

Copy 3

COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

RECEIVED
1954
10
10

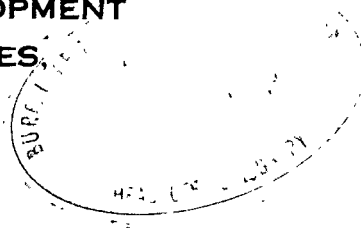
RECORDS 1954, No. 67

REPORT ON SEISMIC REFLECTION
TRAVERSE "C"
GIRALIA ANTICLINE
WESTERN AUSTRALIA

by

E. R. SMITH

COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS



RECORDS 1954. No. 67

REPORT ON SEISMIC REFLECTION
TRAVERSE "C"
GIRALIA ANTICLINE
WESTERN AUSTRALIA

by

E. R. SMITH

C O N T E N T S

	<u>Page</u>
ABSTRACT	(iii)
1. INTRODUCTION	1
2. POSITION OF TRAVERSE	1
3. WORK DONE AND RESULTS OBTAINED	1
4. DISCUSSION OF RESULTS	1
5. CONCLUSIONS	2
6. REFERENCES	3

I L L U S T R A T I O N S

- PLATE 1. Locality Map and Geological
Features.
2. Reflection Cross Section.

A B S T R A C T

A reflection traverse was shot across the centre part of the Giralalia Anticline in the Carnarvon Basin of Western Australia, in an attempt to verify the unconformity between Mesozoic and Palaeozoic sediments shown by a previous traverse across the northern part of the anticline.

Shallow seismic events recorded were of good quality and correlated very well with surface geology. They also indicated two faults in places where steep dips in surface beds might, by analogy with the northern end, be expected.

Deep events were in general of poor quality and inconsistent. However, over approximately a mile of the traverse, they were of good quality and indicated nonconformity with the shallow events.

1. INTRODUCTION

The Giralia Anticline extends for about 65 miles from the head of the Exmouth Gulf southwards to the Lyndon River, in the Carnarvon Basin, Western Australia (see locality map, plate 1). During September, 1951, a seismic party of the Bureau of Mineral Resources completed a reflection traverse (Traverse "A") across the northern part of the anticline. The major conclusion from this survey was that an angular unconformity exists between the Mesozoic sediments in which the anticline had been mapped, and the underlying Palaeozoic sediments. The structure at depth below the axis of the surface anticline and beneath the unconformity was shown to be synclinal (Vale, 1951). To verify the existence of this unconformity, reflection Traverse "C" was shot during October and November, 1951, at Cardabia, about 22 miles south of Traverse "A".

2. POSITION OF TRAVERSE

The apex of the Giralia Anticline is at approximately $114^{\circ}10'$ East, $23^{\circ}00'$ South, and Traverse "C" was almost due east along the 23° parallel. Plate 1 shows the location of the traverse, its position relative to Traverse "A", and the geological features of the Giralia Anticline.

S.P.55, at the western extremity of the traverse, is well down the west flank of the anticline, and S.P.24, near the centre of the traverse, is approximately on the apex. The structure on the eastern flank of the anticline near Traverse "C" is complicated by the Marrilla Anticline, a subsidiary of the Giralia Anticline, and the traverse crosses the two structures near their junction. Steep east dip which exists in the Tertiary-Mesozoic sediments on the eastern side of the Giralia Anticline at its northern end, would, if present, be expected approximately between S.P.'s 5 and 6, along Traverse "C".

3. WORK DONE AND RESULTS OBTAINED

The air-shooting technique, which proved successful along Traverse "A", was used, but the offset of the shot-points was increased from 2,400 ft. to 3,000 ft. This allowed more time to elapse (approx. $2\frac{1}{2}$ sec.) before the sound blast from the explosion swamped the seismic energy received at the geophones, and allowed deeper reflections to be observed than was possible on Traverse "A". Some parts of the line, namely S.P.'s 1 to 9, 15 to 17 and 30 to 33, were duplicated with hole shooting. Reflections recorded from these shots are shown by dotted lines on the cross-section. A general discussion of the technical matters involved in the production of the cross-section (Plate 2) has been given by Vale (1951).

