

Structural Geology

Practical 3

Stereonet 3

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STEREONETS 3 GEOLOGICAL APPLICATIONS OF STEREONETS

Problem 1 Determining the orientation of fold axis from bedding data

In an area of folding, the following bedding attitude data were obtained from an anticline during geological mapping.

112/73	318/63	012/31	307/74
106/57	086/39	105/66	313/72
094/61	329/54	059/36	345/36

- Plot the poles to these bedding planes.
- Mark onto your overlay a great circle which goes through as many of the poles as possible. This great circle represents a plane which is at right angles (termed orthogonal) to the fold axis (Or put another way, the fold axis is normal to this plane).
- Determine the orientation of the fold axis and state it as a plunge and plunge direction.
- Make a sketch showing the orientation of the fold relative to the plane you have drawn and mark on the fold axis.

Problem 2 Rotations to unfold a plunging fold and calculate the original orientations of palaeo-current indicators.

During geological mapping you come across **turbidite sequence which has been folded**. Palaeocurrent data is abundant on the bedding surfaces in the form of linear flute

casts. In order to include the **palaeogeographic palaeocurrent information in your mapping report, you must unfold the fold** in order to see the original orientation of the flute casts before they were rotated during deformation.

You collect the following data presented in Table 1

- **First, plot the poles to bedding and determine the orientation of the fold axis.**
- **On a second sheet of tracing paper, plot the plunge and plunge directions of the flute casts, numbering each point so that you can identify them later!!!**
- **Overlay both sheets of tracing paper and trace onto the sheet with flute cast data, the orientation of the fold axis.**

(OK that was the easy bit!)

- We must now re-orientate the data by rotating the overlays. We need to carry out two steps.

1) We must remove the plunge of the fold axis so that it is horizontal.

- We do this by placing the **fold axis on the east-west line** and marking the point which marks the intersection of the east-west line with the perimeter of the stereonet. This point represents the position of the fold axis after we have rotated it to horizontal.

How many degrees did we rotate the fold axis through? We must also rotate the all of the flute cast data by the same

amount and about the same horizontal axis. The small circles will be our guide-lines!

- We do this by counting along the small circle which the flute cast data points lie upon. (**Hint:** points which disappear off the edge of the stereonet must re-appear on the same small circle but on the opposite side of the stereonet). Mark the position of the rotated points in a different colour. (To help you revise form this, mark on the tracks which the points have taken with some arrows).

2) We must remove the fold by rotating the bedding planes and flute cast data about the fold axis until they are horizontal.

- Rotate the overlay so that the **fold axis overlies the north index** so that we can use the small circles as our guide-lines. Now simply move the new flute cast points along the small circles upon which they lie until they reach the perimeter of the net. **The compass bearings (azimuth) which the second set of rotated flute cast data represent the original palaeocurrent directions which existed before folding!!!!** Put the answers in the data table.

Problem 3 Determining the orientation of the fold axis from the apparent dip of bedding data (This is a very time consuming exercise. You will have to spend time at home completing this one).

In a folded metamorphic terrain the following pairs of data from four outcrops refer to individual compositional banding surfaces as observed on joint surfaces. Exposure between the outcrops is not good and the orientation of a

fold which lies in the area of the outcrops cannot be measured directly at outcrop.

- **From the following data presented in Table 2, determine the orientation of the fold axis** (**Hint:** Plot the poles to the compositional banding for each outcrop. The fold axis is the pole to the great circle which is defined by the poles to banding).

- **Complete only the parts of the Table 2 & 3 with a heavy outline.**

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Table 1

Observation No.	Bedding plane dip and strike	Plunge and plunge direction of the flute cast	Original orientation of the flute cast
1	223/75	24→036	
2	278/48	21→077	
3	330/50	42→098	
4	344/60	55→105	
5	240/60	27→043	
6	218/70	02→218	
7	330/60	55→069	
8	214/80	04→214	
9	300/48	43→060	
10	011/80	24→016	

Table 2

Outcrop Number	Dip and strike of joint	Pitch of the line of intersection between the banding and the joint	Plunge and plunge direction of the line of intersection between banding and the joint	Orientation of banding (Give dip and strike of the planes and plunge and plunge direction of the poles to the planes)
1			45→264 45→132	
2	180/21 118/40	117 60		
3	135/50 171/30	136 70		
4	251/70	39	53→292	

Table 3

Orientation of the plane defined by the poles to banding	Orientation of the fold axis