Iraqi Kurdistan Region
Tishk International University (TIU)
Faculty of Engineering
Department of Petroleum and Mining Engineering (PAME)
Erbil

Structural Geology Lecture Notes

Code No. (PTR-215)

By
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Fall Semester
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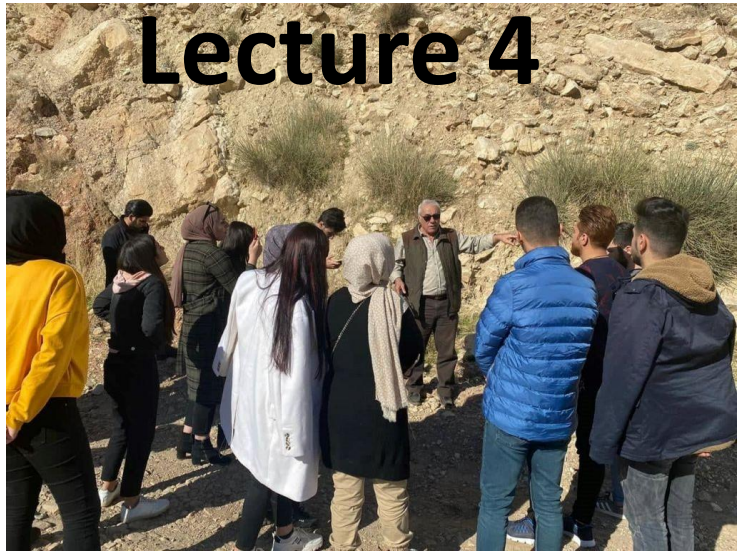
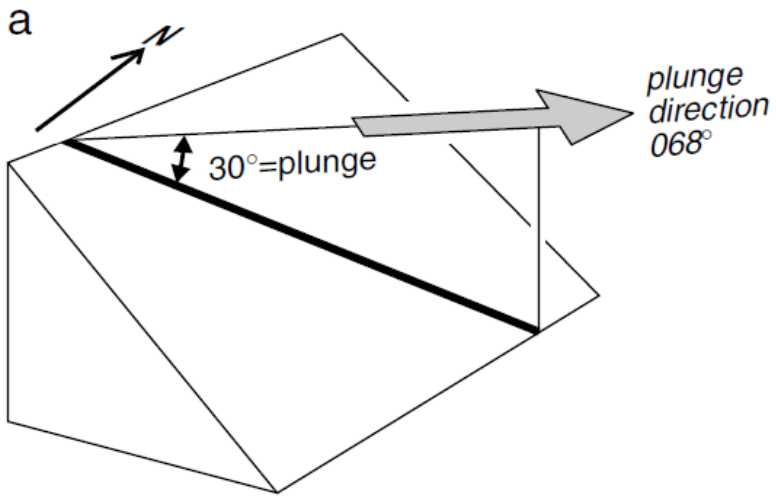
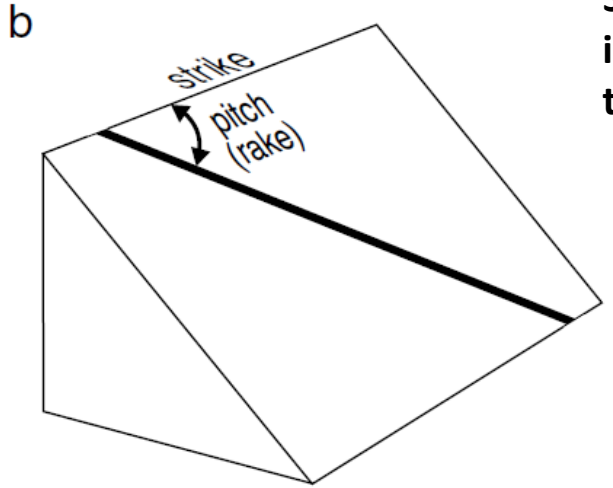


Lecture Contents

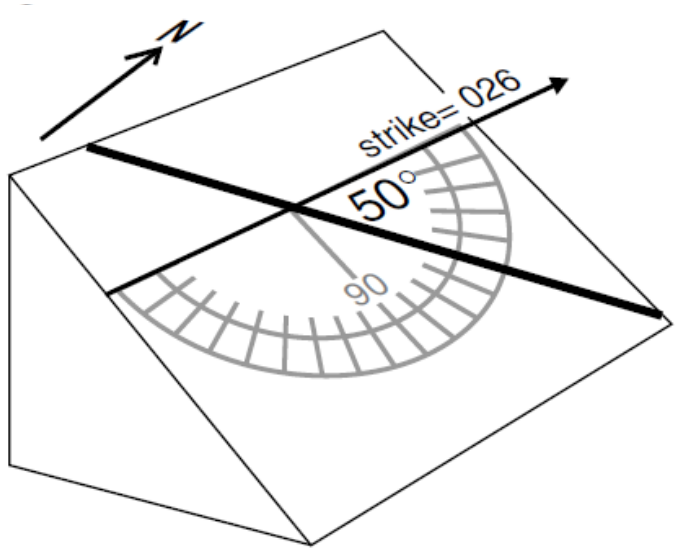
Lines, cont.

Hence, lines are commonly represented by their trend and plunge. We will use the convention that the trend of lines is given with three digits from 000 to 360. So, 000 is N, 090 is E, 180 is S, 270 is W, 360 is again N. The plunge is given with two digits from 00 to 90°. A trend and a plunge give the orientation of any line in space.

