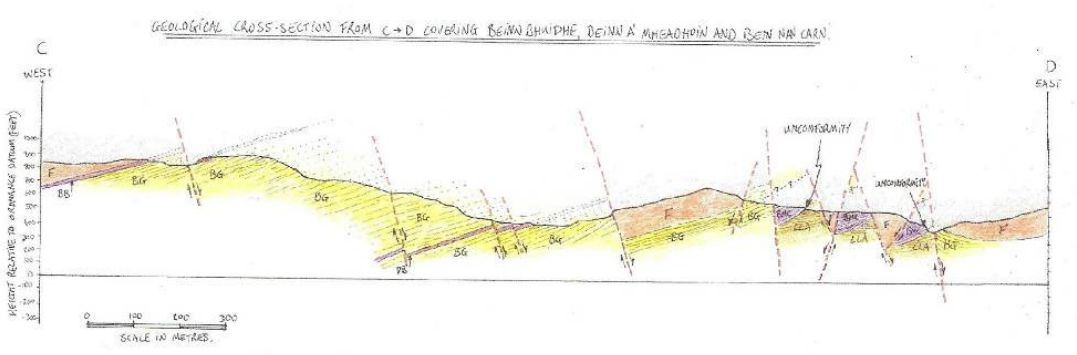
EPSC 240: GEOLOGY IN THE FIELD

# EXTRACTING 3D INFO FROM GEOLOGIC MAPS

## STRUCTURAL CONTOURS & CROSS SECTIONS




*Isle of Skye, NW Scotland, Honours Mapping Project, Nick Timms, 1996*

# DUE

**Next Wednesday, Oct 17, by 2 pm**

- No lab next week (replaced by Grenville trip on Saturday)
- Drop off in Kirsten's mailbox

# TOPOGRAPHIC CONTOURS

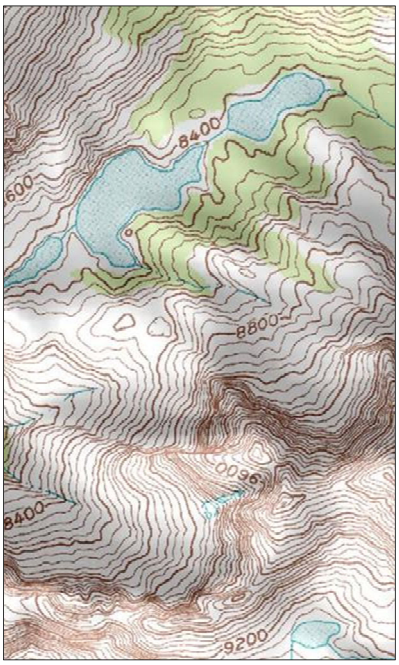
➔ Lines of equal elevation describing ground surface

➔ Close together for steep slopes, farther apart for shallow slopes

- Around high or low areas, contours form a closed loop
- Depressions are shown using a closed loop with tick marks