4. DISCUSSION OF RESULTS

(a) Shallow events (Less than 2,500 feet).

Seismic events returning from less than 2,500 ft. are in general strong and clear. They include both reflections and refractions and the classification of an event is not always clear at first. Refractions usually show a "wash board" effect when plotted on the cross-section as reflections. Individual events of this type are of no use for indicating the value of the dip of the strata they represent, but when several form a continuous sequence they have qualitative value in that they then indicate the direction of dip. This is so between S.P.'s 33 and 5.

The cross-section across the western flank of the anticline shows west dip of 3° from S.P.55 to S.P.48, zero dip between S.P.48 and S.P.38, and west dip of 6° between S.P.38 and S.P.34. On the eastern flank, between S.P.'s 5 and 6, there is a definite break in the continuity of the shallow events, those to the east of S.P.6 arriving about 0.08 sec. later than those to the west of S.P.5. This indicates the presence of a fault between S.P.5 and S.P.6, with an estimated down-throw to the east of about 500 ft. The change in the elevation of the recorded horizons is sufficient to alter the character of the events from refractions on the west to reflections on the east. The location of the fault correlates with a zone of steep dips for the shallow beds and a probable fault in the deeper beds on the eastern flank of the northern part of the anticline (Vale, 1951). From S.P.6 to S.P.18 the profile of the shallow beds is fairly flat.

The shallow reflections recorded when shooting from S.P.18 to the east and S.P.19 to the west are similar in character, but arrive about .050 sec. later at S.P.19 than at S.P.18. This indicates another fault on the eastern side of the Marrilla Anticline, with an estimated down-throw to the east of about 300 ft.

From S.P.19 to the end of the traverse at S.P.45, the profile is generally flat, with exceptions between S.P.'s 40 and 42, where west dip of 3° is recorded, and between S.P.'s 43 and 45, where east dip of $2\frac{1}{2}^{\circ}$ is recorded.

(b) Deep events (Greater than 2,500 feet).

Both the air-shooting and the hole-shooting show an almost complete lack of reflections immediately west of S.P.6, from depths greater than 2,500 ft., while from S.P.6 to S.P.9 there is an abundance of reflections. Some from hole-shooting at S.P.7 come from as deep as 11,000 ft. and are of good quality. The sharp change from numerous reflections to no reflections is evidence that the suggested fault between S.P.5 and S.P.6 in the shallow beds continues through the section. S.P.'s 6 to 8 provide the only reliable dip information for the beds below 2,500 ft. The events on these records show consistent east dip throughout the section from 2,500 ft. to 11,000 ft., the average dip value being approximately 5° . The shallow beds under these shot points are reasonably flat.

Elsewhere along the traverse, although many events have been plotted below 2,500 ft., the dips are so inconsistent that no definite conclusions can be drawn. The nature of many of the events is not known, since they do not appear to meet necessary conditions to be either refractions or reflections. G.F. Francis, United Geophysical Company (1951) suggests that they may be reverberations from within a relatively low-velocity layer.

5. CONCLUSIONS

The only evidence of the angular unconformity, which was indicated by Traverse "A", is below S.P.'s 6 to 8, where the beds to 2,500 ft. are shown to be flat, while below 2,500 ft. an east dip of approximately 5° is indicated.

A fault is indicated in the shallow beds between S.P's 5 and 6, with an estimated down-throw to the east of about 500 ft. There is no indication of direction or amount of movement in the deeper beds.

A second fault is indicated in the shallow beds between S.P's 18 and 19, with an estimated down-throw to the east of 300 ft. This fault is in a similar relative position to the surface axis of the Marrilla Anticline as the other fault is to the surface axis of the Giralia Anticline.