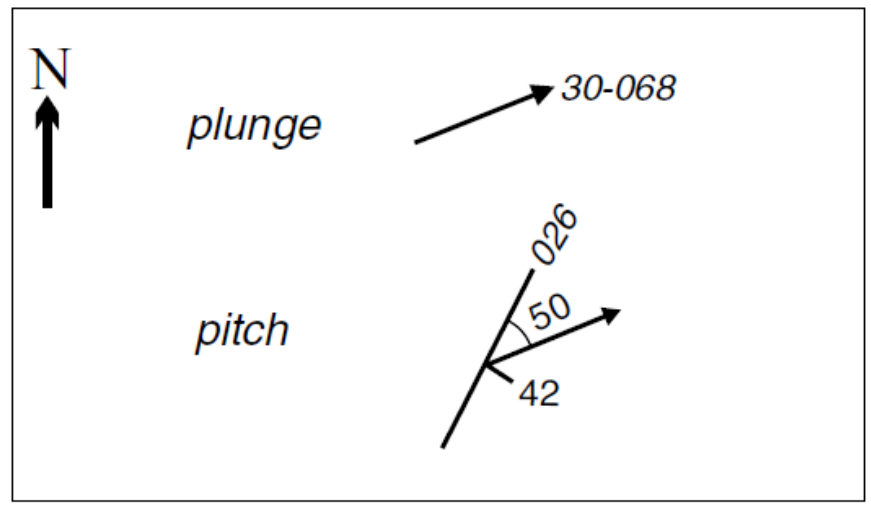




These measurements are written as *angle of plunge--plunge direction*.
For example, a linear structure with orientation 30--068
is tilted down or 'plunges' at an angle of 30◦ towards bearing (compass direction) 068◦.

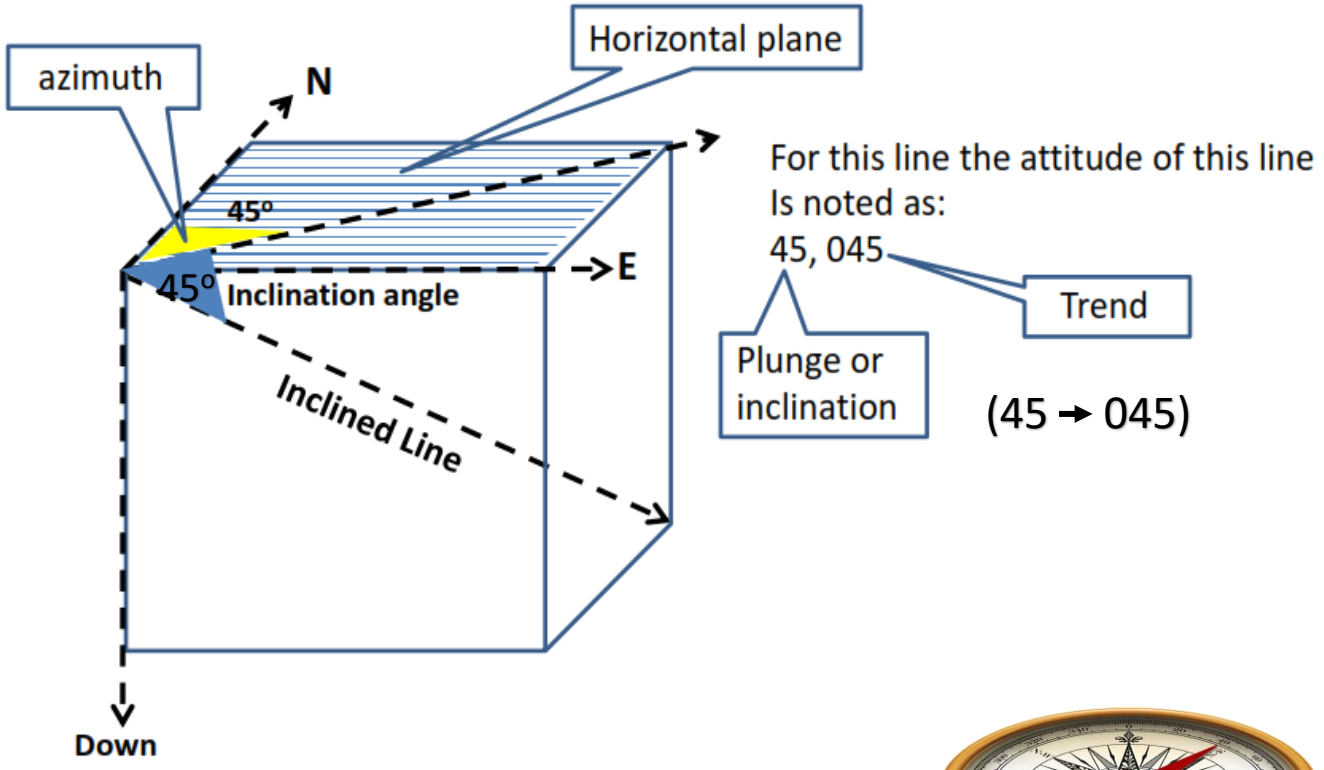


Map symbols

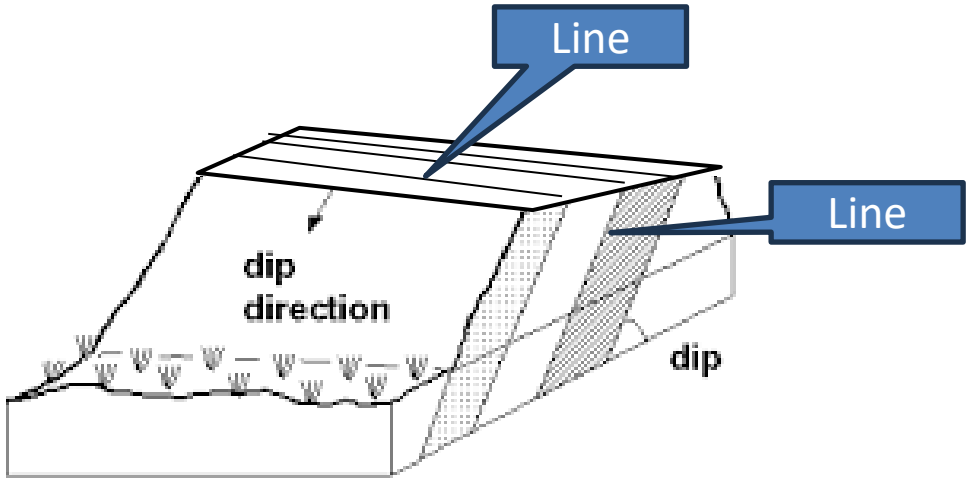


Line orientations are generally written as (plunge trend). Hence, we write th measurement with an arrow pointing from the plunge value toward the tren value.