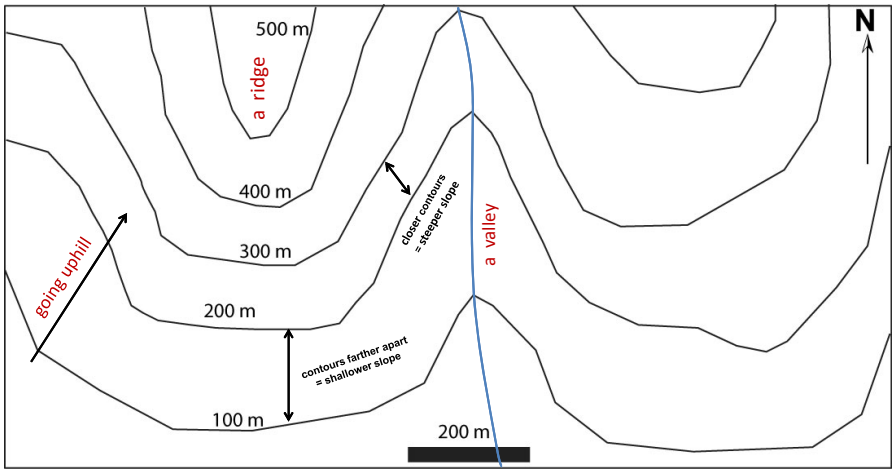
Vs in contours

- Point uphill along rivers / valleys
- Point downhill along ridges




source: mapscaping.com

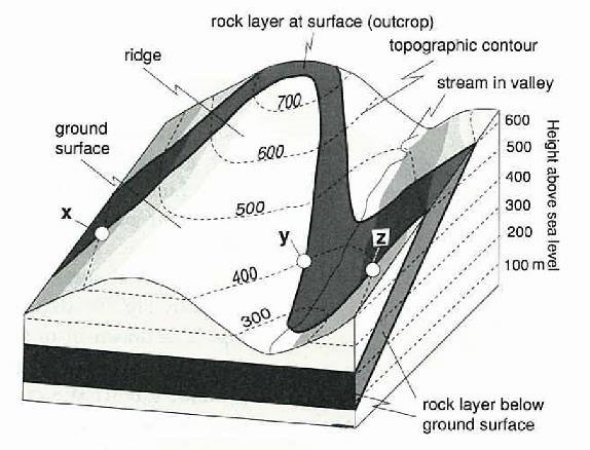
# TOPOGRAPHIC CONTOURS




source: maps.unomaha.edu

# RULE OF Vs: TOPO

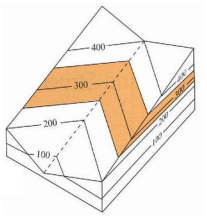
- To maintain equal elevation, contours crossing a valley point uphill
  ➔ Water flows 'out' of the V
- For ridges, the opposite is true



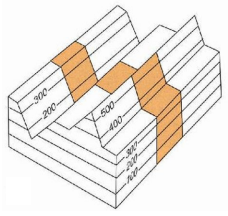

*From Rowland et al. (2007), Structural Analysis and Synthesis, 3rd Ed.*

# RULE OF Vs: CONTACTS

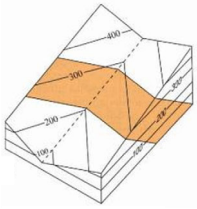
- Planar rock units are eroded in predictable patterns through valleys, depending on their dip angle
- Can use map patterns to estimate dip of a plane



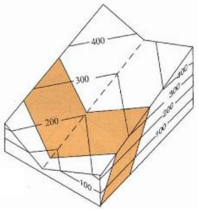
1. Horizontal plane



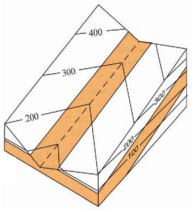
2. Vertical plane



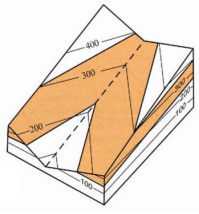
3. Dips upstream



4. Dips downstream



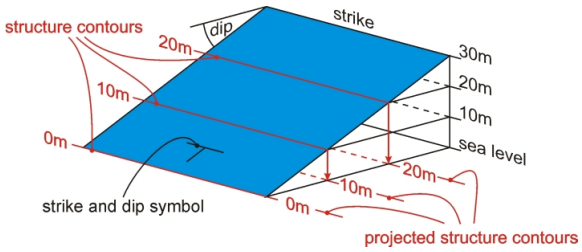
5. Dip = valley gradient



6. Dip downstream < valley

# STRUCTURAL CONTOURS

➔ Lines of equal elevation describing surface of a rock unit (plane)




