STRUCTURAL GEOLOGY LAB MATERIALS

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PRACTICAL 1

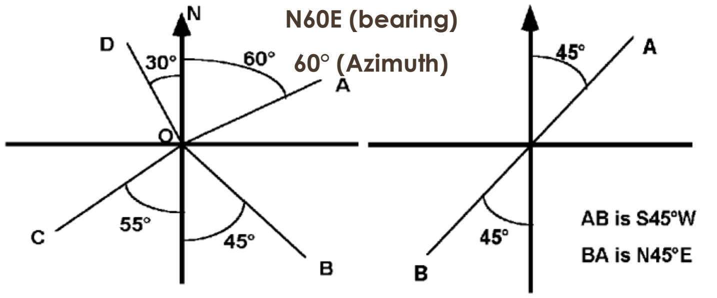
- **Horizontal angles**: angle measured in a horizontal plane by a level instrument, & **Used to determine** locations of points & the orientation of lines
- **Directions of lines:** bearings & azimuths
  - ➢ Defined by a horizontal angle between the line & a defined reference line (**meridian)**

True meridian	**Is the north-south reference line through the Earth's geographic poles**
Magnetic meridian	**Is a north-south reference line as defined by the Earth's magnetic field**

- **Bearings:** the direction of a line by an angle & quadrant letters. (e.g. N30° E), & are never greater than 90°

True bearings	**Based on true north**
Magnetic bearings	**Based on magnetic north**

- **Azimuth:** direction of line from north (only angle)

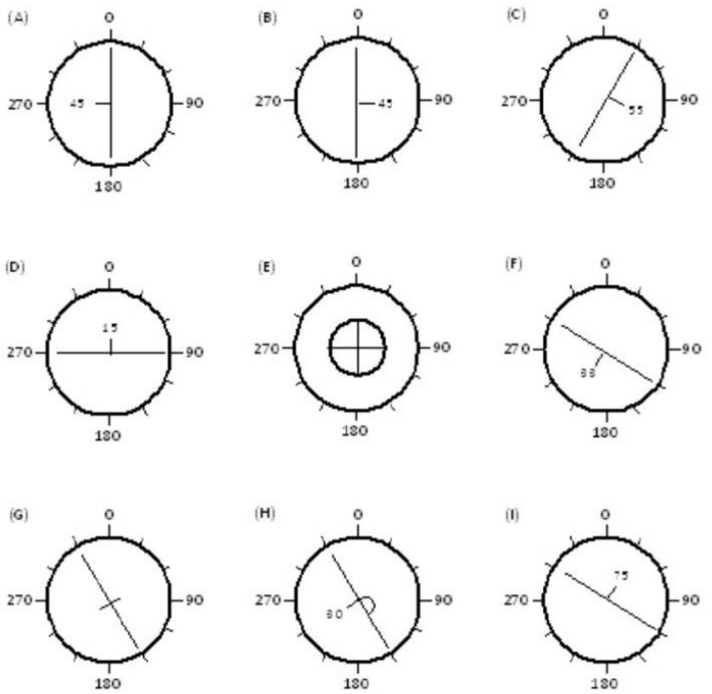


TRUE BEARINGS BEARING DIRECTION

- **The projection of a vertical plane on the outcrops are straight line regardless of erosional surface or not**
- **As angle of dip increases the V-shaped of a stream decrease (inversaly proportional)**

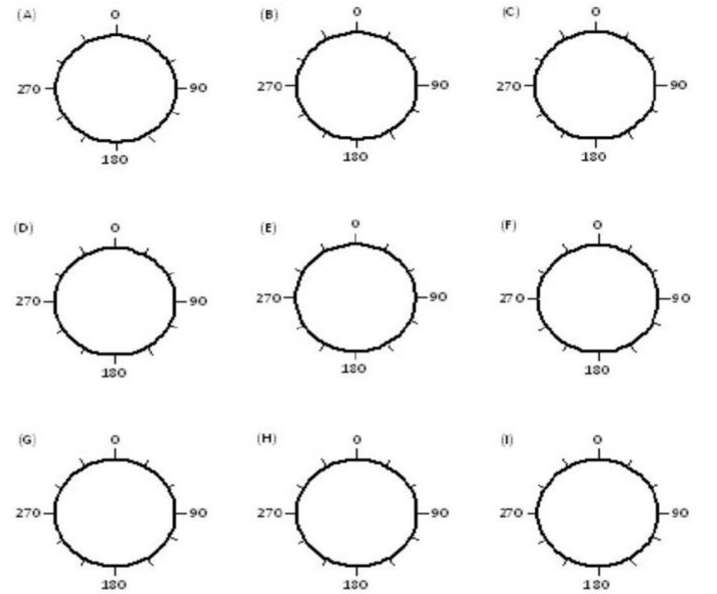
Fill in the below matching items with the proper planar attitude. Use "Strike azimuth, Dip angle & dip quadrant"

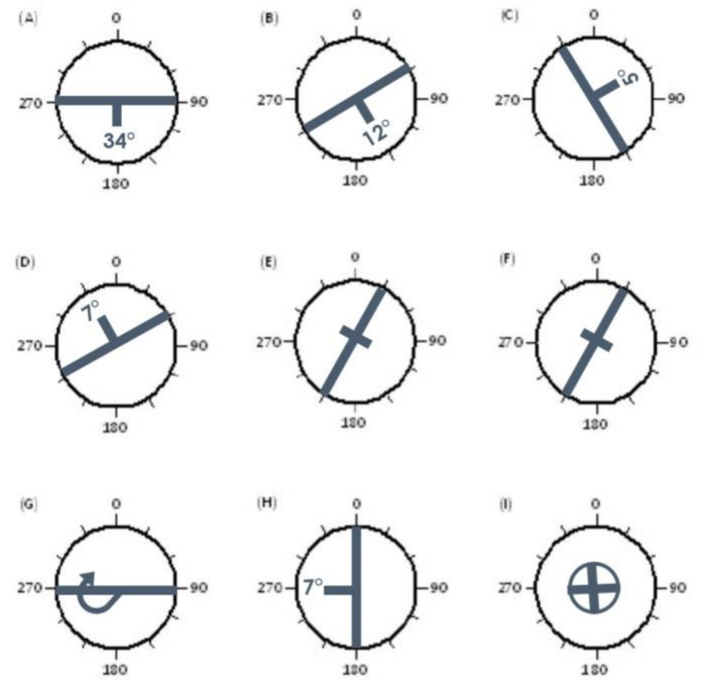
(A) ______________ **(B)**________________ **(C)** ______________
(D) ______________ **(E)** ________________ **(F)** ______________
(G) ______________ **(H)** ________________ **(I)** ______________



(A: 000,45°W), (B: 000,45°E), (C:30°,E55°S), (D:90°,15°N), (E:000,000 horizontal or no dip), (F:120°,S33°W), (G:250°,35°,vertical), (H:overturned), (I:120°,N75°E)

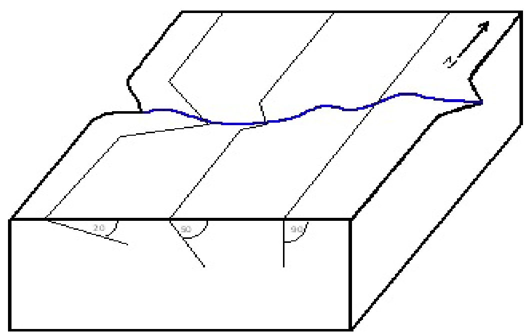
Fill the following diagram with the proper bedding symbol (A:90,34S) (B:N60E,12SE) (C:330,5NE) (D:60,7NW) (E:210,35) (F:N30E,90) (G:trend & angle 270,45) (H:0,7W) (I:Dip=0)





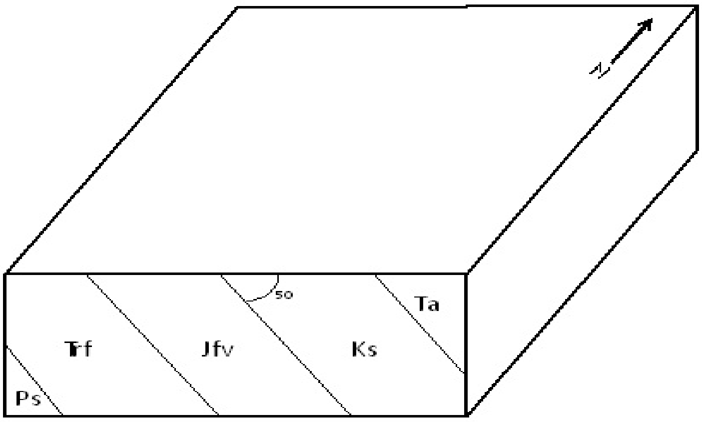
Formulate a rule of V's from the below block diagram governing the size of the V & the dip angle

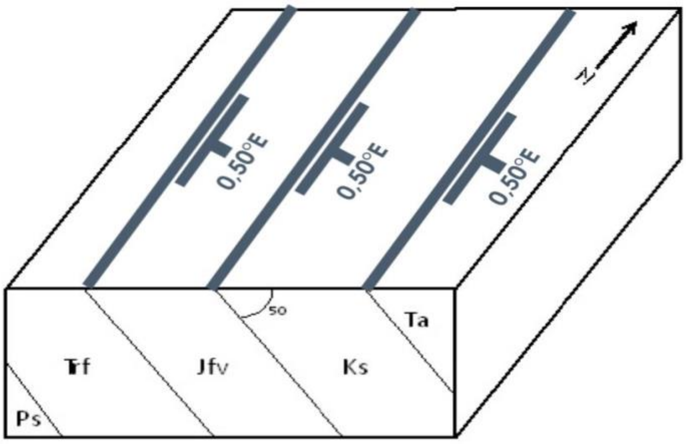
Rule of "V's" for Geologic Contacts Crossing Stream Valleys



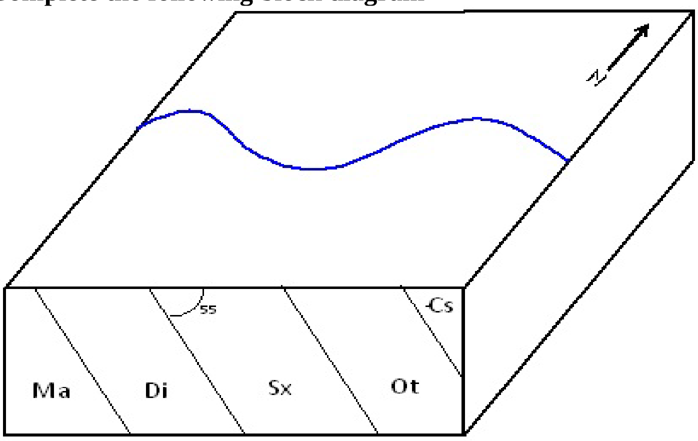
As angle of dip increases the V-shaped of a stream decrease (inversaly proportional), in the diagram above the dip angle is higher in the East west more than in the west side

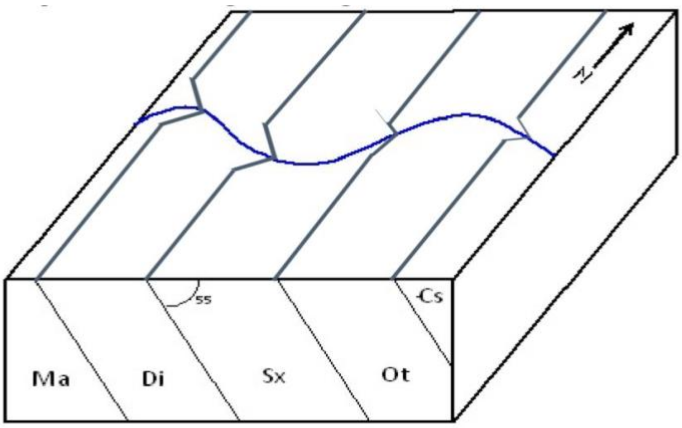
Using the block diagram below add relevant information to the map surface portion of the block diagram. Include strike & dip symbols. Label each stratigraphic unit with the proper abbreviation. If the true dip amount can be determined use it with the strike and dip symbol





Complete the following block diagram





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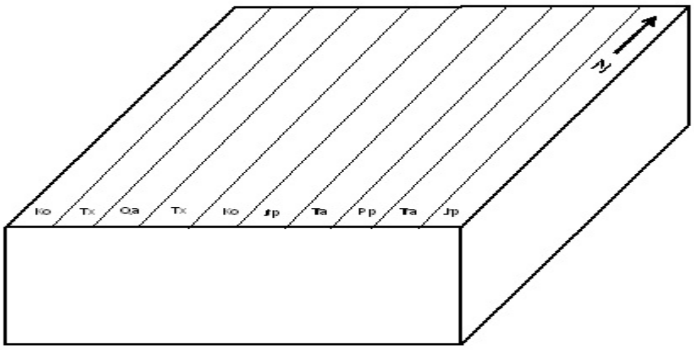
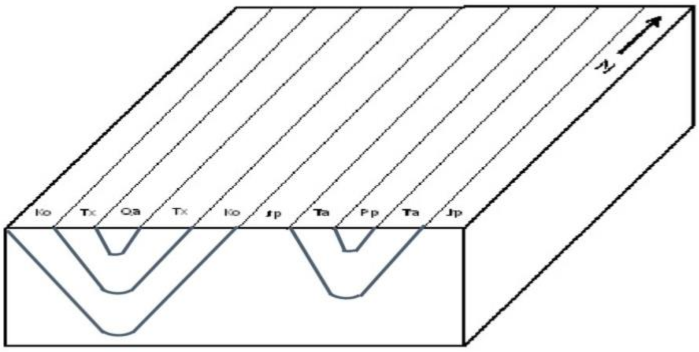




