Interpreting the Stratigraphy of Paleozoic Rocks

As presented in lecture, the progression of sedimentary rocks make up the Paleozoic strata in SE Minnesota resulted from the rise and fall of sea level and the transgression and regression of different depositional environments across the land surface. Deposits of sandstone are interpreted to represent high energy clastic deposits in a beach and near-shore environment affected by wave action. Deposits of shale, siltstone and fine sandstone, are thought to represent off-shore deeps environments where the fine sediment winnowed off the beach settle in to the calm waters below wave base. Limestone deposits are interpreted to represent clean water environments far from the shorelines create by activity of marine organism (reefs). This exercise will investigate the Paleozoic strat sections (see attached) in Goodhue County (Runkel, 1998), just south of the Twin Cities and Freeborn County (Mossler, 1995), near the Iowa Border. We will plot the thicknesses, dominant lithologies, and special sedimentalogical and organic features present in the two section and compare how well they match. We will also make some interpretations as to the environments of deposition based on those features and on how sea level may have changes over the depositional history of these sediments.

Procedure for Drawing Stratigraphic Profiles on the Strat Column Template

1) In the scaled columns labeled “Lithology”, draw the contacts between the main members and formations for the two strat columns. “Hang” your sections at the base of the St. Peter Sandstone. Where a range of unit thicknesses are indicated, use the median thickness. For conformable unit contacts, draw sharp solid lines; for unconformities, use a squiggled line (as shown in the profiles). Continue the lines (in pencil) across the page to the Features columns on the right and left.

2) Color the units by their dominant rock lithologies where:
   - Sandstone (fine to coarse), Sandy dolostone – Yellow
   - Shaley Sandstone - Orange
   - Shale, Mudstone, Siltstone, and/or Fine Sandstone – Brown
   - Sandy Dolostone – Yellow-green (or light green)
   - Limestone, Dolostone – Green (or dark green)
   If lithologic variations occur within a unit, be sure to show this with color variations.

3) Label the appropriate Member/Formation names on the sides of the column. On the Freeborn County side, also label the group name where appropriate. Tag the name to the unit boxes in either of the following manners

4) Mark on the far columns (which have unit contacts drawn) with appropriate symbols, the occurrences of features: cross-bedding (first column), phosphate pellets, glauconite, and Fe-staining (second column), and oolites and algal structures/stromatolites (third column).

5) Draw correlation lines connecting like contacts/unconformities between the two Lithology columns.
Interpreting the Stratigraphy

A) Review your correlation of units. You should notice lots of community. However, there are some significant differences. Comment on the major differences between the two stratigraphic sections in terms of thickness, rock types, and features.

B) In the column labeled “Sea Level”, draw a curve that portrays the rise and fall of sea level that you interpret from the successive rock unit (see the diagram below as a general guide). When sea level drops below the land surface, show this by having the curve touch the left side of the column.

C) Research the following sedimentary features and briefly describe what they infer about the depositional environments in which they form. (A Physical Geology text or even Wikipedia is commonly good for this).

1. Festoon Cross-bedding
2. Hummocky Cross-stratification
3. Oolites
4. Glauconite
5. Phosphate Pellets
6. Stromatolites
7. Borrows