Understanding Geologic Maps

You will need – tracing paper, pencil, colored pencils and (probably) an eraser.

Purpose of the Exercise

One of the aims of this course is to teach you to reconstruct the geologic history of an area. Mostly, this is done through the interpretation of geologic maps. Your main synthesis project in this course is a map interpretation exercise, and there are map interpretation components to the field exercises and the exam. This exercise is designed to get you thinking about geologic maps and learning to read the maps in great detail, paying attention to all of the constituent elements.

Constituent Elements of a Geologic Map – Breaking it down.

You are provided with a section of a map from the Arsenic Peak Quadrangle in Montana, USA. The key to the map units is given on the following page. Using a series of sheets of tracing paper, you are to "deconstruct" this geologic map into the constituent elements – a topographic map (major contours only), a structural map (containing fault, fold and representative bed orientation data) and a map of the different lithologies present. Where reasonable, you may combine units to create a simpler traced map of lithologies. You are advised to add some color to this last map for ease of use, as we will refer back to this exercise in future classes.

A: Using ONLY the topographic map

1. Where is the highest point on the map?
2. In which direction do the major streams flow?
3. How would you describe the topography of the area?

B: Using ONLY the lithological map and the key

1. What is the oldest unit?
2. What is the youngest unit?
3. Where are the unconformities on this map?
4. What are the potential structures in the central portion of the map?

C: Using the lithological map, key and topographic map combined,

1. Which way are the units on the W of the map dipping?
2. Are there domes or basins in the central portion of the map?
3. Are there any units that are horizontal?

D: Using ONLY the structural map and the key,

1. Identify the fault types in the area. Which way do these faults dip? Which is the hangingwall? Estimate the dip of the faults.
2. Draw a cross-section from W-E across the map, being as faithful as possible to the dip of the faults and using an arbitrary horizon to indicate the overall structure.
3. Did the folds occur before the faults or after?

E: Using the structural map, the topographic map and the key,

1. Do the faults run along valleys or high points?
2. Are the folds reflected in the topography?

F: Using the structural map, the lithological map and the key,

1. Check your answer to part C1 above.
2. Check your answer to part C2 above.
3. What is the age of the faults in the W of the map?
4. What is the age of the faults in the E of the map?
5. Which unit do the faults occur in?

G: Combining all of this information,

1. Is the topography mostly governed by lithology or structure?
2. Write a geologic history of the map area.