The Figure below is a geological map of an area of flat ground showing how a sequence of sedimentary strata intersects the surface

1. **WRITE DIP & STRIKE OF SEDIMENTARY LAYERS IN THE FORMAL WAY** **090°,045°S**
2. When considering the ages of the rocks in the legend how can the rough contact between conglomerate & shale below it would be accounted for? **Unconformity (related to erosion & non deposition for longer time)**
3. What type of dip angle is it in the direction A-B? **Apparent dip** What type of dip is the angle represented on the map? **True dip**, Are the 2 angles the same? **NO,** which one would you show on the cross section below? **Apparent dip** why? **Because the cross section is not a vertical line**

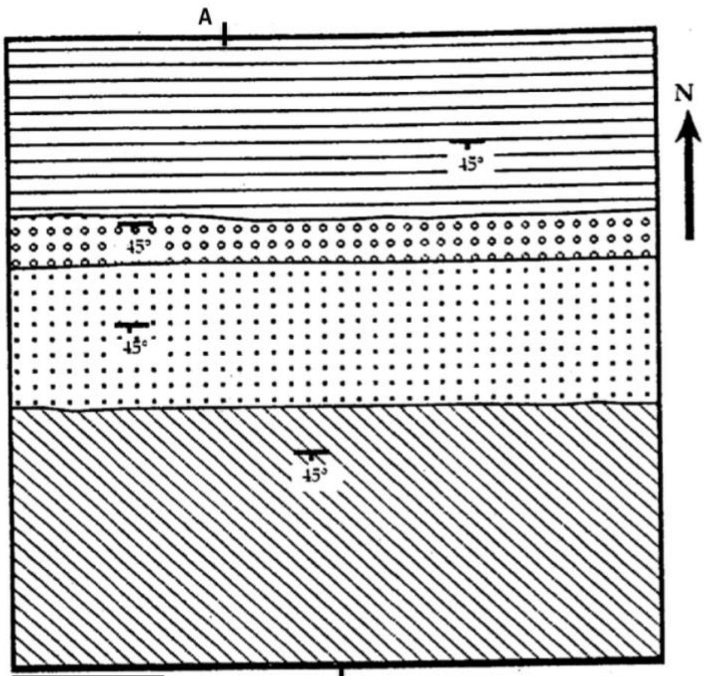


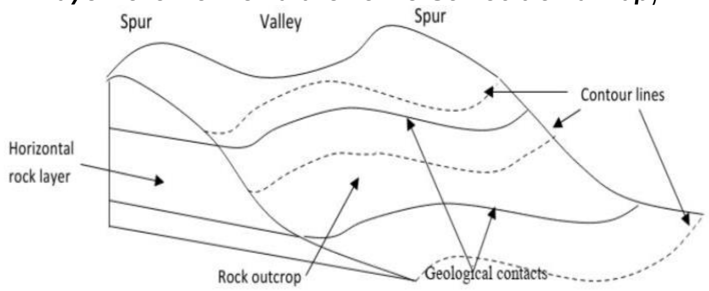
Figure 2.4

Scale: 1cm = 100m

PRACTICAL 2

HORIZONTAL LAYERS

- Most Sedimentary Rocks Are Deposited as Relatively Flat Lying Sheets Or Beds of Loose Sediments, Which On Burial , Gradually Compact & Harden into Rock
- Some Volcanic Rocks are Originally Deposited as Lava Flows of Ash Sheets
- In the Course of Time a Thick Sequence of Different Rock Layers Can Accumulate on the Top of Each Other
- Where a **Horizontal Layer** Penetrates Earth's Surface, the Rock Will be at the **Same Height All Across Landscape**, so the Outcrop Pattern Follow a Horizontal Line in the Same Way as Contour lines do (***Outcrop Pattern of a Horizontal Layer Follow or Lie Parallel to the Contours on a Map***)



INCLINED & VERTICAL PLANES

- During Uplift & Formation of Mountainous Landscapes, Horizontal Layers can Remain Flat Lying but Often Become Folded so that the Layers Tilt at Angles to Horizontal
- Other Rock (eg. Dikes) don't Form as Horizontal Sheets, They Oriented at Different Angles to Horizontal when Form (large batholithes Have Vertical Sides but Flat on top)

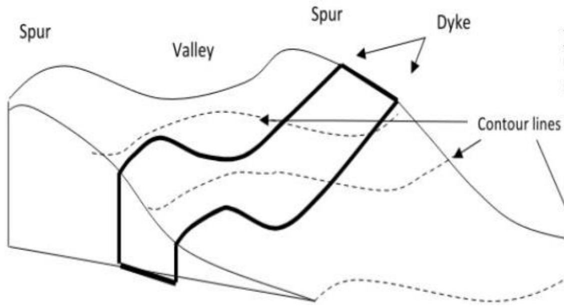


Figure 1b: Blo
Outcrop pattern
strata

- **Vertical Layers:** straight line on the map, & cutting the topographic couture lines
- **Inclined Layers:** Their Outcrop Patterns Will Neither Follow the Contours nor Cut Directly Across Them
- The Relationship of the Outcrop Boundaries of Dipping Strata to Contours are Used to Determine the Dip Direction

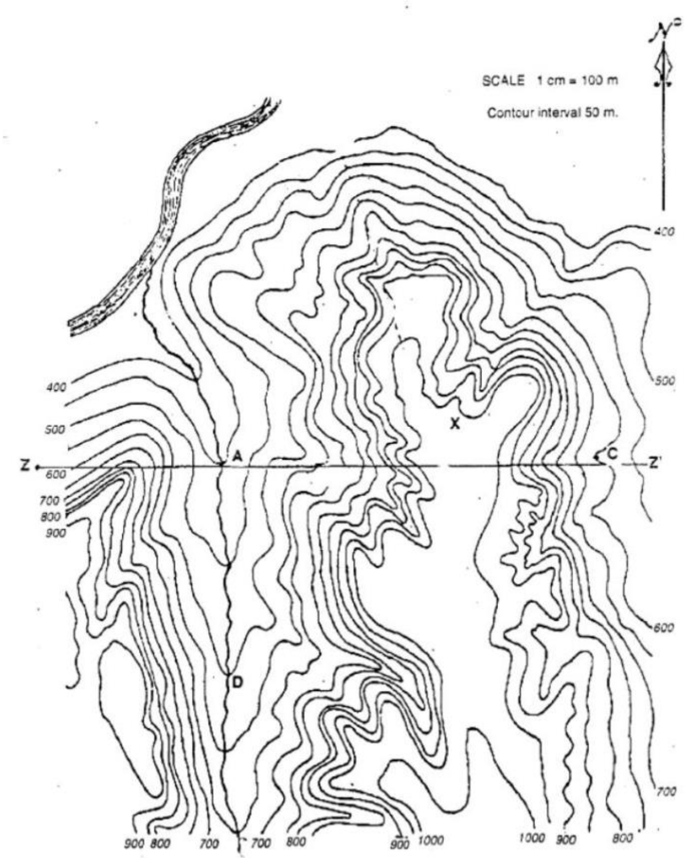
Depending on the following map, Answer the questions

1. Label 2 main topographic features: **steep slope (Ω), gentle Slope (Φ), Stream (λ), Plateau (Δ)**
2. Calculate the slope between A-D & A-X

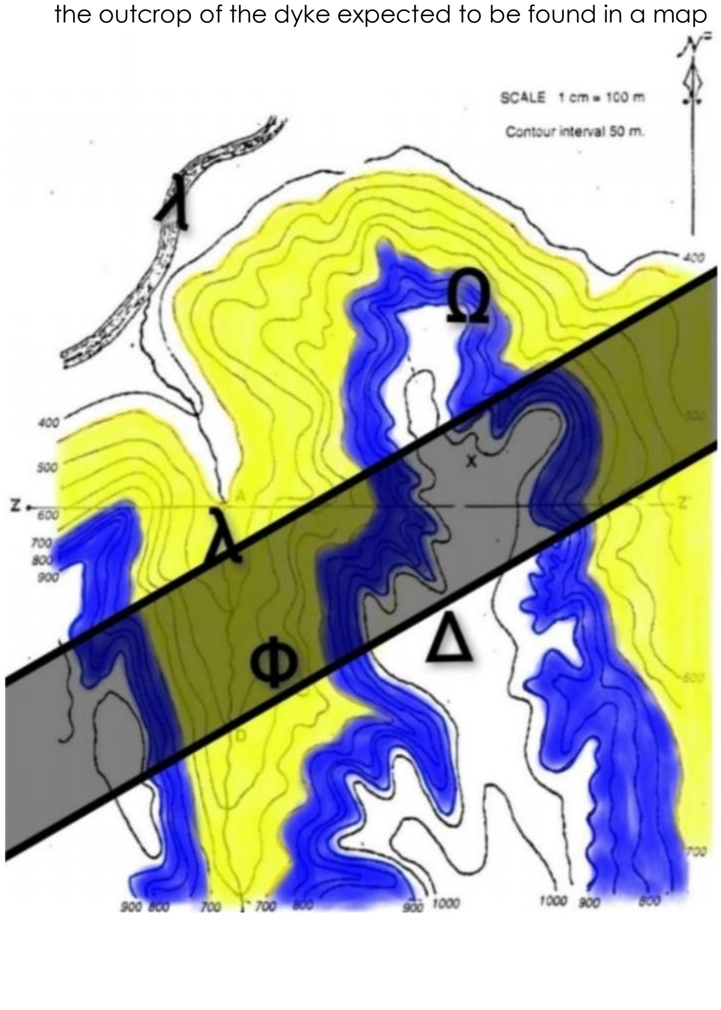
$$S_{A-D} = than^{-1}\left(\frac{\Delta elevation}{\Delta distance}\right) = \tan^{-1}\left(\frac{550m - 450m}{4cm * 100\frac{m}{cm}}\right) = 14°$$

$$S_{A-X} = than^{-1}\left(\frac{\Delta elevation}{\Delta distance}\right) = \tan^{-1}\left(\frac{950m - 450m}{3.8cm * 100\frac{m}{cm}}\right) = 26°$$

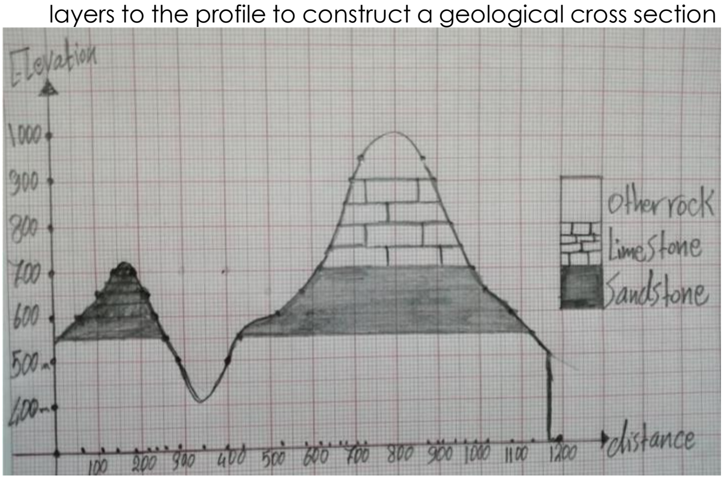
3. What is the relationship of slope & distance between contour lines on the map? **As distance between contour lines decreases, the slope increases (steeper slope), in other words inversely proportional**
4. The upper surface of a horizontal sandstone at elevation 700m & the lower surface at point A, Calculate the thickness of the sandstone layer: **The thickness of a sandstone layer is 700m – 450m = 250m**



