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UNPUBLISHED REPORT 1984/87

Short course: Stratigraphy and structural characteristics of the folded rock-units on the north coast, Tasmania

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D.B. SEYMOUR

SHORT COURSE : STRATIGRAPHY AND STRUCTURAL CHARACTERISTICS OF THE FOLDED ROCK-UNITS ON THE NORTH COAST, TASMANIA.

WEDNESDAY 7 NOVEMBER

9.15 a.m.	Meet at Pipers River P.O./Store
9.45	Bellingham - general introduction
10.00	Talk - Mathinna Beds (EW)
10.15	Talk - Folds (EW)
10.35	Collection of field data - minor structures within a selected single fold of a thin sandstone bed.
11.35	Data collection - minor structures within a selected single fold of a thick sandstone bed.
12.30 p.m.	Drive to Stony Head (25 mins. to Bridport Rd. : 35 mins. to Stony Head).
1.30	Lunch at Stony Head
2.00	Talk - Summaries ref. Mathinna Beds, Folds, and notes on kink folds (EW)
2.30	Data collection - minor structures of selected single fold of a sandstone bed.
4.00	Drive to Bridport Road and Devonport
6.00	Register at Gateway Motor Inn, Devonport
7.00	Dinner
8.00	Talk - Stereonets (EW)
8.20	" - Profiles (EW)
8.30	Field data plots
9.30	Talk - Cleavage (DBS)
10.00	" - Cleavage at Bellingham (EW)
10.20	" - Folded rocks of Tasmania (EW)
10.40	Finish.

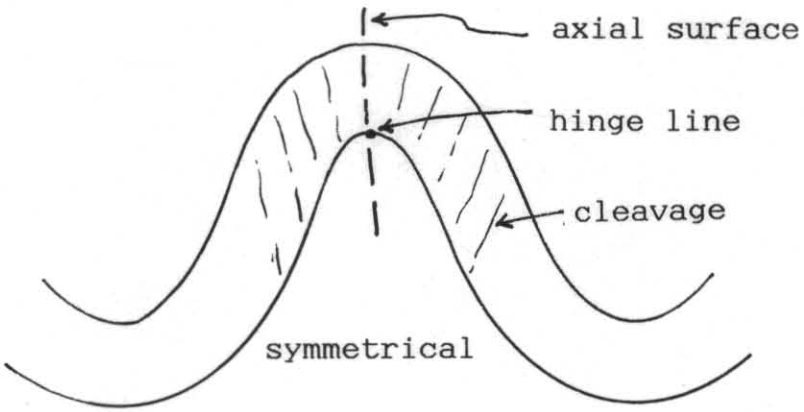
THURSDAY 8 NOVEMBER

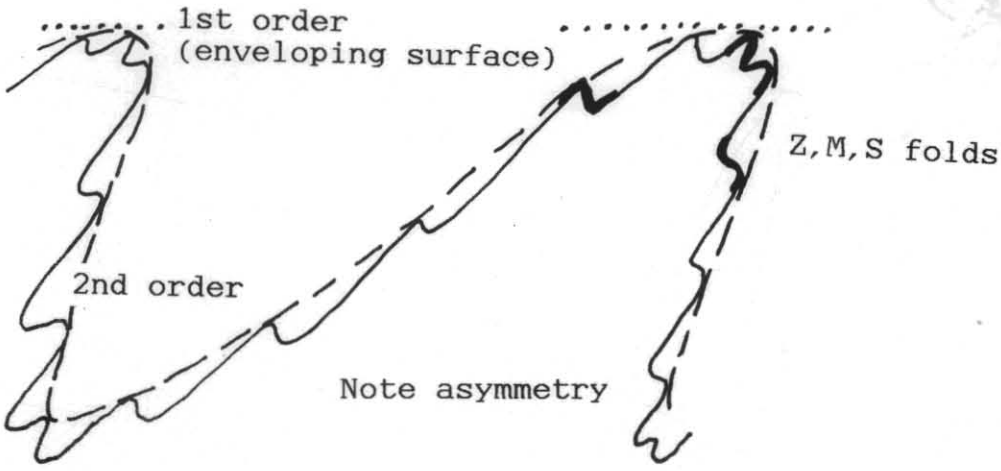
8.30 a.m.	Depart Motor Inn
10.00	Badger Head - data collection - minor structures within selected single fold.
11.00	Talk - Badger Head geology and superimposed folds (EW)
11.40	Depart Badger Head
12.00 p.m.	Flowery Gully turn-off - brief examination of sequence
12.30	Drive to Grunter Hill, near Mole Creek
1.40	Lunch at Grunter Hill
2.10	Talk - Mole Creek area (DBS)
2.30	Gordon Limestone - brief examination
2.40	Drive to Cethana area
3.20	Cethana unconformity - brief examination
3.30	Drive to Lorinna Road
4.00	Talk - Round Hill geology (DBS)
4.10	Data collection - cleavage at Lorinna Road unconformity
4.50	Drive to Devonport
5.40	Register at Devonport Motor Inn
6.15	Talk - Stony Head (EW)
6.35	Break
7.00	Dinner
8.00	Talk - Strain analysis (DBS)
8.30	" - Areal distribution of rock-units during Early Palaeozoic times (EW)
8.50	" - Proposals for seismic reflection profiles in Tasmania (EW)
9.10	Finish.

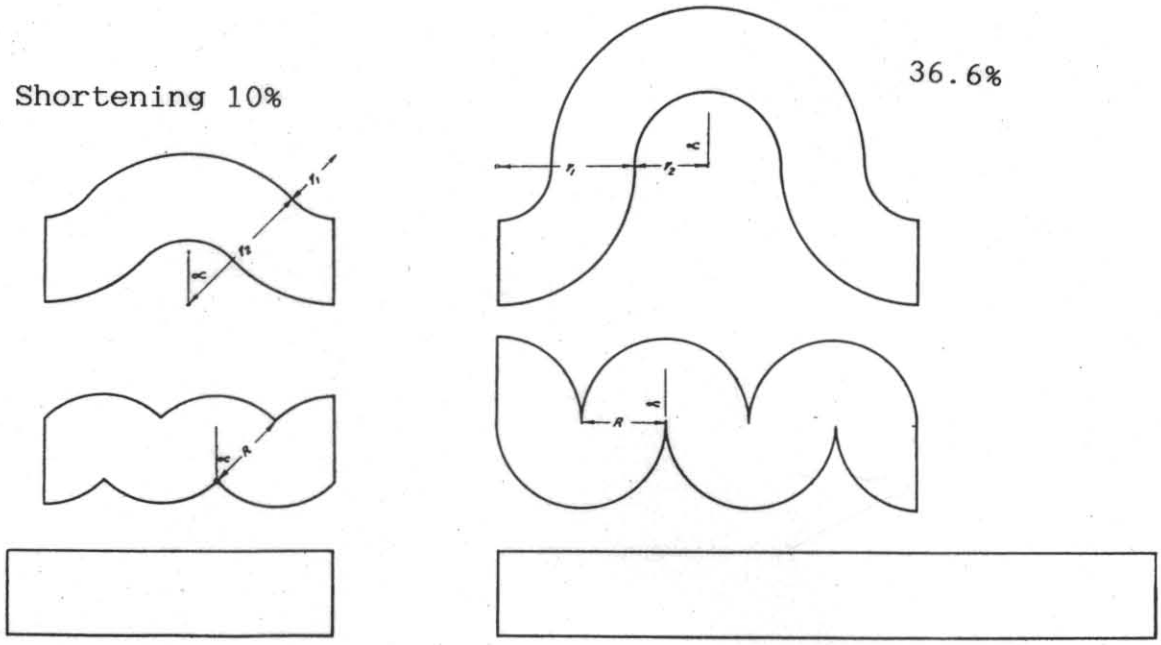
FRIDAY 9 NOVEMBER

9.15 a.m.	Depart Motor Inn
9.45	Picnic Point, Ulverstone
	Talk - Dial Range geology (EW)
10.00	Brief examination of Picnic Point
10.15	Drive to Goat Island for data collection
12.00 p.m.	Brief examination of Burnie Formation at Goat Island
12.25	Drive to Penguin unconformity for brief examination
1.05	Drive to Sulphur Creek unconformity for brief examination
1.30	Lunch
2.00	Drive to Eugenana
2.40	Examine and discuss structures at Eugenana quarry
3.25	Depart for Burnie
4.30	Burnie and finish.

FOLDS





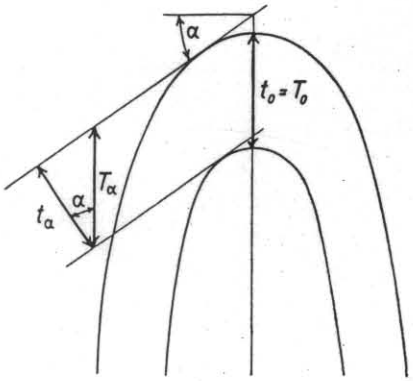


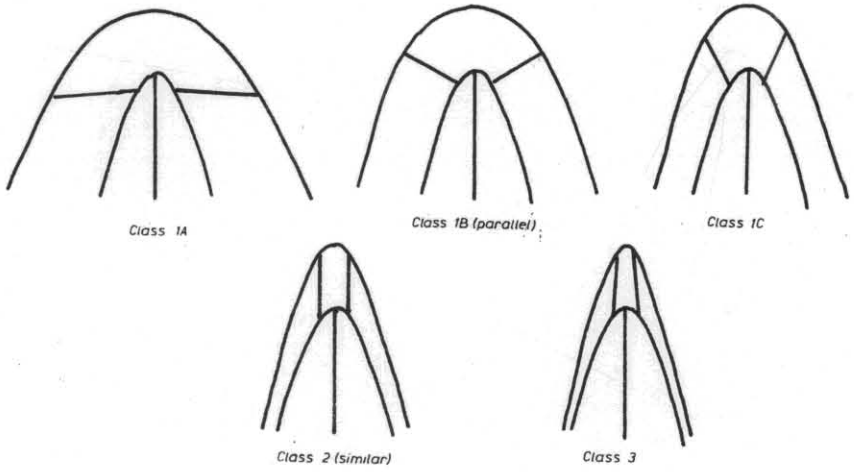
after Williams 1967

5 cm

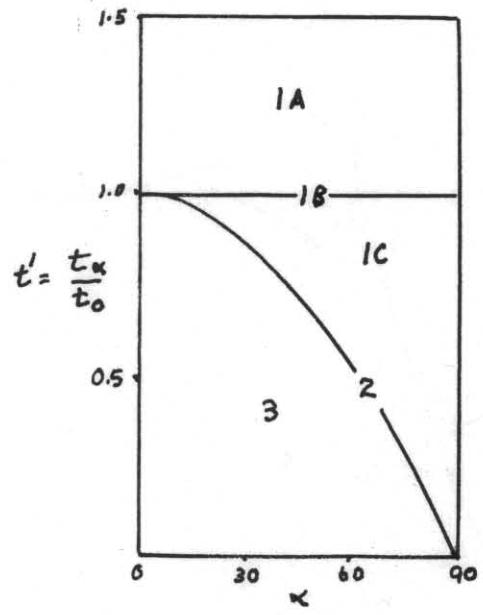
5 cm

after Ramsay 1962





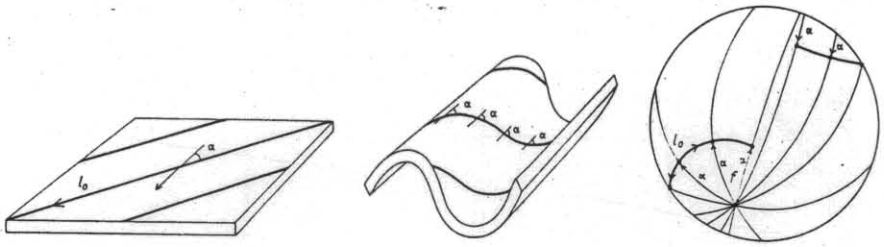
Fold classes. Dip isogons for $\alpha = 60°$ from lower to upper surfaces.



