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GLG310 Structural Geology

Geological Maps and Cross sections

The purpose of today's lab is:

Develop your ability to produce geologic cross-sections from real geologic maps.

Much of the material for this comes from Spencer, E. W., *Geologic Maps: a Practical Guide to the Interpretation and Preparation of Geologic Maps*, Prentice Hall, 1993.

Also relevant is the Appendix E from Davis and Reynolds (p. 669 to 674).

Cross section construction guidelines

1) Size up the problem. Read the geologic map and have an intuitive feeling for what the geology is doing.
2) Select appropriate line of section. What are you trying to show with this cross section? What is the point? Usually this will be perpendicular to the major structural trends in the area.
3) Produce topographic profile. In general, do not exaggerate the topography or the geology vertically.
4) Transfer control points. Locate contact and fault intersections with line of section. Also locate nearby strike and dips projected along strike to the line of section.
5) Draw control lines for the attitudes. Don't forget about apparent dip!
6) Maintain constant bedding thickness where appropriate.
7) Use observed outcrop patterns, nearby strike and dips, map patterns, and geologic common sense to aid interpretation at depth. When in doubt, use 60 dip for normal faults and 30 dip for reverse.
8) Depth of subsurface interpretation is constrained by map information and may vary along the section.
9) Color and label units and structures. Include scale, A-A' or whatever letter end designators, Cardinal directions at the ends of the profile, title, elevation scale with labels.
10) Use the cross section to do something (answer a question).

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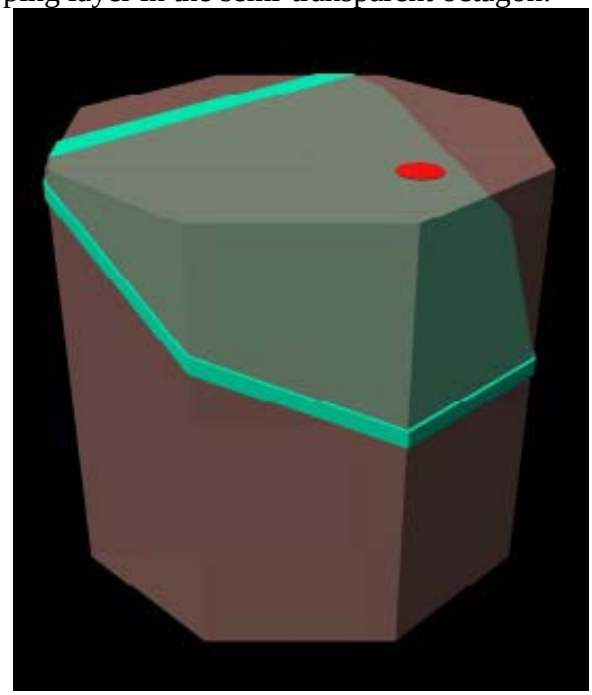
Part 1:

Reminder of Apparent dips

Only if the line of cross section is perpendicular to the strike of a bed will the cross section show the true dip. All other dips are apparent dips!

Let's consider the dipping layer in the semi-transparent octagon:



To determine the Apparent dip, we can do it a number of ways (graphical, trigonometric, nomogram (see below), and stereonet). We will use the trigonometric and the nomogram methods for convenience.

The nomogram is shown on the next page and also is in the text book on page 672 of Davis and Reynolds.

The trigonometric solution is often very convenient:

$$Tan\ \alpha = tan\ \delta sin\ \beta$$

Where α is the apparent dip (in the line of section), δ is the true dip, and β is the angle between the line of strike and the line of interest (section).