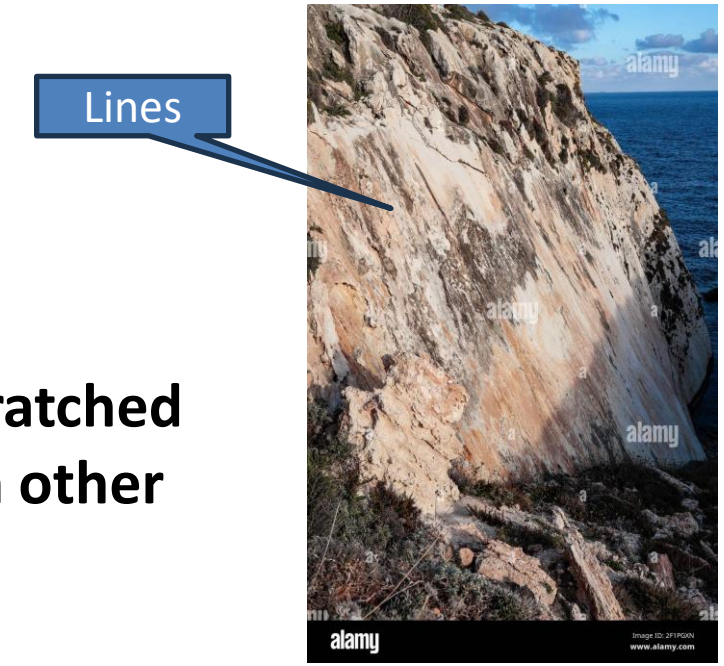
Examples of line orientations:
00 → 000, (Horizontal, N-oriented,),
00 → 084 (horizontal, in direction 084,
42 → 084 (the trend is the same as line above, but the line plunges only 42°)



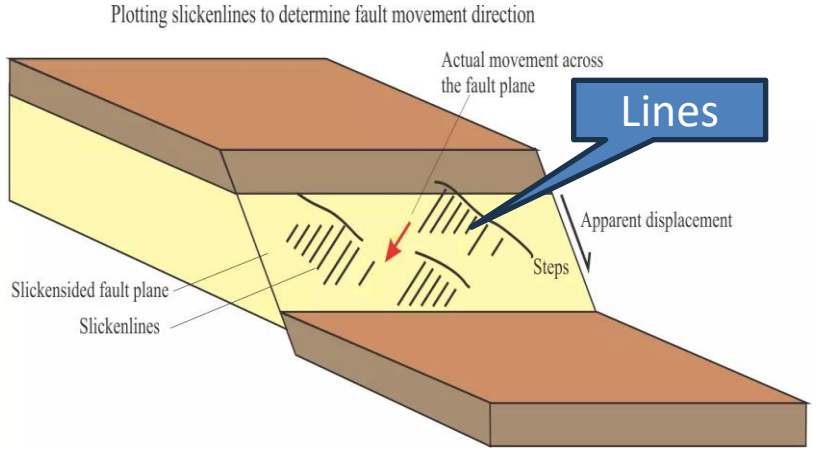
Lines in geological structures:



1- Intersection lineation
Such as the intersection of an inclined layer with ground surface. (i.e., trace of the bedding plane on the Earth). This line is, or is not parallel to the strike line.

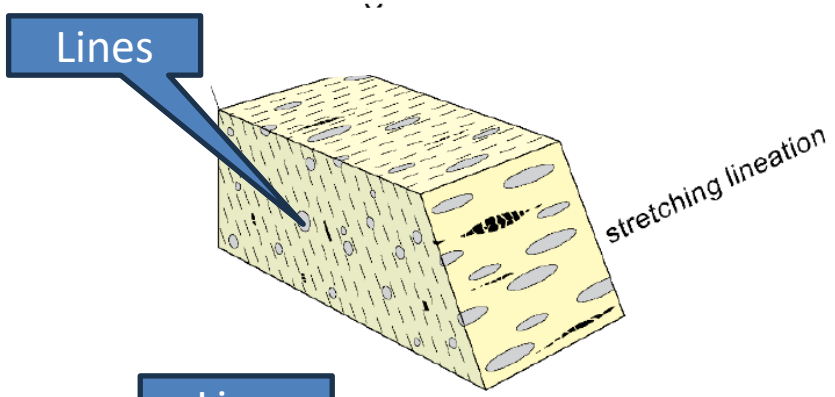


2- Slickensides
Are rock surfaces naturally scratched by motion of rocks along each other (shearing feature).