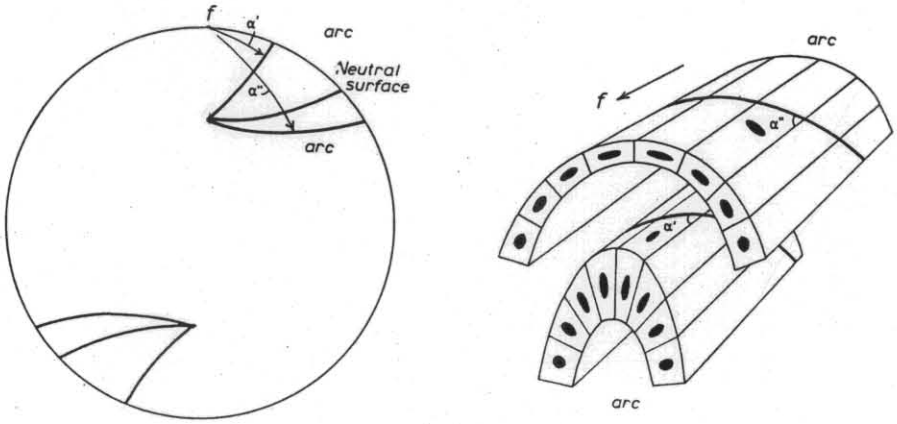
Plots for fundamental fold classes.

5 cm

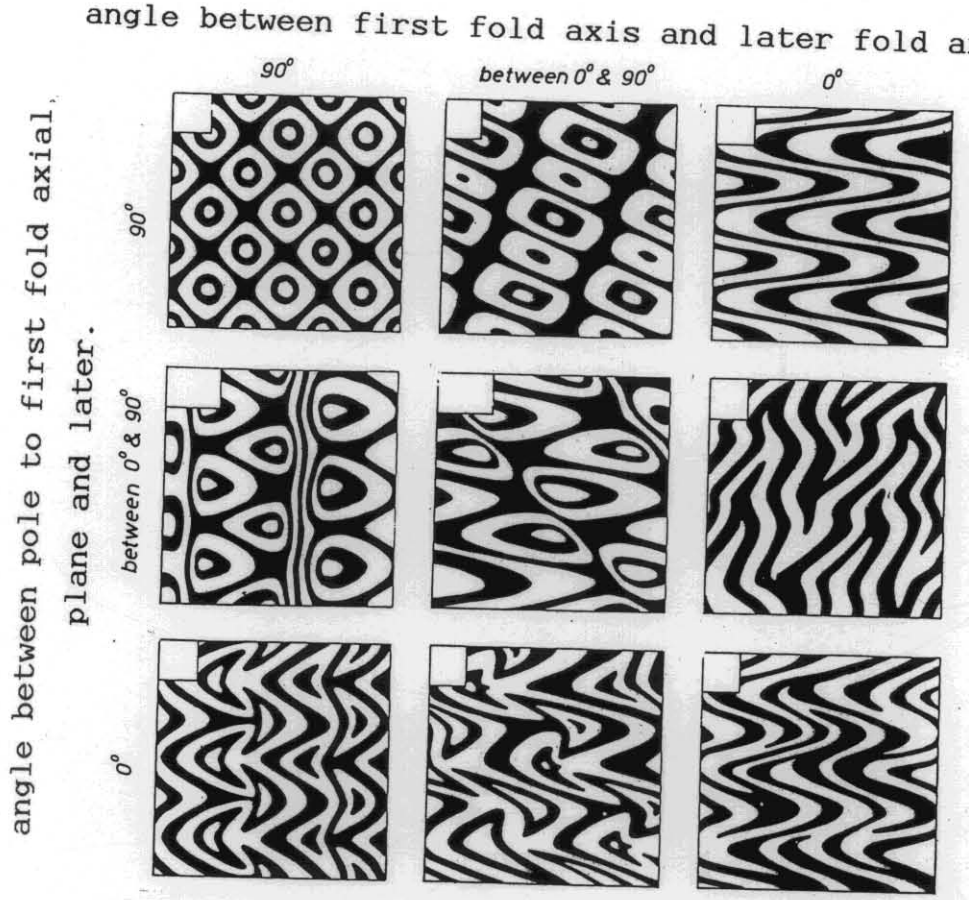
after Ramsay 1962.



Flexure folding deformation of linear structures



Linear structures deformed by buckling and internal deformation

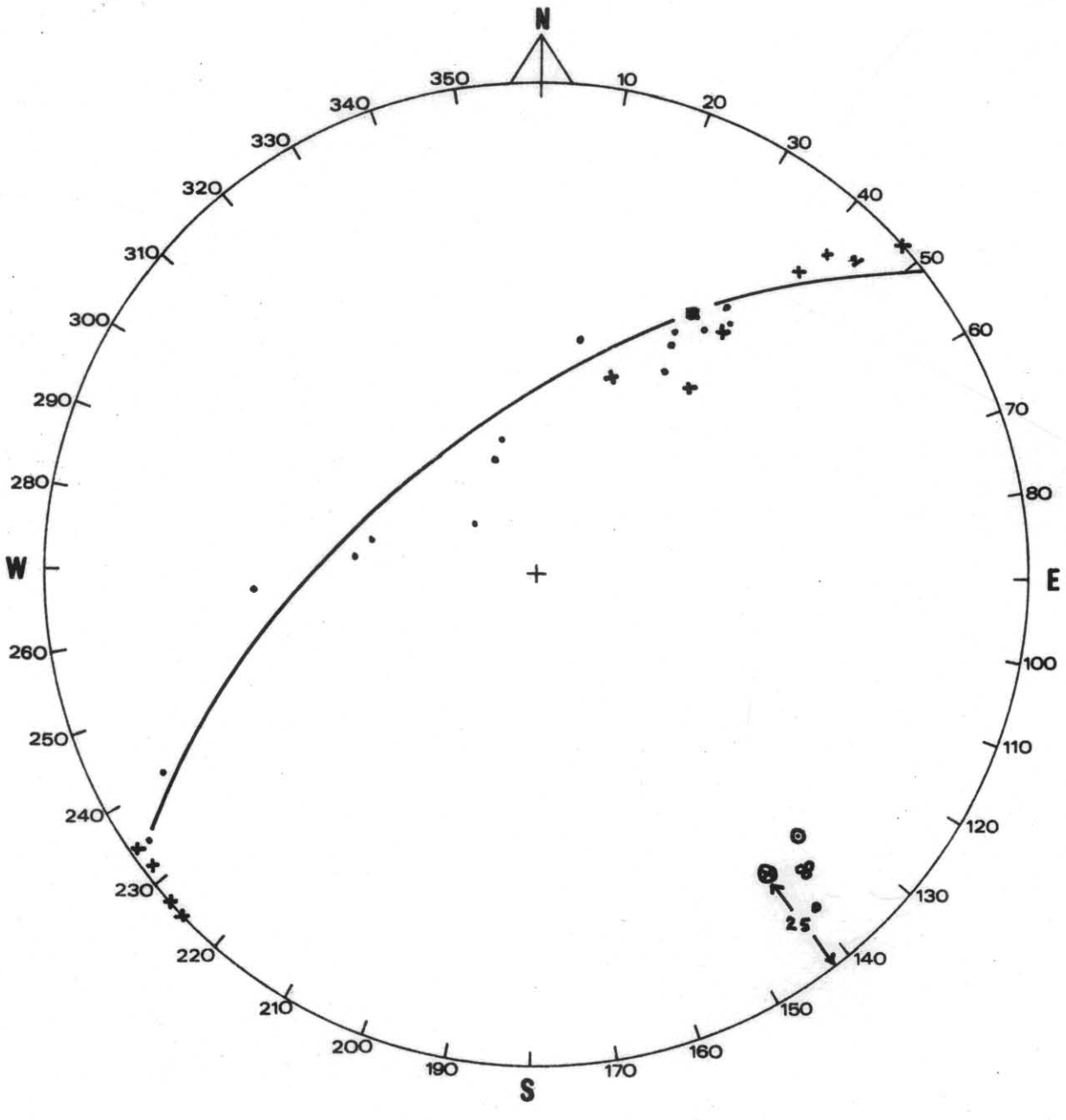


Rock type distribution produced by two successive foldings

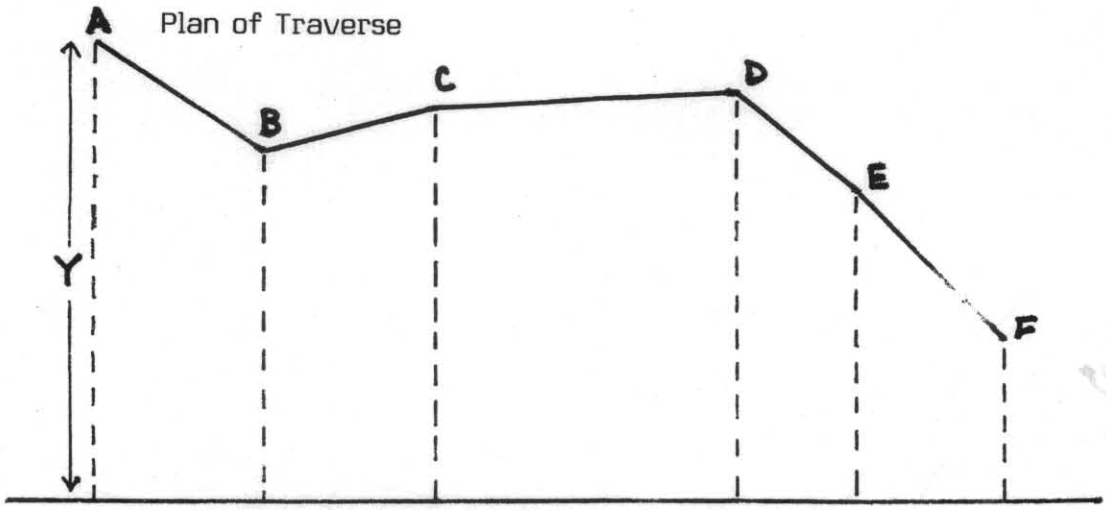
BELLINGHAM

Single fold of comparatively thin sandstone layer.

- • Bedding pole, right way up
- ⁄ " " , overturned
- \+ Cleavage pole
- ○ Bedding/cleavage intersection lineation
- ⊙ Fold hinge line
- ■ Pole of axial surface
- ⊗ Pole of best fit great circle

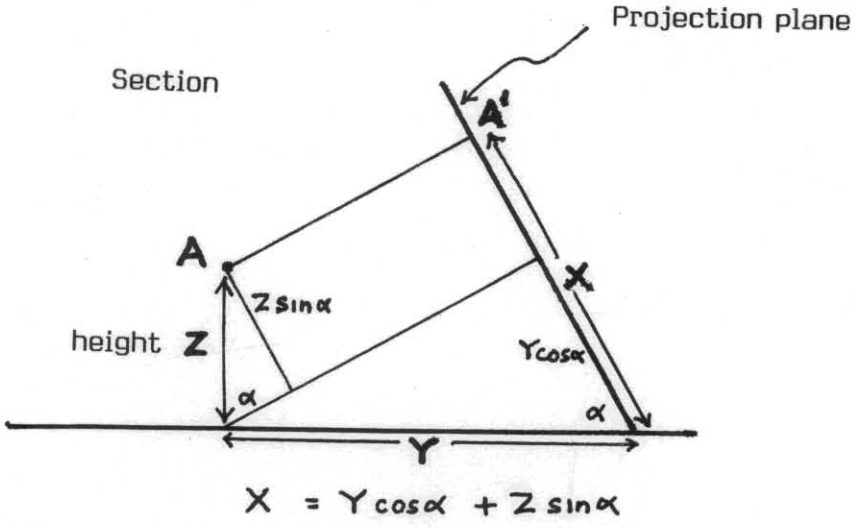


Plotting and Construction of Profiles



Selected projection plane (datum line)

