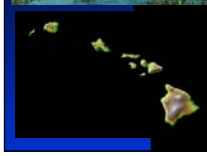
ES089 – Working in Three Dimensions



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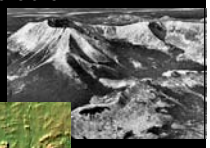
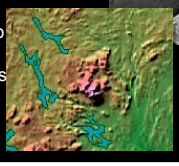
Topography

- This is a convenient way of expressing things that are three dimensional in two dimensions.
- Example: Mount Katahdin, Maine. This photograph was taken from the north side of the mountain.
- The modern topographic map shows the different altitudes as different colours.





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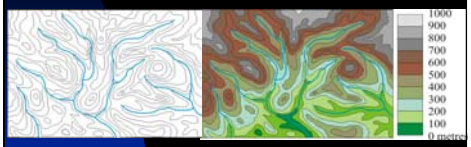
Topographic Contours

- In order to construct this kind of map, lines of constant elevation were plotted and then colour values were assigned to ranges of altitude.



- The lines that make the boundaries of these colours are the topographic contours.

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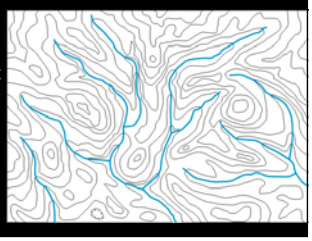
Contour Lines

- The blue lines on this map represent water in the form of streams, creeks and rivers. This also true of lakes and seas on other topographic maps.
- The black lines are contour lines – that is; lines of constant elevation.
- Interpretation is both an art as well as a science.



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Interpretation

- There are a number of established conventions with respect to reading maps:
- 1) north is always assumed to be the top of the map sheet when you're reading anything written upon it.
- 2) closed contours are always higher than the adjacent ground.
- 3) if hatchure marks appear on a closed contour, the enclosed area is lower than the adjacent ground.
- 4) closely spaced contours indicate steep slopes, while widely spaced contours indicate shallow slopes.
- 5) horizontal surfaces are rare except for standing bodies of water (ponds, lakes seas …).

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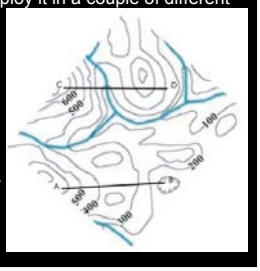
Topographic Profiles

- It is important that you understand the following technique. You will employ it in a couple of different ways.
- Here is a portion of the the last map with lines along which profiles are to be drawn.
- In order to draw a profile, we need a grid. Graph paper is very useful…



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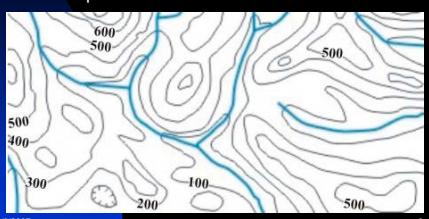
Interpretation II

- The altitude of lakes may be marked on its surface.
- Key altitude/elevation values appear on the map to make interpretation easier.



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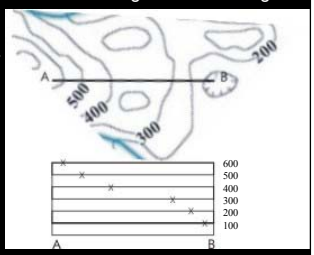
Topographic Profiles II

… yet it's possible to construct a grid based on a given scale.

- Here is the lower part of our map fragment with a set of horizontal lines.
- These are spaced according to a scale not shown here.



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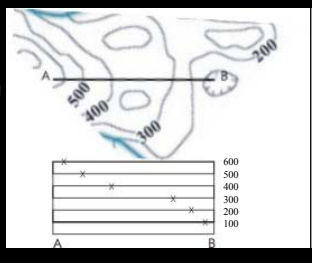
Topographic Profiles III

- The Xs that appear on the grid represent where the A-B line crosses a contour of a particular elevation.
- To plot these, take a piece of scrap paper and place the edge of it along the line.
- Mark the end points with labels as well as where the contours cross.



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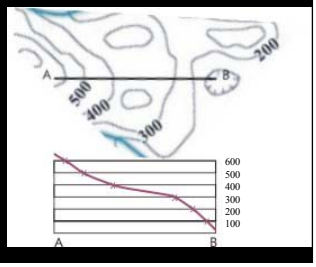
Completed Topographic Profile

- To complete the profile, a line is drawn that connects the Xs and extends beyond them.
- Ideally, this is a smooth line and has no flat portions unless a standing body of water is present.
- To extend line follow the trend that has been established.



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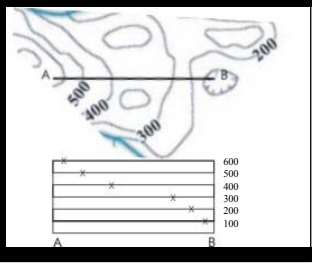
Topographic Profiles IV

- Next take the paper with information and plot where each elevation appears on the grid.
- In this example, each X is directly below where its contour crosses the line.



