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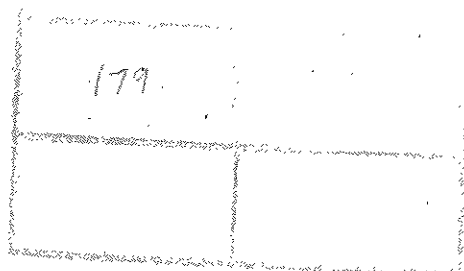
Item 1720

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AREA E
STRUCTURAL INVESTIGATION
OF AN AREA NEAR THE
BANDALUP CREEK/
JERDACCUTTUP RIVER JUNCTION

By C.J.Flesher
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Box 635



AREA E
STRUCTURAL INVESTIGATION
OF AN AREA NEAR THE
BANDALUP CREEK/JERDACUTTUP RIVER JUNCTION

This study was carried out near the Bandalup Creek, half a mile north of its junction with the Jerdacuttup River.

This area was chosen because exposure here is relatively good. It was hoped to establish or at least infer the attitude of this section of the jaspilite sequence by the interpretation of minor structural data collected here.

PREVIOUS WORK AND INTRODUCTION

J. Sofoulis (G.S. Bull. 110 1952) covers this area in his regional structural interpretation. From his comments it would seem probable that Sofoulis has used "the distribution, disposition and mutual relationships of the lithological units of the Ravensthorpe system" i.e. broad scale observations, backed mainly by dip/strike observations, to interpret the structure of the area. Of minor structural phenomena (schistositities, foliations, faulting, drag folding, cleavage, shearing, jointing) Sofoulis says - "Minor structural phenomena recognised

in the metamorphic and granitic terrains have facilitated the interpretation of the regional geological picture" i.e. simply corroborated his broad structural scheme. The use of broad scale features is probably the best method of interpreting the structure and conformation of rocks in any area, as it usually gives the least ambiguous result. But unless large areas are investigated, the recognition and delineation of these large scale features (large lithological units, faults, folds) is very difficult, especially in areas with poor exposure.

In the small area under investigation here, correlation of lithological and structural features across the fold or along strike was impossible. The problem was, therefore, to collect enough valid small scale data in order to be able to determine the structure unambiguously. Unfortunately, steep to vertical dip values, lack of reliable way-up evidence, large and small scale (amplitudes 60' to several inches) drag folds, possible slumping, poor exposure at key points, variable topography, and local, occasionally abrupt changes in strike direction, all combine to give a confused picture and make interpretation difficult. Metamorphism and weathering also mask the true nature of the rocks, and prevent correlation of beds.

ROCKS

The jaspilite sequence here includes several moderately distinctive units, as follows :-

1. Well-bedded black-orange/brown laminated shales. These are often contorted either into chevron type folds (amplitude $60' > \frac{1}{2}"$) or irregular slump structures, and are frequently strongly cleaved.
2. Thickly-bedded soft calcareous? sandstone beds, which are generally "washed out" pale yellow, white and pale mauve colours.
3. Hard siliceous, brown/orange, thinly-bedded ($\frac{1}{2}" < 3"$) iron-stained quartzite/siltstone, often interbedded with shales.
4. Distinctive thinly-bedded grey quartzite, usually inter-bedded with dark brown iron-rich quartzite/siltstone/shale bands.
5. Jaspilite bands, dark brown, siliceous, iron-rich layers, usually thinly bedded $\frac{1}{2}" < 3"$, often interbedded with siltstones/shale layers.

Exposed along the southerly length of the Bandalup Creek in the area investigated (location F) were rocks consisting of massive blocks and lenses of -

6. Soft grey/green fine-grained, non-magnetic siltstone with shaley material of apparently similar composition between the blocks.

All available structural data was collected,
and is as follows :

Dip/strike measurements

Drag fold attitudes, size, plunge

Sedimentary structure - Cross stratification

"Sole" structures Way-up

Graded Bedding Evidence

Basal Breccia

Bedding/cleavage relationship.

Stratigraphy was not observed systematically or in any detail. The same rock types, even when observed in small exposures, varied considerably, mainly due to differential weathering, iron-staining, and lateral and horizontal variations in original texture and composition; stratigraphic correlation is impossible.