Strike γ Dip α



$X = Y\cos\alpha + Z\sin\alpha$

Note: for coastal sections height is zero

5 cm

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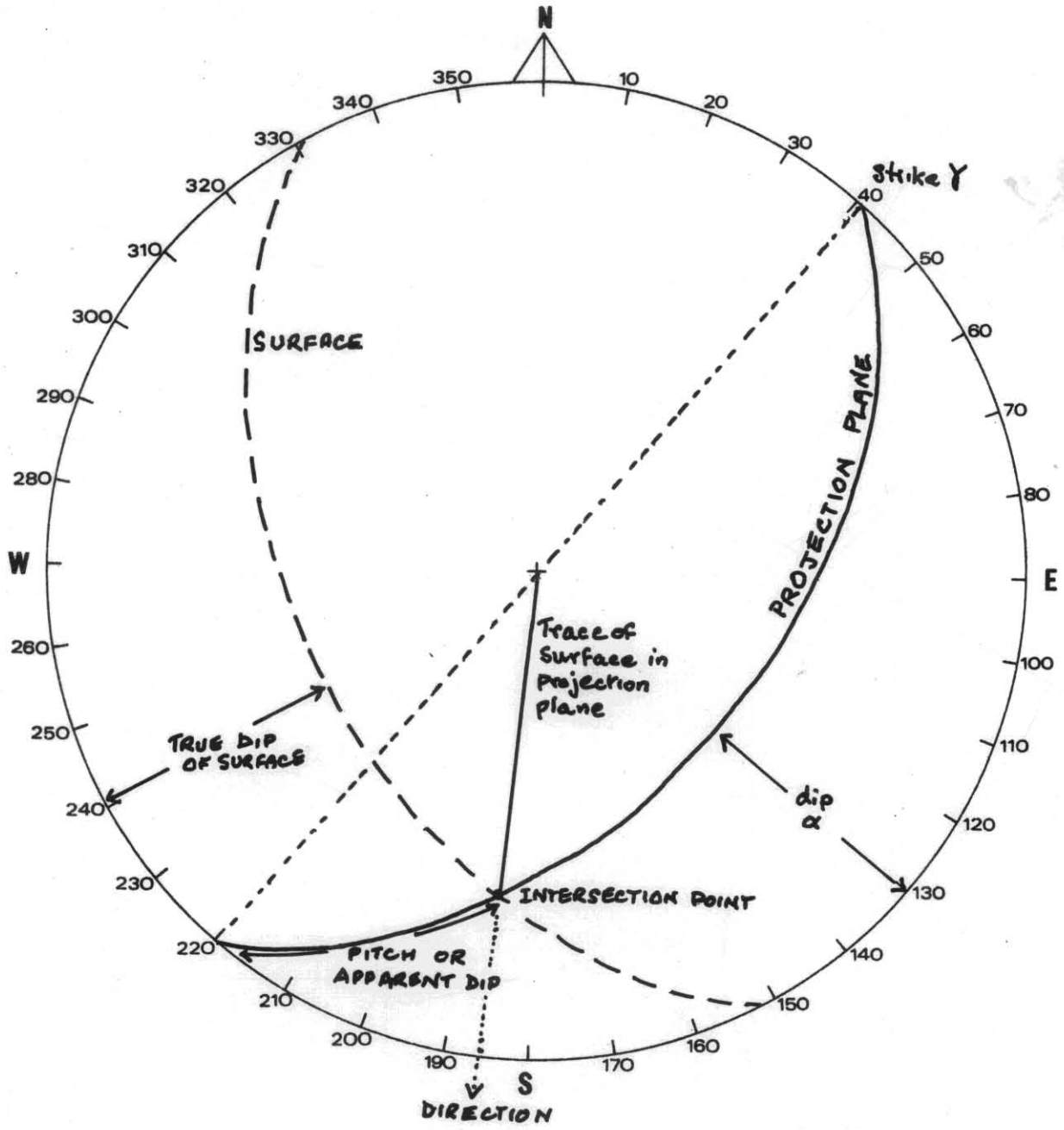
4 "

Plot of structural features (e.g. surfaces) as trace on projection plane



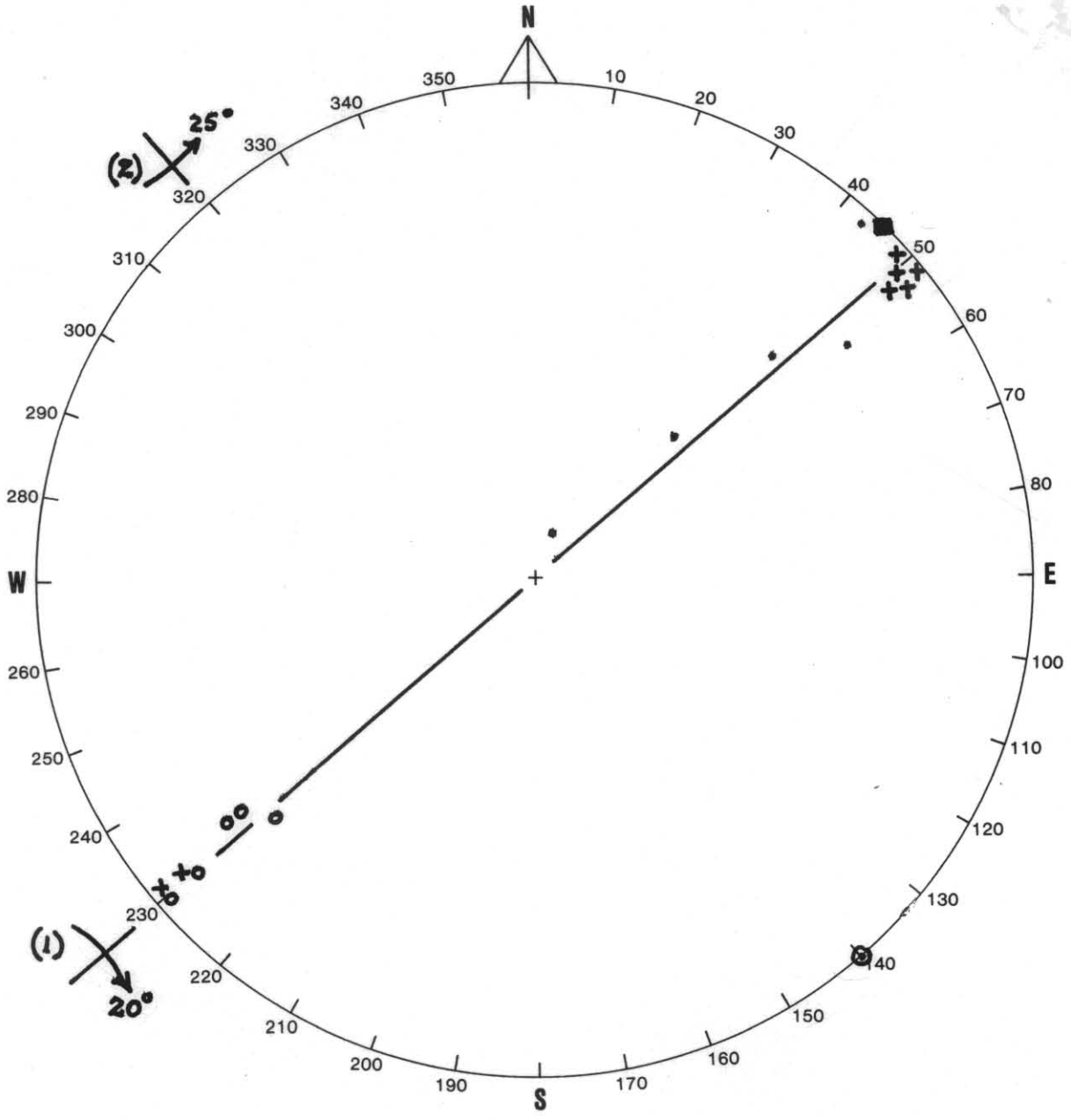
5 cm

BELLINGHAM

Rotation of western limb of fold to upright.

Western limb of fold of thin sandstone/mudstone

- • Bedding pole, right way up
- o Sandstone cleavage pole
- \+ Mudstone cleavage pole
- ⊙ Fold hinge line
- ■ Pole of axial surface



12/27

5

BELLINGHAM

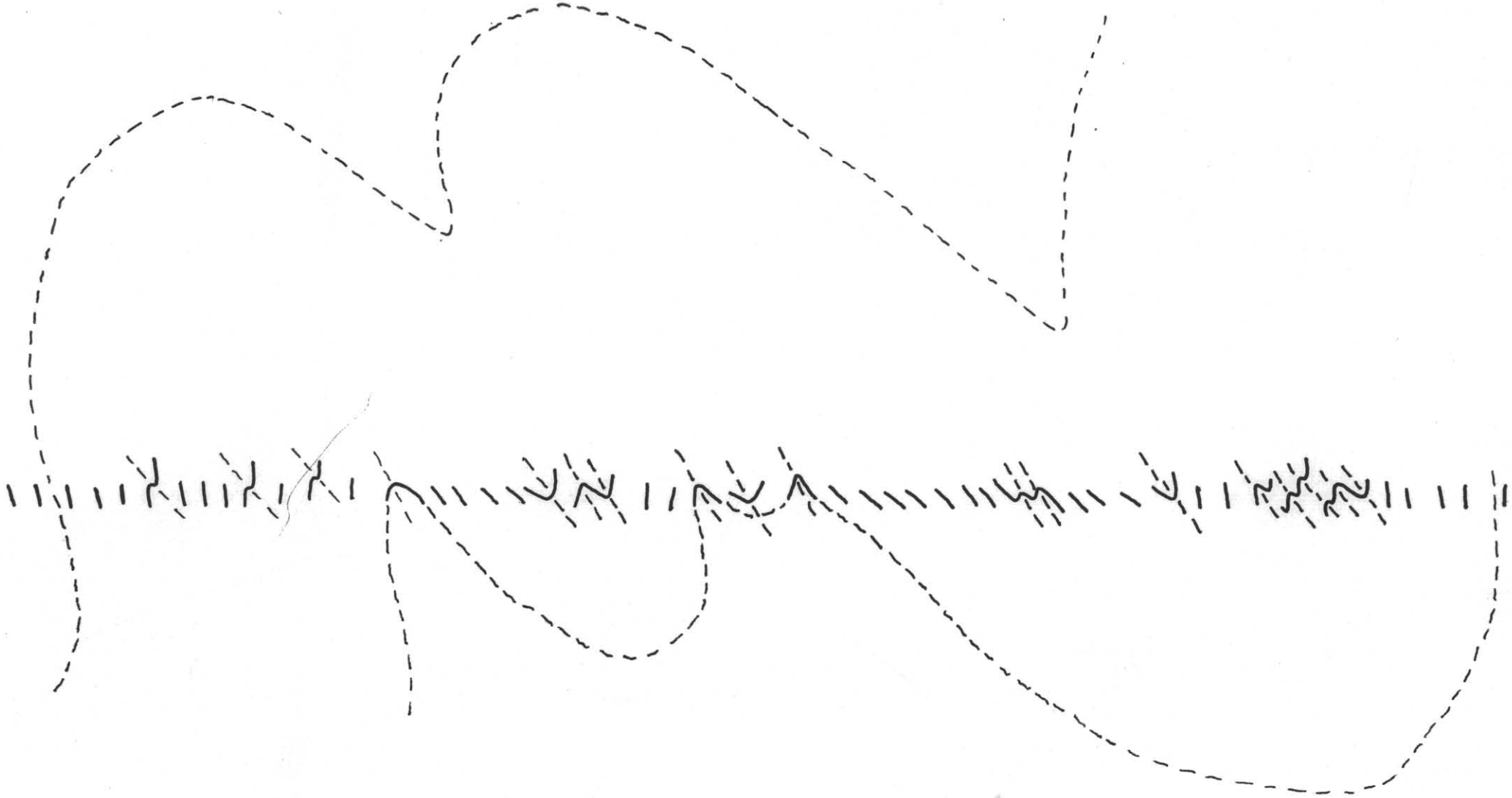
Selected profile : projection plane 45°/80° to 315° : view 135° declination 10°.

5 cm

Scale

0 15 30 m

Total stratigraphic thickness at Bellingham 207 m.



