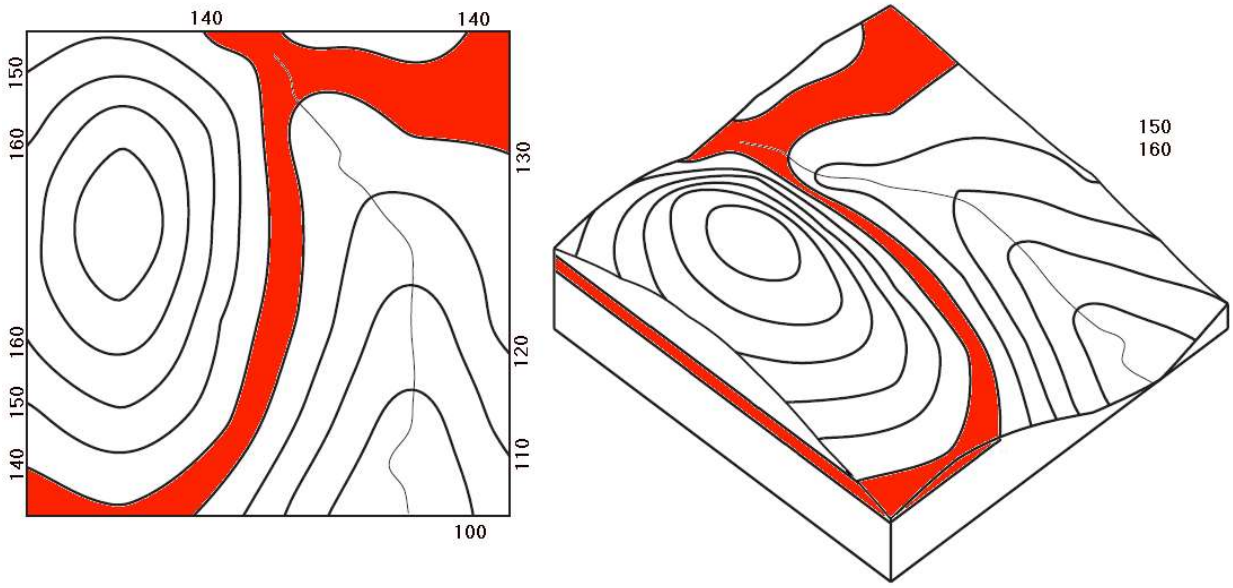
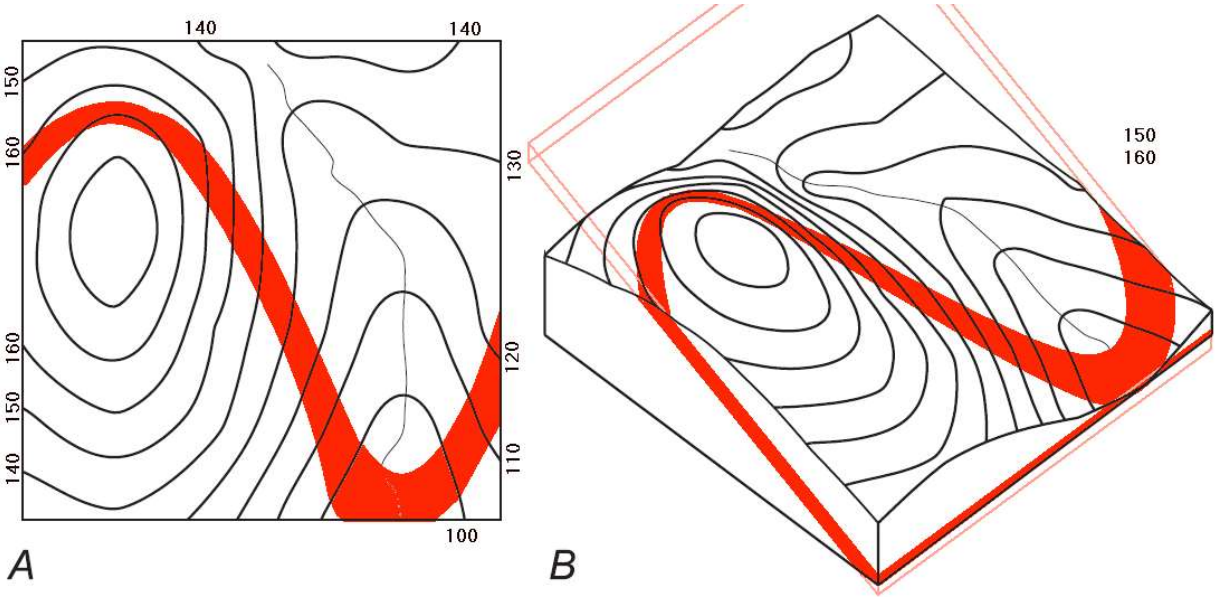
Determining the Dip (and Strike) of an Inclined Rock Bed from a Geological Map

A geological map is just a topographic map that shows where certain rock layers can be found at the earth's surface. This exercise assumes that the bed is flat, but not necessarily horizontal.

