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

RECORDS 1955, No. 110

SEISMIC REFLECTION SURVEY OVER DEEP WELL ANTICLINE, MYROODAH, KIMBERLEY DIVISION, WESTERN AUSTRALIA

by

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CONTENTS.

ILLUSTRATIONS.

ABSTRACT

A seismic reflection traverse was shot over the Deep Well Anticline, Myroodah, W.A., between August and October, 1954.

The anticline had been geologically mapped at the surface and closure was suspected in sediments of the Liveringa Formation.

The seismic results showed that the anticlinal structure becomes more pronounced in depth and extends to a depth of 24,000 feet.

Further seismic work is recommended to delineate the structure and prove closure.

1. INTRODUCTION.

As part of the general oil search programme of the Bureau of Mineral Resources, Geology and Geophysics in the Kimberley Division of Western Australia, the Geophysical Section has a programme of geophysical surveys. As part of this programme a seismic reflection survey was made along one traverse, approximately north-south, across the Deep Well Anticline on Myroodah Station.

The traverse, which was approximately 16 miles long, crossed Licence to Prospect No. 15H held by Associated Freney Oil Fields, N.L. and extended in both directions into Licence to Prospect No. 30H held by West Australian Petroleum Company, N.L.

The survey was commenced late in August, 1954 and was suspended early in October, 1954 because of unsuitable weather conditions.

The field party comprised L.W. Williams, (party leader) E.W. Turner (geophysicist) and 18 field assistants, drillers, etc.

2. GEOLOGY.

The following notes have been taken from reports by Schneeberger (1952) and Guppy (1953) and these reports, together with that by Wade (1936), should be consulted for further information.

The Deep Well Anticline is within the Fitzroy Basin, which lies between the Pinnacle Fault on the north and the Fenton Fault on the south (Plate 2).

Sediments which occur in the Fitzroy Basin and which are of importance in the search for oil are of Ordovician, Devonian and Permian age.

The Ordovician sediments have been mapped only in the Prices Creek area and it is not known whether they attain regional significance within the basin.

There are extensive outcrops of Devonian sediments on the north-eastern side of the Pinnacle Fault, but if these sediments occur within the basin, they are completely overlain by Permian sediments.

Four formations of Permian age are known in outcrop within the basin. These are the Grant Formation, the Poole Sandstone, the Noonkanbah Formation and the Liveringa Formation. Of these, the thickest member is the Grant Formation. The Liveringa Formation outcrops in the area occupied by the Deep Well Anticline.

The Deep Well Anticline is bounded on the south by the Dry Corner Syncline and on the north by the Myroodah Syncline.

Although the flanks of the Deep Well Anticline are obvious from aerial photographs it is not possible to map the plunge either on the ground or from photographs. "By comparison with the adjacent plunging synclines, however, it can be reasonably expected that the Deep Well Anticline has a surface closure in sediments of the Liveringa Group." (Guppy, 1953).

The country occupied by the Deep Well Anticline is largely covered by blown sand with some low sand-hills. The vegetation is mainly spinifex and low scrub.

3. EQUIPMENT AND FIELD PROCEDURE.

The recording equipment used was a 24-channel portable reflection seismograph manufactured by the Technical Instrument Company, U.S.A. For this survey, portable operation was not required and the equipment was mounted in a recording cab on a Morris 4 x 4 chassis. A shooting truck and Land Rover (cable vehicle) were used in conjunction with the recording truck.

The shot-hole drill was a Failing "750" mounted on a Commer 4 x 4 chassis, and two water-tenders, each of 700 gallon capacity, were used to maintain the water supply for the drill.

A surveyor from the Department of Interior, Perth, accompanied the party and did the necessary surveying of traverses.

The reflection method of seismic prospecting was used on this survey and split-spreads were used for recording. Shot points were laid out at quarter-mile intervals along the traverse and eleven geophone points, each 110 feet apart, were pegged between adjacent shot points.

The best shooting depth ranged from 80 to 130 feet and was normally 90 to 100 feet.

4. REDUCTION OF RESULTS.

The reflections recorded were not sufficiently continuous for correlation methods to be generally applied, and consequently the dip and depth of each reflection were calculated. These reflections were then plotted on a cross-section (Plate 3).