5 cm

BELLINGHAM

Single fold of comparatively thick sandstone layer.

a,b,c,d,e,f. Sets of readings around fold.

1. Bottom bedding pole
2. Pole of cleavage at bed bottom.

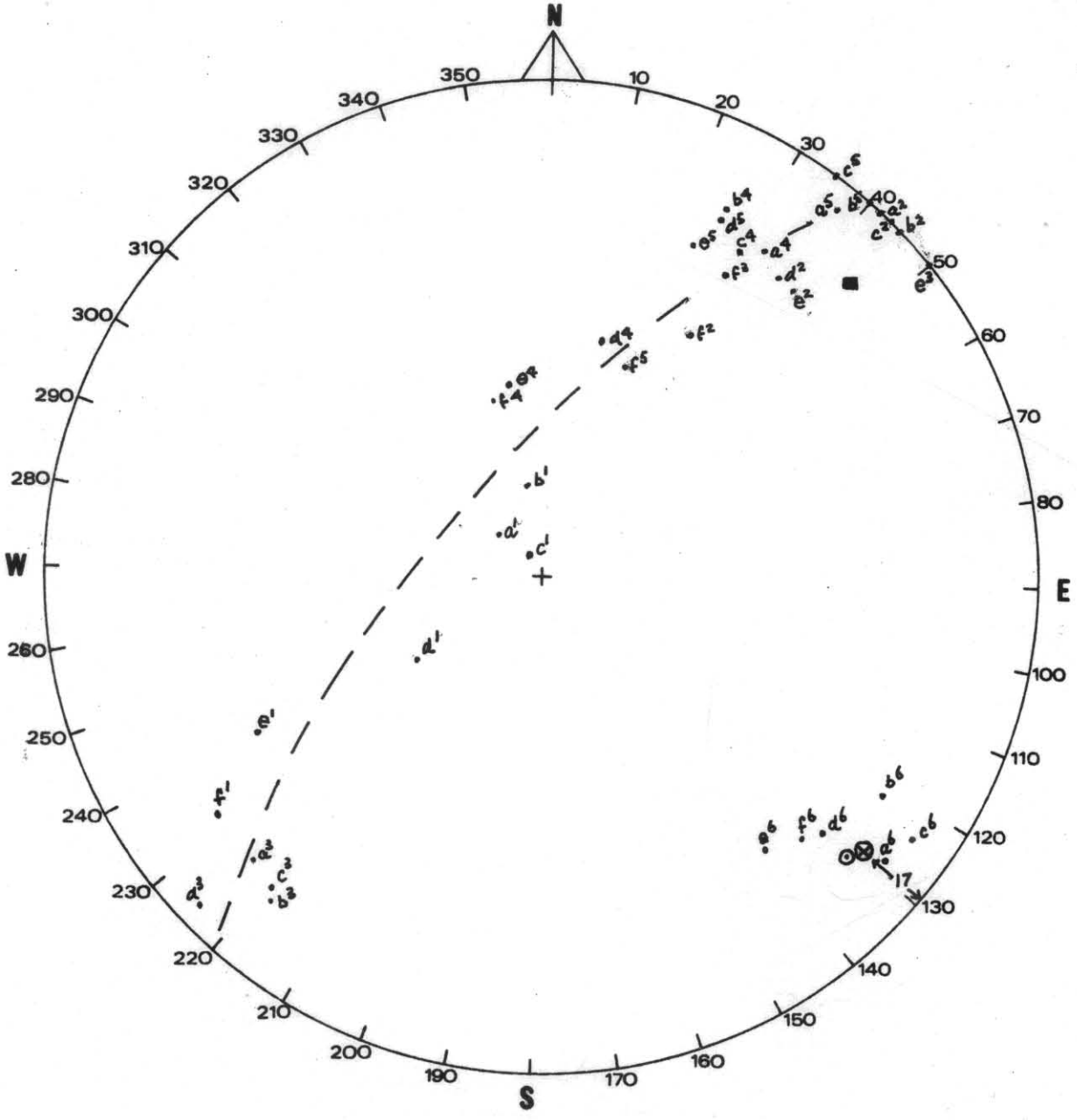
3 & 4. Poles of conjugate cleavages of middle of bed.

5. Pole of cleavage of bed top.
6. 3 & 4 intersection lineation.

⊙ Fold hinge line.

■ Pole of axial surface.

⊗ Pole of best fit great circle.

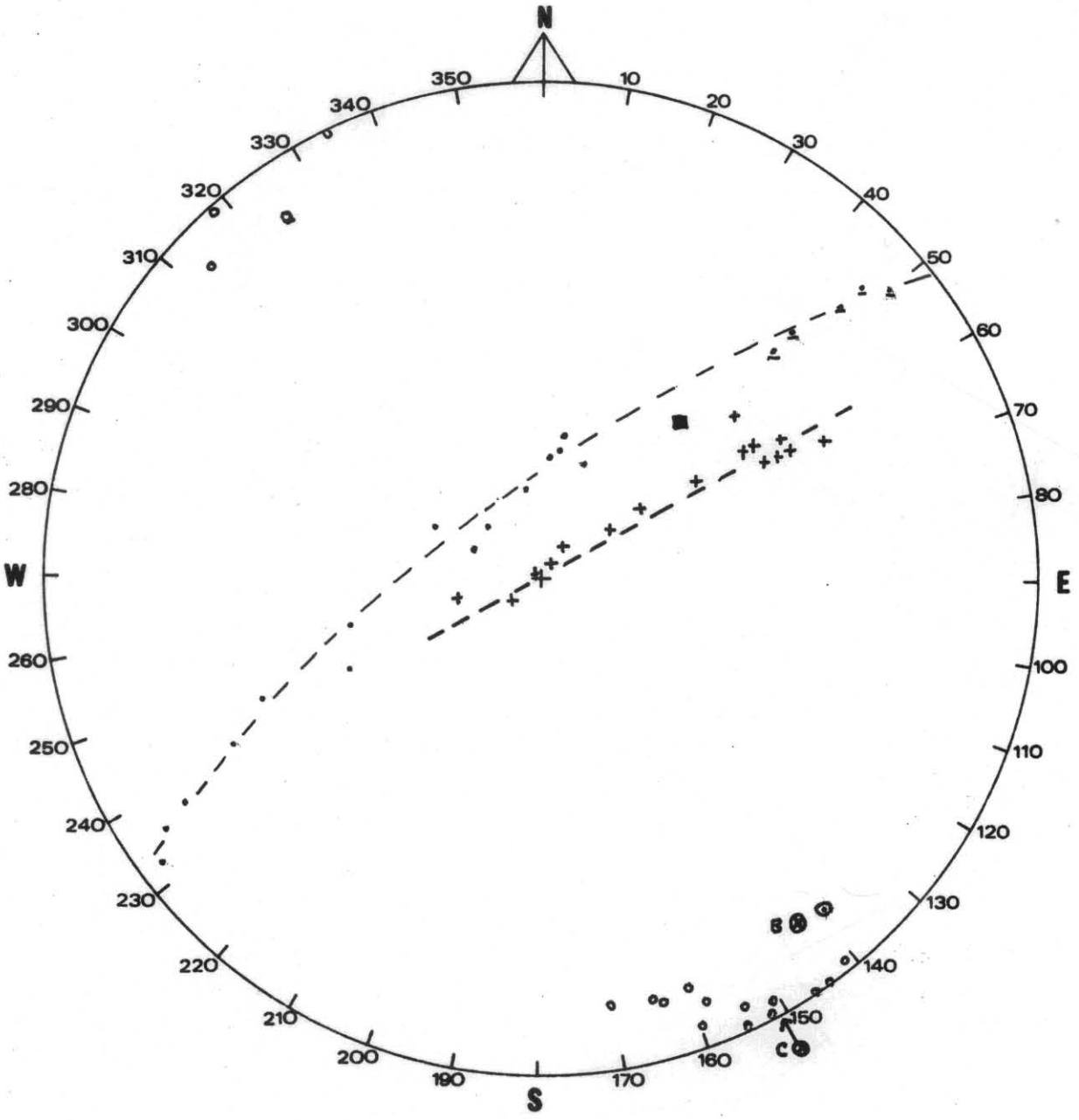


5 cm

STONY HEAD

Single fold of sandstone layer.

- • Bedding pole, right way up
- ⊙ " " , overturned
- \+ Cleavage pole
- ○ Bedding/cleavage intersection lineation
- ⊙ Fold hinge line
- ■ Pole of axial surface
- B ⊗ Pole of best fit circle for bedding poles
- C ⊗ Pole of best fit circle for cleavage poles