Dip/strike measurements

(a) Dip values are generally steep, and give a confused picture. "Overturning" due to soil creep on slopes can critically alter dip and strike values. Observations at locations A and B, however, were clear and unconfused, and clearly show that the strata here dip in towards the proposed axis, A being on the east limb, B on the west.

Observations at locations D, E, C, seem to confuse the picture but are probably due to superficial overturning due to soil creep, and local variation due to the

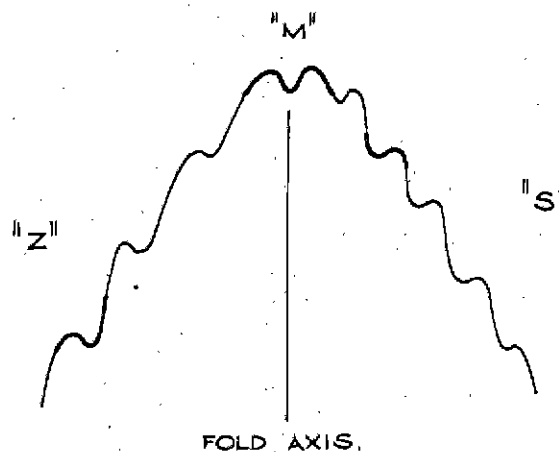
presence of drag folds, which were definitely recognized at D and E.

Values at other locations seem totally unrelated to any broad structural trend. Observations at location F possibly indicate a minor anticlinal axis, parallel to the main axis.

(b) Strike directions were quite uniform and generally trend North - South.

Drag Folds

Large chevron-type folds (20' - 60' amplitude) were seen at locations E, G and D. However, topography complicates observation of their attitude, and makes interpretation awkward. It does seem probable that folds E, G and D represent different exposures of small scale linear corrugations, running parallel to the main (inferred) fold axis. These corrugations are close to the axis, and, therefore, give little indication of the "limb" they are on. Considering the S.M.Z. relationships for drag fold/fold limb, these are probably "M" type folds.



Very small scale drag folds ($\frac{1}{2}$ " - 12" amplitude) are commonly found on the limbs of these "minor" (but much larger) drag folds, and drag fold/fold limb relationships are well illustrated on a small scale.

At location H, possible drag folding of a white magnesite-rich(?) band, which perhaps represents weathered dolomitic marl, gives "S" type folds, which infers that the bed here is either on the east limb of a syncline or the west limb of an anticline. This folding may, however, be due to pre-diagenetic slumping, and, therefore, unrelated to post-diagenetic movements.

Small scale folds were seen at several other locations, but interpretation of these isolated folds would be of dubious value.

The plunges of drag folds seen were not clear, but those at locations E and G seemed to have horizontal axes.

Cross-bedding

Cross-bedding was noted at several exposures. However, that seen at location G was felt to be the only reliable example, and indicated the beds here were not overturned and face East. *(Cross-bedding bed dip 70°W)*

"Pseudo-cross-bedding" was noted quite frequently. Fine close-spaced cleavage and weathering effects

had in these cases produced effects very similar in appearance to a truly cross-bedded rock.

Sole Structures

Several outcrops displayed features which were tentatively recognised as load casts, but due to contortions, weathering effects, and general uncertainty regarding orientation of the strata at these individual outcrops, these features cannot be used with confidence.

Graded Bedding

The rocks here are a well-bedded sequence of very fine to coarse-grained sediments, and undoubtedly, good examples of graded bedding will occur. Several specimens were taken, cut with the diamond saw, and observed under a binocular microscope. However, none of the specimens examined showed any convincing graded bedding; weathering effects and metamorphic recrystallisation have obviously obscured this effect to a large extent.

Basal Breccia

At location J, a highly contorted, highly cleaved, black slate/siltstone is overlain possibly unconformably by a coarse poorly sorted breccia/agglomerate (some grains are rounded) of about 10' - 15' thickness, which passes up into poorly bedded shales and siltstones (this last fact seems

to rule out the possibility of this being a fault breccia). The breccia, which is badly oxidised, consists of fragments (up to ½" across) of a dark grey fine-grained (basic volcanic?) rock, white opaque quartz blebs, and orange-brown oxidised siliceous fragments, in a sparse interstitial matrix of oxidised orange siliceous material, white quartz and dark grey/green fine-grained (basic?) material. There is a well-defined growth of secondary silica around some grains.