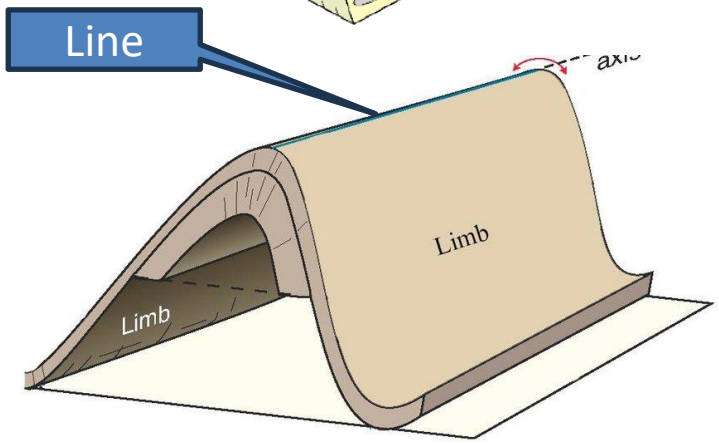


They record the slip steps and orientation of the fault plane movement

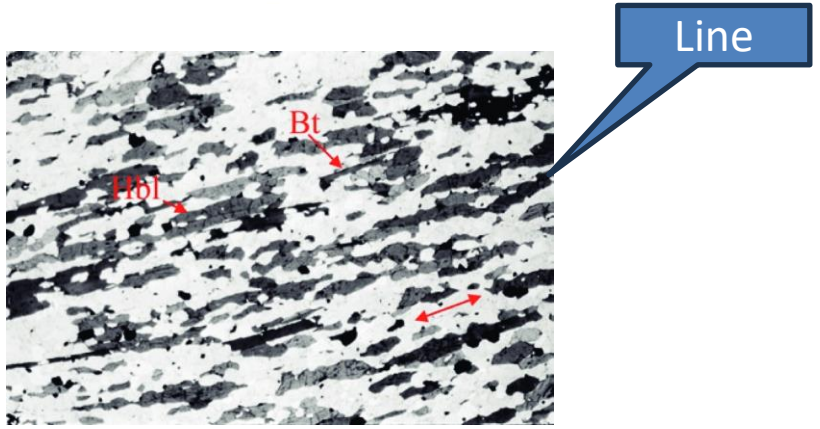
3- Stretching lineation
Formed by the parallel alignment of individual detrital grains such as elongated pebbles during the presence of currents.



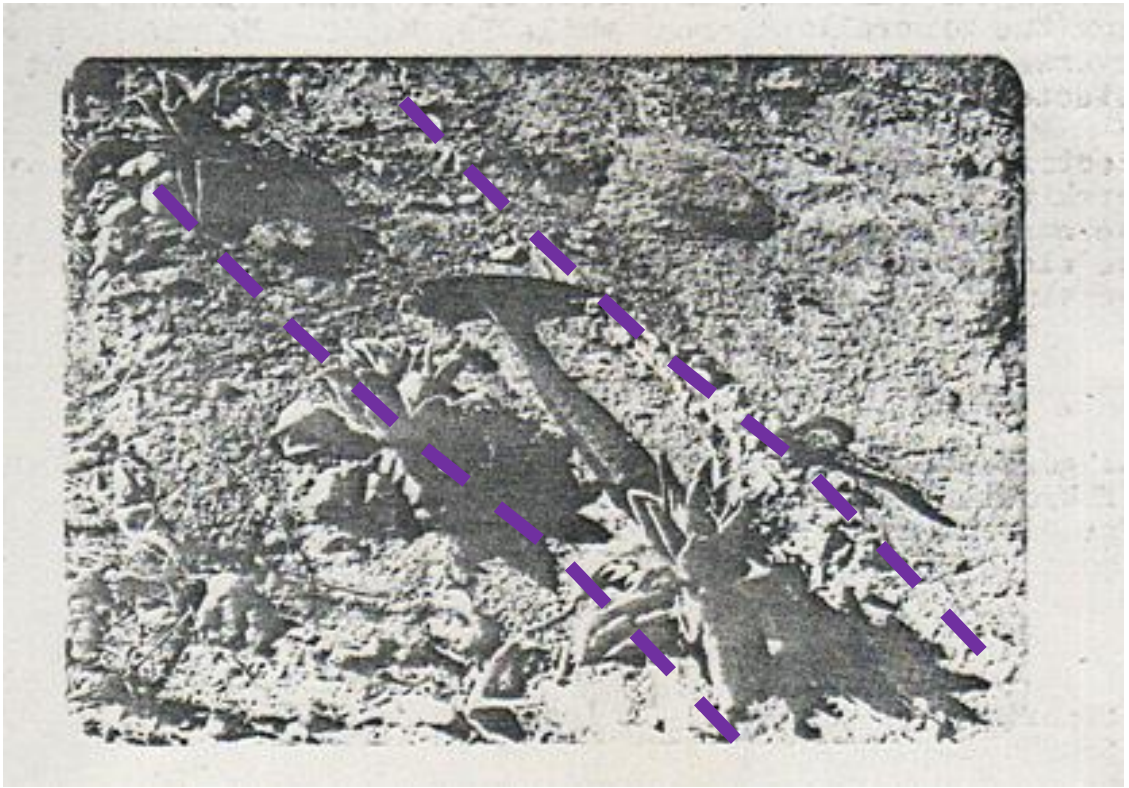
4- Axes of folds
Hinges of cylindrical folds are linear structures.



5- Mineral lineation
Metamorphic minerals often grow with a preferred crystallographic and dimensional orientation,
i.e., with their long axes in parallel alignment.