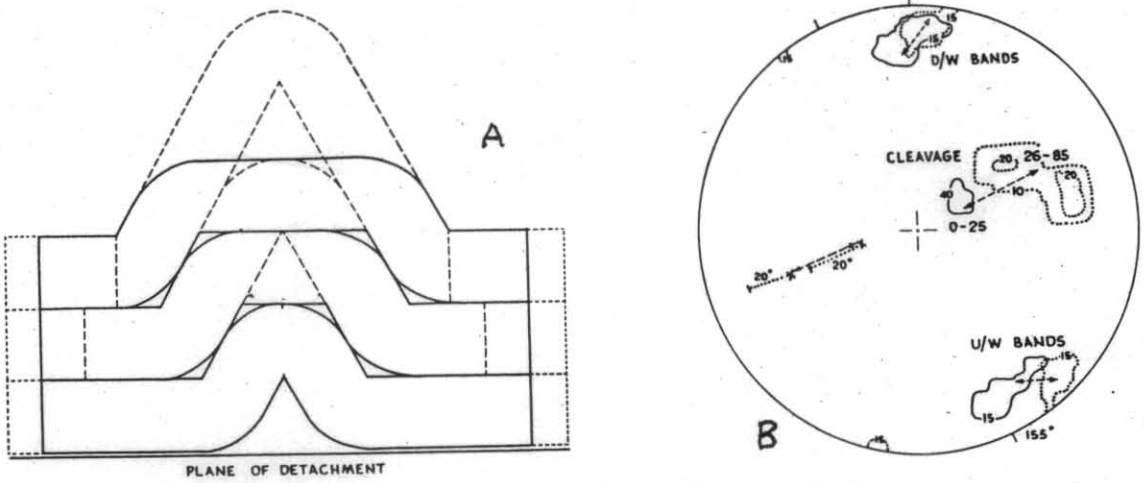


DEVELOPMENT OF A FOLD

STONY HEAD

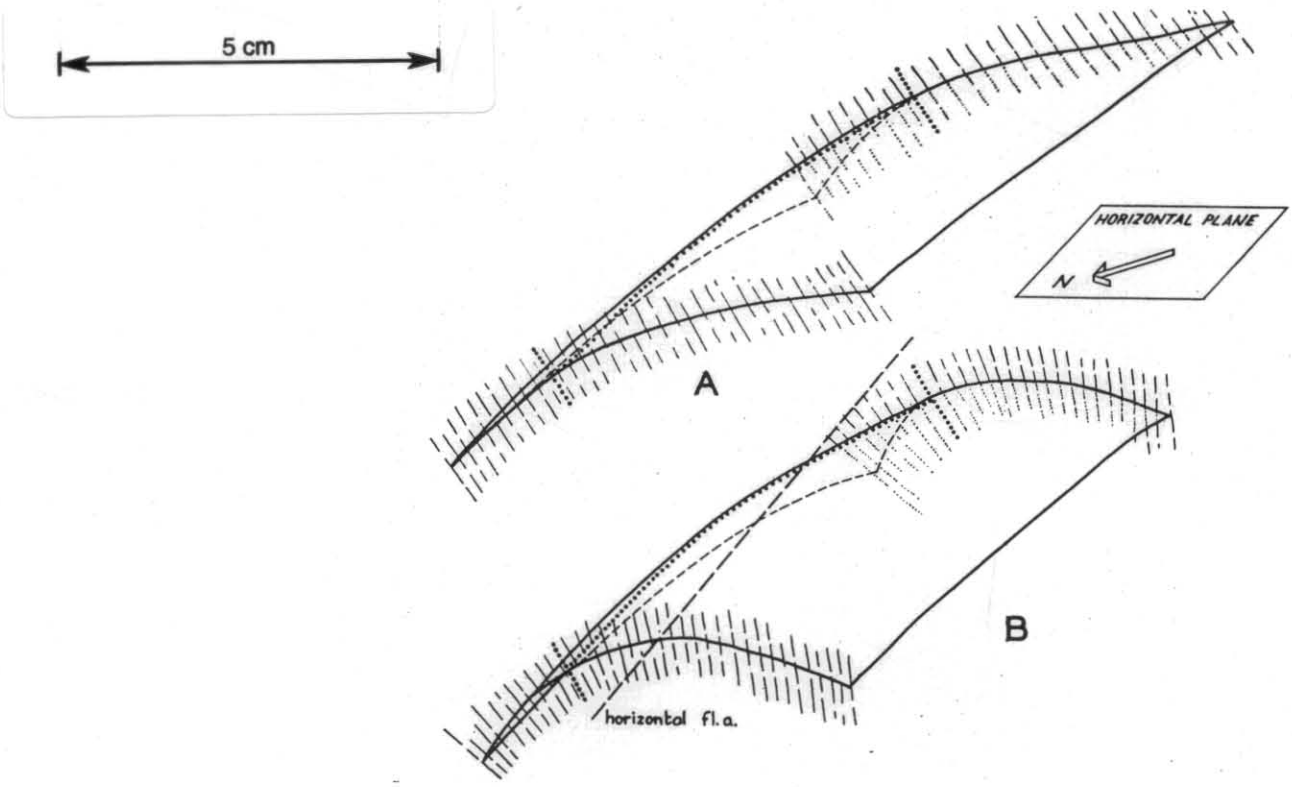
8

After Williams, 1970



A. Profile section giving comparison of deformation of layers by chevron folds and conjugate kink-bands. Ends of undeformed layers of small dashes; model of conjugate kink-bands solid line; model of chevron folds of large dashes where not coincident with conjugate kink-band model.

B. D/W and U/W bands with cleavage of dip 0–25° (110 readings: D/W 64, U/W 46) = unbroken lines; 26°–85° (115 readings: D/W 40, U/W 75) = dotted lines. Contour intervals of bands ≥ 15%; cleavage 0–25°, ≥ 40% and cleavage 26°–85°, 10–20%, ≥ 20%. Broken lines with arrow ends are partial small circles related to horizontal axis of direction 155°. Crosses indicate lines of intersection of bands of plunge of 20° with respect to corresponding cleavage surfaces.



View east-southeast of diagrammatic representation of development of folded sandstone layer, Stony Head. Solid lines are margins of deformed bed and thin broken lines hidden margins. Cleavage trends in profiles shown by thin impersistent lines and lines of small dots where hidden. Large dots indicate early fold hinge-lines within bed and trace of axial surface in profiles.

A. Sandstone layer folded with development of cleavage sub-parallel to axial surface.

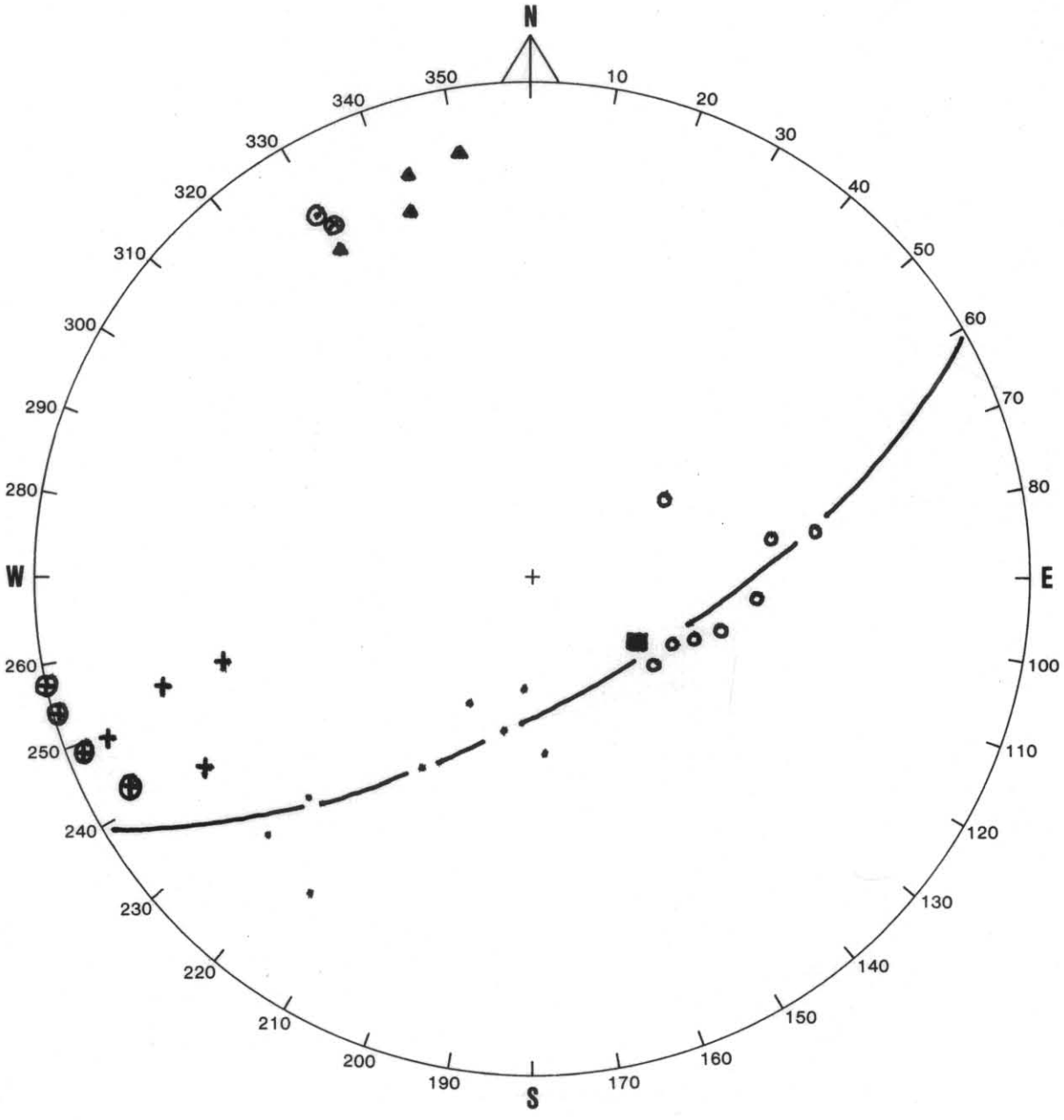
B. After formation of kink-bands folded sandstone layer inhomogeneously flattened about horizontal intermediate axis (fl. a) within cleavage subparallel axial surface of earlier fold, with maximum extension at right angles and parallel to cleavage surfaces.

5 cm

BADGER HEAD

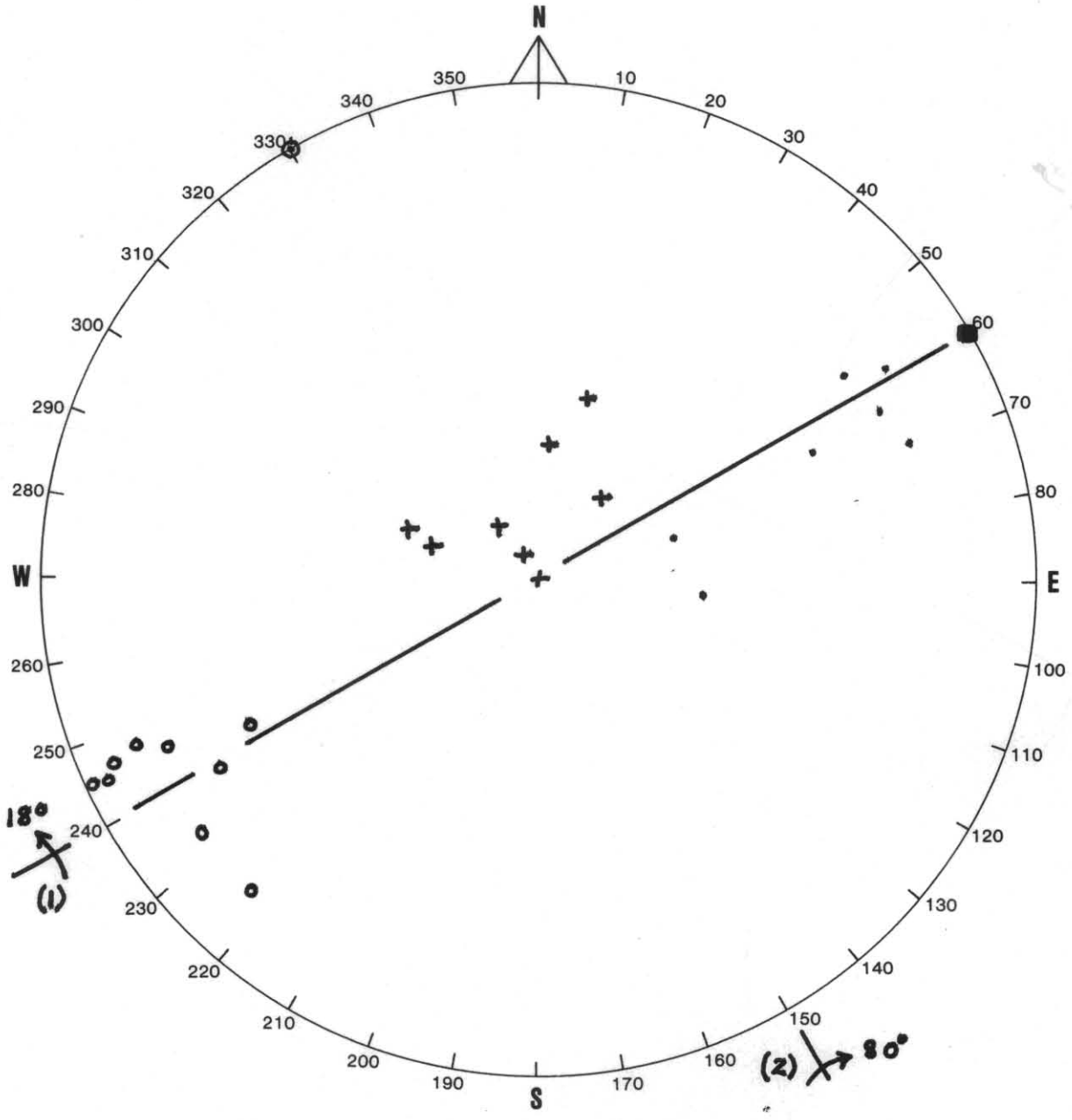
Upper western limb of overfold of sandstone/mudstone

- • Bedding pole
- o Sandstone dominant cleavage pole
- \+ Mudstone dominant cleavage pole
- ⊙ Fold hinge line
- ■ Pole of axial surface
- ⊗ Pole of best fit circle
- ▲ Minor fold associated with mudstone dominant cleavage
- ⊕ Pole of axial surface of minor fold and mudstone dominant cleavage