It is suggested that this coarse clastic material is derived from volcanic debris which has undergone secondary silicification. The generally small fragment size and rounding of some fragments suggests it may have been bedded, even poorly, before being mobilised and rapidly redeposited in the "alien" black shale environment. Larger fragments, if previously present, seem not to have been involved in the second sedimentation. It is hard to say whether the contortions in the black shale/siltstone are due to syngenetic, or post-genetic influences. The absence of cleavage or shearing, even on a fine scale in the breccia, as compared with the well cleaved black slate/siltstone, possibly infers a large unconformity between the breccia and the slate. It is also possible that the breccia represents

a relatively recent fault breccia. Insufficient detailed observations were made to satisfactorily explain this suggestion. It does not, however, seem unreasonable to infer that this coarse brecciated unit represents a short very rapid period of sedimentation, at the start of a new cycle of sedimentation. As such, it would represent the basal portion of a new sedimentary sequence, also considering the dip/strike data from this locality it seems the rocks here face west.

Bedding/cleavage relationships

Four reasonable bedding/cleavage observations were noted at locations G, D, J, C. The observations from these locations enable us to locate the axis, roughly as shown. However, strike directions at location A and cleavage direction (which is assumed to be almost axial planar) at location J, indicate a possible flexure in the axis as indicated. This flexure fits well with the regional structural regime (see diagrams).

CONCLUSIONS

Based on the information collected, the most acceptable explanation for the conformation of strata in this area, is that the rocks form a tight, slightly flexured north-plunging syncline.

The tight synclinal structure is suggested by dip values and strike directions, plus the meagre way-up evidence available.

The plunge is suggested by the bedding/cleavage observations which infer a closure of the structure some distance to the north, as illustrated. Value of the angle of plunge of the syncline is not known, but is probably quite shallow. The "tightness" of the structure, is confirmed by the highly cleaved/sheared nature of many of the rocks encountered. The indefinite, but possibly "M" type drag folds at locations E and G also confirm the tightness of the structure and the proximity of these structures to the inferred fold axis.

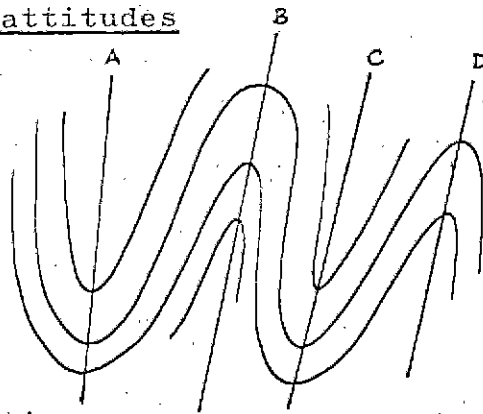
The rock types encountered (well bedded, sequence and basal breccia?) suggest a sedimentary/volcanic, medium to deepwater (basin?) environment, with fairly rapid sedimentation.

The structural data presented is often contradictory. However, the weight of evidence does suggest a synclinal rather than anticlinal attitude for the rocks in this area. This interpretation supports the regional picture in the Ravensthorpe area.