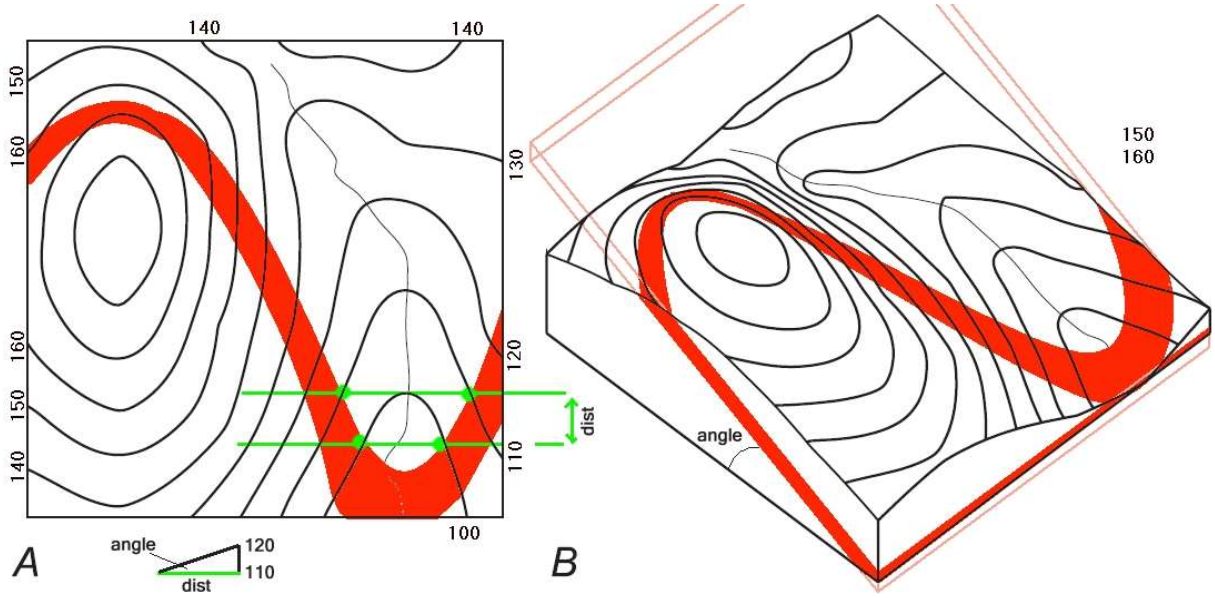
If the bed is horizontal, the bed contacts will follow the contour lines.



If the bed is inclined, then the bed contacts will cross contour lines. A general indication of the dip of a bed can be derived from an observation of where the contacts of that bed with other beds intersects the contour lines. In the example below, the bed is intersecting lower and lower contour lines from the top of the left hand map to the bottom. Thus, we know that the approximate dip of the bed is to the south (assuming the bottom of the map is south).



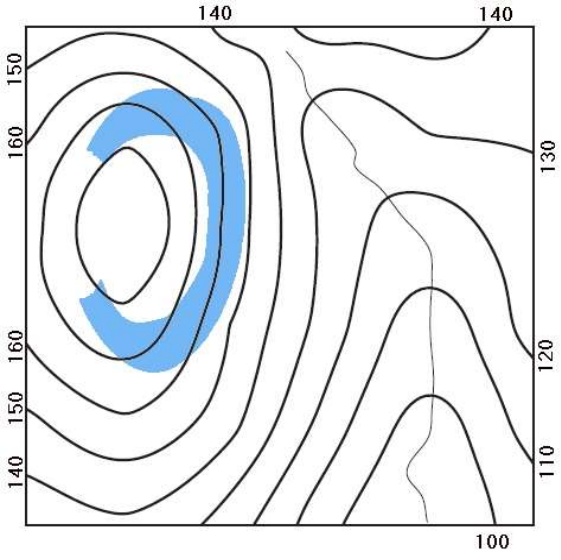
If we want a more precise strike and dip, we must mark where the upper or lower contact of the rock bed intersects the same contour elevation in at least two places. If we connect those two points with a line, we have drawn a strike line for that bed. The dip angle is exactly 90° to the strike. If we make a similar strike line for a lower contour line, then we can calculate the dip angle by measuring the distance between one strike line and the other. This gives us a "run," while the difference in elevation of the two contour lines gives us a "rise." From these, we can calculate the slope of the bed and from the inverse tangent function of the slope, we can get the angle of dip.



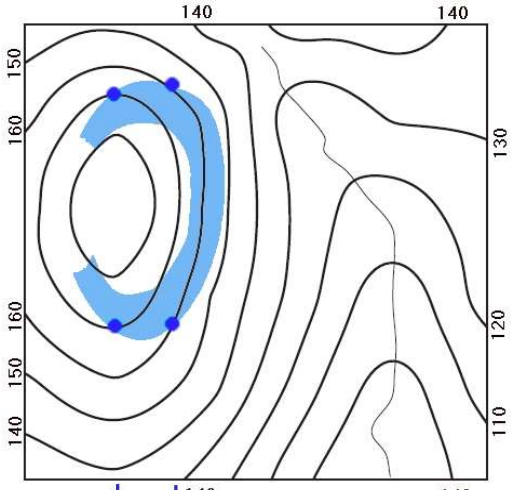
To calculate the bed dip for a map with just a few outcrops, we employ a similar approach. We must have at least two points where the bed contacts intersect the same contour line in order to draw a strike line. If the bed is flat, then we only need one other place where the bed crosses a different contour, since we know that the strike lines must be parallel in a flat bed.