Ex. Palygorskite Mineral in Jabal Maqlub
A case Study

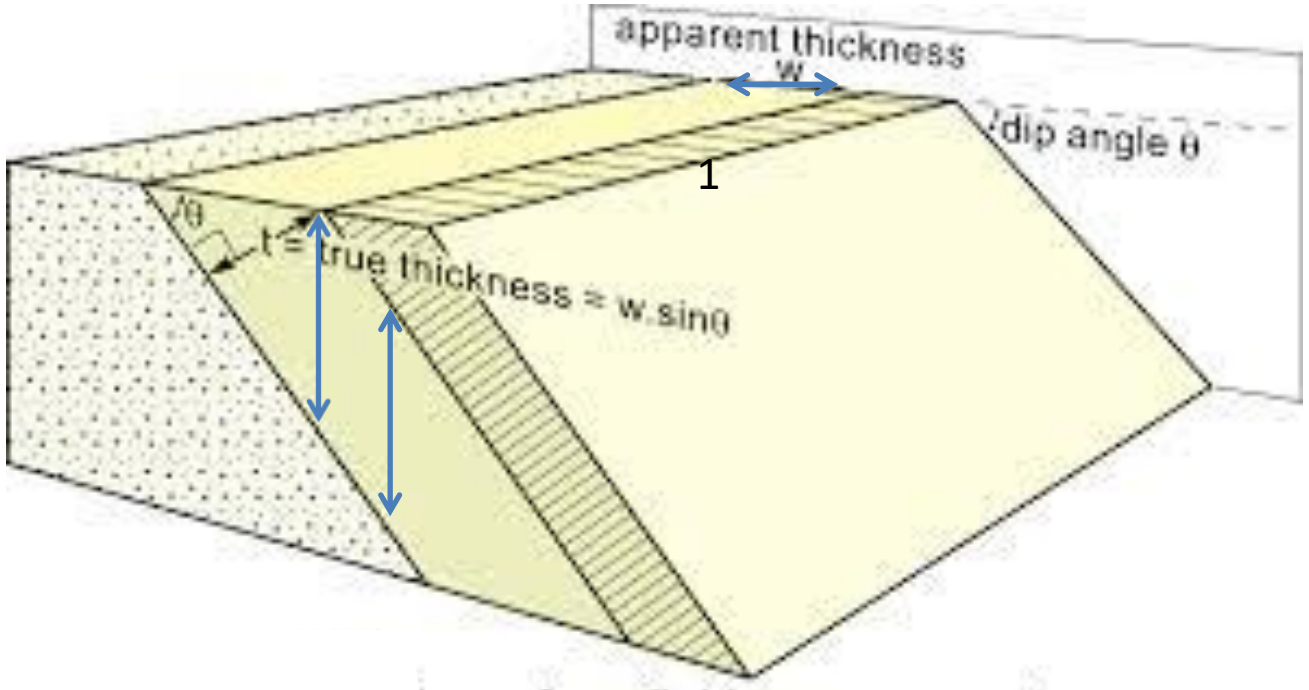


The plant is known as Verbascum Litum
It is distributed on land as lineaments along the traces of the mineral

Thickness of strata and Depth

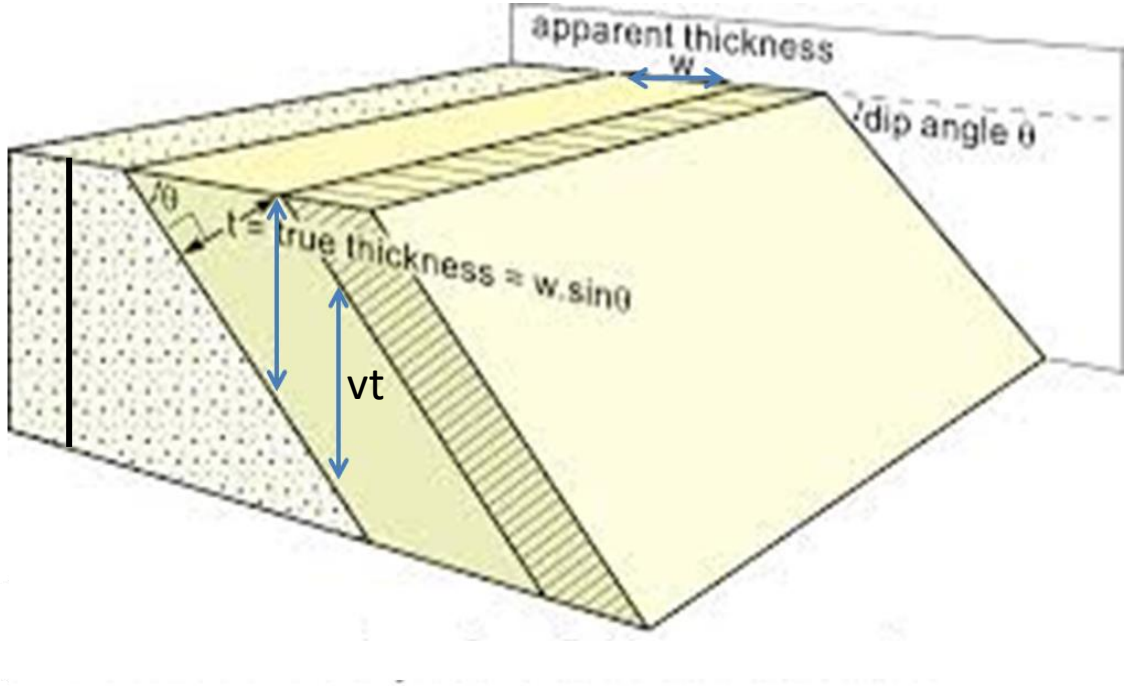
Thickness of geological strata ranges from few millimeters to several meters.
There are many types of strata thickness:

(1) True thickness (t): the perpendicular distance between the parallel planes bounding a tabular body, as displayed on any section perpendicular to these planes; also called the stratigraphic thickness.



Note:
When thicknesses are very thin (less than a few millimeters) layering is called Lamination. They are commonly found in sedimentary rocks, such as shale, and are the result of repeated depositional events, often representing changes in sedimentary conditions or seasonal variations.

(2) Apparent thickness (w): it is any thickness other than true. The apparent thickness is equal to the true thickness only when the unit layer is vertical. It is always greater than true thickness. When vertically measured in a hole it is drilling thickness (vt) or vertical apparent thickness.