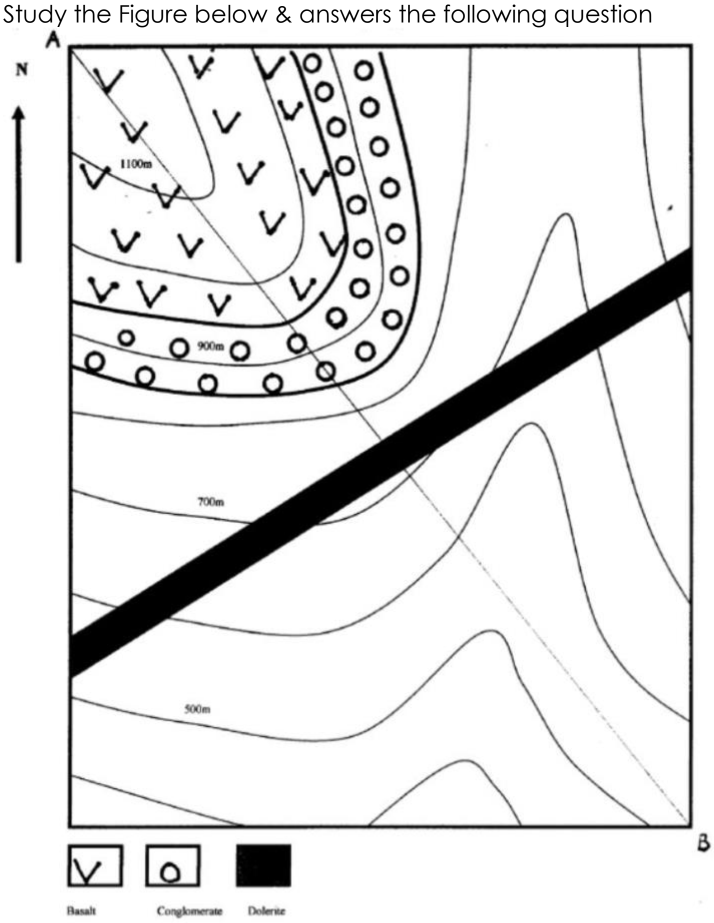
5. Draw the outcrop of the layer on the map (yellow), & If the sandstone layer is overlain by a 200 m limestone, draw the geological contact of the upper limestone & colour the limestone outcrop with blue colour
6. draw in the boundary of a vertical dyke that passes through C & D. The northern boundary of the dyke is found 300m away. Draw in the other boundary & shade in where the outcrop of the dyke expected to be found in a map



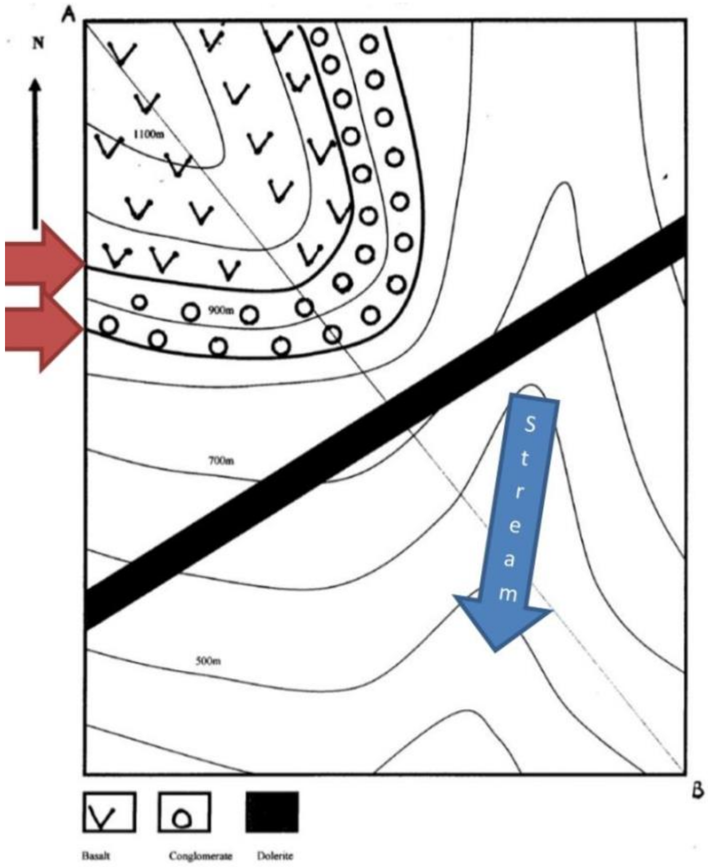
7. Draw a topographic profile through Z – Z' using a vertical scale same as horizontal scale & then add the geological layers to the profile to construct a geological cross section

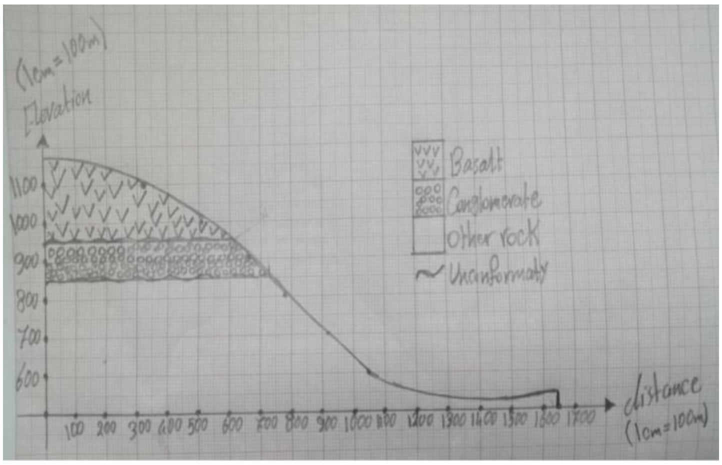


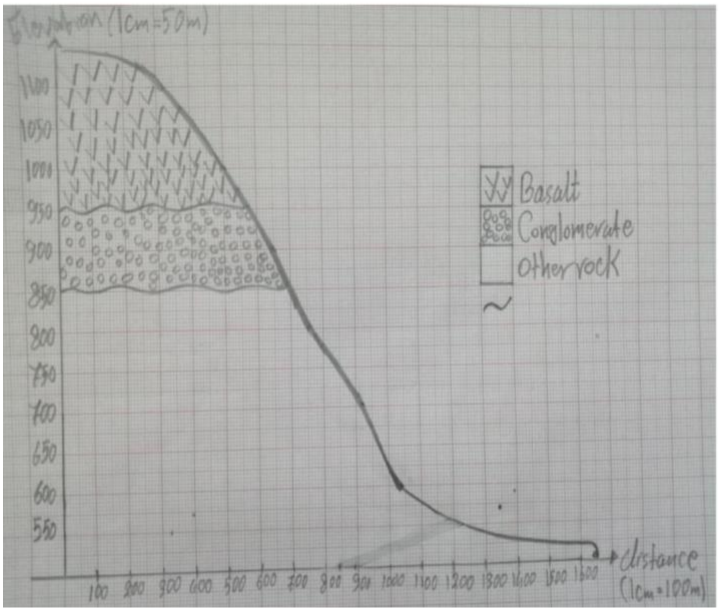
Study the Figure below & answers the following question



1. Draw a blue colour line on the map to show the direction of flow in the stream **NE → SW**
2. Highlight the unconformity by irregular red arrow. & What is the type of unconformity **is a Nonconformity (unconformity between unstratified igneous "basalt" & stratified sedimentary rock)**
3. What is the relationship between basalt & conglomerate geological contacts to the contours **parallel**
4. Identify horizontal layers & mention the relationship with contours **basalt & conglomerate layers (both are parallel to the contours lines "because both are horizontal layer")**
5. Identify inclined & vertical layers & Describe the relationship between each of them & the contour lines **there is no inclined layer in this map but a vertical layer is a dyke which is dolorite layer**
6. Draw a geological cross section through AB using vertical scale equal to horizontal scale, & then another cross section using a vertical scale of 1 cm = 50 m



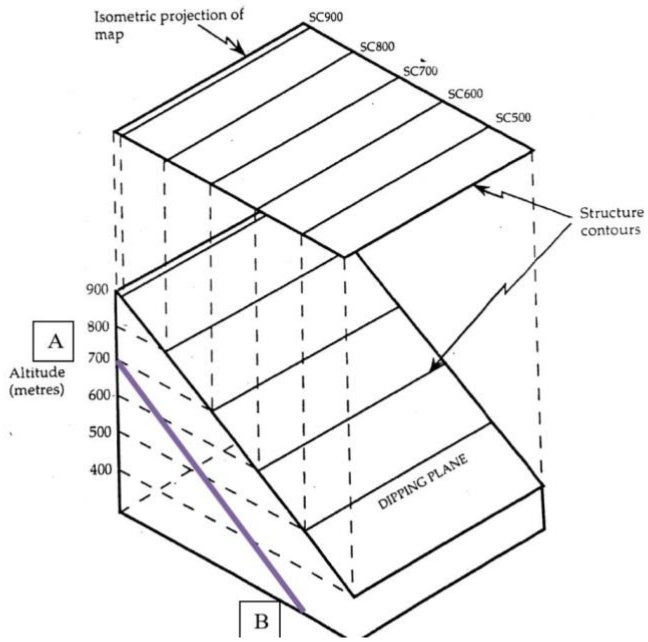




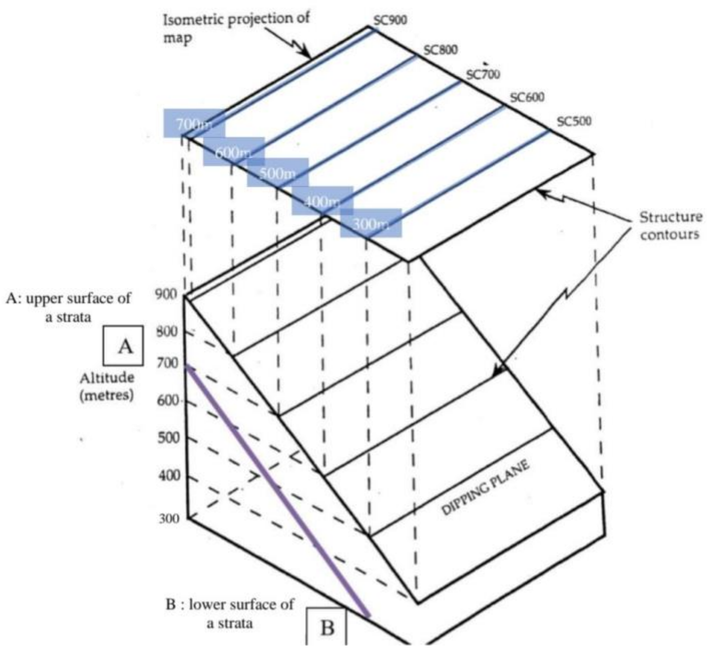
PRACTICAL 3

- **Structural contours or strike lines**: lines drawn on a surface to connect points of equal elevation or height or altitude
  - **structural contours**: drawn on the surface of a layer or a fault plane
  - very useful as a tool in mapping surface feature, predicting how structures would develop in 3D under the landscape & to draw cross sections
- The simplest geological structure that contours can be drawn for is that of a planar dipping surface (monocline) like the top or bottom of a tilted bedding or a fault planes

Figure below shows how the imaginary contour lines on a dipping planar surface projected onto a flat map surface. Line AB represents the lower surface of a marl bed. The top surface that is labelled as DIPPING PLANE represents the upper surface of the marl bed. Structural contours (strike lines) are drawn on the upper surface that are projected on the horizontal plane on the top of the figure with their numbers sc500 to sc900 based on vertical scale to left of the figure with the altitudes



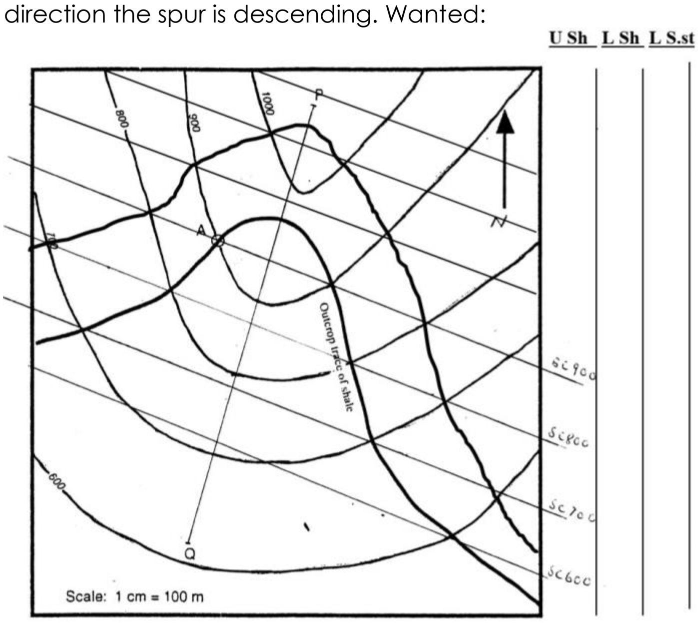
1- Draw the projections of strike lines that represent the lower surface on the horizontal plane, & number them



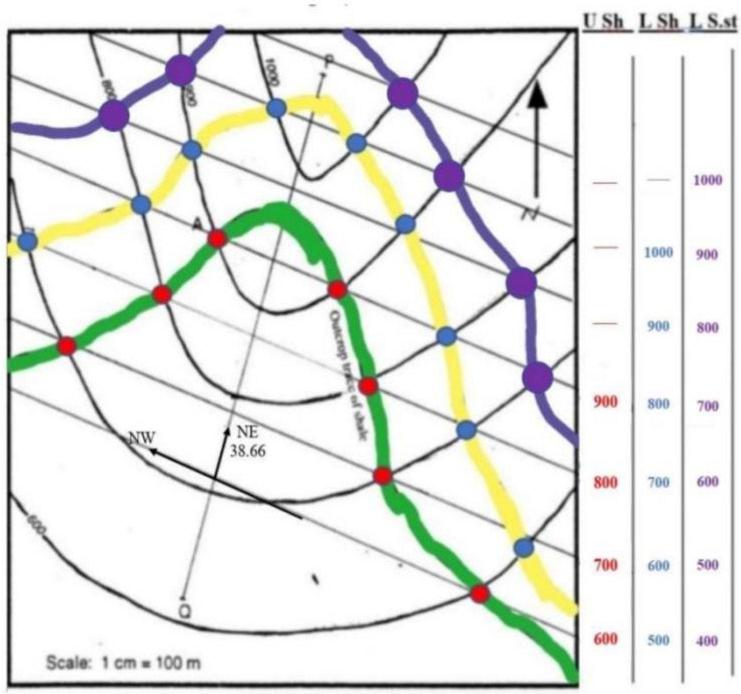
2- If the angle of dip = 30°, calculate the true thickness of the marl layer

$$\mathbf{V.T = 900m - 700m = 200m}$$
$$\mathbf{T.T = V.T x cos\theta \ where \ \theta = dip \ angle}$$
$$\mathbf{T.T = 200m \ x \ cos30° = 173.2m}$$

The following Figure shows a map that has topographic contours of a simple spur & the outcrop pattern of a shale bed showing lower & upper geological contacts. Structural contours have been drawn for the shale bed. They are all straight parallel & equidistant lines as they should be for a planar dipping surface. The lines have been drawn so that they intersect the topographic contours where the outcrop pattern meets the surface. The shale bed dips as a planar surface under the landscape to the southwest, in the same direction the spur is descending. Wanted:



1. Label the top surface (colour green) & the bottom surface (colour yellow) of the shale
2. The structural contour lines are numbered on the right side of the map relative to the southern geological contact. Number them relative to the northern geological contact. Label the upper & the lower surfaces
3. Draw the contact of a lower sandstone layer below the shale bed. The vertical thickness of the sandstone layer =100m. Give numbers to all strike lines relative to the three contacts. Each strike should have 3 values.



