Rule of Vs: interaction between a planar feature and a 3D object

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Learning objectives:

- Observe how the topography of a surface influences how planar features outcrop across that surface.
- Use geological measurements at the surface to understand layer orientation in 3D
- Use the 'rule of V's' to anticipate where contacts will run across a valley

Key Visible Geology skills:

- Build custom topography
- Adjust tilt angle of layers
- Apply decals to show layer orientation

Timelines:

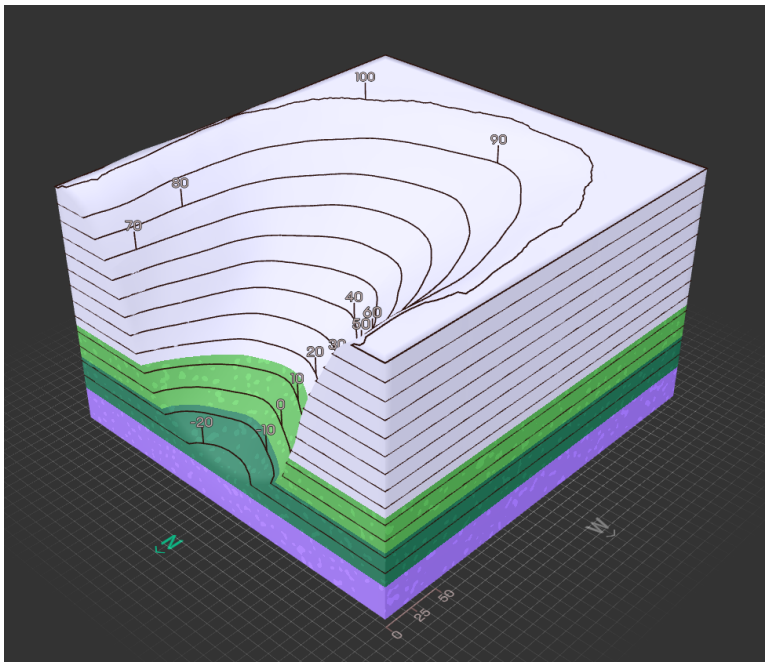
- Workflow 1 – 5: ~30 mins
- Questions and Exercise: ~30 mins

Glossary: see page 3!

Workflow

1. Increase block size and create a concave topography (e.g., a bowl/valley)

<u>Topography</u> -> new -> adjust block size, Terrain Editor -> lower (create rough bowl) -> smooth (smoothen out) -> Name: "Bowl" -> Save & Return [Remember: the more 'perfect' you try and make your topography, the less realistic it is!]



2. Add layers until the whole block is filled in with colours (each coloured section represents a layer)

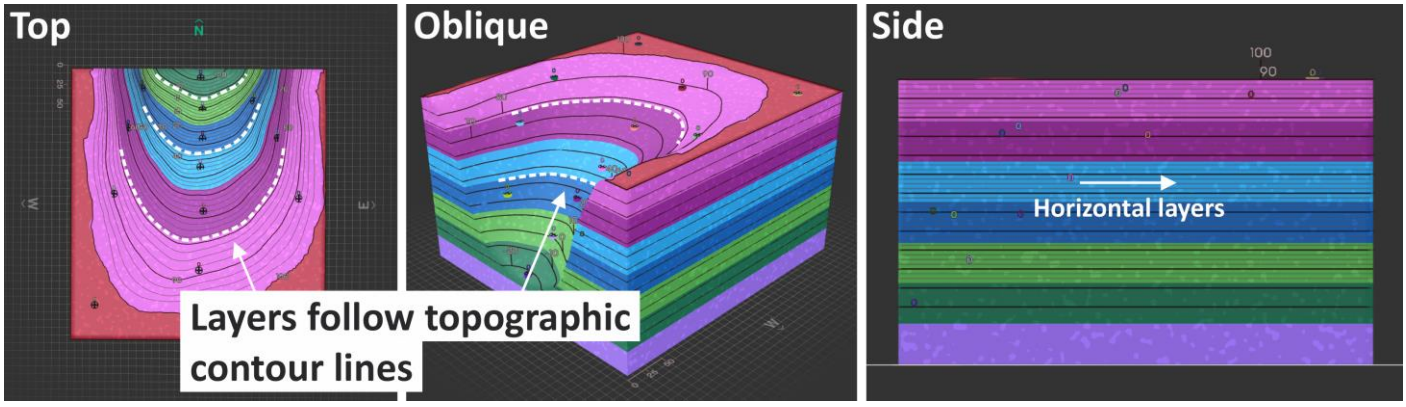
<u>Layers</u> -> add layers (add at least two more layers above the top of your block; you don't need to adjust layer thickness)

3. Add Decals to show the tilt angle and orientation of the layers (i.e., the 'dip' and 'strike')

<u>Decals</u> -> add (add at least 1 per layer)

Learning observation!