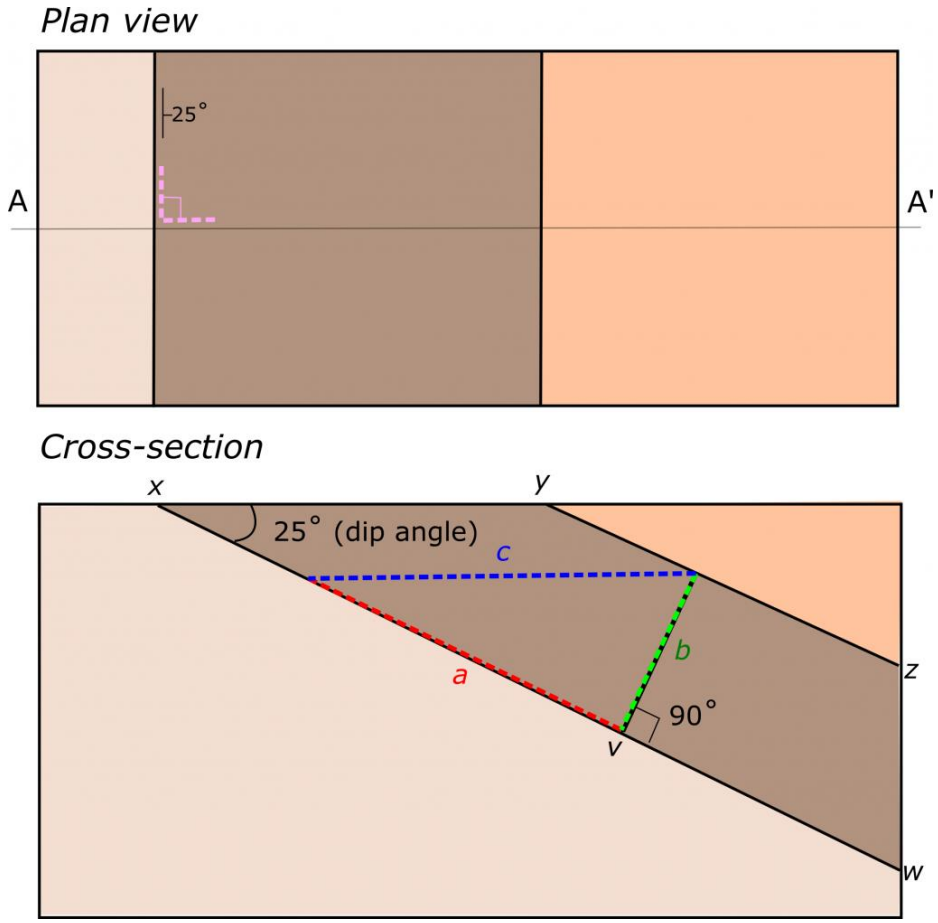


(3) Outcrop thickness (ot): the strike-normal distance between the traces of the parallel bounding planes measured at the earth's surface. It may be measured horizontally or on an incline (apparent thickness).

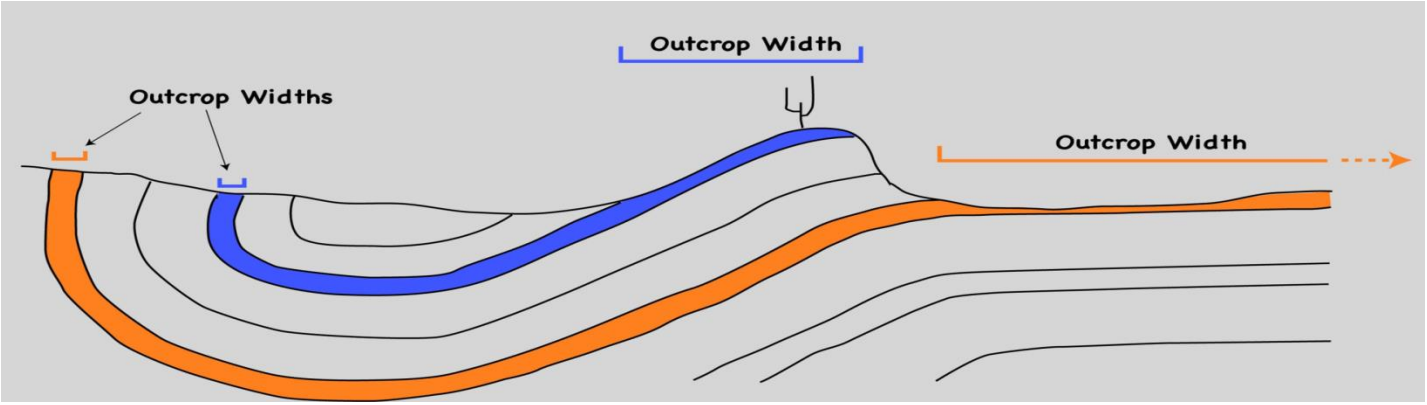
The Depth (d): is the vertical distance from a specified level (commonly the earth's surface) downward to a point, line or plane.

Apparent vs true bed thickness.