Standard methods were used in calculating corrections for elevation, weathering and spread.

Phantom horizons have not been drawn, partly because of the long distances along the traverse where there are no reflections, and partly because, where there are reflections, the dips of these reflections are sufficiently consistent to show the trends.

The velocity distribution which was calculated and used in the reduction of the results was very similar to that calculated for the Poole Range area (Smith, 1955).

5. DISCUSSION OF RESULTS.

The two main structural features shown on the cross-section are a syncline centred near SP127 and an anticline apparently centred near SP96 or SP97. The results over the anticline are typical of those found over others in the Fitzroy Basin, in that there is a marked absence of reflections near the axis. In this instance there is a gap of approximately two miles in the reflections; this is much smaller than that observed on other anticlines which have been investigated.

It is very noticeable that numerous reflections were recorded on the flanks of the anticline down to a depth of about 24,000 feet, whereas in the syncline very few reflections were recorded deeper than one very strong band at a depth of 4,000 to 5,000 feet.

The absence of deep reflections in the syncline may be caused by the shallow horizon being such an efficient reflector that very little energy passes through it. This could result in insufficient energy returning to the surface from any possible deeper reflector to enable the reflector to be recognised.

A feature of the reflections recorded over the anticline is that the dip of the reflections increases with depth. This feature, together with the apparent thickness of section, could mean that the deeper reflections were not real but were multiple reflections of the shallower ones. This possibility was given a great deal of attention and, although some slight evidence was found that a few reflections were multiples, the evidence showed overwhelmingly that most of the reflections were real and that there is therefore a very thick section.

Another feature which deserves consideration is the break in the shallow reflecting horizon near SP120. Through the syncline, from SP137 to SP121, this horizon is continuous, then it is very broken from SP119 to SP111, and becomes continuous again from there to SP103, where there are no reflections near the axis of the anticline. Also, SP111 is approximately the northern limit of the numerous deep reflections. The meaning of this feature is discussed more fully in the next section.

The shallow reflecting horizon, if it can be assumed to be the same one throughout, ranges in depth from an esimated 1,500 feet at the axis of the anticline to 5,000 feet in the centre of the Myroodah Syncline. By comparison with the Nerrima No. 1 Bore, in which the Noonkanbah Formation is present to a depth of 800 feet (Guppy, Cuthbert and Lindner, 1950), it seems reasonable to assume that this reflection is from the top of the Poole Sandstone. As the Liveringa Formation occurs at the surface in the Myroodah Syncline it appears that the Liveringa and Noonkanbah Formations have a total thickness there of 5,000 feet. This indicates that one (or both) of the formations is considerably thicker than the previously estimated maximum thicknesses of 1,400 feet and 1,200 feet respectively (Guppy et al, 1950).

6. CORRELATION WITH GRAVITY DATA

The gravity profiles on Plate 4 were constructed from the results of field work done by Wiebenga and van der Linden (1953) and by Waterlander and Green in 1954 (unpublished). The residual gravity profile shows a "high" which corresponds with the axis of the anticline shown on the seismic cross-section.

The lack of reflections from the shallow horizon between SP111 and SP119, which was referred to in the previous section, may be due to a zone of faulting. The gravity low at approximately the same position could be interpreted as being due to a down-faulted block. This possibility is supported by evidence from the geological map of the area (Mt. Anderson East, 1 inch = 2 miles). This map shows a fault crossing the traverse near SP110 and another fault which, if it continues across the traverse, would cut it between SP118 and SP119.

Based on the foregoing evidence, a down-faulted block between SP110 and SP119 appears to be a reasonable hypothesis.

7. CONCLUSIONS AND RECOMMENDATIONS

The seismic reflection traverse which was shot across the Deep Well Anticline shows a pronounced anticlinal structure which persists to a depth of about 24,000 feet. It is possible that the northern flank of the anticline is disturbed by a down-faulted block approximately 2 miles across. There is no evidence that the axis of the structure migrates with depth. Although only one traverse has been shot, the results to date are encouraging and further seismic work is recommended to find the extent of the structure and to prove whether or not closure exists.