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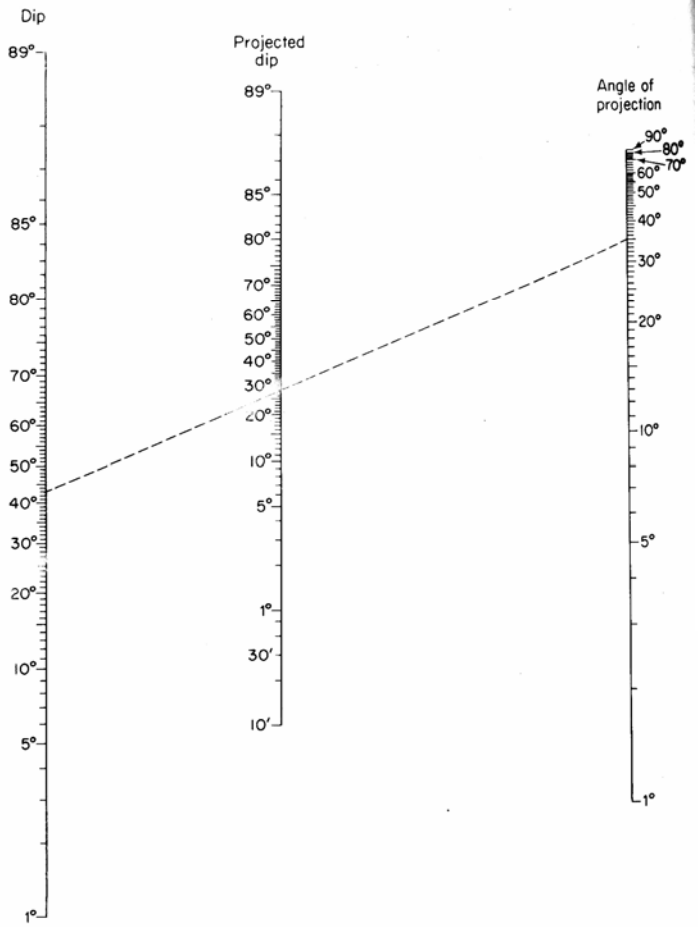
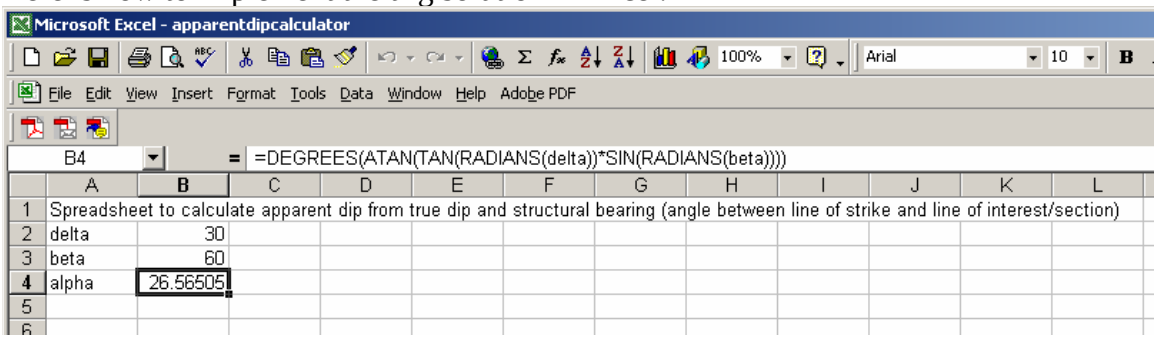


Figure E.4 Chart used to convert from true dip to apparent dip when constructing geologic cross sections. If the true dip is 43°, the apparent dip on a vertical section making a 35° angle with the strike of the bedding would be 28°. [From Billings, M. P., STRUCTURAL GEOLOGY, © 1972, p. 523. Reprinted by permission of Prentice Hall, Upper Saddle River, New Jersey.]

Here is how to implement the trig solution in Excel:



Or:

=degrees(atan(tan(radians(B2))*sin(radians(B3))))

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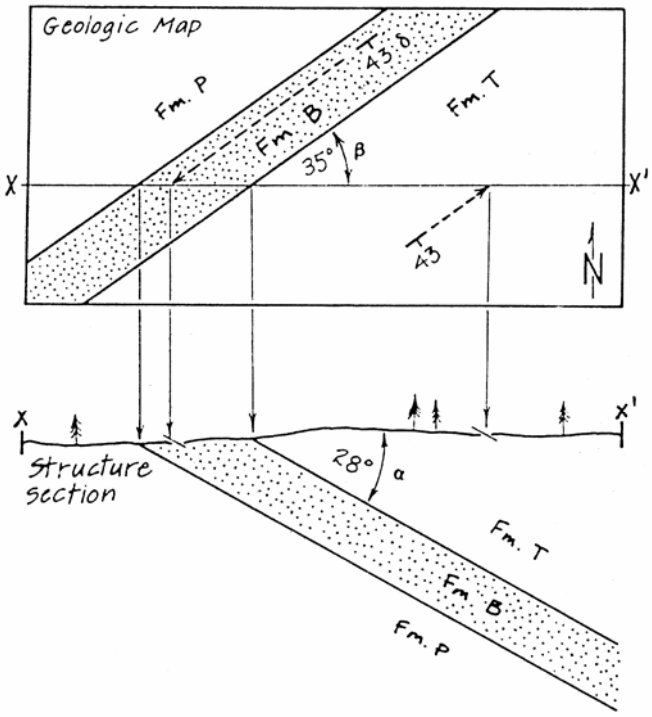

Fig. 4.4 Geologic map and corresponding structure section drawn at an angle to strike. Dip from map becomes apparent dip in section.

Here is another way to look at it

Let's determine the apparent dip for the octagon and check the calculations for the figure above using both methods.