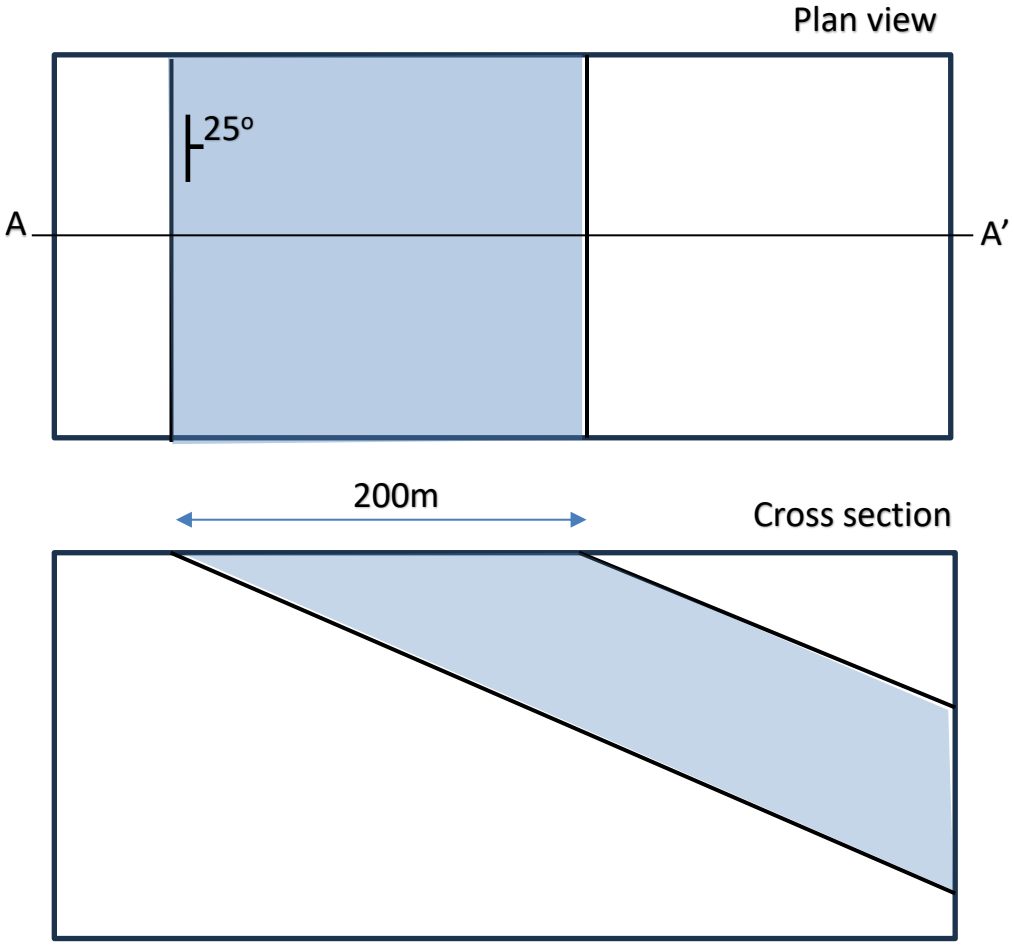
The plan view map (top) shows how the cross-section is oriented perpendicular to the strike of the dipping beds along the line labelled A-A' (note strike and dip symbol and pink lines illustrating 90˚ angle between A-A' and the strike of the beds). The cross-section (bottom) shows how the distance between the upper and lower contacts of the brown bed (y-z and x-w respectively) are further apart at the surface (x-y, or c) than if you measure the shortest distance between the beds (b).



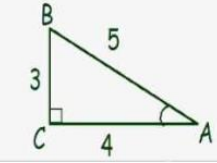
Note that where an individual rock unit intersects the land at a high angle, it crops out over a smaller area. Where beds are steep and the topography is gentle, such as at the left side of the diagram, the outcrop width is approximately the true thickness of the unit. By contrast, the outcrop width increases when the topography and the dip of the rock approach parallelism. In the case of the blue unit near the center of the diagram, it forms a "dip slope" and outcrops over a fairly large area even though it is dipping moderately. Where both the rock and the topography are nearly horizontal, units can crop out over very extensive areas, even though they are relatively thin.



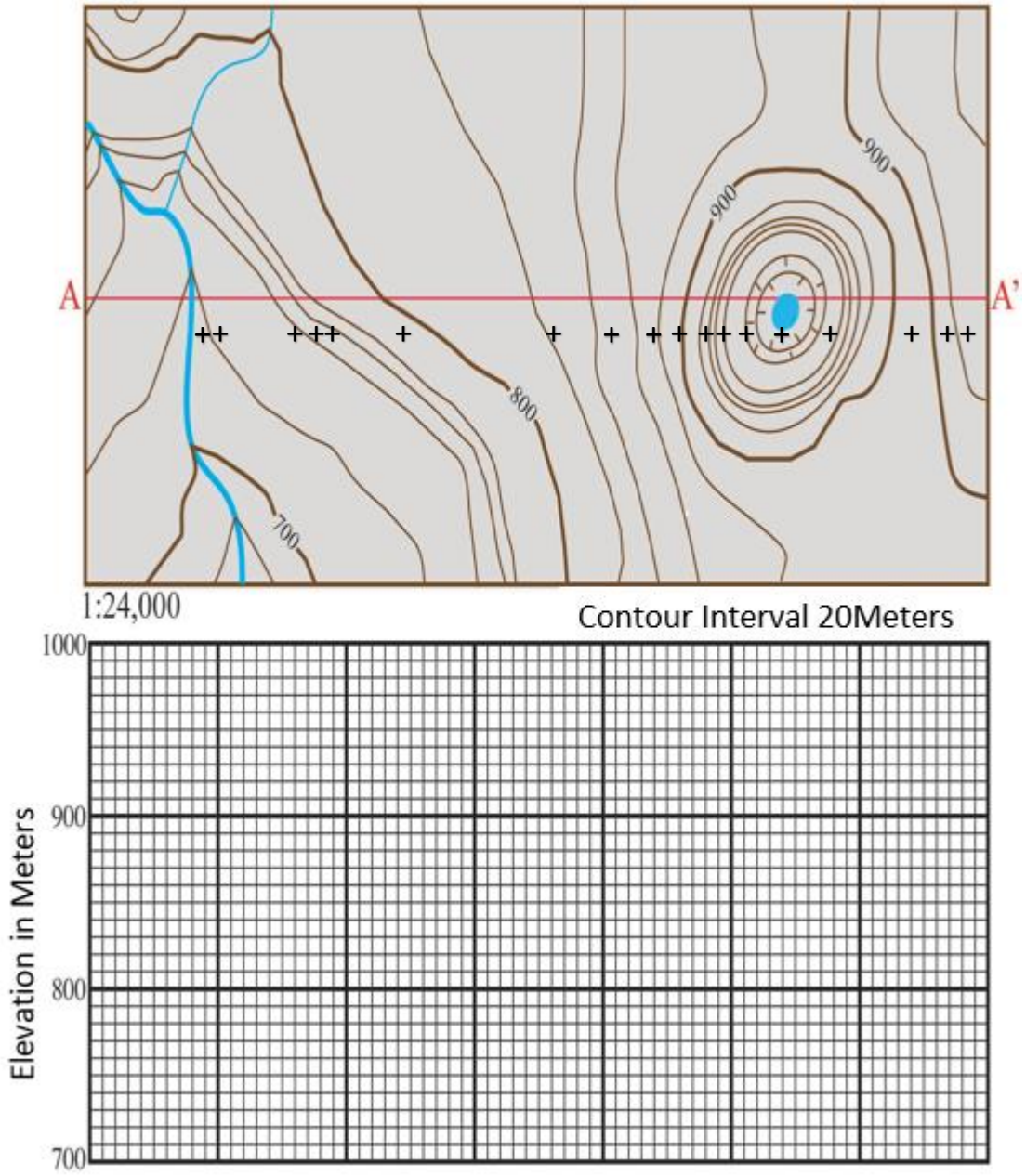
For the same example calculate the true and vertical thickness of the layer shown in the figure