No seismic evidence of reversal of dip corresponding to the Marrilla Anticline was recorded, probably because the traverse was located too far south. A small reversal in the shallow beds is shown, however, at S.P.43.

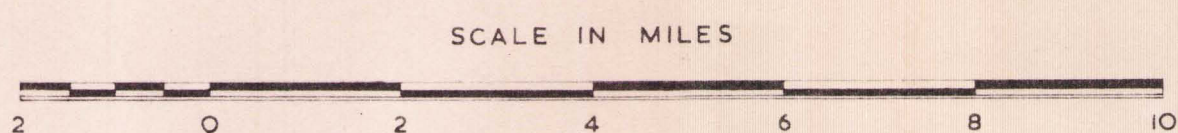
Apart from the results obtained below S.P's 6 to 8, seismic evidence of structure in the deeper beds is not reliable.

6. REFERENCES

- Francis, G.F., 1951 - Personal communication.
- Vale, K.R., 1951 - Report on Giralia-Bullara Seismic Reflection Traverse, Western Australia, Bur.Min.Res., Geol.& Geophys., Records 1951, No.62.
-

GEOPHYSICAL SURVEY, GIRALIA RANGE, W.A.
LOCALITY MAP AND GEOLOGICAL FEATURES

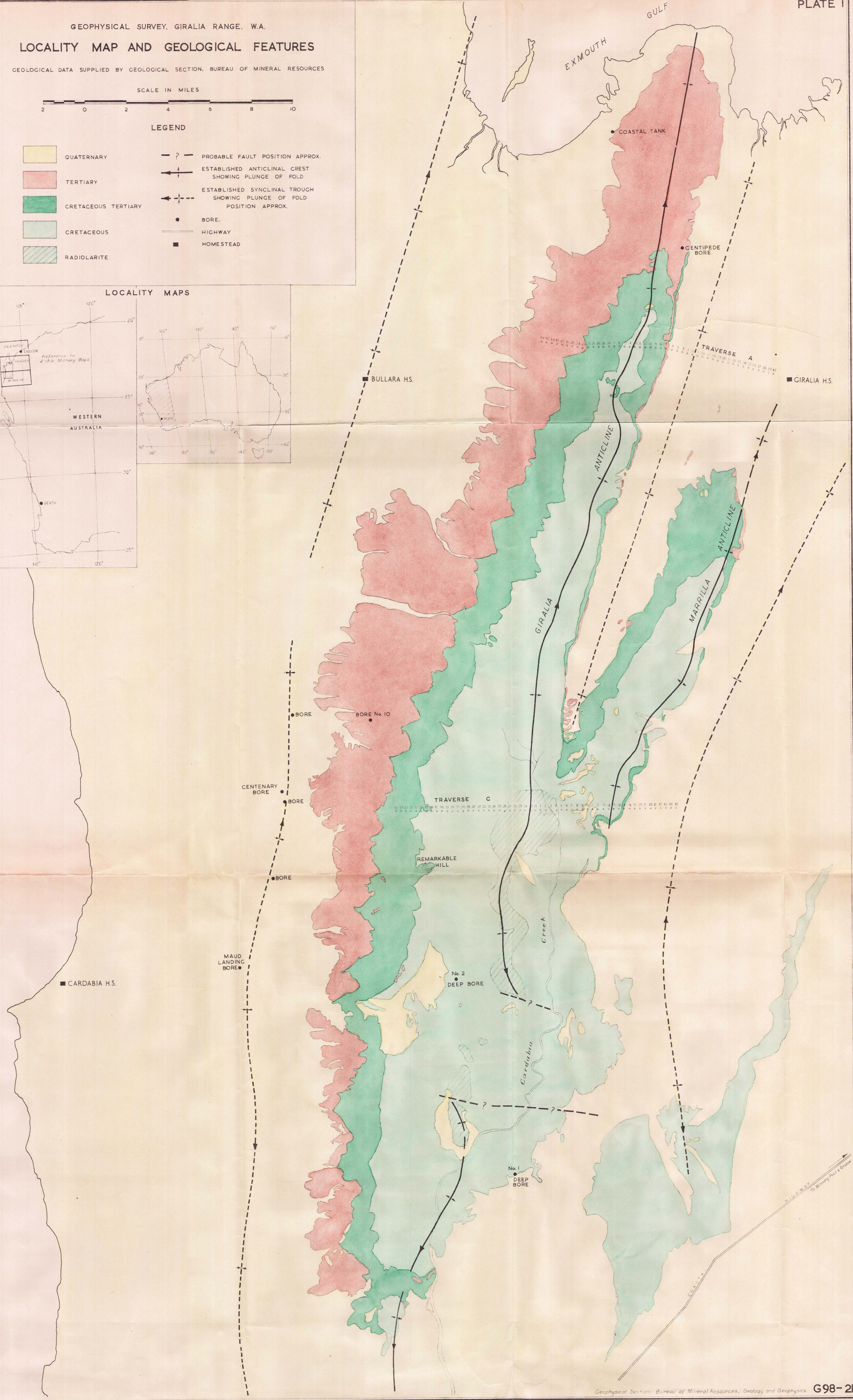
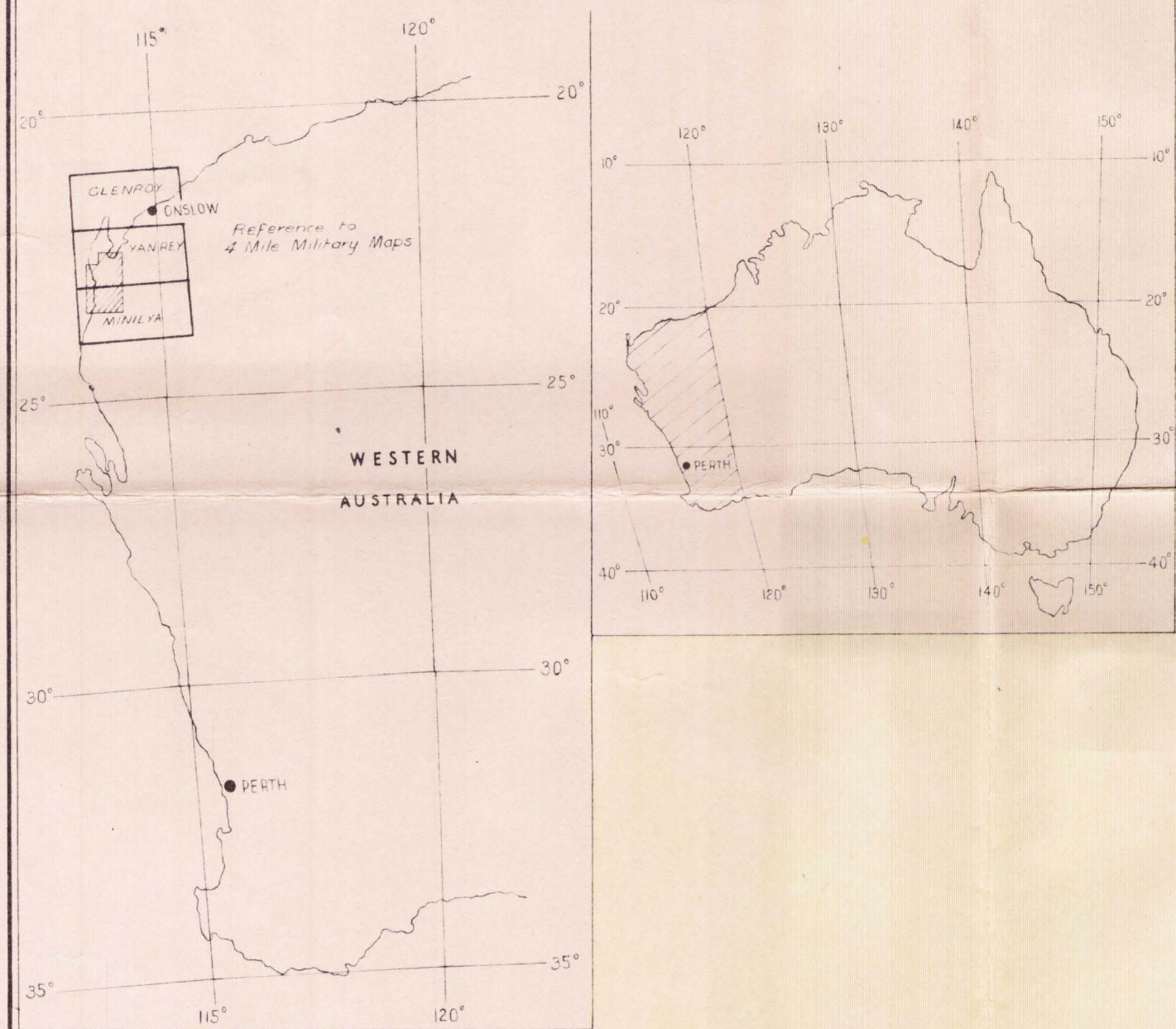
GEOLOGICAL DATA SUPPLIED BY GEOLOGICAL SECTION, BUREAU OF MINERAL RESOURCES