8. REFERENCES

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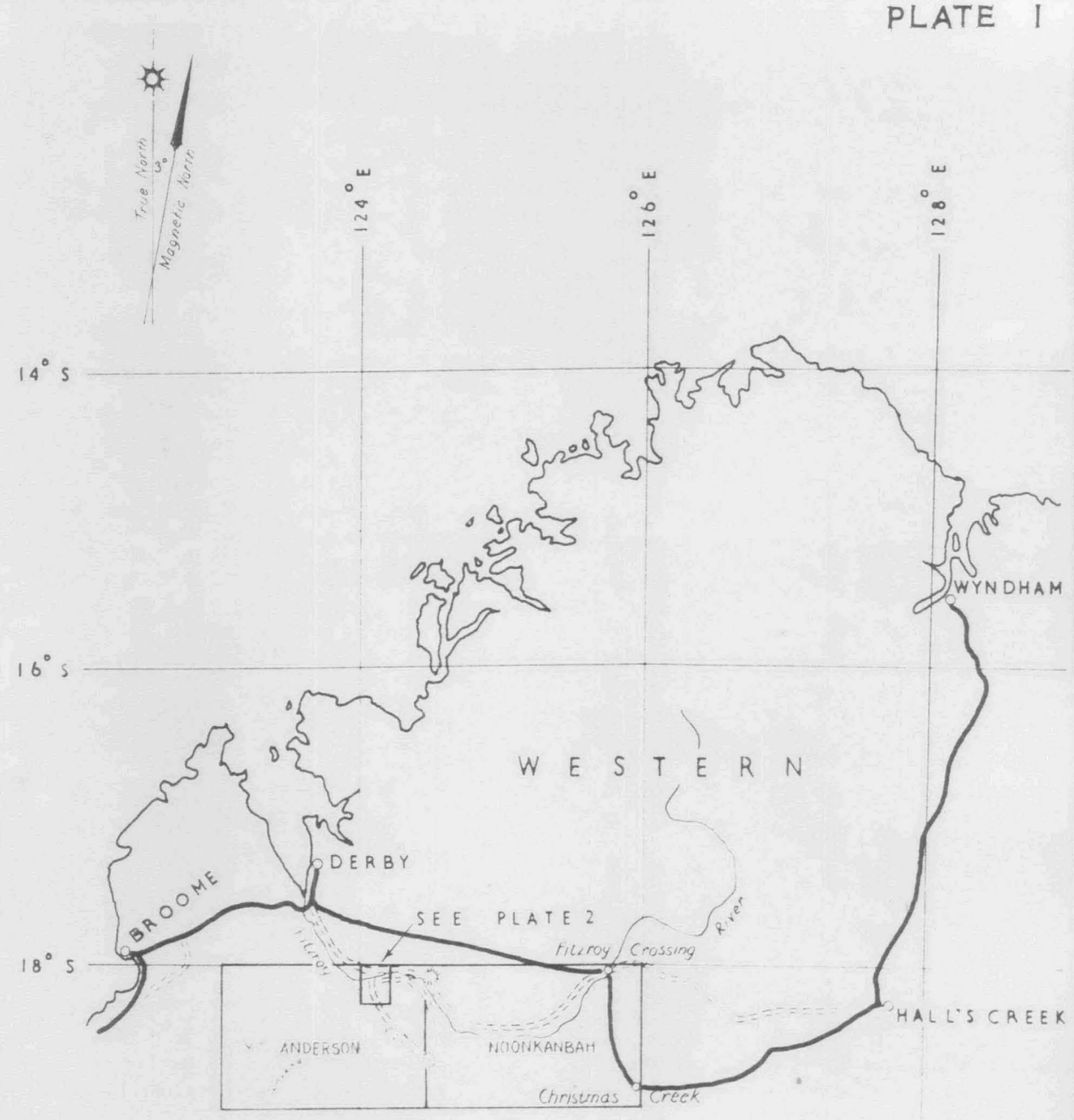
PLATE 1