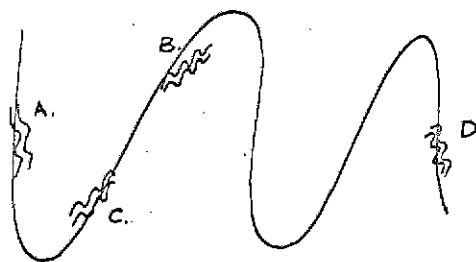
C.J. Flesher

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Inferred fold attitudes



Drag Fold location

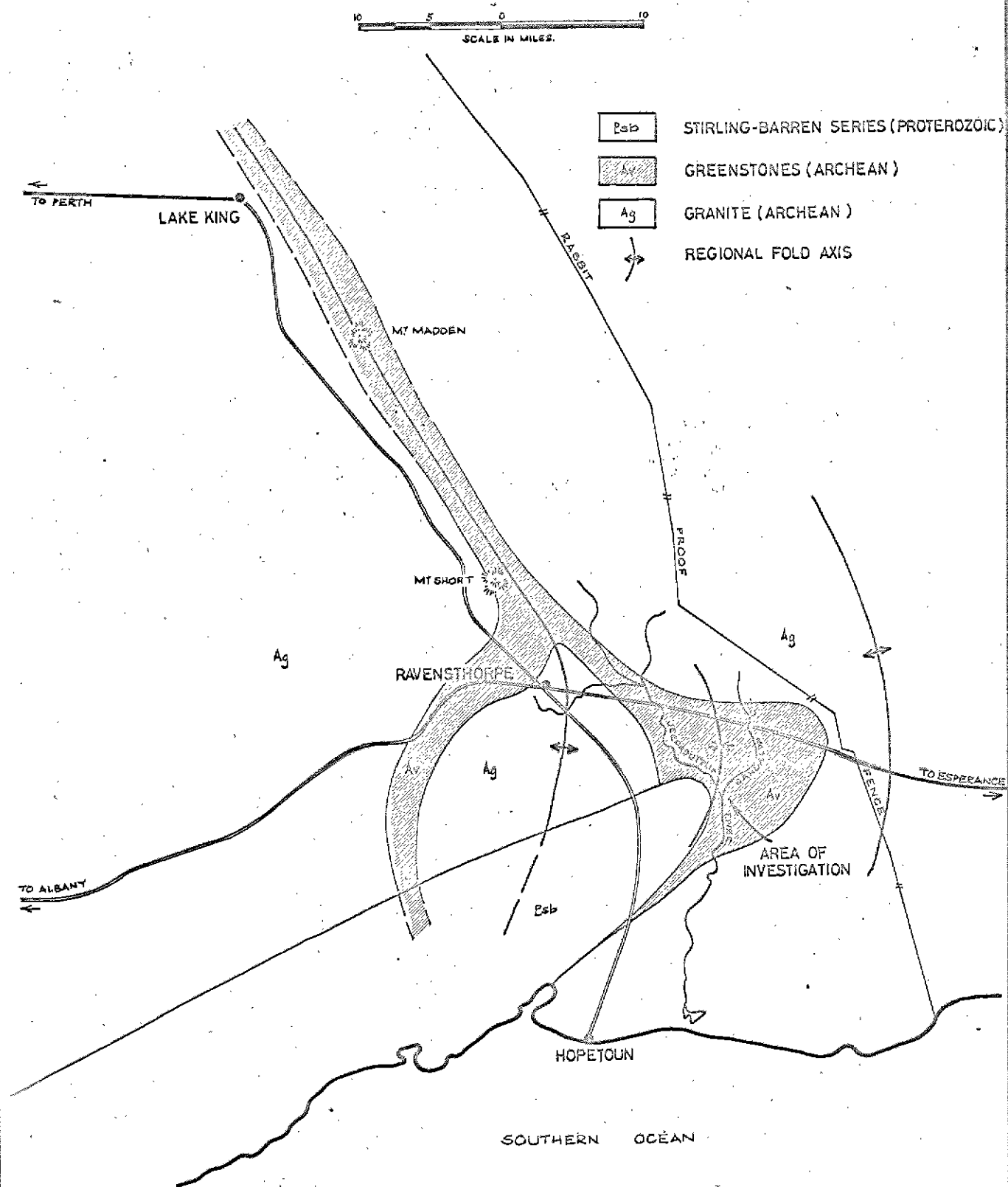


- A. Weak cleavage in black shale, Amplitude $18'' - 4'$.
- B. Well cleaved poor shape, Amplitude $6'' - 12''$, merge into contortions rather than Drag Folds.
- C. Well defined cleavage in black slate, Amplitude $12' - 1''$.
- D. Poorly defined Drag Fold? "Picked out" in black slate by an iron-rich band, Amplitude $3'$.
- E. Very tight axes strike 175° dips $90^\circ > 75^\circ$ to the west, Amplitude up to $20'$.