4. Calculate the true dip of the shale

$$T.D = \tan^{-1}\left(\frac{SI}{CI}\right) = \tan^{-1}\left(\frac{100m}{1.25cm x100\frac{m}{cm}}\right) = 38.66°$$

5. Calculate the true thickness of the shale bed. You need to number the strike lines relative to second surface

$$T.T = V.T \text{ x } \cos\theta = 100m \text{ x } \cos(38.66°) = 78.09m \approx 78m$$

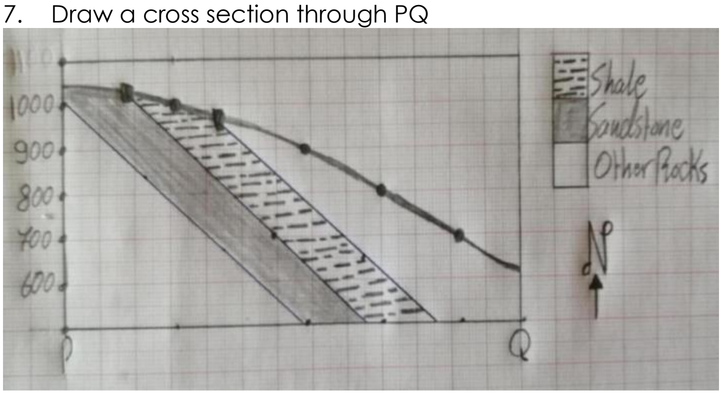
6. Sandstone is a good aquifer. Calculate the cost of drilling water well at point A to the lower surface of the sandstone aquifer. The cost of drilling is 500 JD/meter depth

$$V.T = 100m$$

$$\Delta h_{A-ss} = 2 * 100 = 200m$$

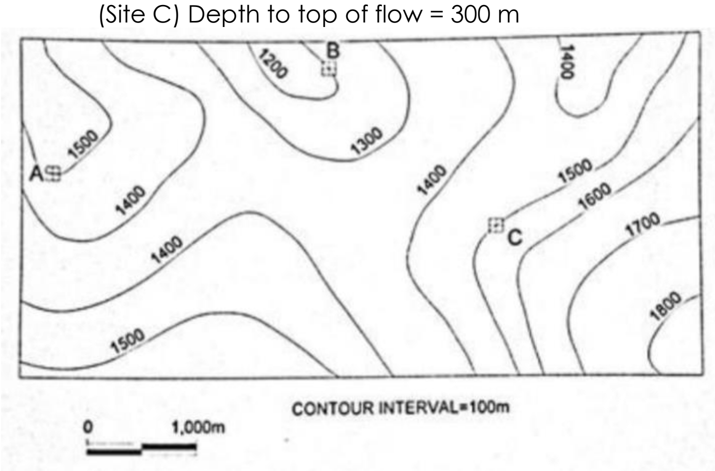
$$\text{the cost} = 200m \text{ x } 500JD/m = 100,000JD$$

7. Draw a cross section through PQ

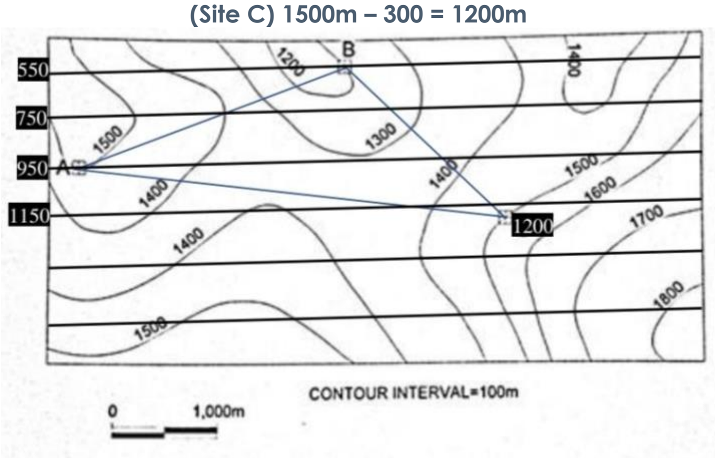


Three drill holes were sunk on the map included in following Figure, The drilling at all 3 sites encountered the top of a mineralized basaltic lava flow at various depths below the land surface. Find the attitude of the top of the flow assuming it is planar. The below information is provided:

(Site A) Depth to top of flow = 550 m
(Site B) Depth to top of flow = 650 m
(Site C) Depth to top of flow = 300 m



(Site A) 1500m – 550m = 950m
(Site B) 1200m – 650m = 550m
(Site C) 1500m – 300 = 1200m

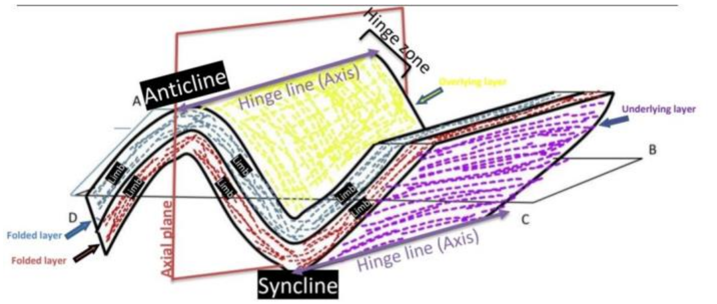


PRACTICAL 4

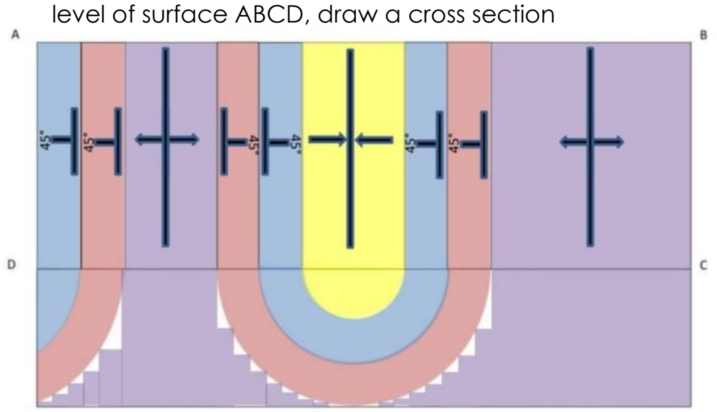
The diagram below depicts 2 layers of sedimentary strata that were formed as Horizontal layers & are now folded into a symmetrical, upright & parallel fold

Figure 4.1

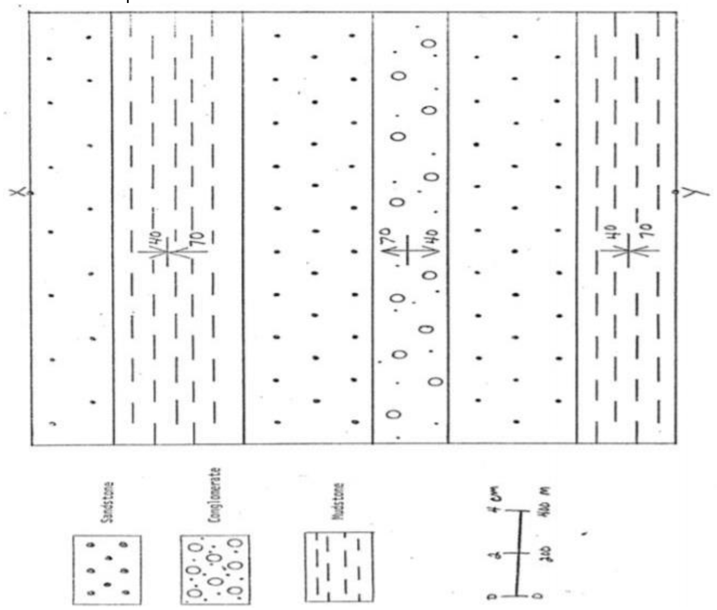
1. add labels & lines to indicate each of the following parts of the fold structure: Anticline, Syncline, Hinge, Hinge line, Fold Axis & fold Limb. Shade the strata in 3 distinct colour



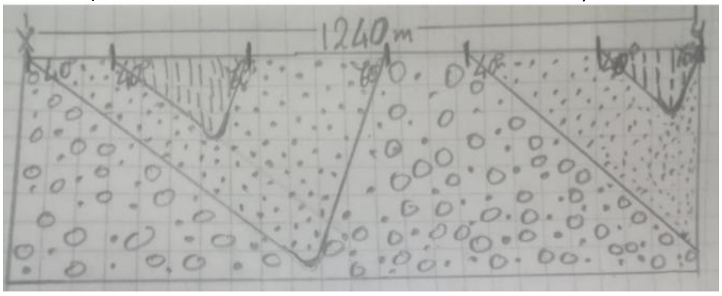
2. Imagine that the folds were eroded to a flat plane at the level of surface ABCD, draw a cross section



The Figure below shows how the outcrop pattern at the surface would appear. The outcrop for the two Strata is shown, in reality there would be other layers filling the empty spaces on the map

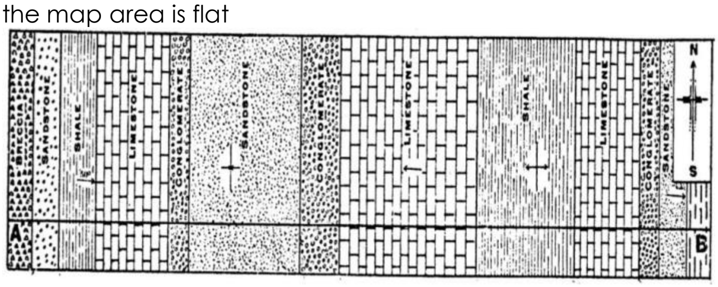


1. Sketch a cross section through X-Y (Use the scale of the map once and thence a scale of 1 cm: 100m)

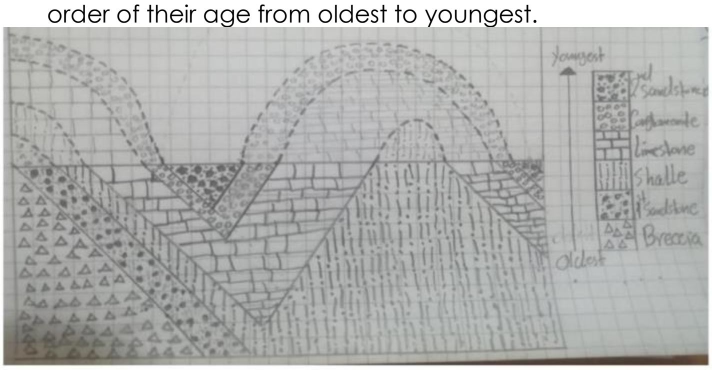


2. Geological structures in the area: **plunging fold (plunging anticline & plunging syncline) because outcrop isn't parallel on both side, & there is no another structures (because the erosional surface is planer)**
3. Type of fold considering symmetry, axial plane, & plunging ***inclined fold*** **(which is Asymmetrical "axial plane is tilted from vertical plane with one limb dipping more steeply than another, & have different bed widths").** ***Asymmetrical syncline*** **where the 2 limp are moving toward each other, with 2 different angles (hear are 40°,70°).** ***Asymmetrical anticline*** **where the 2 limp are moving away & opposite to each other, with 2 different angles (hear are 40°,70°)**
4. The width of outcrop controlled by **erosional rate, slope (inversely proportional), & rock lithology**