source: maps.unomaha.edu

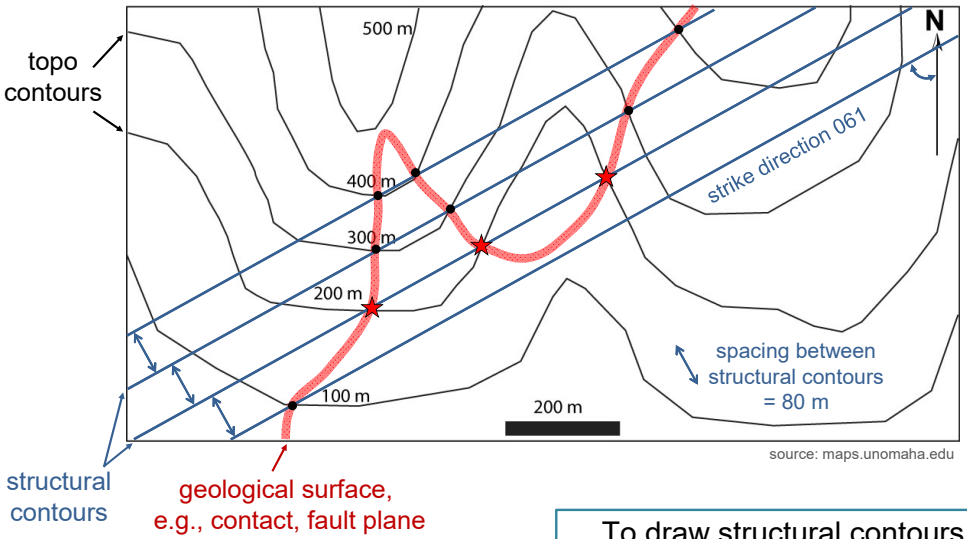
Unlike topo contours, these…

- are always straight lines
- are parallel each other & strike line
- have constant spacing

* Assumes planar feature with constant strike and dip

source: www.fault-analysis-group.ucd.ie

# STRUCTURAL CONTOURS



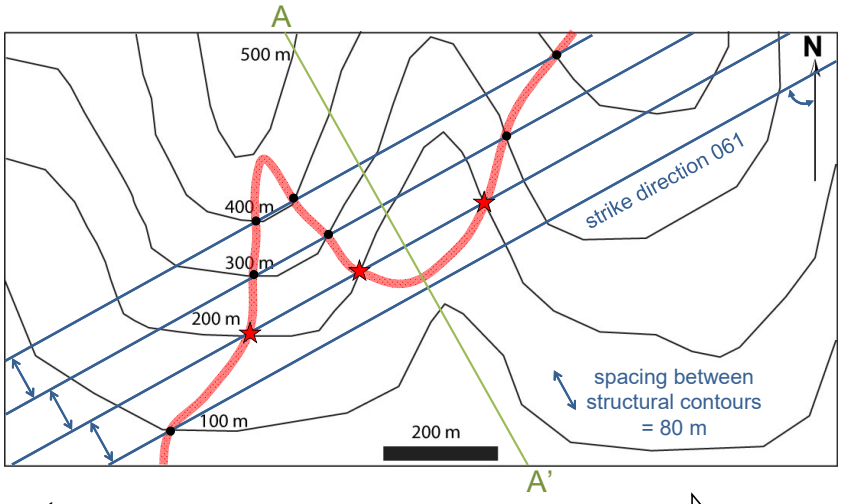

source: maps.unomaha.edu

*What is the dip direction?*

To draw structural contours…

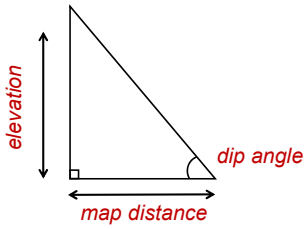
Plot intersections of the surface with topo contours of equal elevation & connect the dots

# DIP CALCULATION

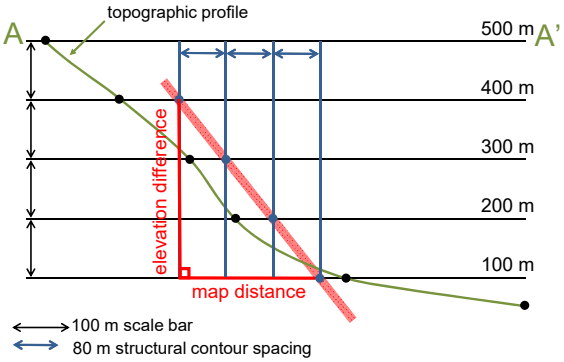



Trigonometry:

- tan (angle) = opposite / adjacent
- sin (angle) = opposite / hypotenuse
- cos (angle = adjacent / hypotenuse

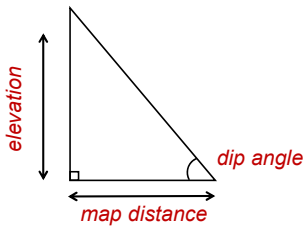



# DIP CALCULATION




source: maps.unomaha.edu

- tan (angle) = opposite / adjacent
- tan (dip angle) = elevation / map distance
- $\tan^{-1}(300/240) = 51°$



# CROSS SECTIONS

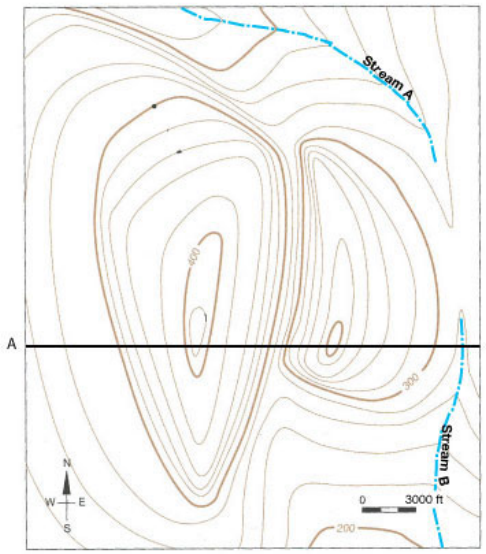
➔ Graphical representation of vertical projection into subsurface

➔ Include topography & geology

Used to…

- extrapolate surface features, e.g., dips of planes
- interpret geology at depth
- build a geological model

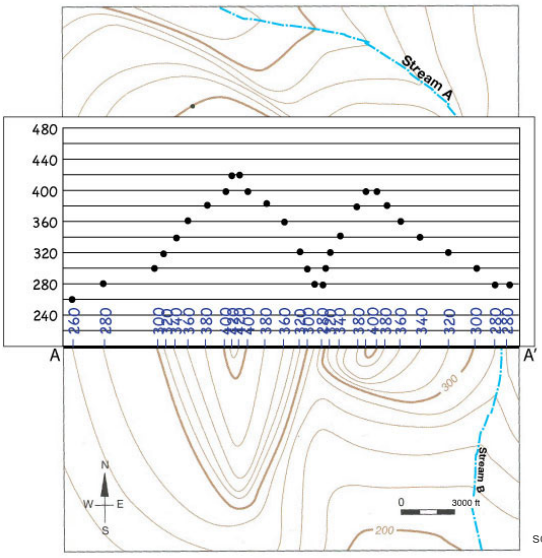
# CROSS SECTIONS: TOPO




source: serc.carleton.edu

1) Take a line of interest (usually running perpendicular to strike), e.g. A-A'
2) Line up a sheet of paper along A-A' and mark off the locations of contour intersections

# CROSS SECTIONS: TOPO

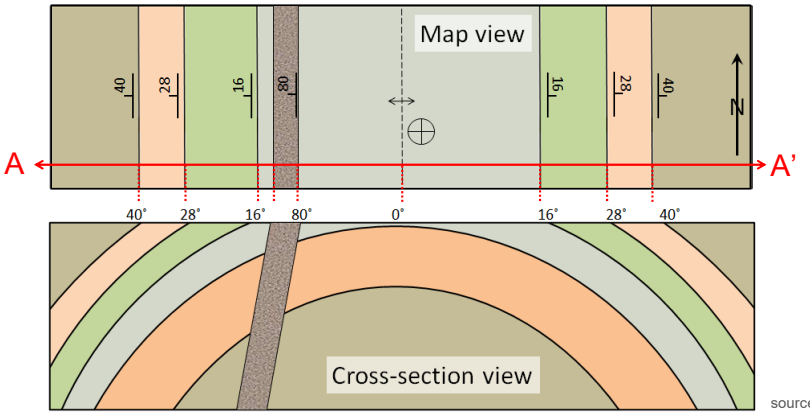



source: serc.carleton.edu

- Add a scale for elevation along the y-axis, and mark off the intersections along the x-axis
- Plot a point for the elevation at each intersection
- Connect the dots!