SCALE IN MILES

75 0 75 150

SEISMIC REFLECTION SURVEY
OVER DEEP WELL ANTICLINE,
MYROODAH, KIMBERLEY DIVISION, W A

LOCALITY MAP

SHOWING POSITION OF AREA DEALT WITH IN REPORT
AND REFERENCE TO AUSTRALIAN FOUR MILE SERIES

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics G 115-59

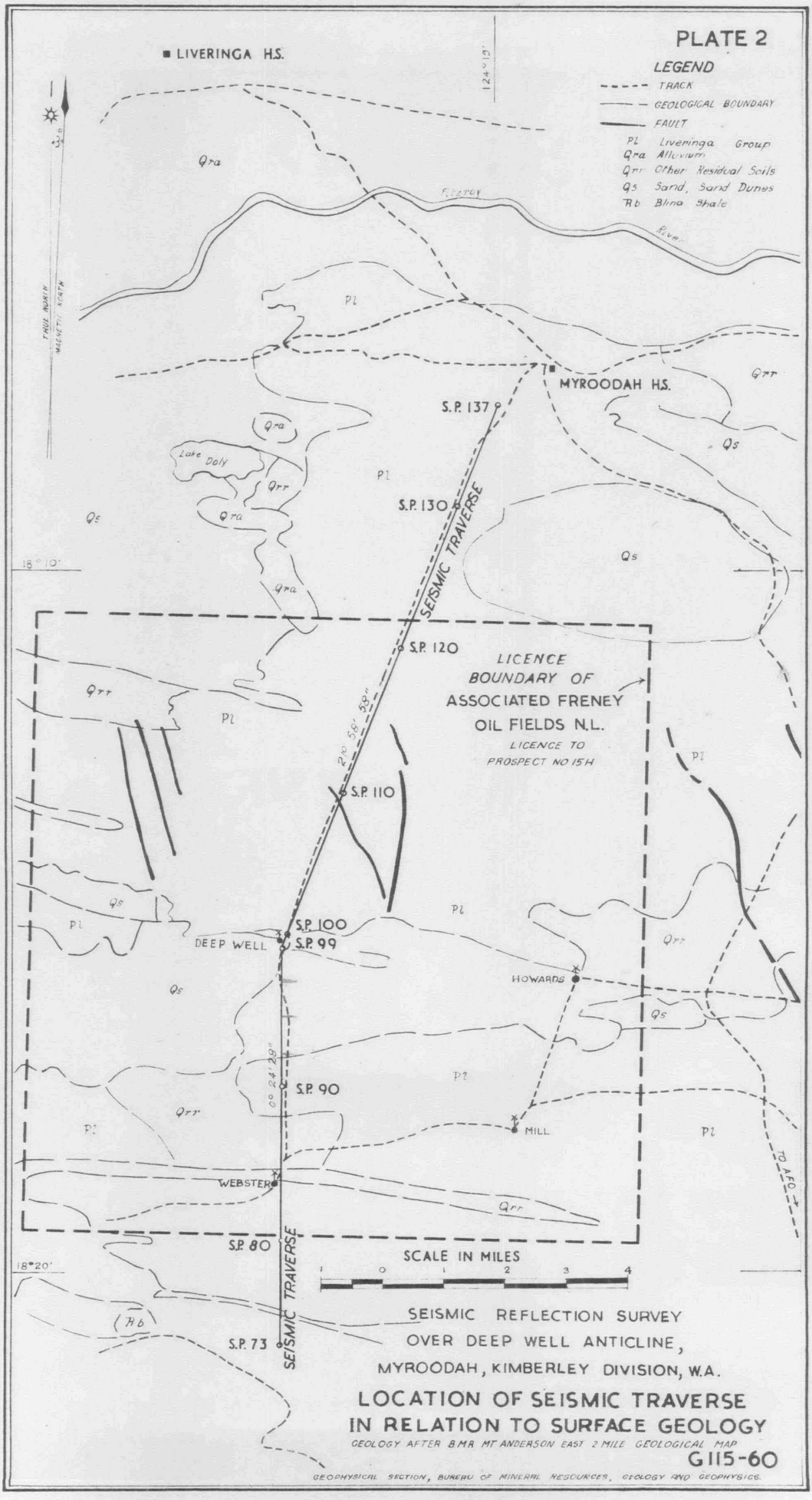
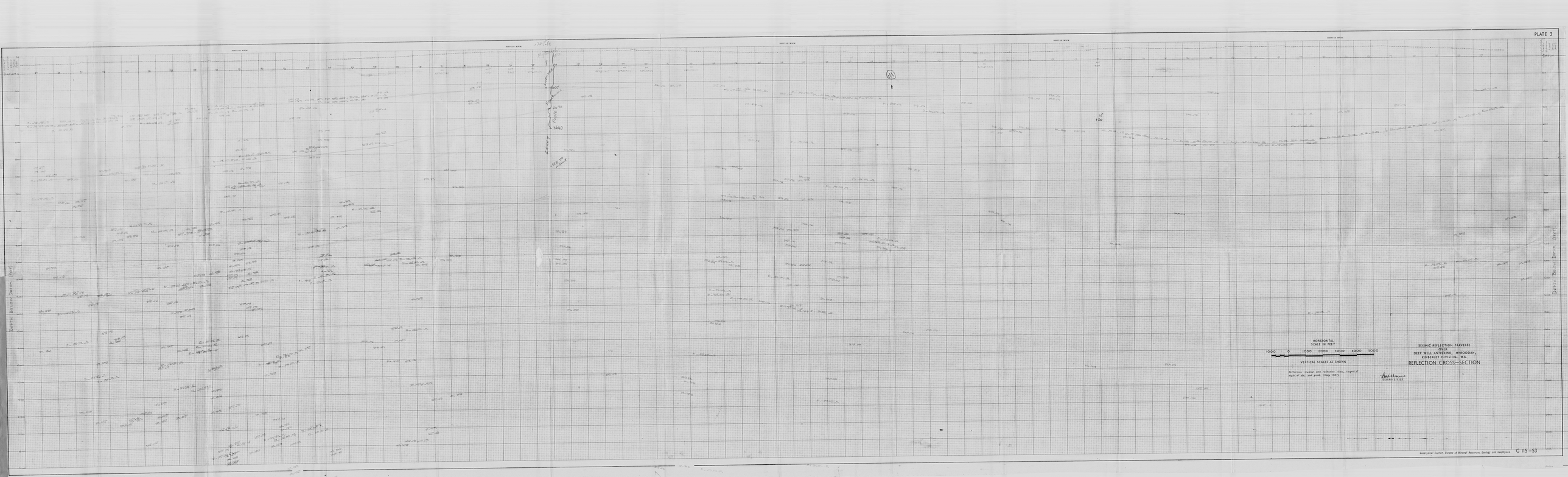