When layers are horizontal, contacts between layers (i.e., where the colours change) are parallel to contour lines:



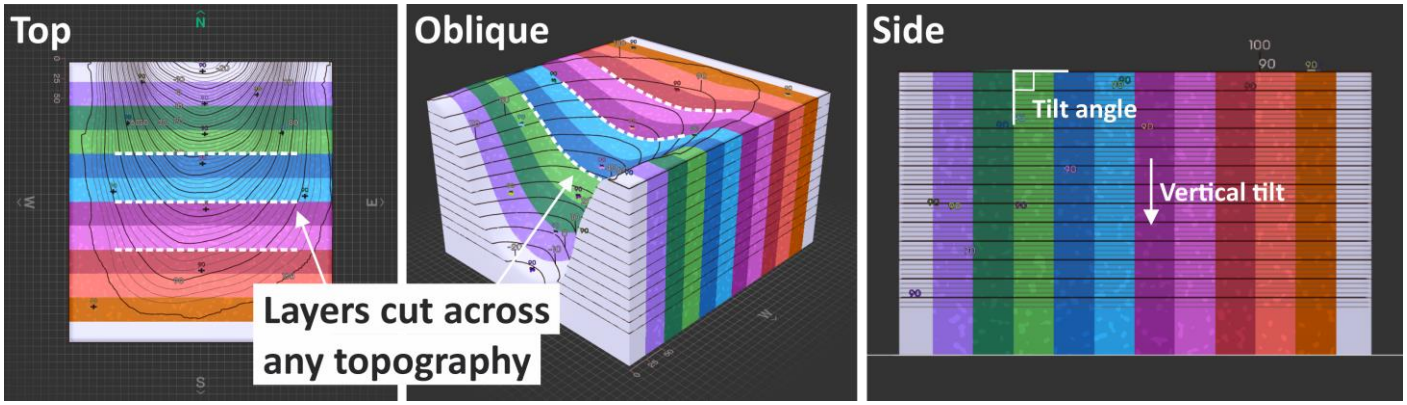
Rule of Vs: interaction between a planar feature and a 3D object

4. Let's investigate what happens when we change the orientation of the layers. First, tilt the layers until they are vertical:

Events -> tilt -> set strike = 90 -> set dip = 90 (you might have to move the layers until they are in the centre of the block using the red arrows in the middle)

Learning observation!

When layers are vertical, contacts between layers cut straight across the topography:



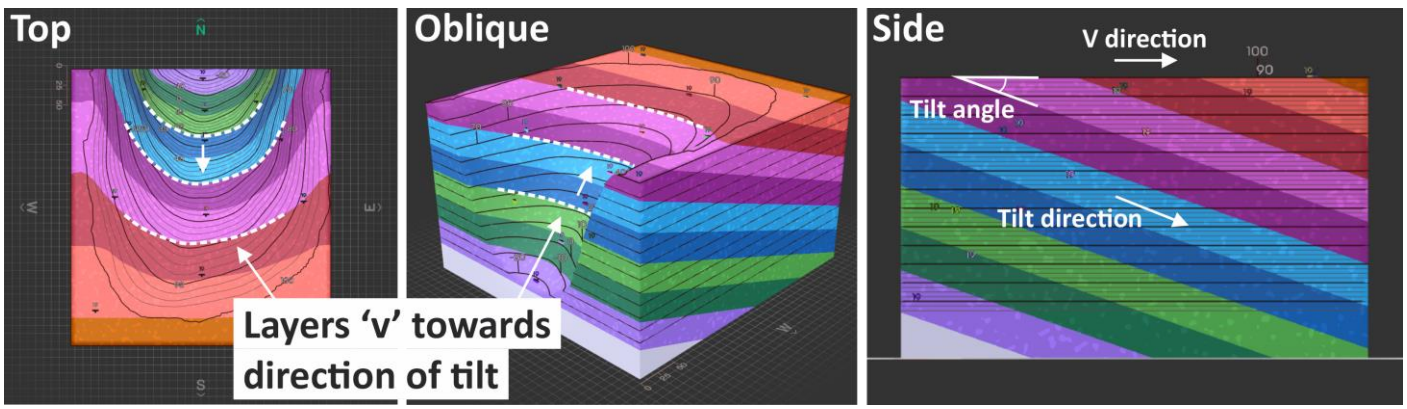
---

5. But what happens when the units are tilted (i.e., 'dipping') at an angle between horizontal and vertical? Change the dip angle of the layers and see how the contacts travel across the valley:

Events -> tilt -> set strike = 90 -> Adjust tilt angle back and forth (large red arrow)
[Note: Make sure you keep the same colour at the bottom!]