The following Figure shows a geological map. The surface of the map area is flat



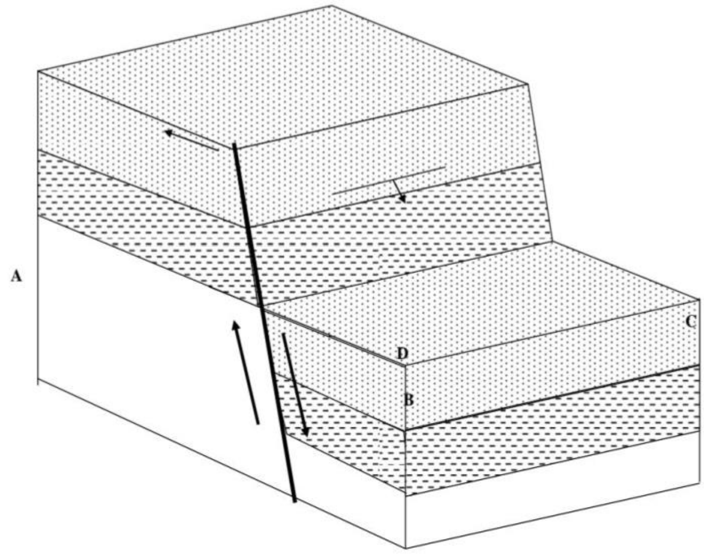
1. Why do you think the geological contacts are straight lines in the map? **Because the erosional surface is planar, so there's no topography in this area**
2. Why do you think the width of outcrops are different from each other? & why the same layer has different widths on the same map? **Because the erosional rate are different due to differences in the dip angle (Inversely proportional to the width), the type of rocks, & the thickness of layers**
3. Suggest dip angles for the limbs of the folds in the map & explain the basis used for the estimation. **The dip angle depending on the width of a layers**
4. Geological structures found in the map? **Asymmetrical Syncline, & Asymmetrical Anticline**
5. Sketch a cross section for the map from A to B in the box provided (land surface is flat), & Draw dashed lines to indicate where the folded layers would have been in the past above the present landscape before the area was eroded, & Under the cross section list the rock types in order of their age from oldest to youngest.

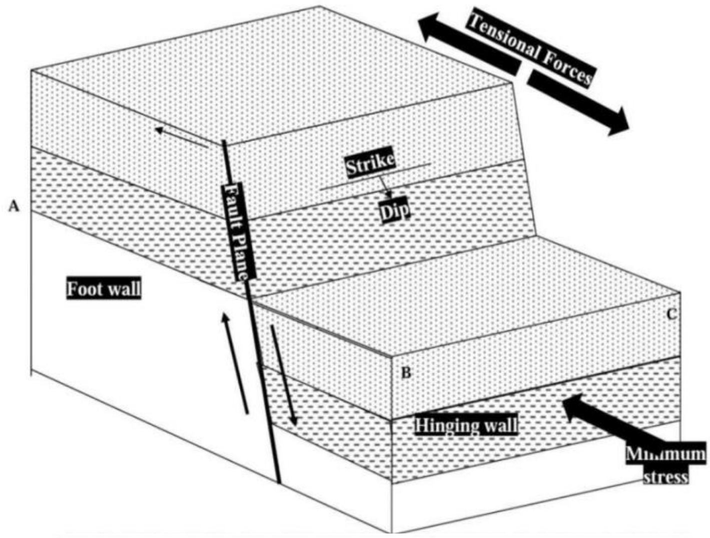


From OLDEST to YOUNGEST: **Breccia, 1st Sandstone, Shale, Limestone, Conglomerate, 2nd Sandstone**

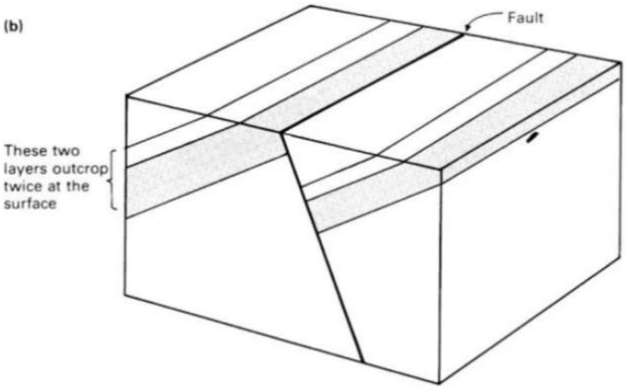
PRACTICAL 6

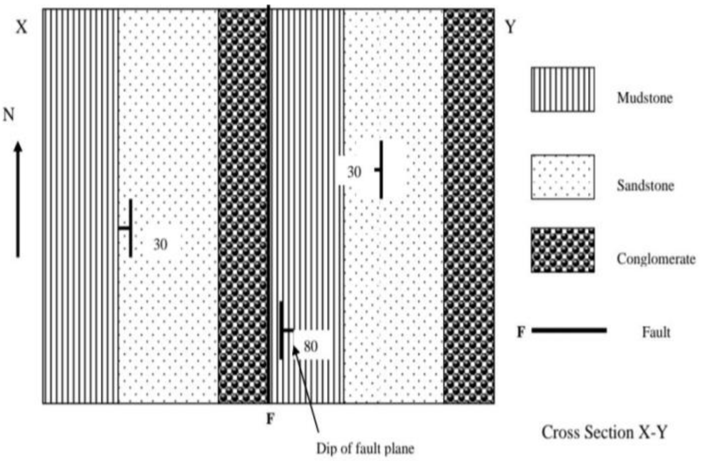
The following Figure show Normal faulting of horizontal strata. On the diagram add these labels: Fault plane, Hanging wall, Footwall, Horst, Graben. Add two arrows to indicate the type of forces that would have operated to cause this fault signifying the direction of principle & minimum stress then Imagine that the fault movement that the up-thrown block was eroded flat to the same elevation as the down-thrown block that is level with surface ABC. The surface of the down-thrown block suffered only slight denudation. Draw a surface map of ABC as it would appear after the erosion

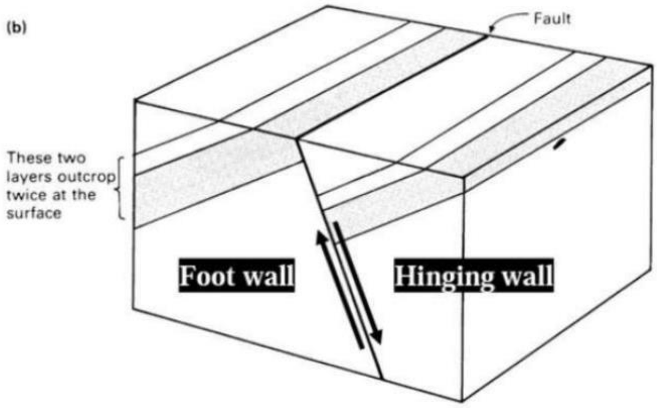


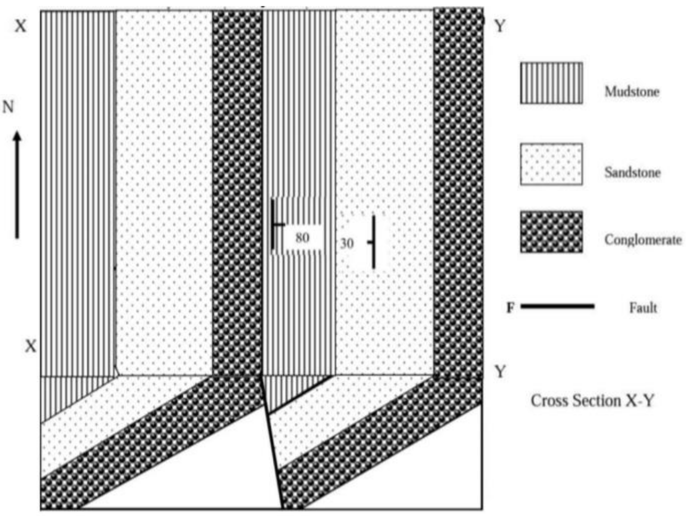


A normal fault intersecting dipping strata. In the diagram the footwall block is shown already eroded down to the same level as the hanging wall. Add labels that identify the footwall & hanging wall & 2 arrows that show the sense of movement along the fault plane, & drow a cross section

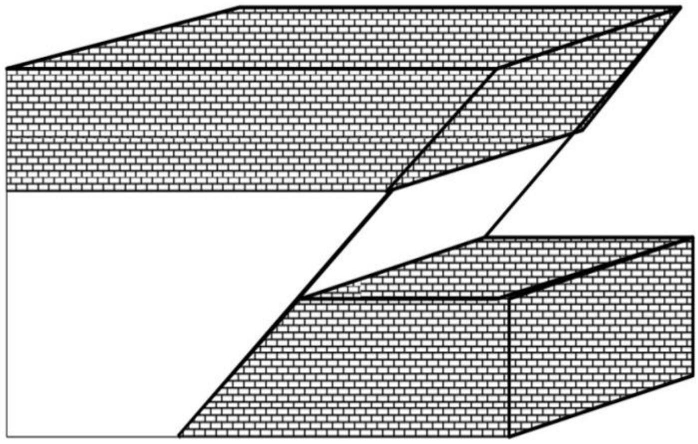


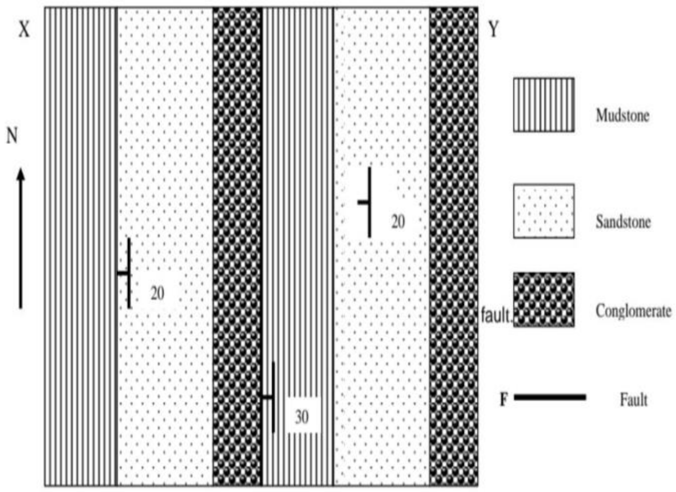


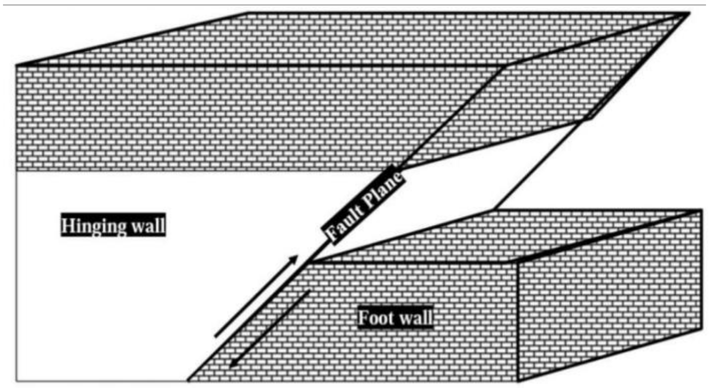


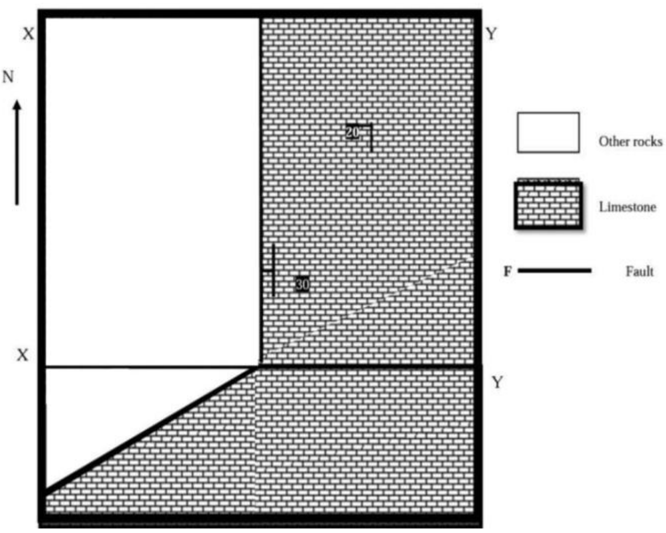


To the diagram add labels that highlight the fault plane, footwall & hanging wall. Use arrows to indicate the directions of maximum & minimum stress that would cause this fault & drow a cross section