PLATE 2
LEGEND
TRACK
GEOLOGICAL BOUNDARY
FAULT
Pl Liveringa Group
Qra Alluvium
Qrr Other Residual Soils
Qs Sand, Sand Dunes
Rb Blina Shale
LIVERINGA H.S.
MYROODAH H.S.
S.P. 137
S.P. 130
S.P. 120
S.P. 110
S.P. 100
S.P. 99
S.P. 90
S.P. 80
S.P. 73
SEISMIC TRAVERSE
LICENCE BOUNDARY OF ASSOCIATED FRENEY OIL FIELDS N.L.
LICENCE TO PROSPECT NO 15H
DEEP WELL
HOWARDS
MILL
WEBSTER
Lake Doly
Fitzroy River
TRUE NORTH
MAGNETIC NORTH
124°13'
18°10'
18°20'
2° 56' 59"
0° 24' 29"
SCALE IN MILES
0 1 2 3 4
TO AFO
SEISMIC REFLECTION SURVEY
OVER DEEP WELL ANTICLINE,
MYROODAH, KIMBERLEY DIVISION, W.A.
LOCATION OF SEISMIC TRAVERSE
IN RELATION TO SURFACE GEOLOGY
GEOLOGY AFTER BMR MT ANDERSON EAST 2 MILE GEOLOGICAL MAP
G115-60
GEOPHYSICAL SECTION, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

PLATE 3



SEISMIC REFLECTION TRAVERSE
OVER
DEEP WELL ANTICLINE, HYRODAR,
KIMBERLEY DIVISION, W.A.