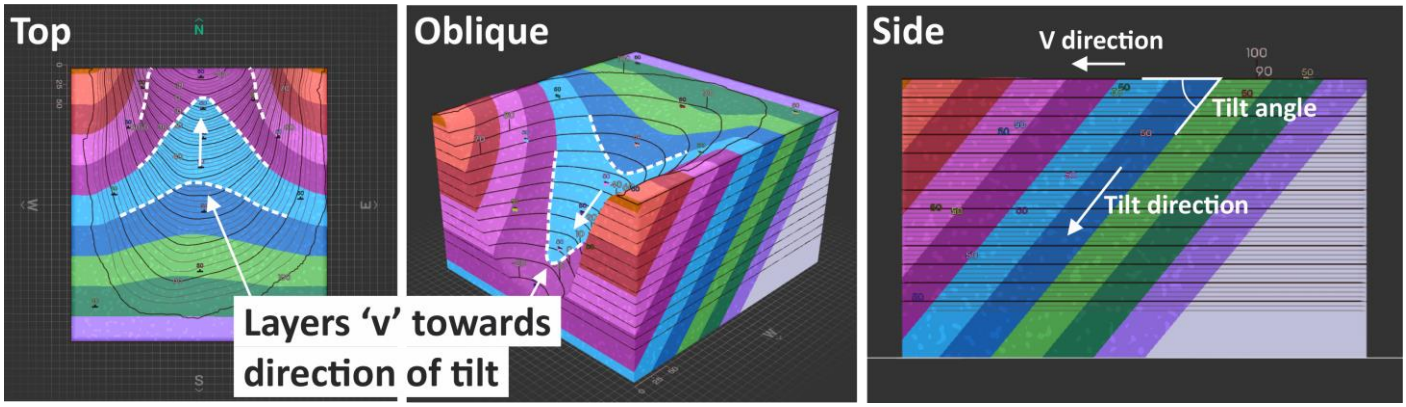
Learning observation!

When tilted, planar features running across concave topography will form a v shape towards the direction of downward tilt – **The Rule of Vs**



In geology, this means tilted planar geological features (e.g., beds, contacts, faults, dykes) crossing a valley will make a v shape pointing towards the dip direction.

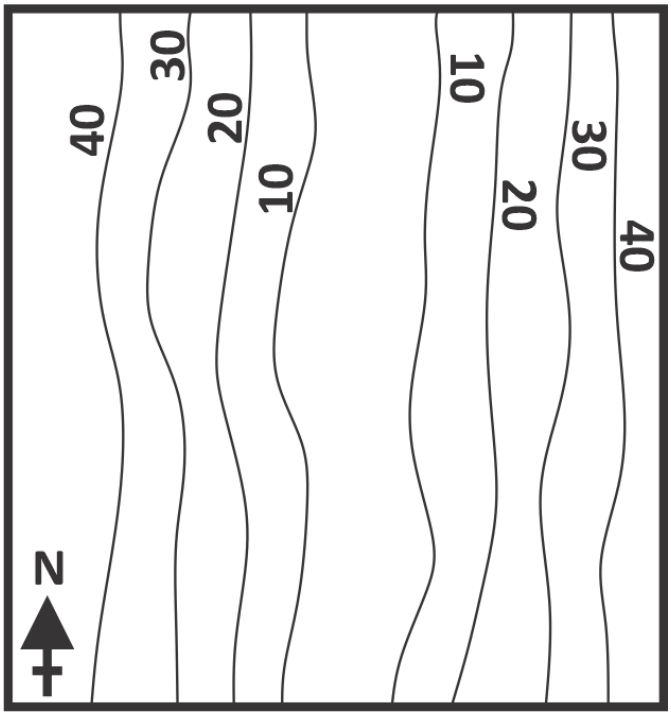
Rule of Vs: interaction between a planar feature and a 3D object



Questions

- For each tilting scenario, how does the thickness of the exposed layers change across the valley and why?
- Do the dip and strike directions (shown by the bedding markers) within a single layer/colour change across different topography?
- Is the v-shape more pronounced or less pronounced with increasing tilt angle?
- Is the v-shape more pronounced or less pronounced with steeper topography/slope angle?
- Are there any tilt angles where the rule of v's does ***not*** apply?