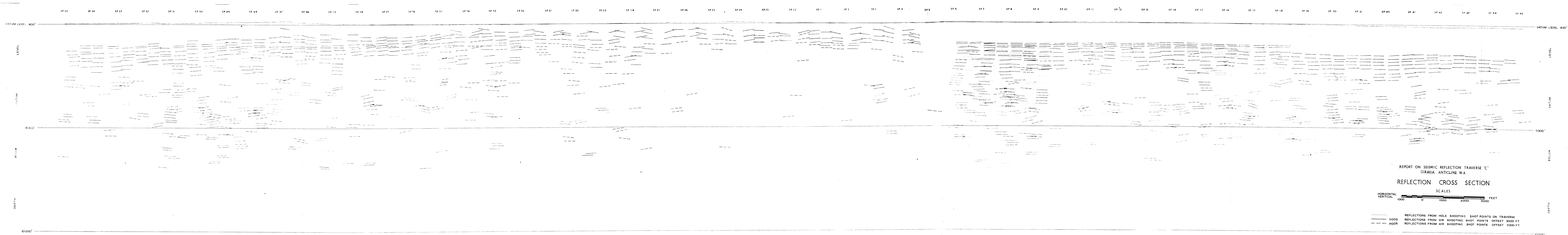


LEGEND

- | | | | |
|--|---------------------|--|--|
| | QUATERNARY | | PROBABLE FAULT POSITION APPROX. |
| | TERTIARY | | ESTABLISHED ANTICLINAL CREST
SHOWING PLUNGE OF FOLD |
| | CRETACEOUS TERTIARY | | ESTABLISHED SYNCLINAL TROUGH
SHOWING PLUNGE OF FOLD
POSITION APPROX. |
| | CRETACEOUS | | BORE. |
| | RADIOLARITE | | HIGHWAY |
| | | | HOMESTEAD |

LOCALITY MAPS





REPORT ON SEISMIC REFLECTION TRAVERSE "C"
GIRALIA ANTICLINE W.A.
REFLECTION CROSS SECTION
SCALES
HORIZONTAL 1000 0 1000 2000 3000 FEET
VERTICAL
REFLECTIONS FROM HOLE SHOOTING SHOT POINTS ON TRAVERSE
GOOD REFLECTIONS FROM AIR SHOOTING SHOT POINTS OFFSET 3000 FT.
POOR REFLECTIONS FROM AIR SHOOTING SHOT POINTS OFFSET 3000 FT.