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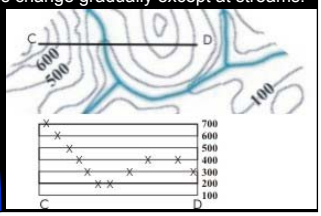
Second Topographic Profile

- The C-D line crosses a stream - a local low spot.
- Some of the Xs are points at the same altitude. In order to satisfactorily complete the profile, keep in mind that there are no standing bodies of water and that slope trends change gradually except at streams.



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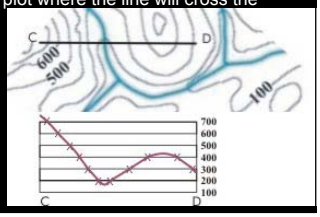
Second Topographic Profile II

- This line satisfies the conditions dictated by the data.
- Going from left to right, the points at the same altitude represent opposite sides of the stream and a local high spot.
- It is possible to plot where the line will cross the stream, but the elevation is unknown. By following the slope trend, an approximation can be made.



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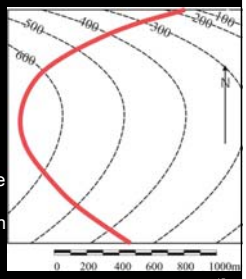
Determining the slope of a Structure

- Consider the following:
- Any two points on the same contour are at the same altitude.
- If these points are where an inclined plane goes into the surface of the ground, then a straight line drawn between these points is both at a constant elevation and on the surface of the plane.



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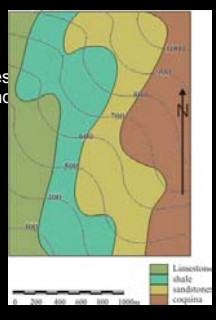
Structures within the Ground

- On many occasions, geological planes are exposed at surface. These may be the contacts of dykes joints, sedimentary beds, and faults.
- When topographic contours are present, it becomes possible to add more information to our topographic profile so that it becomes a structural cross-section.



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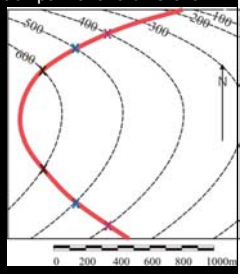
Determining the slope of a Structure II

- So here are pairs of Xs. Each pair is for a different elevation.
- If we draw lines to go through each pair, we get structural contours that tell us about the shape of the structure – as opposed to topographic contours (which tell us about the shape of the surface).



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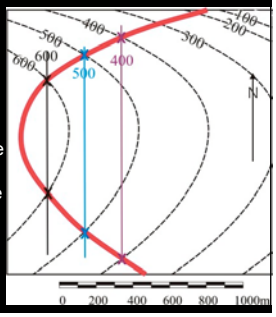
Determining the slope of a Structure III

- Once the lines are drawn, we can treat the structure just like we did in doing a topographic profile.
- In this case, we'll use the map scale in order to establish the true slope of the structure.



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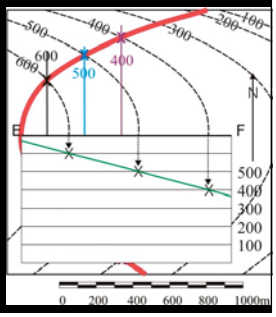
Structural Cross-section II

- After the surface is drawn, the structure can be plotted and drawn.
- It is important to keep all of this information well organized. Otherwise, too many Xs can lead to a great deal of confusion.



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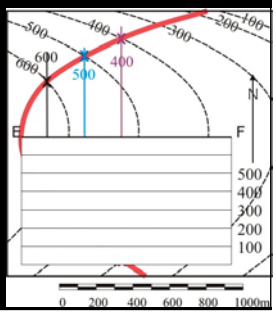
Structural Cross-section

- The structural cross-section is going to be at right angles to the structural contours, between points E and F.
- We'll begin by doing the topographic profile.



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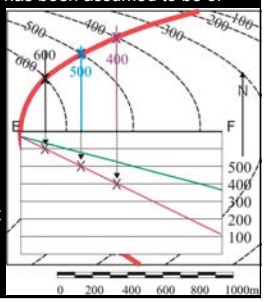
Structural Cross-section III

- The plane in this case has been assumed to be of constant slope. As a result, we can extend the line representing that plane beyond the points that have been plotted.
- From this, we can get a pretty good idea of how deep below surface our plane is at places along the E-F line.



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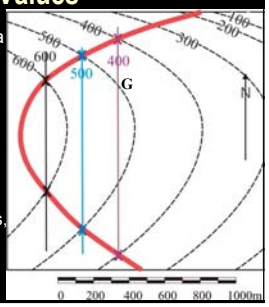
Structural and Topographic Contour Values

- Something to notice on this map is that at a few places, the structural contours cross the topographic contours.
- At such places, like "G", the depth below surface is equal to 500-400 = 100 metres, the numerical difference.



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This Week's Assignment

- You are given a couple of maps.
- One is a colossal, partially exposed sculpture being exhumed by wind from a sand dune.
- It is believed to look like this.
- Archeologists have discovered a crack that must be repaired. As part of the work, a profile of the crack and exposed surface are required.
- You are also expected to find how deep the sand is above the statue at a particular place.

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