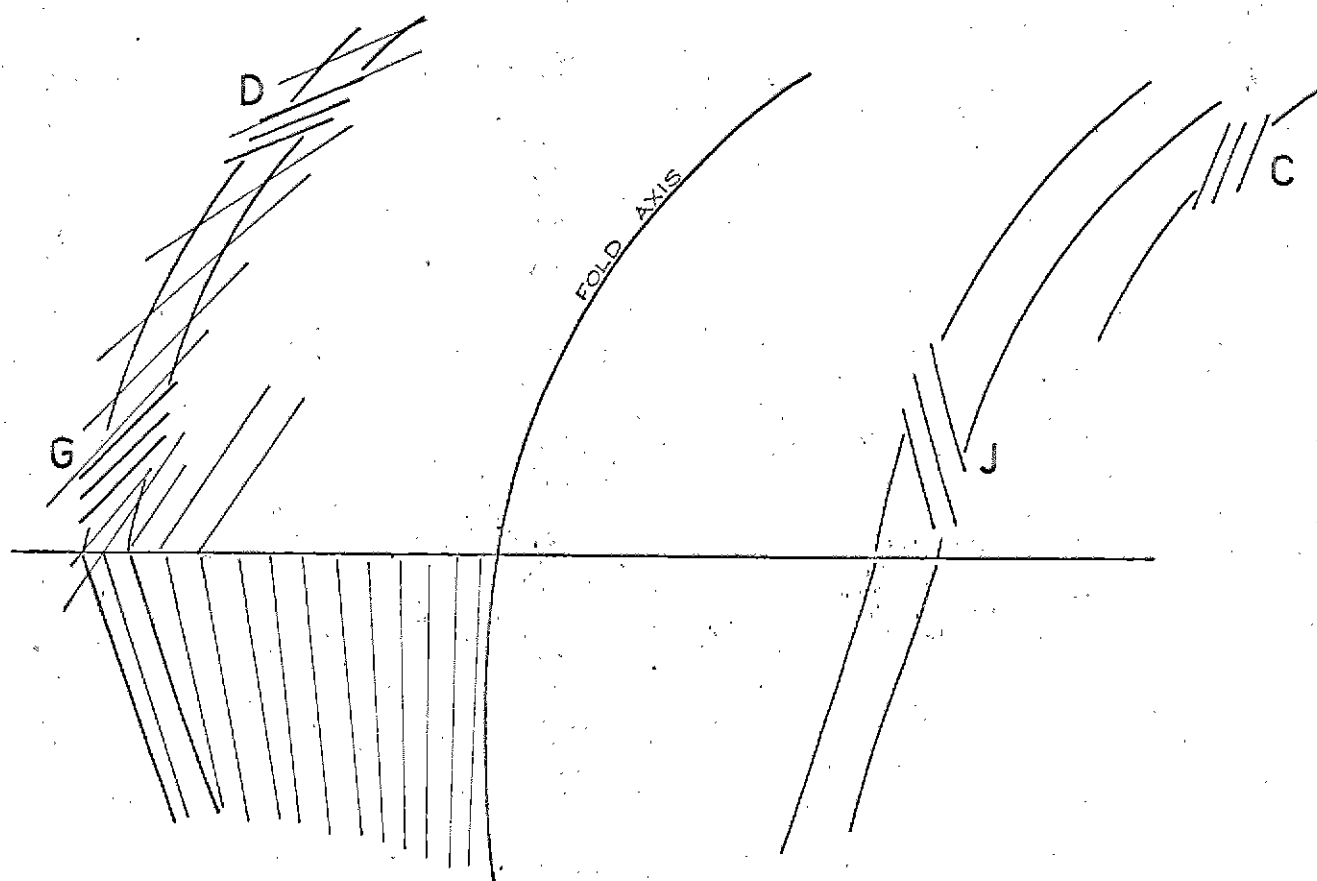
Observations

- 1. Bedding and cleavage in same plane almost, indicates a very tight fold.
- 2. Axis trending N.S.
- 3. Large amount of shearing and faulting generally on small scale.