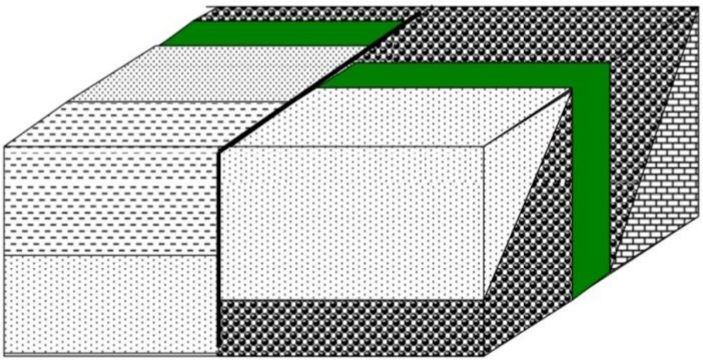




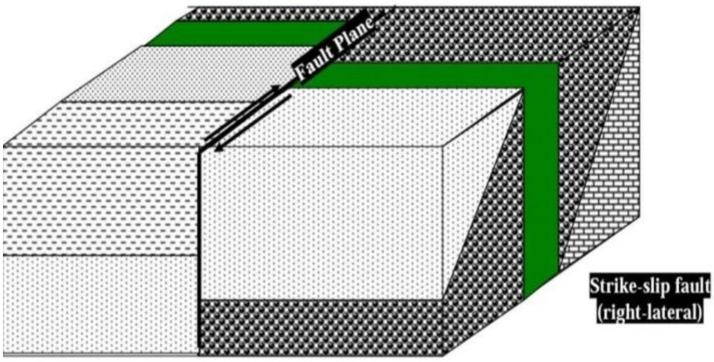




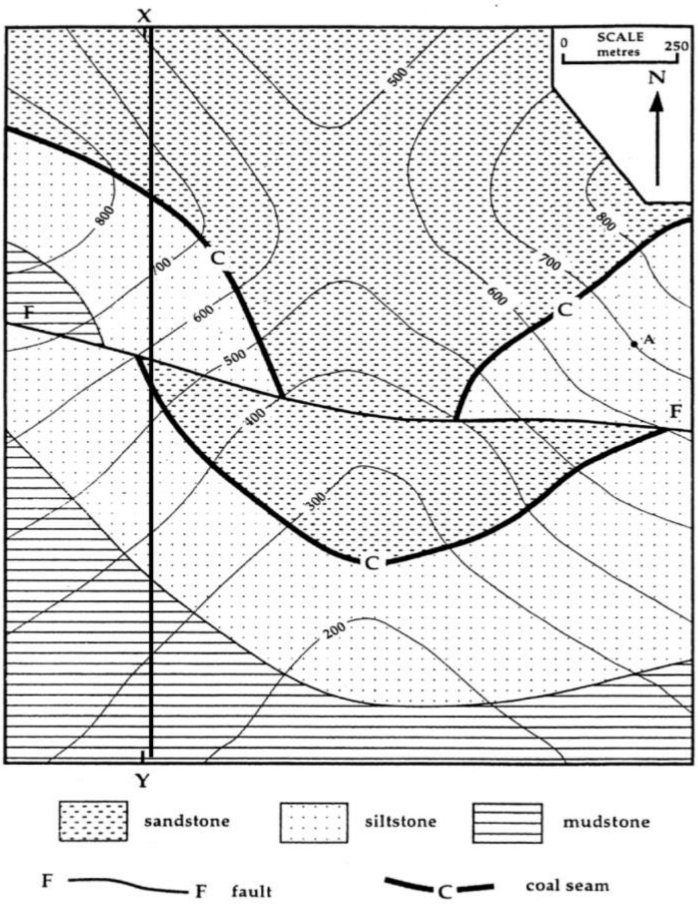
Study the following diagram

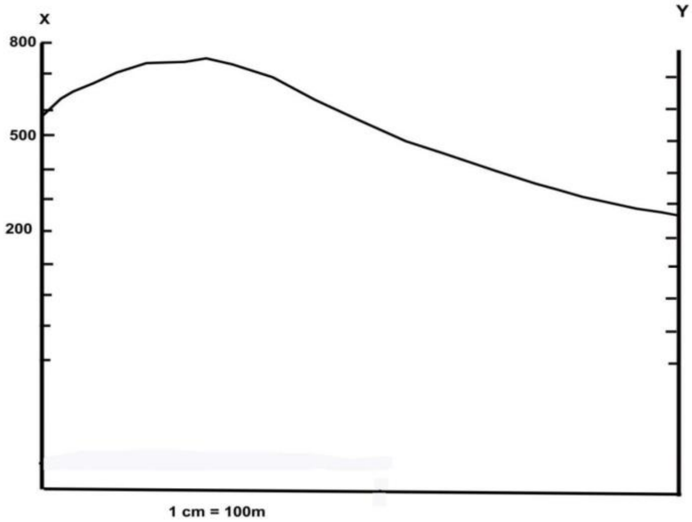


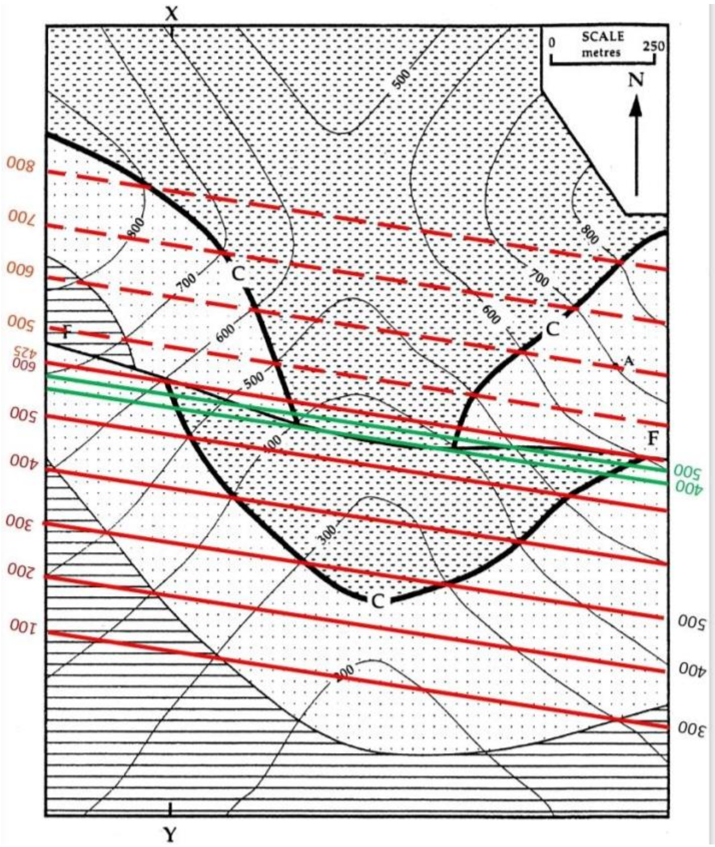
Draw arrows to show the direction of movement for each block & label the fault plane



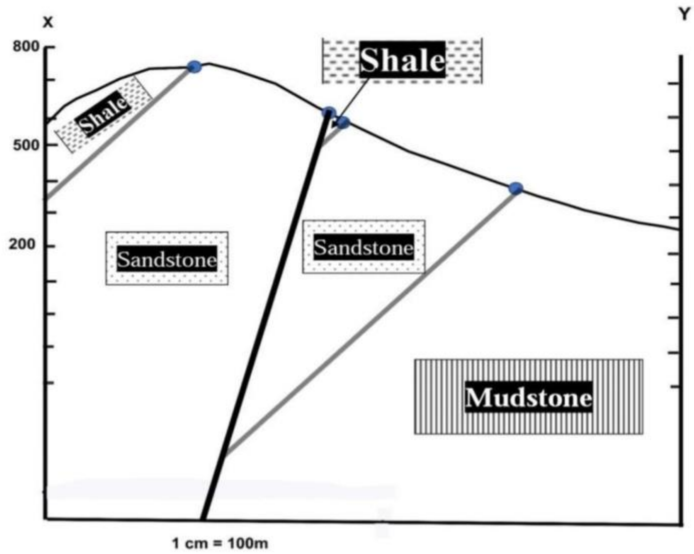
On the map of Figure 7 a sequence of sedimentary strata is dissected by a fault. Draw structural contours for the fault & the coal seam on both sides of the fault. Use these structure contours to draw in the fault plane followed by the coal seam onto the cross section for X-Y for which the topographic profile has been provided. The other sediments can be assumed to have the same dip as the coal layer. Complete the cross section & under the diagram state what type of fault movement has occurred







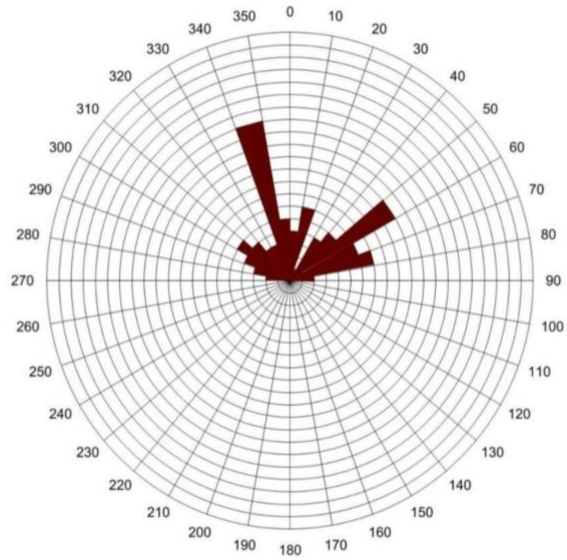
The type of fault is strike slip fault

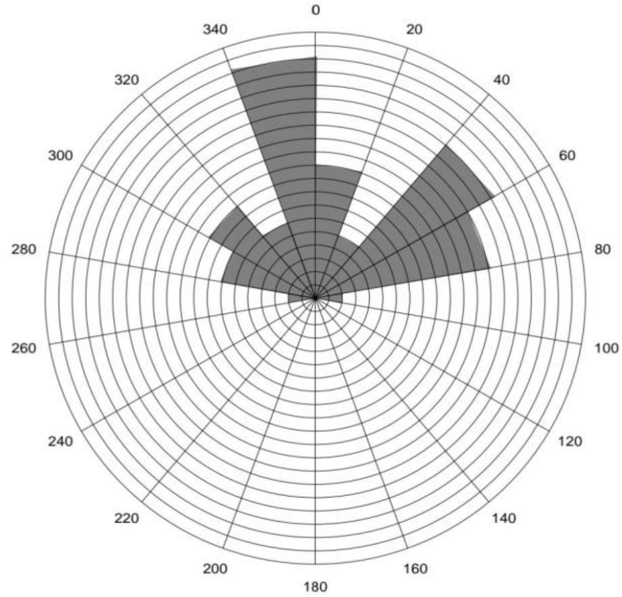


PRACTICAL 8

Drow the rose diagram of the following data

Strike and Dip of Fracture Data - G302 Exercise						
Strike	Dip	Dip_Direction		Strike	Dip	Dip_Direction
345	65	NE		60	83	SE
329	83	SW		52	84	SE
328	75	NE		68	84	SE
347	74	NE		73	86	NW
330	32	SW		57	70	SE
346	81	NE		70	84	NW
277	74	NE		47	80	NW
330	81	NE		18	85	NW
347	78	NE		38	40	SE
349	48	NE		77	82	SE
292	84	SW		11	27	NE
350	77	NE		78	80	NW
351	15	NE		48	85	NW
350	84	SW		6	56	SE
349	83	NE		39	66	SE
358	80	SW		63	82	SE
300	82	NE		68	80	NW
338	55	NE		53	88	SE
343	78	NE		17	83	NW
353	38	NE		55	82	NW
348	83	SW		72	80	NW
348	81	NE		42	66	SE
287	82	NE		83	75	SE
303	78	NE		52	69	NW
328	75	NE		1	88	SE
293	85	SW		37	84	NW
348	76	NE		68	75	NW
307	69	NE		51	62	NW
316	43	SW		4	88	SE
273	83	SW		55	84	SE
298	18	SW		18	82	NW
303	83	NE		18	80	SE
342	76	SW		54	82	SE
340	22	SW		68	75	SE
280	38	SW		32	85	NW
306	38	SW		52	87	NW
285	82	NE		72	50	NW
312	70	SW		41	64	SE
298	18	SW		84	90	
310	37	SW		3	53	NW
313	83	SW		53	70	NW
347	51	NE		71	72	NW
20	78	NW		15	68	SE
				45	70	NW





PRACTICAL 9

(principles of STEREONETS without exercises)

Plotting a Plane

- An inclined plane plots alog a great circle
- The endpoint of the cyclographic trace of a plane with a non-zero dip are at diametrically opposed pointson the primitive circle, these points define the line of strike for the plane

EXAMPLE to drown a plane with 60° Strike & 50° Dip

Step 1: Lay tracing paper over stereonet

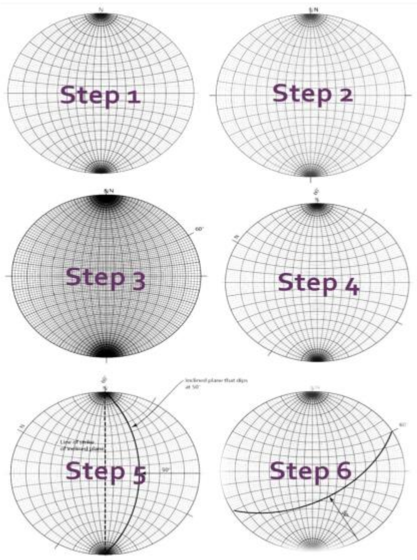
Step 2: trace primitive circle with a compass (label 0°, 90°, 180°, 270°, & N at 0)

