Cross sections

EPSC 240, Geology in the Field

Nov 19, 2018

Key concepts for Week 12:

General rules for drawing cross sections

1. Decide what the cross section is going to be used for, and use this to guide you in selecting the appropriate scales, position and direction of the cross section.

2. The line of intersection between the land surface and the plane of a cross section as, shown on a map, is called the *line of section*. The line of section is usually drawn *perpendicular* to the strike of folded strata.

3. The topographic profile along the line of section should be constructed carefully. Sections should be drawn with no vertical exaggeration unless there is a specific reason. Remember that geometries and dips are distorted when there is vertical exaggeration.

4. The direction (and magnitude) of the dip of contacts may be inferred from the law of superposition. *Beware overturned beds*; if you find them, the dip pattern may be inferred by reversing the law of superposition.

5. Where strikes are uniform, the *attitudes* (orientations) of the planes may be projected into the line of section along the strike direction.

6. You will want to pay attention to *apparent dips* because the section may not be everywhere (or anywhere) perpendicular to the strike of a unit.

7. In areas of unmetamorphosed, stratified rocks, *stratigraphic thickness* may be assumed to be constant unless there is evidence to the contrary. In areas where metamorphism or strain are variable, use field observations to constrain the shape of units in the section.

8. Contacts must conform to dips, but watch out for unconformities.

9. Intrusive rocks may either crosscut or be conformable with adjacent rocks. *Assume crosscutting* until you find evidence for conformity.

10. Make sure your section is legible, accurate and shows your interpretation clearly.

11. Remember: the cross section is a representation of the same geological model contained in the map, so the *section and map must be consistent*. Relative timing and spatial relations must be the same.

12. To test a cross section, consider whether the deformation is geologically plausible. If you *retro-deform* the section (return the offset components to their original positions), does it restore to a balanced state (i.e., with a geologically-reasonable geometry, and without change in area)?

Procedure for drawing cross sections

1. Choose a line of section on the map. Try to orient it perpendicular to the average unit strike and parallel to the transport direction. Locate it so that it shows the details!

2. Plot the topographic profile. The west or north end are typically on the left by convention. Use a strip of paper to record the positions of topographic contours along the line of section. Transfer these to a piece of graph paper. Leave enough space to allow the section to be projected to around 1000 m below the surface.

3. Locate geologic contacts on the topographic profile. Again, use a strip of paper to record the position of contacts and locations of strikes and dips. Note any contacts that approach, but do not cross the line of section. Make sure to label the units and faults with names or symbols.

4. Plot dips on the topographic profile. *Calculate apparent dips if the strike direction is >20° different to the strike of the line of section.* The equation that relates true dip to apparent dip for any plane striking at an angle to the line of cross section is:

   tan a = (tan b)(cos c)

   where angle **a** is the apparent dip, angle **b** is the true dip, and angle **c** is the angle between the true dip direction and the apparent dip direction.

5. To constrain major structures, focus on one or two contacts to begin with. Project them to depth and above the topographic profile. THINK: Are they folded/faulted? What method is appropriate for constructing the shapes of the structures?

6. Examine, consider and revise your interpretation (if necessary). Is the section *restorable*? Is the section *admissible* (does it make geological sense)?

7. Fill in the rest of the units on the section. Remember, a restorable section typically has *constant unit thickness* – is this a fair assumption based on your field observations?

8. Ink in your final copy using the appropriate colours for different lines and *dashed lines where uncertain*. Colour units lightly, add labels, title, explanation etc.