REFLECTION CROSS-SECTION

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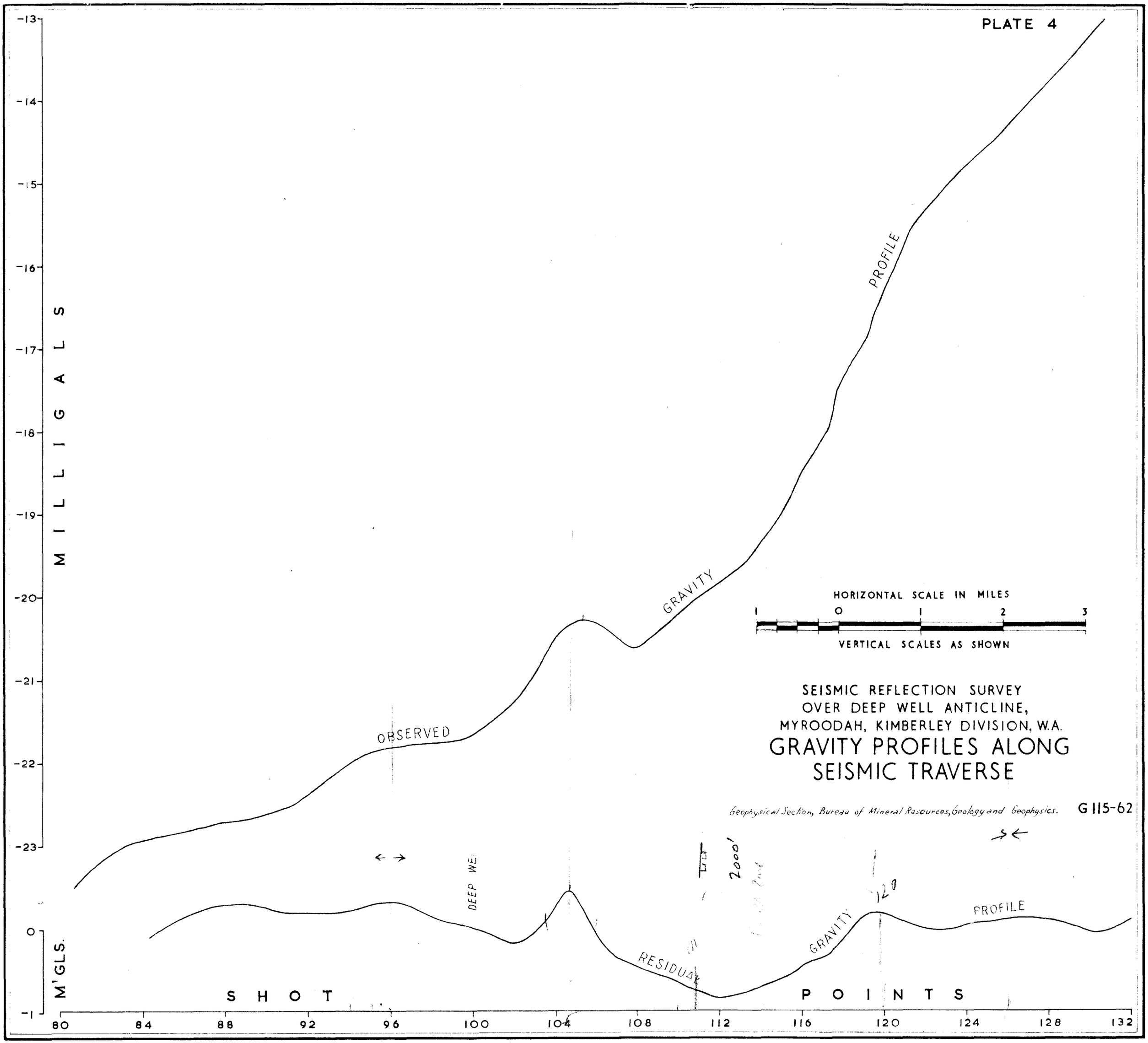
G 115-53

PLATE 4



SEISMIC REFLECTION SURVEY OVER DEEP WELL ANTICLINE, MYROODAH, KIMBERLEY DIVISION, W.A.

GRAVITY PROFILES ALONG SEISMIC TRAVERSE

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