REGIONAL STRUCTURE OF THE RAVENSTHORPE AREA

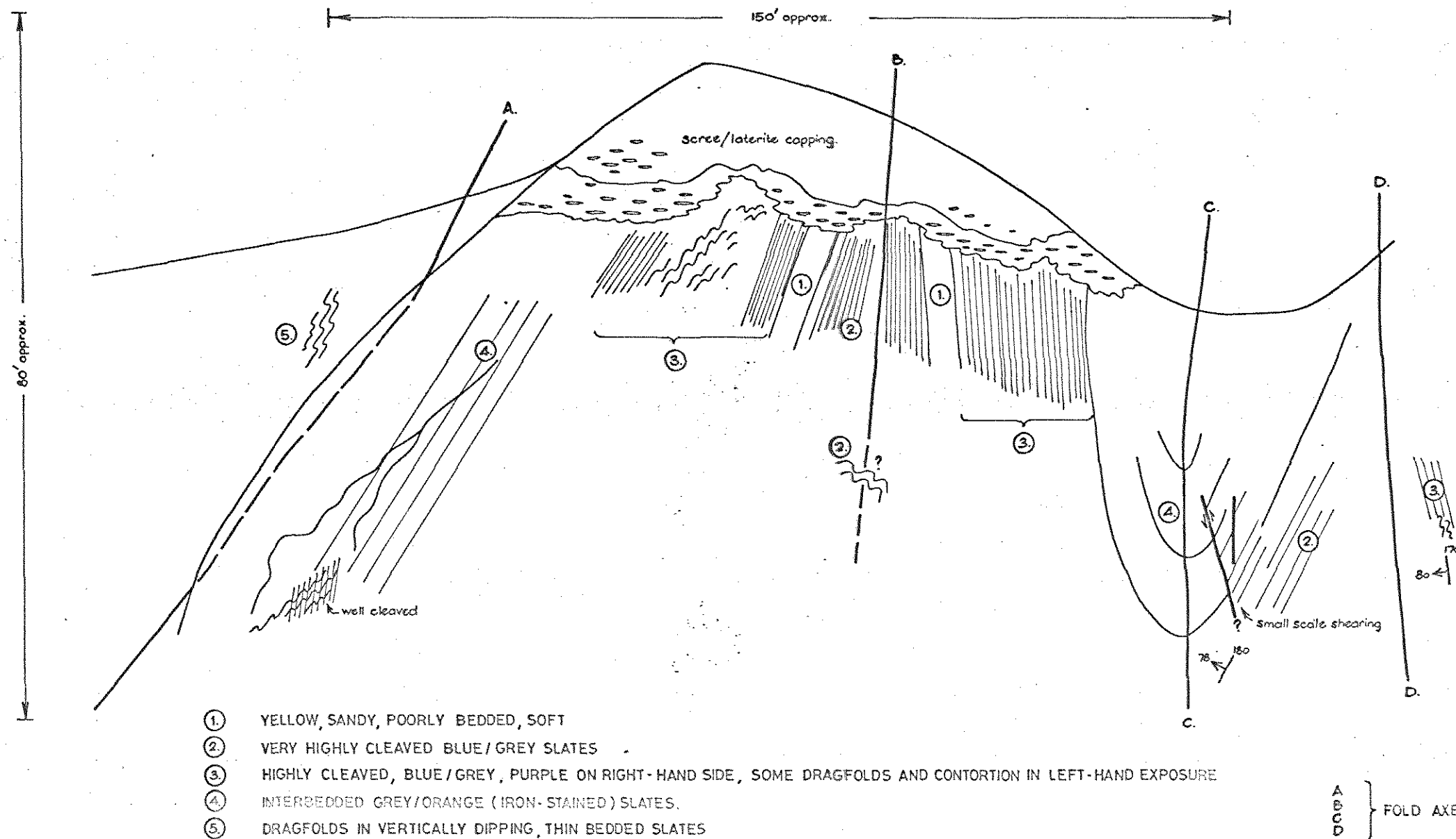


BANDALUP CREEK - SOUTH AREA E
DIAGRAMMATIC SECTION THROUGH INFERRED SYNCLINE



BANDALUP CREEK - SOUTH AREA E

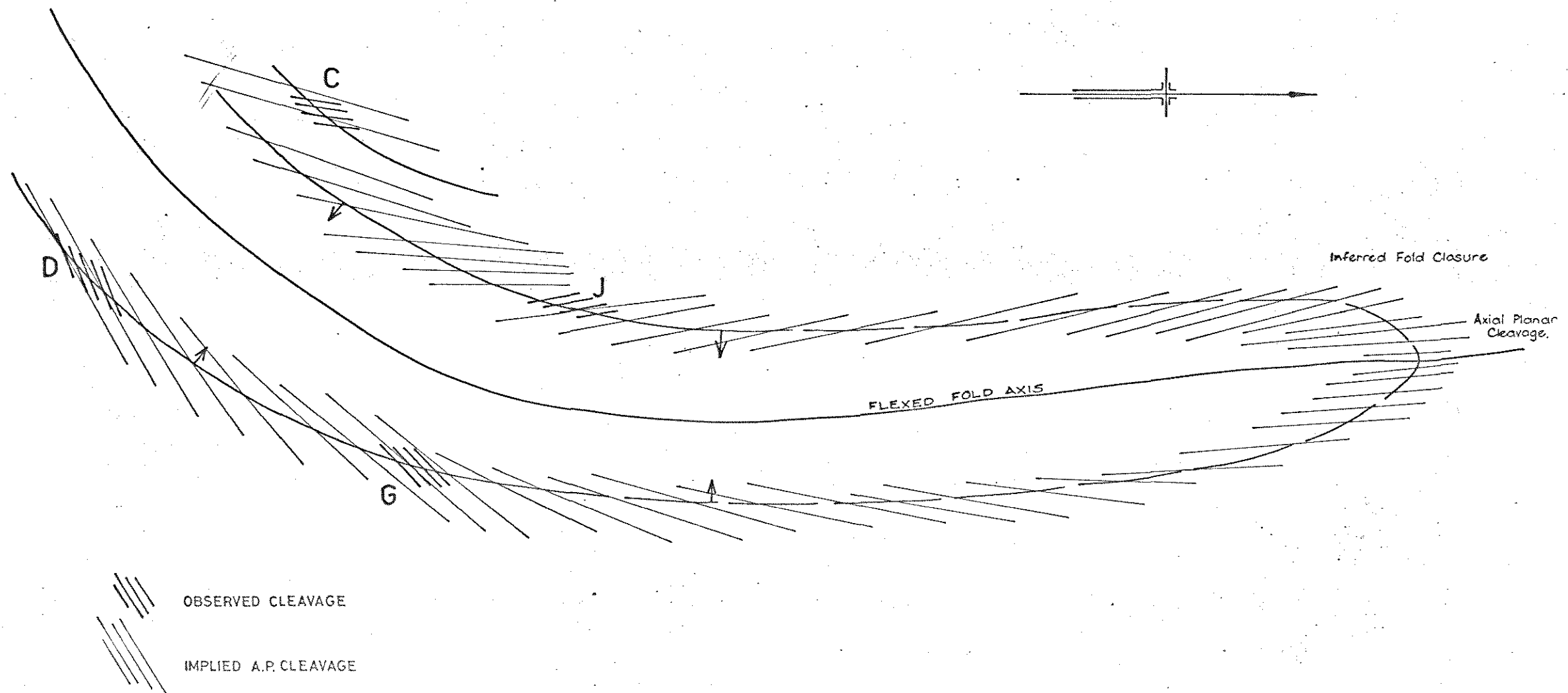
SKETCH SHOWING INFERRED STRUCTURE OF DRAGFOLDS AT LOCATION E



FROM ⑤ ONWARDS ROCKS DIP EASTWARDS AND CONCLUSIONS REGARDING STRUCTURE ARE BASED ON STRIKE DIRECTION, DRAGFOLDING, CLEAVAGE

C.J.F. APRIL, 1971.

BANDALUP CREEK - SOUTH AREA E
DIAGRAM TO ILLUSTRATE BEDDING/CLEAVAGE RELATIONSHIP AND INFERRED STRUCTURE



C.J.F. APRIL 1971

BANDALUP CREEK - SOUTH AREA E
STRUCTURAL MAP



- LEGEND
- STRIKE DIRECTION
DIP VALUE
 - G LOCATION IDENTIFICATION
 - ANTICLINAL AXIS ?
 - SYNCLINAL AXIS
 - INFERRED FLEXURE OF SYNCLINAL AXIS
 - AXIAL PLANAR CLEAVAGE (DIRECTION INDICATED)
 - CREEK (ARROW INDICATES DIRECTION OF FLOW)
 - INFERRED DRAGFOLDING