Step 3: Plot a strike mark (60°) on primitive circle

Step 4: rotate tracing to placing the strike mark at N

Step 5: Draw the plane of the dip (50°)

Step 6: Remove stereonet to see the results, Visualize the results, & check to see if they make sense



Plotting a Line

- **A line lies at the intersecon of 2 planes:**
  1. **A vertical plane (magenta)** with a strike that matches the trend of the line
  2. **An inclined plane (violet)** with a dip that matches the plunge of the line & that dips in the direction line plunges

EXAMPLE to drown a line with 60° trend & 50° plunge

Step 1: Lay tracing paper over stereonet

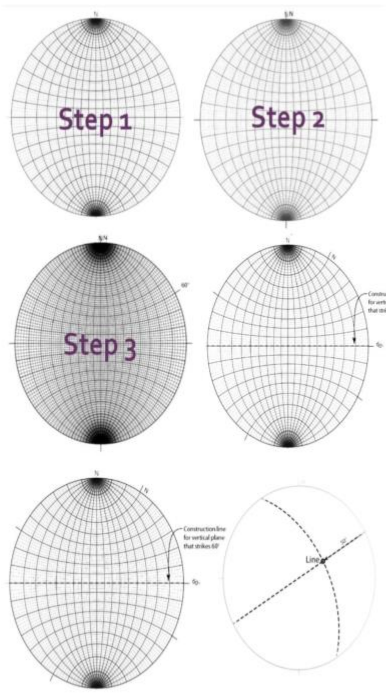
Step 2: trace primitive circle with a compass (label 0°, 90°, 180°, 270°, & N at 0)

Step 3: Plot a trend mark (60°) on primitive circle

Step 4: rotate tracing to placing the trend mark at small circle that projects as a straight line (i.e., the equatorial line)

Step 5: Mark off the plunge (50°), counting from the primitive circle towards the center of the plot (The line of interest is at the intersecon of the vercal pink plane and the plunging violet plane)

Step 6: Remove the stereonet to see the results



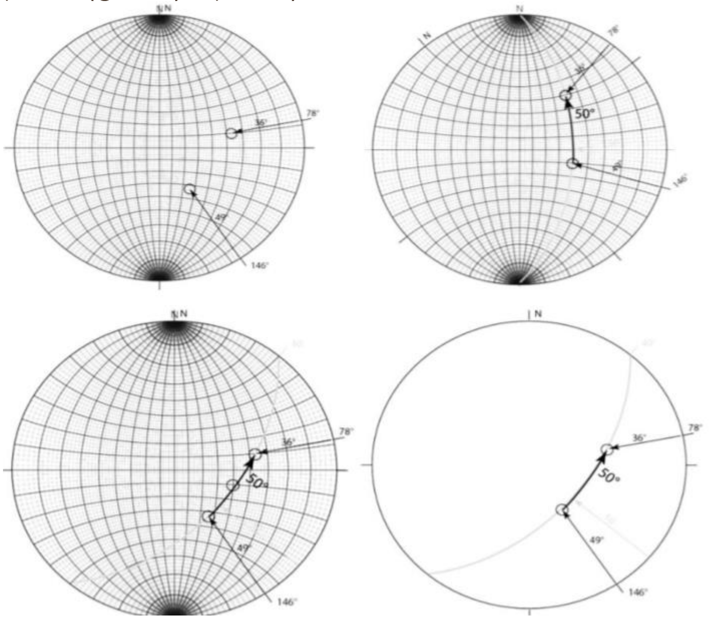
Measuring the angle between two lines

- The angle between the lines is measured along the cyclographic trace of the plane that contains the lines
- The procedure is exactly analogous to measuring the angle between two lines with a protractor

Example find the angle between 2 lines one trends 78° & plunges 36°; & the other trends 146° & plunges 49°

Step 1: Plot the lines

Step 2: Find the plane that contains both lines (Rotate the tracing paper such that both lines lie on a single great circle & measure the angle along the great circle between the 2 lines. Here = angle 50° & the common plane (green) dips 50°)

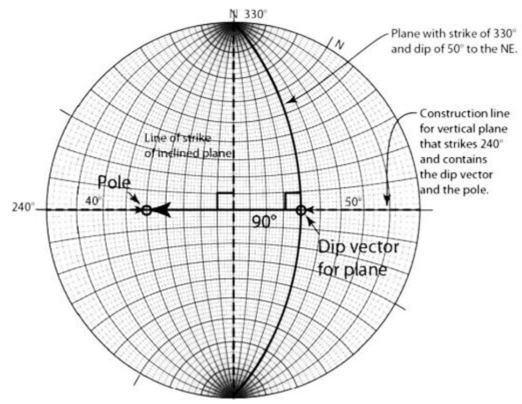


Plotting the Pole to a Plane

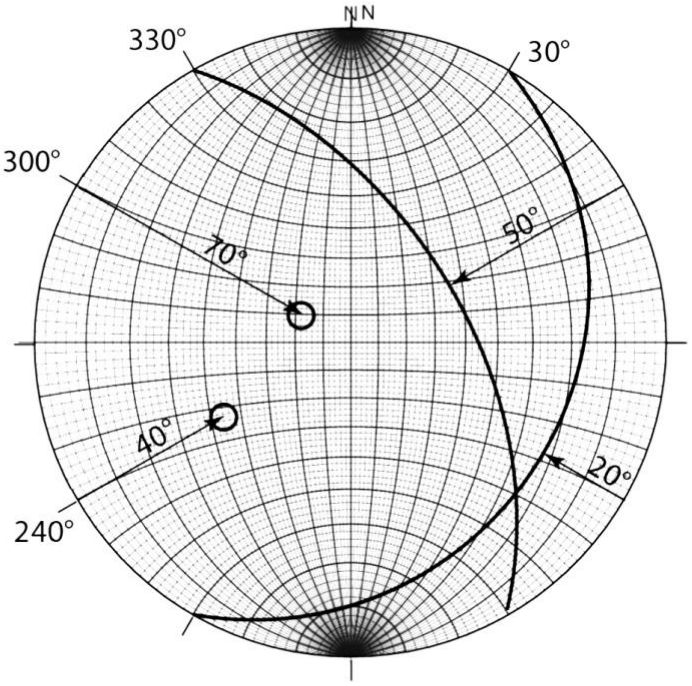
- The pole to a plane is a line that plotted like any other line
- The pole to a plane of interest lies in a vertical plane perpendicular to the plane of interest
- The pole also makes a 90° angle (as measured in the vertical plane) with respect to the "dip vector" of the plane of interest

Example Consider a plane of interest that strikes 330° & dips 50° to the NE, its pole can be found by simple calculations.

- ➢ The pole trends 240° & plunges 40°
- ➢ The pole to a plane lies in a vertical plane perpendicular to the plane of interest
- ➢ The pole also makes a 90° angle (as measured in the vertical plane) with respect to the "dip vector" of the plane of interest

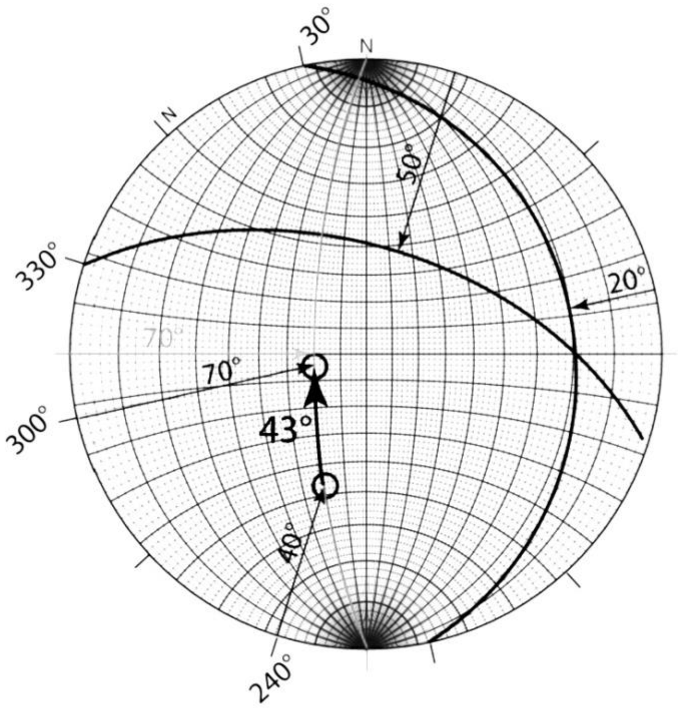


Measuring the angle between two planes

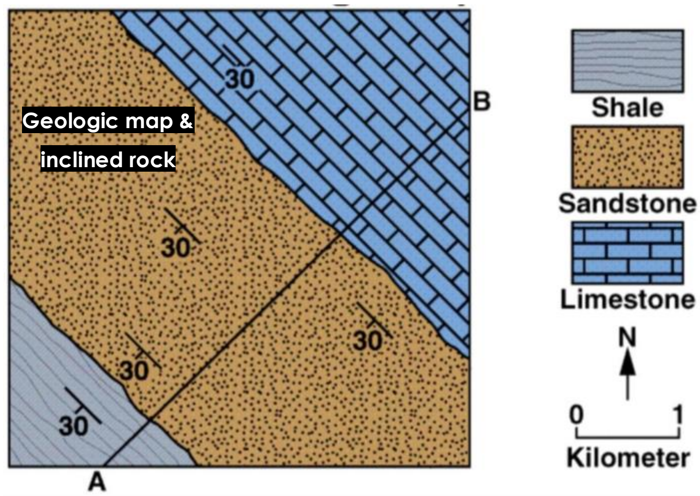


Measure angle between poles in a plane containing the poles

- Rotate the tracing to find the common plane that contains the 2 poles
- The angle between the planes is measured in the plane containing the poles
- The angle determined graphically is 43° (measured to the nearest degree)



GEOLOGIC MAPS

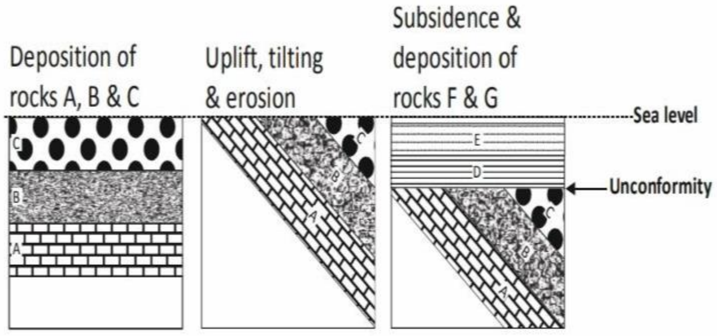


- **Elements of a geologic map**: rock types, relative ages, geologic contacts between different rock units, geologic structures (e.g., faults), & maybe topographic contours
- **Layer-cake stratigraphy:** planar (horizontal) layers with constant thickness & continue
- **Orientation of plane**: boundaries between units
- **Bed**: thin layers within the rock, each bed formed over a short period of time, & the surface of a bed formed the sediment surface at some point in the past
- **Units**: collection of adjoining bed that grouped together when have some similarity (mineralogy, palaeontology, structures) that indicate a process in their origin
  - ➢ Mappable & distinct from one another, but the contact doesn't have particularly distinct
  - ➢ Grouped together in stratigraphy as formations & members of formations
- **Outcrop patterns:** represent the intersection of 3D shape of the rock with the land surface
  - ➢ Where the rocks are flat & the land is not the boundaries will outcrop along topographic contour lines
  - ➢ **Vertical features (or plane):** straight line cut contours
  - ➢ **Horizontal layer:** follow the contour lines (parallel)
  - ➢ **Inclined layer**: intersect the contour line (intersecting with the contour lines along the straight line))
  - ➢ **Plunging folds**: not parallel in poth side of outcrops
  - ➢ **Non-Plunging folds:** parallel in poth side of outcrops
  - ➢ **Folds** forming V – shapes in valleys & ridges
- Geologists define the orientation of dipping beds using the terms **strike & dip**
  - ➢ **Strike**: azimuth (bearing on a compass) of a horizontal line on a bed (line perpendicular to

steepest angle of dip) (e.g. 090 for a bed striking EW)

- **Dip:** angle from the horizontal of the steepest gradient of the bedding surface (horizontal bed has a dip of N20E)
- Strike & dip are measured with a compass or clinometer on an area about 10cm x 10 cm
- Dip direction is from older to younger layers
- True dip is a line perpendicular to the strike & is the steepest line along the plane of the bed
- **Apparent dip** is the angle from a horizontal line that is not perpendicular to the strike

- **Dip variations** Folds & faults are the most common causes of variation in strike & dip
  - Folding & faulting , followed by subsequent erosion & deposition of a younger rock produces an unconformity
  - Unconformities are variations to the simplest case of sedimentary rocks, identifiable on maps as place where more than one younger rock is in contact with several older rocks