6. Now let's apply what you've learned! Below is a clear topographic map of a valley. Draw a layer orientated/striking East-West and dipping to the south. Using the rule of v's, how do you expect it to outcrop through the North-South valley in the centre? Once done, use your new Visible Geology skills to recreate it in 3D and see if you were right!

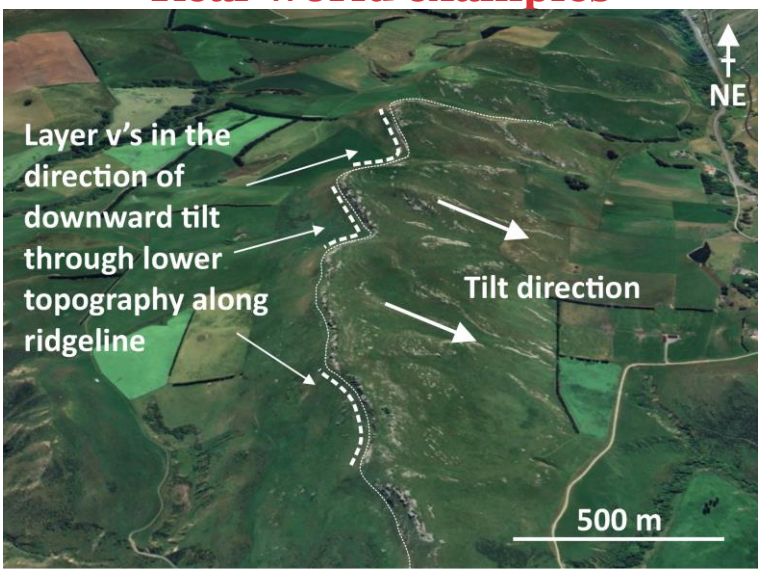


Glossary:

Topography: the shape of a surface
Concave: curves inwards (e.g., valley)
Convex: curves outwards (e.g., hill)
Contour lines: map lines connecting points at the same elevation above a reference height (usually mean sea level)
Orientation: direction of a feature in 3D space
Contact: the interface between two different rock types
Bedding: parallel layers within sedimentary/metamorphic rocks of different characteristics
Planar: forms a flat surface/plane (e.g., geologic bed, contact, fault, laptop cover, car windscreen, chopping board)
Strike: The orientation of a horizontal line (tilt = 0°) along a planar surface (i.e., the direction the plane is travelling in). Will *always* be orientated perpendicular (90°) to the dip.
Dip: The maximum downward tilt angle of a surface from horizontal, measured in degrees. Will *always* be orientated perpendicular (90°) to the strike.

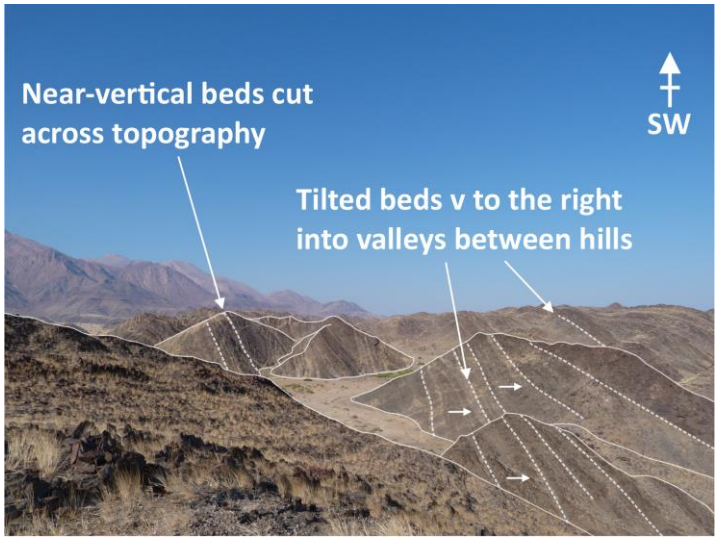
Rule of Vs: interaction between a planar feature and a 3D object

Real-world examples



Tilted limestone layer outcropping along a ridgeline. Weka Pass, Canterbury, Aotearoa/New Zealand. Image: Google Earth Pro ©2026 Maxar Technologies, Airbus.

Shallow tilted limestone beds v deeply into lower topography. Castle Hill Basin, Aotearoa/New Zealand.



Steeply tilted mudstone beds v to a lesser extent into valleys. Ugab river, Namibia.

Rule of Vs: interaction between a planar feature and a 3D object

Discussion points

- What might cause geological layers to be tilted like this?
- How would understanding the rule of v's be useful when in the field?