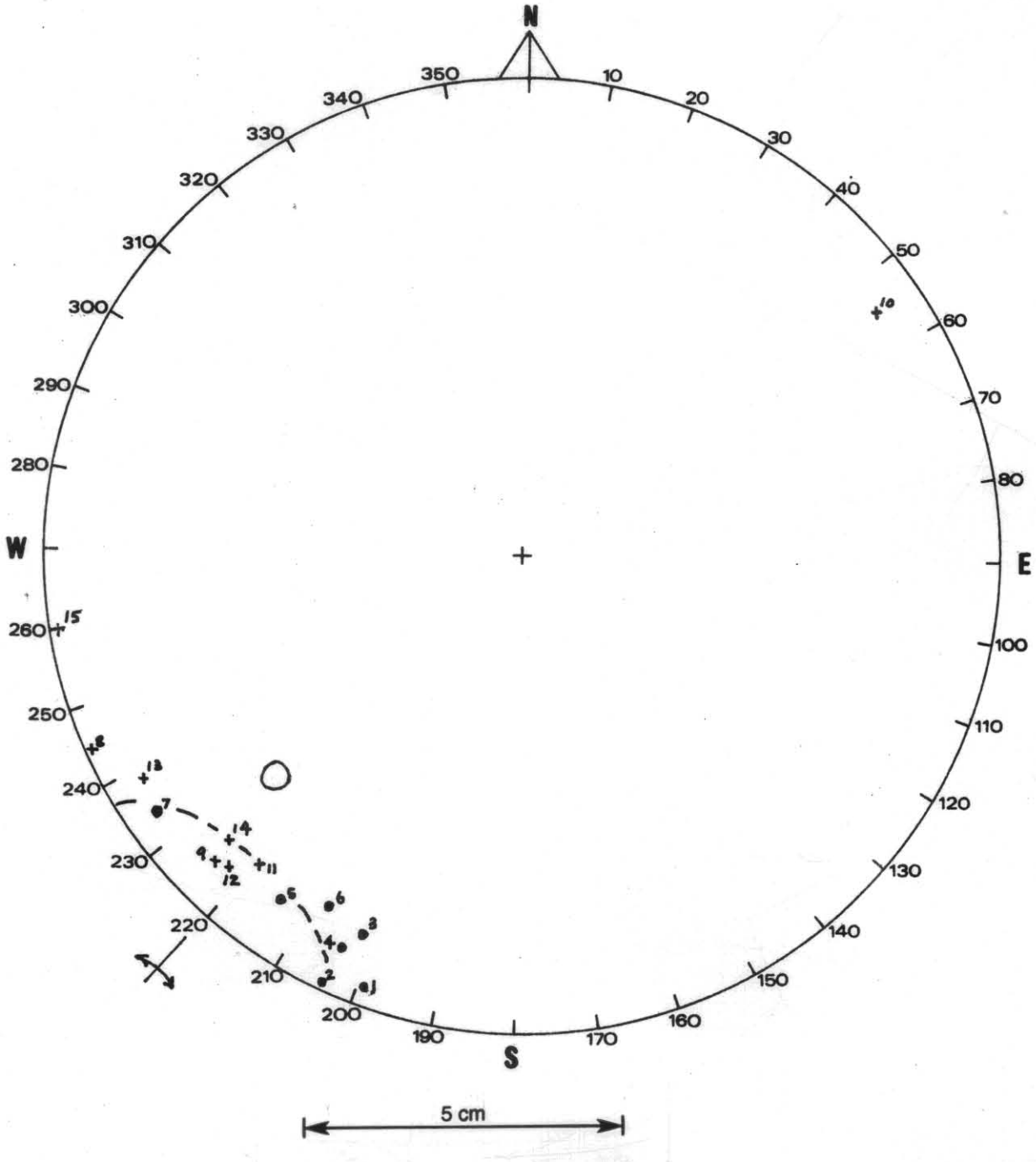
BADGER HEAD

Rotation of upper western limb of overfold to upright.



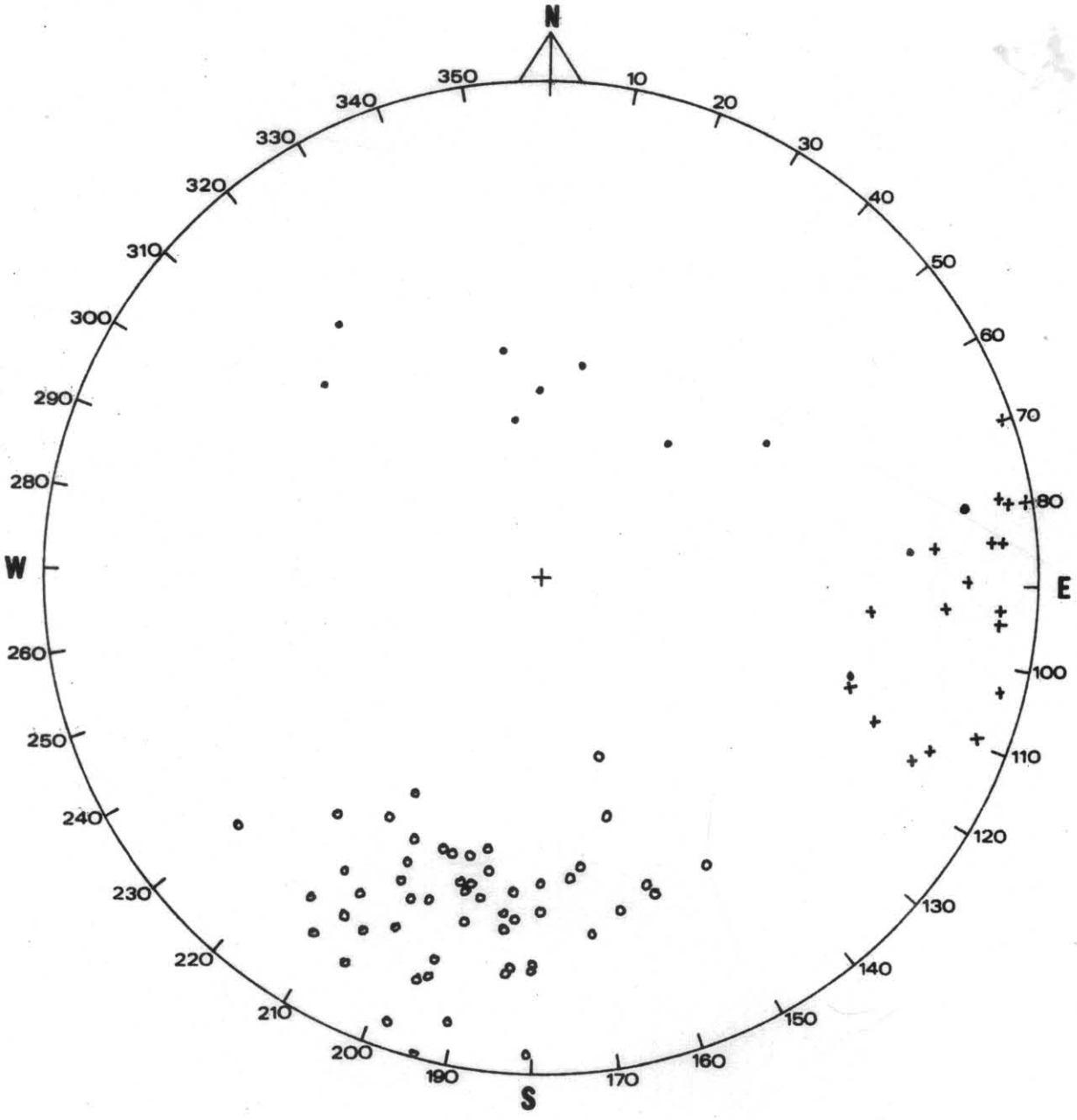
LORINNA UNCONFORMITY

- • Cleavage poles of underlying Cambrian siltstone with locality numbers indicating proximity to unconformity (1 - 7 nearest).
- o General pole of Cambrian siltstone.
- \+ Cleavage poles of volcanic pebbles within overlying basal comglomerate of Ordovician sequences with locality numbers indicating proximity to unconformity (8 nearest - 15).



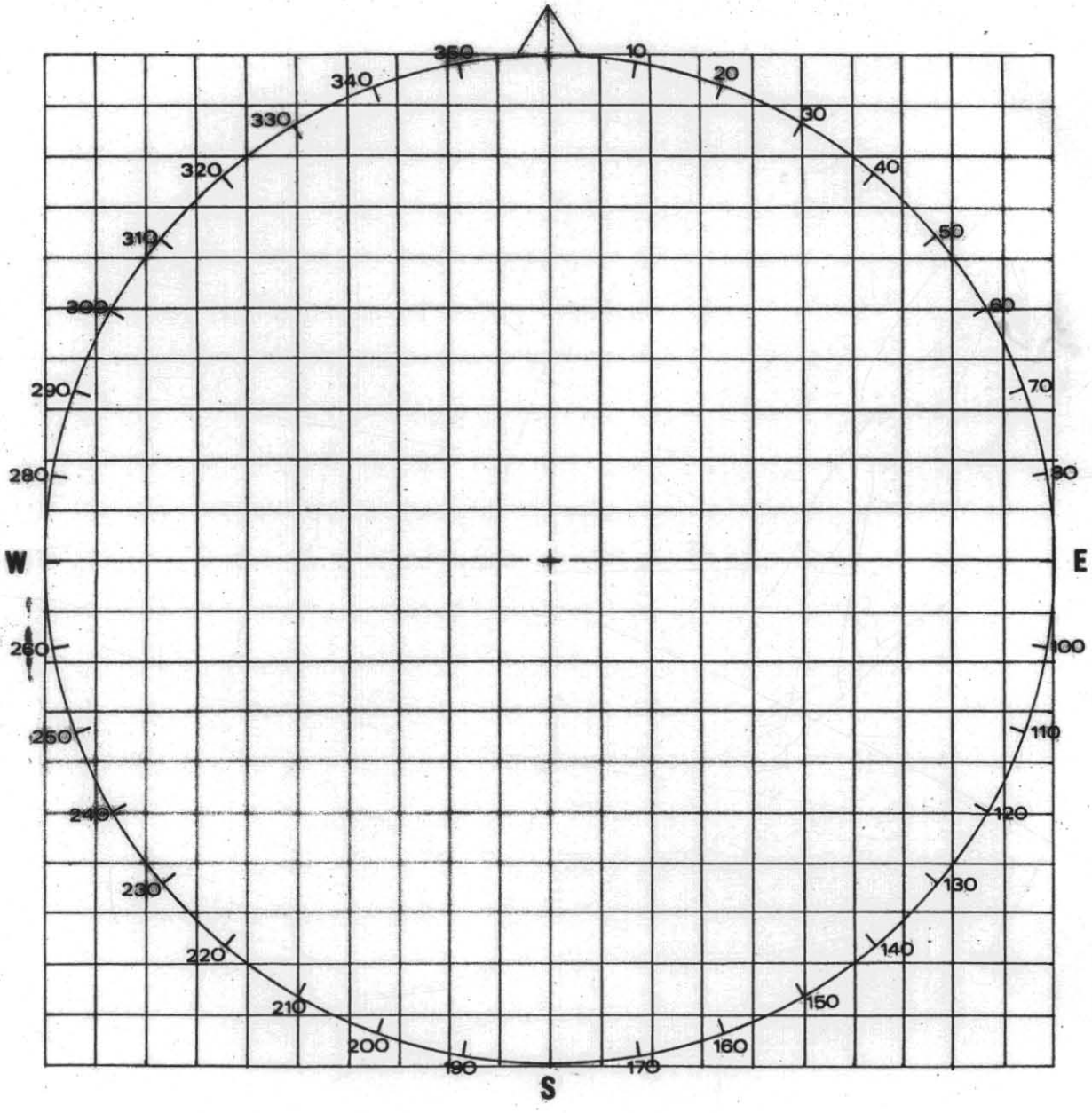
GOAT ISLAND

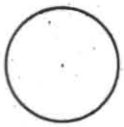
- o Elongation direction of pebble-like inclusions
- \+ Foliation pole
- • Compositional layer pole