We also would want to know at what other locations on the map that this bed could be found at the surface.

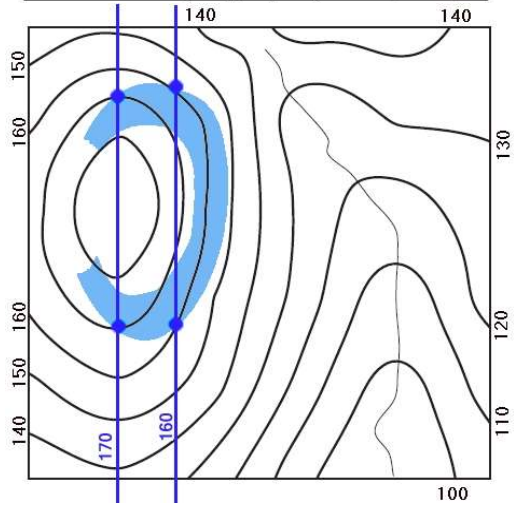
In this example, we will first work out the dip and location of the lower contact of this bed.



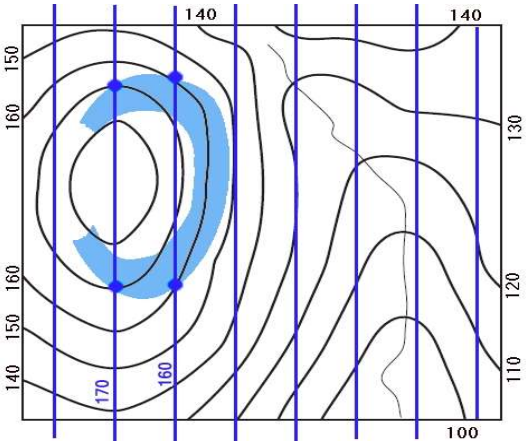
First, we not that the lower surface of the bed (the one found on lower contour lines) crosses two different contour lines, both in two places: the 160 m line and the 170 m line. We mark both sets of points on the map.



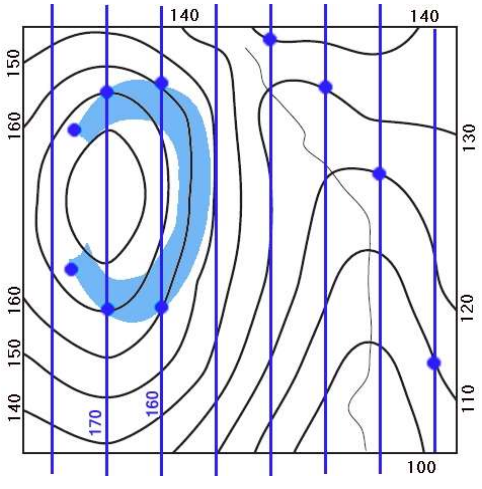
We then connect the 170 m intersections and the 160 m intersections with strike lines. This bed has a strike of 180º.



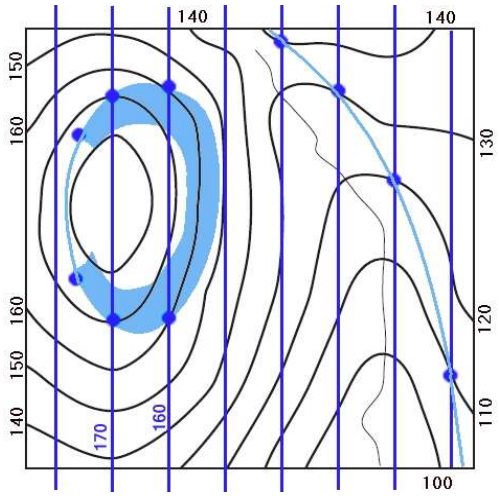
We now fill in the other strike lines for the bed. By doing so, we have a second set of contours on our map showing the elevation of the lower surface of the bed. All that we needed to do is draw in a set of lines parallel to the first two and equally spaced.



Mark each point where a contour line for the rock bed intersects a ground elevation contour line of the same value.



Join these points up and you will have a map showing where this lower bed contact should be found at the earth's surface (within the confines of the map).



You can do the same thing for the upper bed contact. This gives you a geological map showing all places on the map where this rock layer can be found.

From the map, one can sketch a cross section showing what the rock layer would look like in a slice through the earth in any direction (the sketch below shows a west-to-east cross section through the crest of the hill).

For a more accurate cross section, place a sheet of paper along the line you want to have for your section. Mark each contour line as it crosses your paper edge. Also mark each place where your paper cuts across the rock layer. Transfer your markings to the base of your cross section and use them as guides to draw an accurate cross section of the ground surface and the rock layer.