# CROSS SECTION: GEOLOGY

1) Take a line of interest (usually running perpendicular to strike), e.g. A-A'
2) Line up a sheet of paper along A-A' and mark off the locations of each contact
3) For each contact, draw the dip of the units to project them into the subsurface, e.g., for a bed with a dip of 30°, draw a line at a 30° angle *(no vertical exaggeration)*

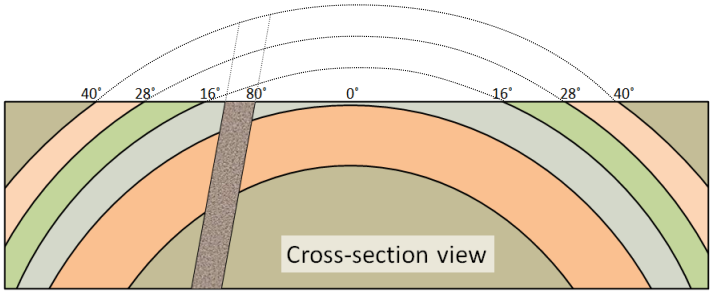



source: opentextbc.ca

- Interpret your units below the surface – is this a fold, a fault?

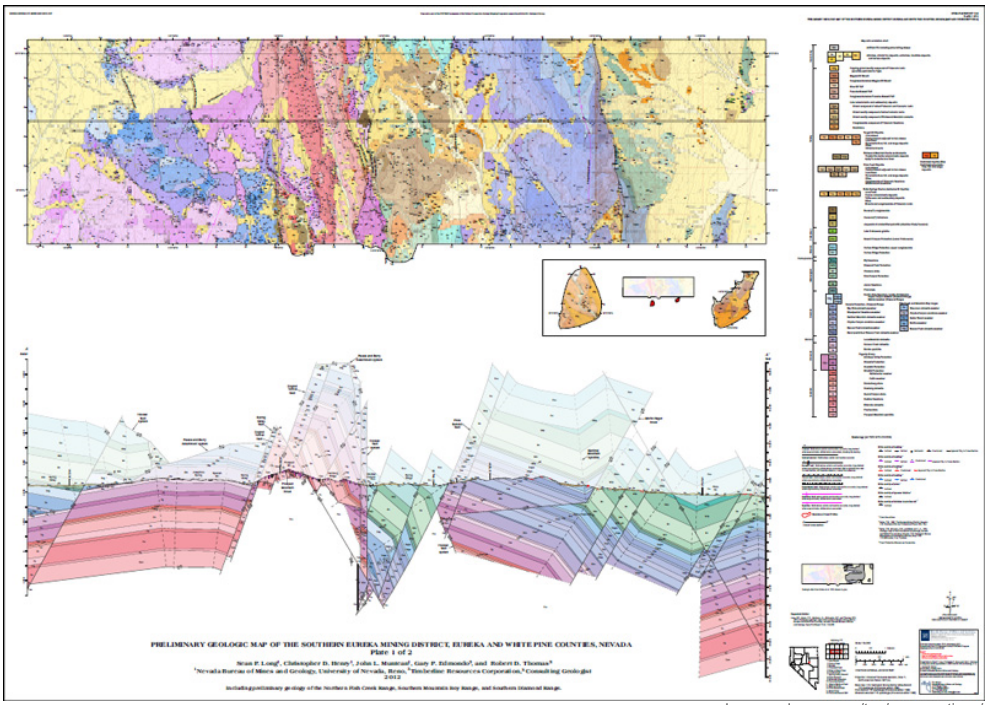
# CROSS SECTION: GEOLOGY

➔ Use dotted lines to project units above ground to pre-erosion positions




source: opentextbc.ca

# CROSS SECTIONS




source: nbmg.wordpress.com/tag/crosssections/