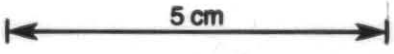
5 cm

15 cm Counting Net





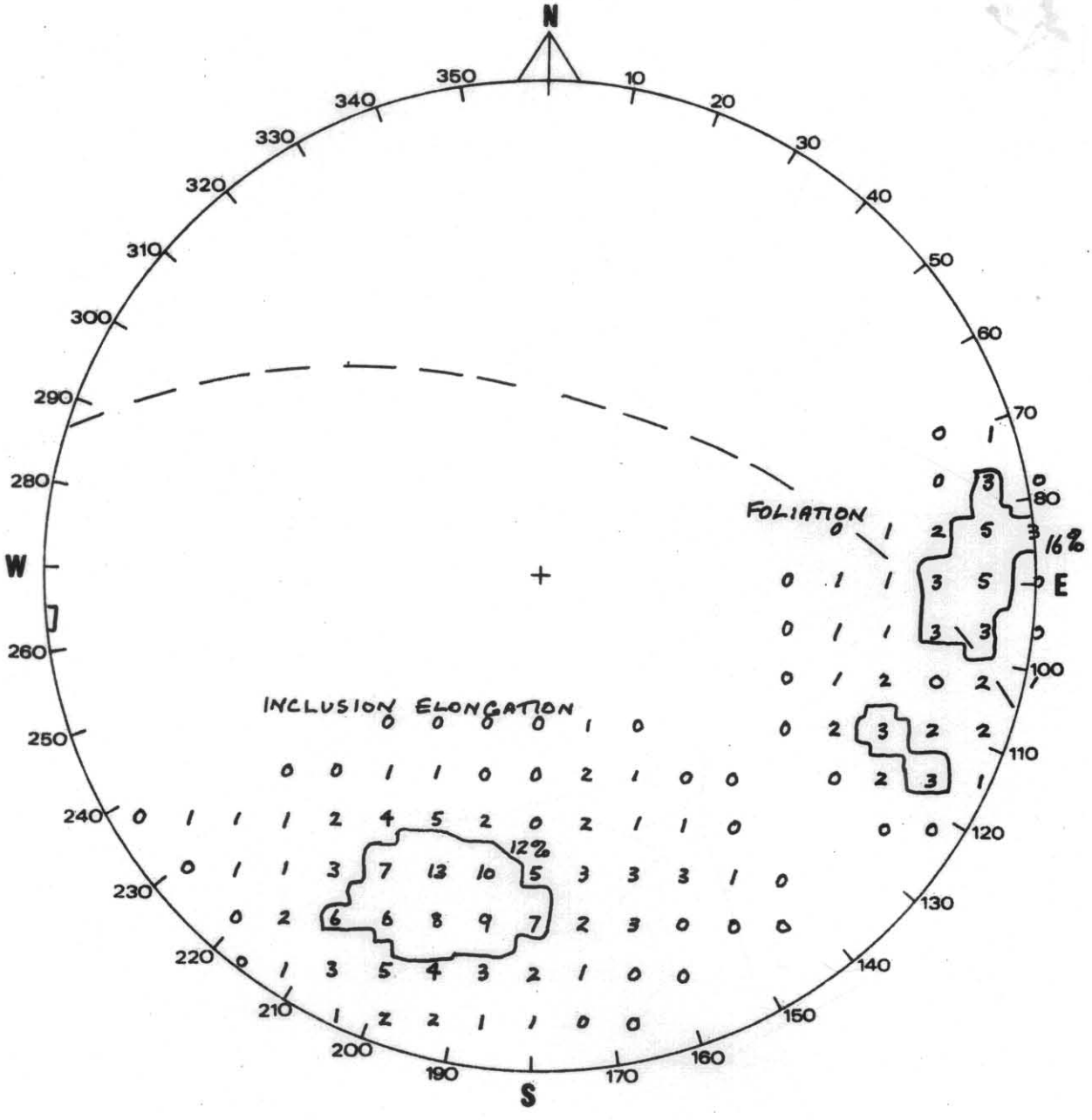
Counter: 1% of stereonet area



GOAT ISLAND

Contoured diagram and best fit circle

for poles of compositional layers indicated



DEVONPORT

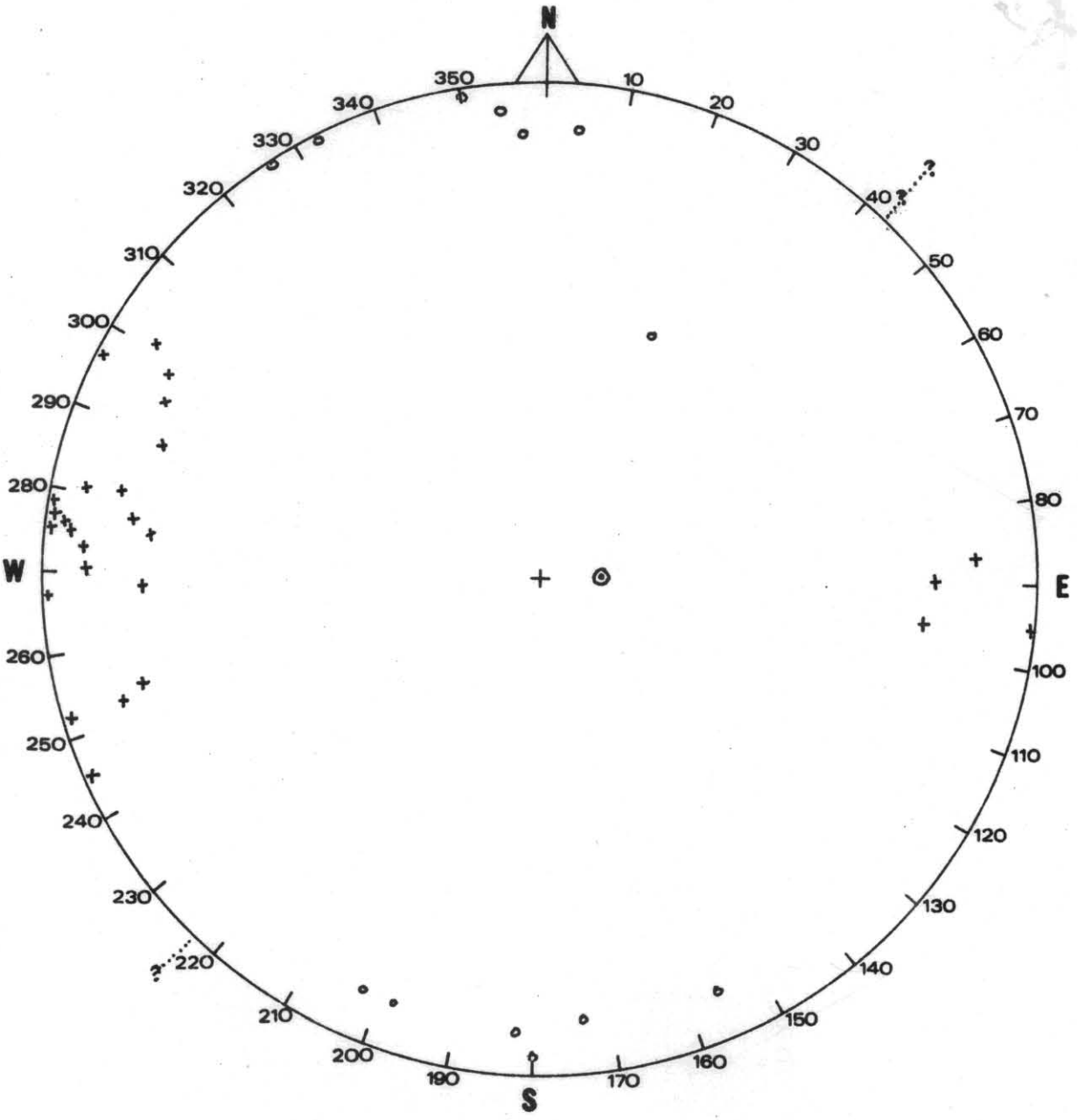
Geological Atlas 1" = 1 mile Series

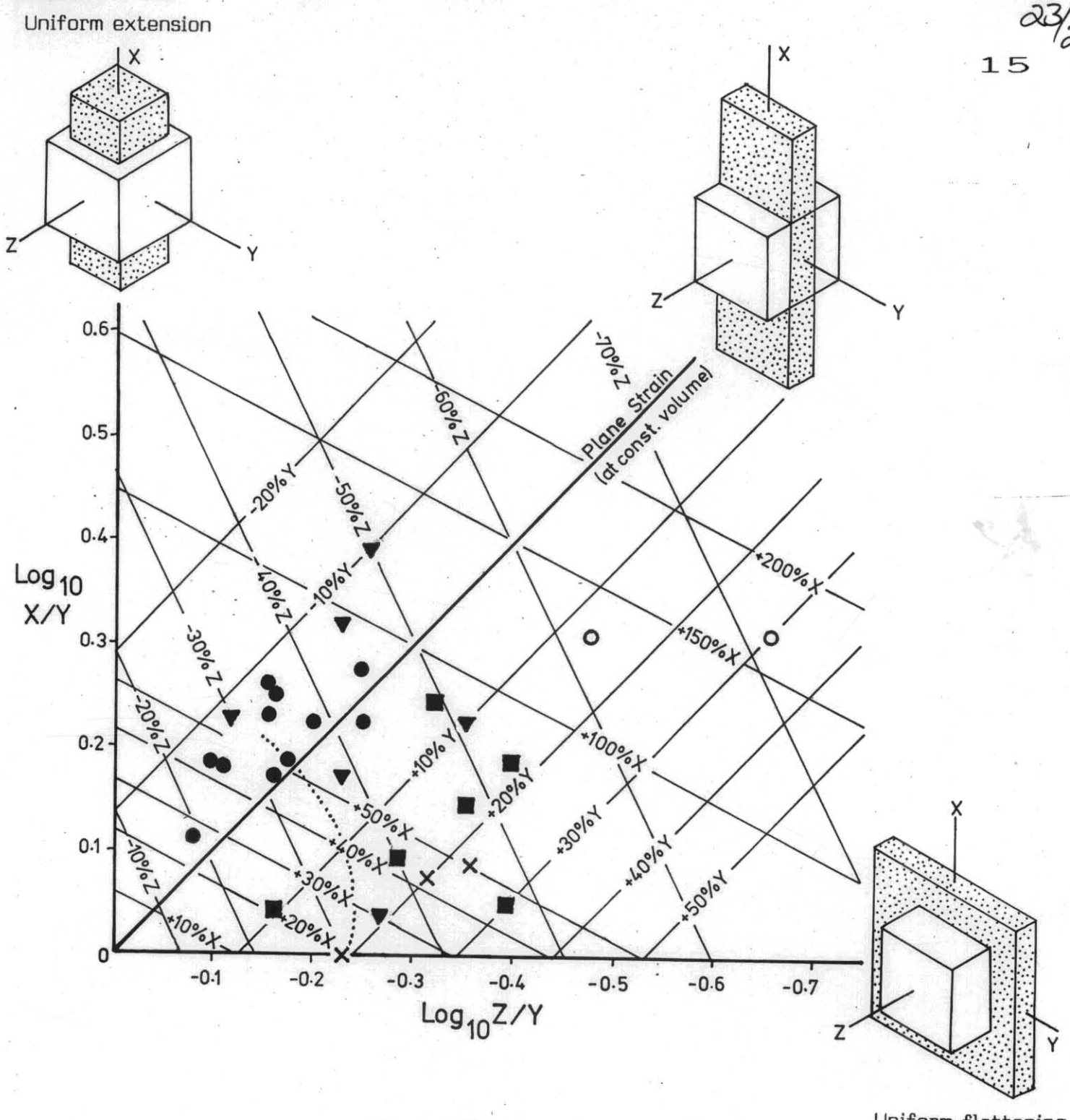
Burns 1963

+ Cleavage poles

o Minor fold hinges

⊙ Pole to best fit circle of cleavage poles: regional rotation axis.



