritic (branching) stream pattern of SE Minnesota indicates that the underlying geology is showing no preferential resistance to erosion. This is common in a glaciated terrane, where till and outwash are rather homogeneous in terms of its erodability. It is also true in areas underlain by flat-lying rock strata. This is the case in SE Minnesota. During the Paleozoic, this area was inundated with shallow (epicontinental) seas that deposited a thick package of transgressive and regressive sedimentary sequences of sandstone, siltstone, shale and limestone (now, commonly dolostone).

We will be evaluating the flat-lying Paleozoic stratigraphy of Fillmore County that is portrayed on a 1:100,000 scale geologic map by John Mossler. This geologic map and a bedrock topography map are part of the Fillmore County Geologic Atlas produced by the Minnesota Geological Survey in 1995 (Atlas C-8). For this lab, we will construct geologic cross sections that show this sub-horizontal “layer cake” geology in profile and that show how the intersection of flat-lying geologic layers and a deeply dissected, dendritic land surface gives rise to the map pattern observed.

**Procedure for making a Cross Section**

1) **Drawing a topographic profile**
   Tape together 2 pieces of graph paper such that it straddles a N-S profile across the map. On the Bedrock Topography plate, tape down the top edge of the graph paper along the N-S township line between R10W and R9W. Mark the bedrock surface elevations along the profile (these are basically color coded topographic contour lines). Note that the elevations are not all the same spacing - see the elevation key in map explanation.

   After marking all the elevation points, detach the graph paper then construct the cross section elevation axes at the north and south ends of the profile. Use a scale of 1sq = 200’ vertical elevation. Calculate the vertical exaggeration this will create and write this value at the bottom of your graph paper (the exaggeration is the multiplication factor that the horizontal scale must be expanded to equal the vertical scale and is commonly given a ##X, e.g., 20X). Although significant vertical exaggeration can play havoc with accentuating the angles that contacts and faults dip into the subsurface, it is less of an issue when the geologic contacts are sub-horizontal as in this area.

   Mark elevation points on your scaled profile and then connect the dots with a smooth line. This represents the topographic profile of your cross section.

2) **Drawing in the geologic units**
   Fold the upper part of your graph over to hide the topographic information. Now position your graph on the same township profile line, this time on the Bedrock Geologic Map plate. Mark the points where the geologic contacts cross the profile line and note the geologic unit that occurs between each contact with the map symbol or a color bar. Also note where you cross an anticline ←→ or syncline axis →↓←. Project the contact points down to your topographic profile and mark where they intersect. Also note where an anticline or syncline axis projects by writing an A or an S above the profile.
Now you want to draw the contacts through the subsurface. In most cases, there would be strike and dip symbols to guide you on how to dip the contact into the subsurface. This map does not show these measurements. Instead, you will note the presence of broad anticline and syncline axes symbols on the map. We will talk in more detail later about these structures, but for now, we just need to know that they generally show whether a unit is gently tilted to the north or south by the arrows at the anticline/syncline axes (we will go over this in class). You can see from the cross sections on the map that these fold structures are very broad and subtle. You should show the same on your map.

Another guide for drawing contact lines is to find other places on the topographic profile where the contour lines appear and connect them up. Recognize the locations of anticline and syncline axes which will require you to gently warp your line according to the structure.

Note that the lowest unit exposed along your profile is the Jordan Sandstone (Cj). On your cross section, be sure to also show the two units below the Jordan and the contact with the Precambrian basement. Note that the thicknesses of these units are listed in the legend. This will guide in figuring how thick (x vertical exaggeration) to show those lower units.

Once you have the unit contacts in the subsurface figured out, color them according to the color scheme on the map. Also write the map unit symbol at various scattered locations on the cross section (see how this is done on the cross section on the map). Then adjacent to the map, make a unit key naming the colored units in their proper stratigraphic order (oldest at the bottom).