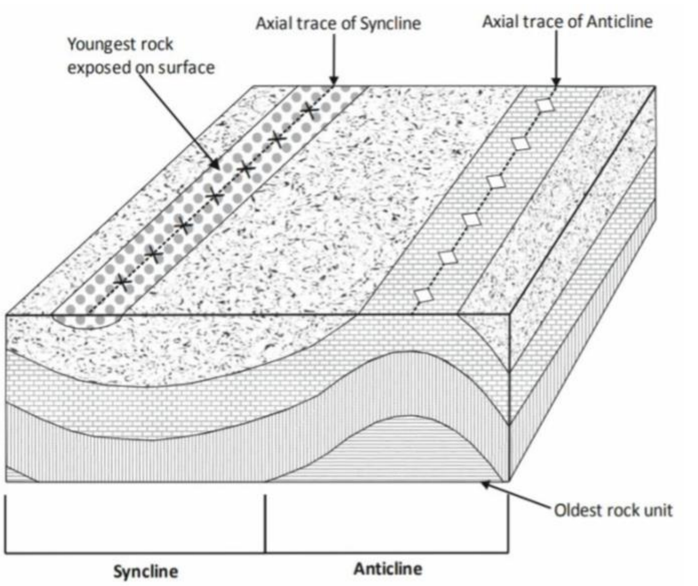


$$t = w \, x \, sin\theta = V \, x \, sin\theta$$

w =V= vertical thickness or width, θ=dip, t=True thickness

$$slope = \frac{\Delta Y}{\Delta X} = \frac{vertical\ distance\ (CI)}{horizontal\ distance\ (SI)}$$

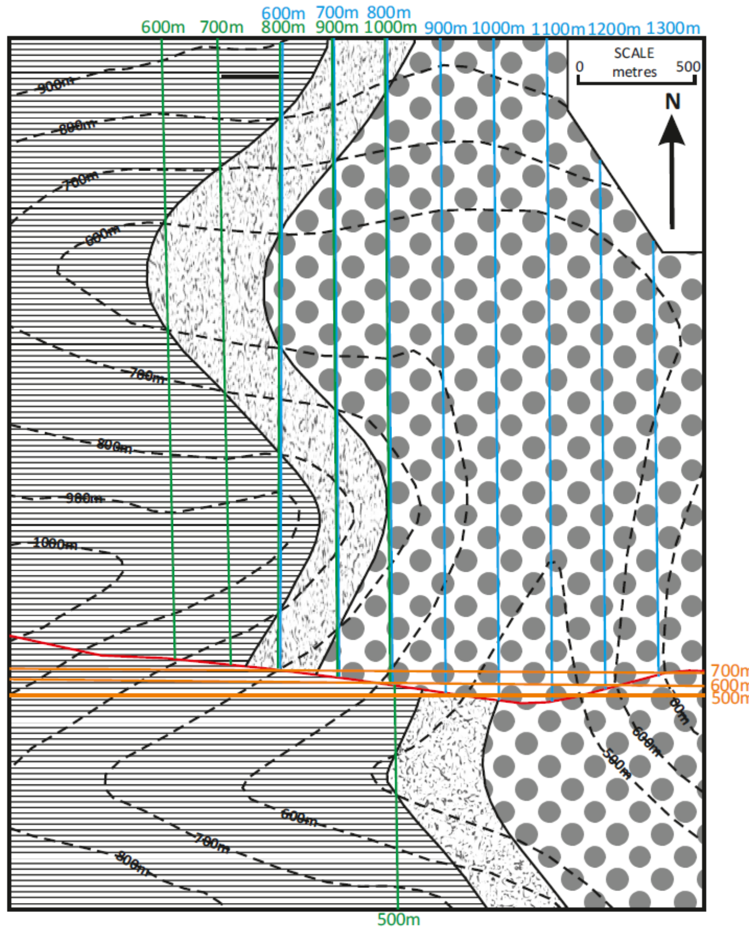
$$True\ Dip = tan^{-1}\left(\frac{CI}{SI}\right)$$



- Faults are surfaces in the Earth across which there has been some displacement , usually by cataclasis (the deformation of rock via crushing & shearing)
  - usually narrow in proportion to their length & breadth , often planar or gently curved & exist mainly in the top 10-15km of the Earth's crust
  - Below this depth , rock deforms in a plastic fashion , without fracturing, Because faults involve displacement, one of the targets of geologists is to quantify this displacement (ideally as a vector) .
    - Horizontal offset (displacement) is **heave**
    - Vertical offset (displacement) is **throw**
    - if horizontal beds are displaced horizontally, heave & throw are both zero
    - dipping beds with measurable heave & throw displacement could be solely horizontal, solely vertical or oblique

Study the map & the structural contour (strike). The numbers of the N-S strikes are related to the geological contacts & the E-W strikes represent the fault plane

ملاحظة: الخريطة لا يوجد عليها Kay والرموز المستخدمة غير قياسية سأفترض ان الطبقة الوسطى هي ال sandstones وفي حال كانت طبقة اخرى كل الحل خاطئ ☺



1. Determine the thickness of the sandstone

The differences between upper (green) & lower (blue) surfaces = 200m which is vertical thickness

2. Determine the apparent & true dips of the sandstone

$$\theta = tan^{-1}\left(\frac{CI}{SI}\right) = tan^{-1}\frac{100m}{0.5cmx500\frac{m}{cm}} = 22°$$

Strike & Dip: 000, 22°E

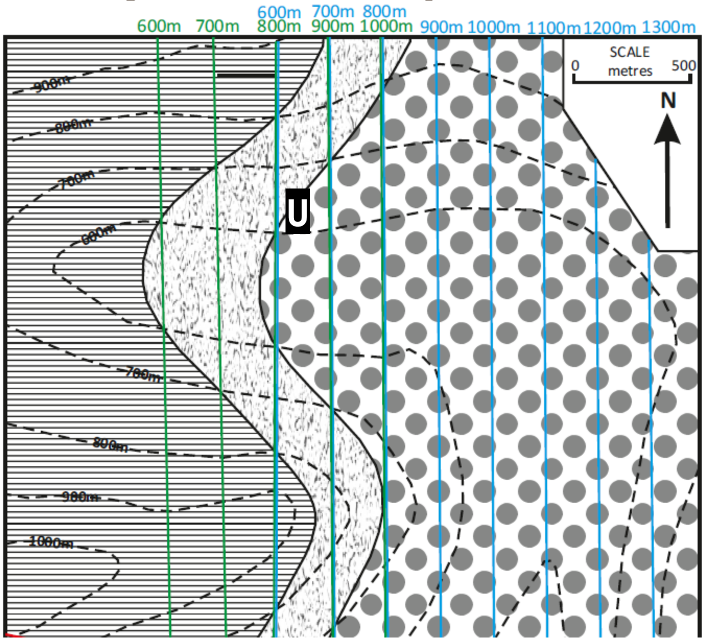
3. What is the type of the fault?

Strike-slip fault (right lateral)

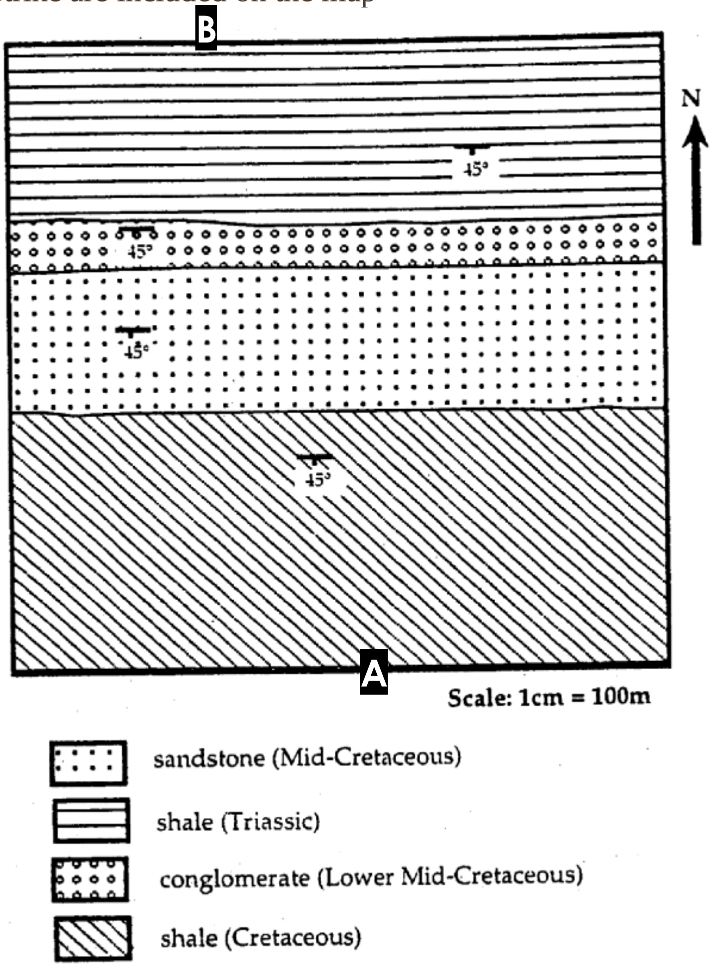
4. Determine the fault displacement

Heave, right lateral

5. Label the upper surface of the sandstone layer by writing the letter U on the map



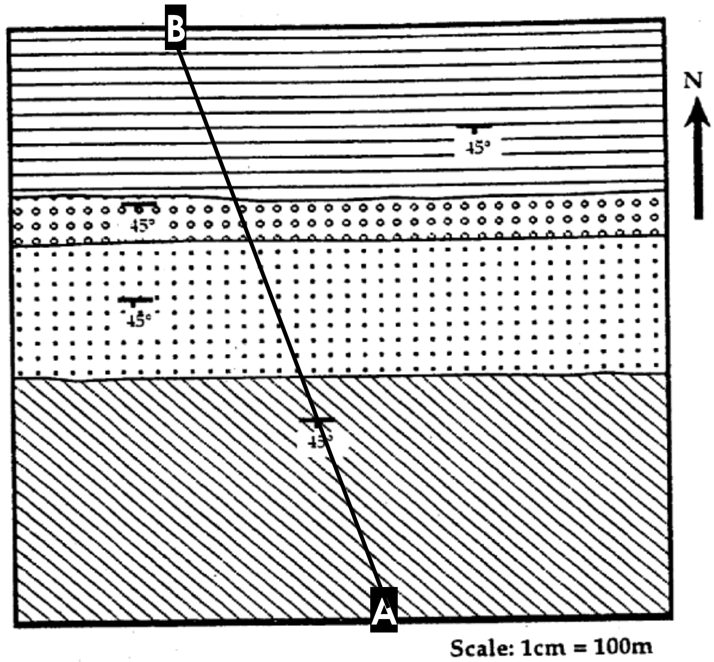
The following figure is a geological map of an area of flat ground showing how a sequence of sedimentary strata intersects the surface. The measurements of dip & strike are included on the map



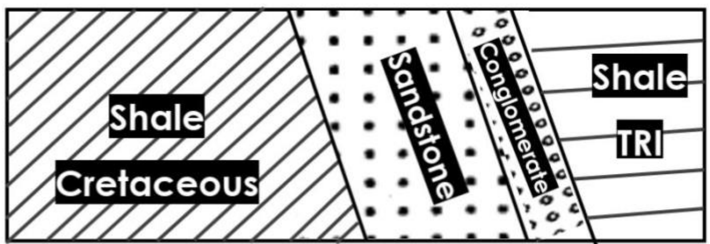
1. Write the dip & strike of the sedimentary layers in the formal way **090°,045°S**
2. When considering the ages of the rocks in the legend how can the rough contact between conglomerate & shale below it would be accounted for?

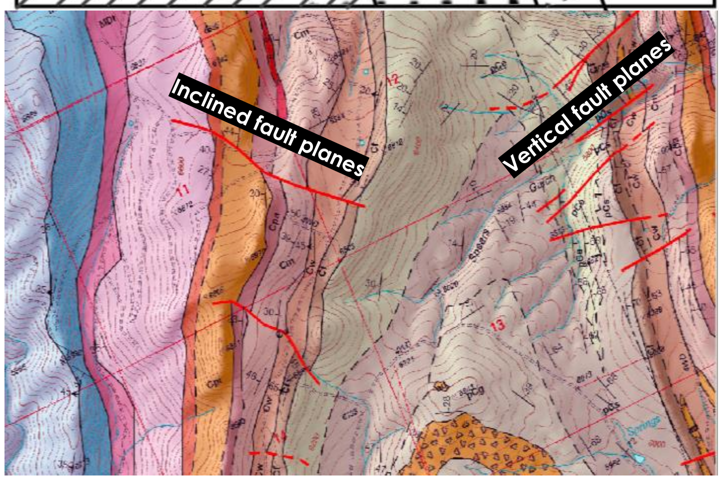
Unconformity (related to erosion & non deposition for longer time)

3. What type of dip angle is it in the direction A-B? **Apparent dip** What type of dip is the angle represented on the map? **True dip**, Are the 2 angles the same? **NO,** which one would you show on the cross section below? **Apparent dip** why? **Because the cross section is not a vertical line**



4. draw a cross section from A to B, the ground surface is horizontal. Use vertical scale of 1 cm = 50 m





Geological map of a plunging anticline

the width of outcrops how it varies within the same layer due to variation in erosion, slope, & dip angles (on both sides or limbs)