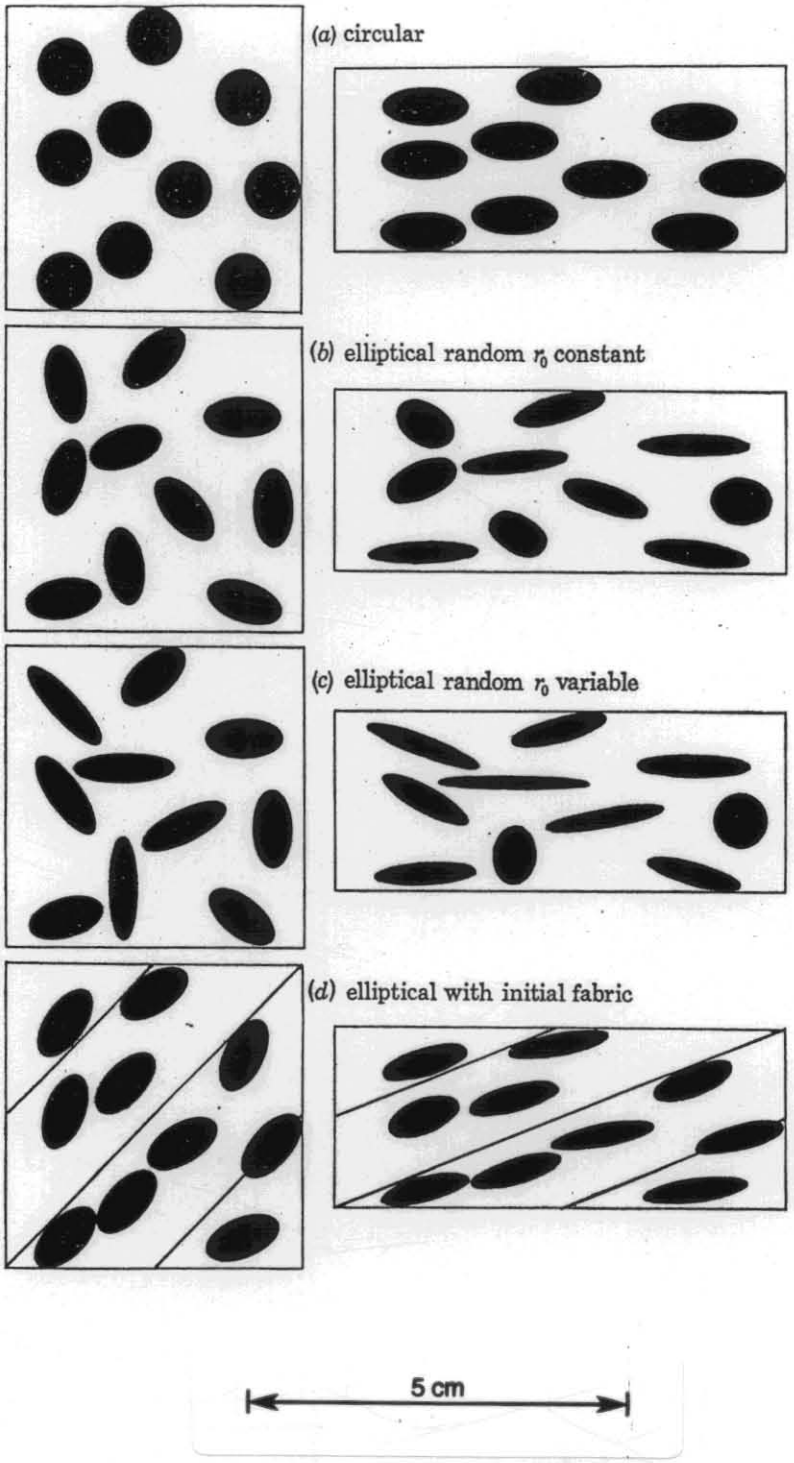


STRAIN DETERMINATIONS IN TASMANIAN PALAEOZOIC ROCKS

- ● Gordon Limestone, Grunter Hill (Mole Creek region)
- ○ " " , Claude Creek (Cethana region)
- × " " , Mayberry (Mole Creek region)
- ▼ Mount Read Volcanics, Queenstown (Cox, 1981)
- ■ Cleaved mudstones from Misery Hill quarry, West Coast region (C.A. Boulter, unpub.)

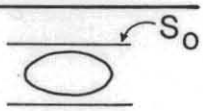
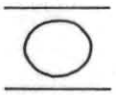
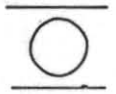
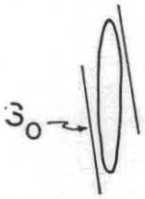
Lower limit of cleavage development in slates (Wood, 1971, 1974)

5 cm



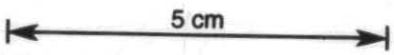
The effects of superimposition of homogeneous strain on suites of elliptical markers with various initial fabrics.

(From: Ramsay, J.G., 1976, Phil. Trans. R. Soc. Lond., v. 283, p. 3-25)

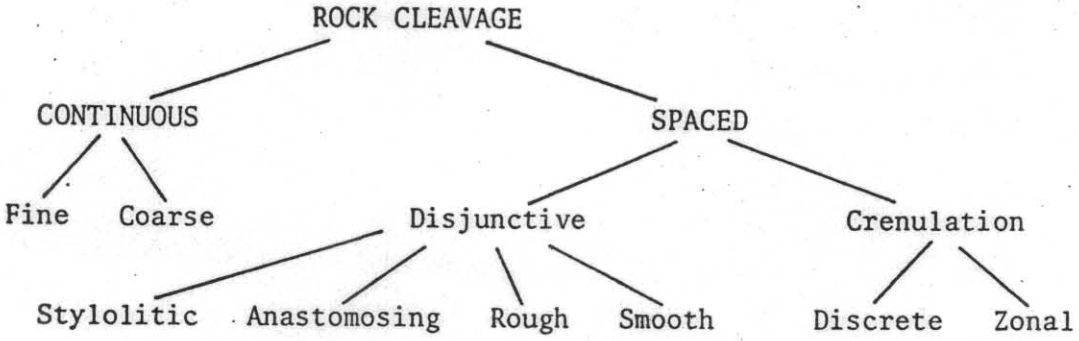
	PHASE	INCREMENTAL STRAIN	FINITE STRAIN
I	Sedimentary Compaction (50% uniaxial volume loss)	 1.0:1.0:0.5	 1.0:1.0:0.5
II	Layer Parallel Shortening (25% plane strain)	 1.33:1.0:0.75	 0.67:1.0:0.75
	Tectonic Compaction (10% uniaxial volume loss)	 1.0:1.0:0.9	 0.67:1.0:0.67
III	Limb Rotation	—	
IV	Cleavage Formation (62% plane strain)	 2.63:1.0:0.38	 1.76:1.0:0.25

An example of a more realistic complete deformation history of a folded and cleaved rock.

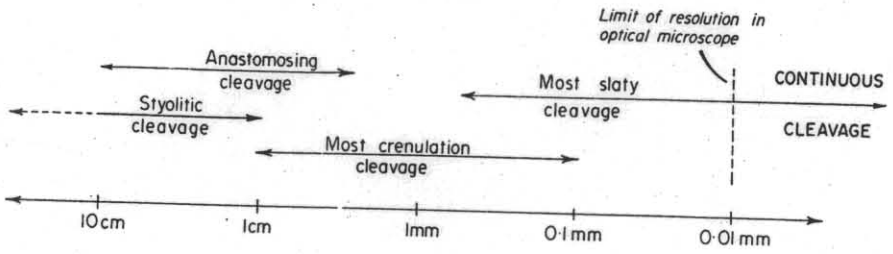
(From: Beutner, E.C., 1978, Amer. J. Sci., v.278, p. 1-23)



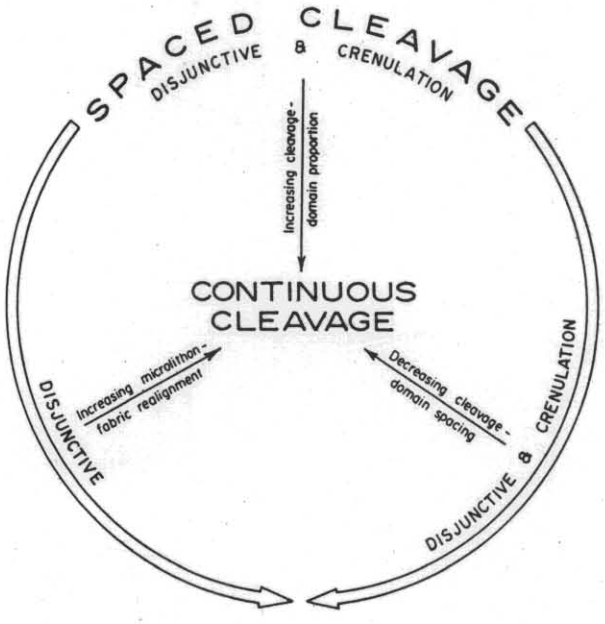
Morphological classification of rock cleavages:



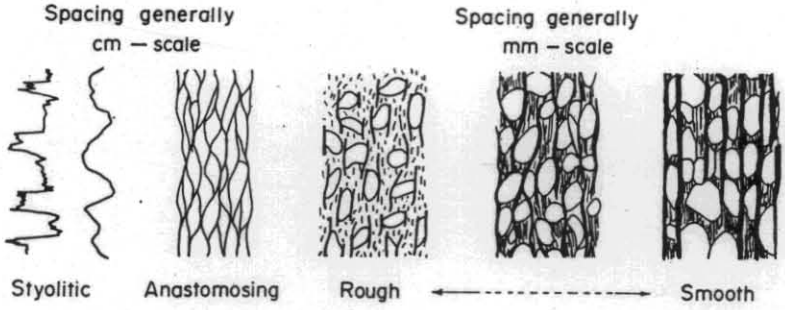
Average spacing of cleavage domains:



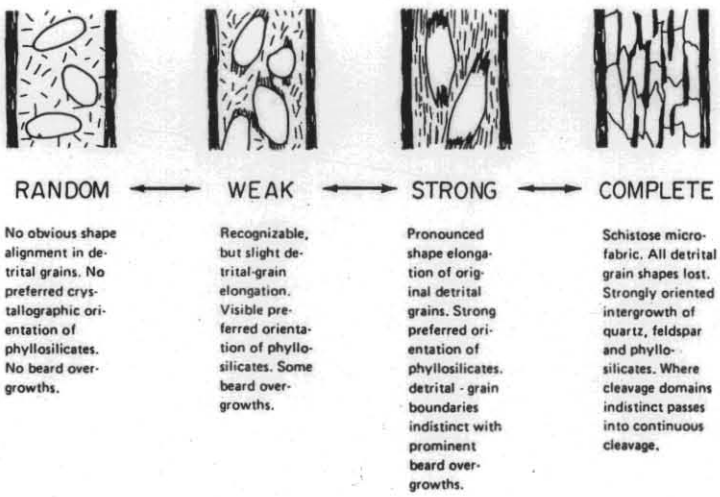
Suggested relationships between Spaced Cleavage and Continuous Cleavage:



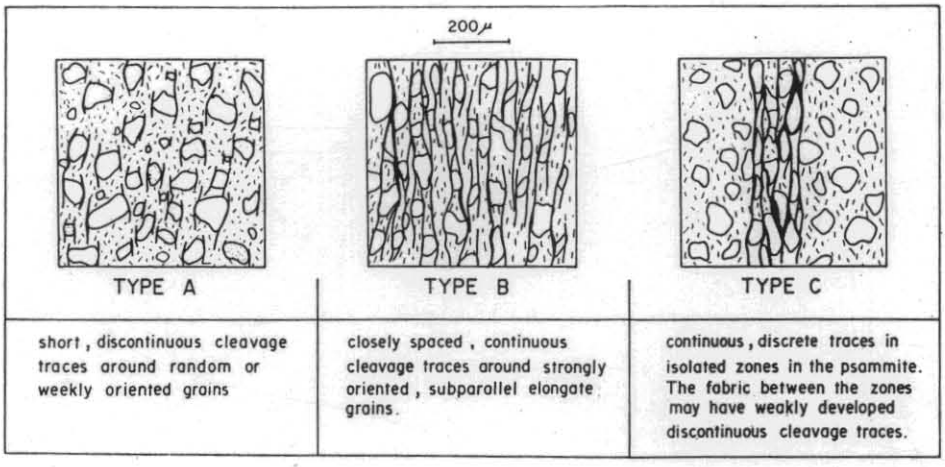
(After Powell, C. McA., 1979, Tectonophysics, v.58, p.21-34)



Morphologies of the various types of Disjunctive Spaced Cleavage (from Powell, 1979, Tectonophysics, v.58, p.21-34).



Possible 4-stage classification of the degree of fabric realignment in the microlithons between the cleavage domains in a rocks with Spaced Cleavage. (from Powell, 1979).



A subdivision of the morphologies of Rough Cleavage in sandstones (from Gray, D.R., 1978, Geol. Soc. Amer. Bull., v.89, p.577-590).