$\sin = \frac{\text{opposite}}{\text{hypotenuse}}$ $\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$ $\tan = \frac{\text{opposite}}{\text{adjacent}}$



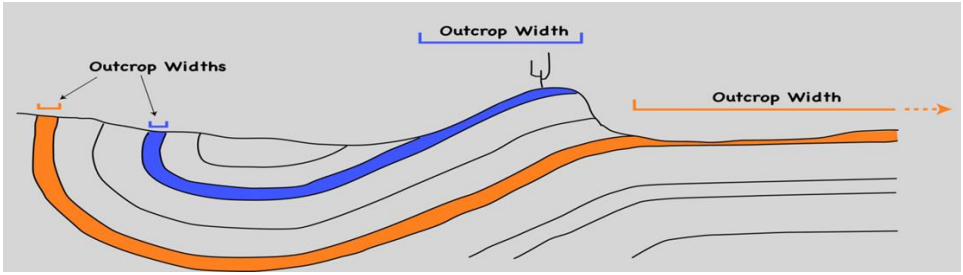
A review for drawing a profile
From topographic map



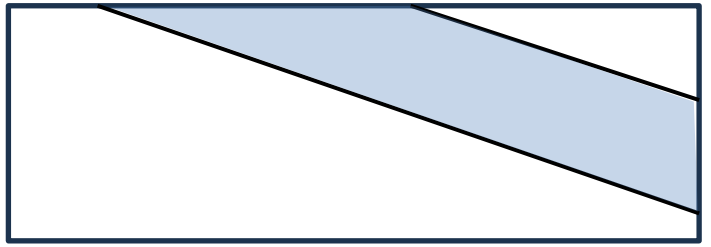
Questions:

1- When defining the direction of a line; 000 means North, 090 means (----), 180 means (----), 270 means (-----) and 360 means (----).

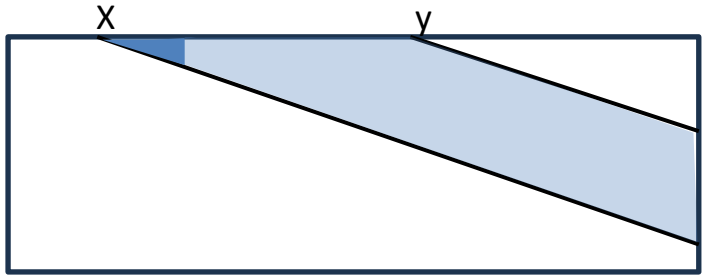
2- Give some notes for the purpose of giving you the figure:



3- An inclined layer is shown in the box, show on the figure: Vertical thickness, Outcrop thickness and true thickness.

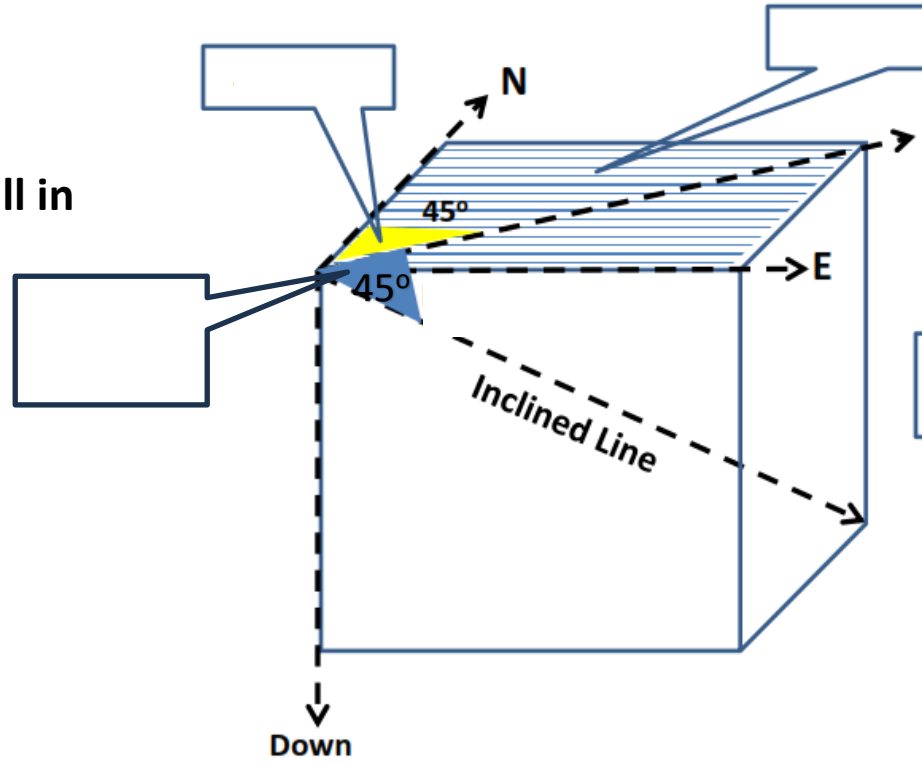


4- If you know that the dip angle is 300 and the outcrop thickness is 100m, calculate the vertical and true thicknesses.



5- Draw a fold showing the line of axis and th

6- The figure shows attitude of lines, fill in the boxes.



For this line the attitude of this line
Is noted as:
45, 045

(45 → 045)