# A REVIEW OF SEISMIC DATA

# MEREENIE ANTICLINE

# &

# ALICE SPRINGS

# ONSHORE

BY

GEODEX PTY. LTD

FOR

MAGELLAN PETROLEUM AUST. LTD



PR74/35

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PR 74/35

September 8, 1974.



Mr. R.M. Hopkins,
Magellan Petroleum Aust. Ltd.
G.P.O. Box 445F,
BRISBANE. Qld.

Dear Sir,

The seismic data around the Mereenie Anticline and the Alice Springs No.1 well has been reviewed according to your request. A report on my findings is attached.

In summary:- The northern flank of the Mereenie Anticline is controlled by a fault trend which is fairly well defined by seismic data and is substantiated by the gravity profile along line 73-1-4.5. Cross faults are evident towards the south-eastern extremity of the feature. Some indications of similar faults were noted in the area between W. Mereenie No.2 and N.W. Mereenie No.1 but the quality of data is poor and the evidence must be considered speculative.

Immediately north of the Alice Springs No.1 well, the lack of control for low velocity determinations has contributed to the deterioration of the seismic record sections, but geological factors also appear to be important. The Alice Springs No.1 well is on the south-western edge of a high feature located at the southern end of a north-south trending nose. North closure is effected by a normal fault which trends east-west. Less certain, and based to a large degree on replots of lines G and J, a thrust fault is thought to pass close to, but slightly north of the well. This fault also trends east-west. A higher area than the Alice No.1 site is indicated to the northeast of the well.

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The use of shallow refraction to determine accurate static corrections would serve a useful purpose in the Alice Springs area to improve processed sections, verify the high feature and determine its extent to the east and north. The low velocity problem is more extreme to the north where the possibility of further reversals to the southerly plunge of the nose exist.

It is feasible to use Magellan personnel in Alice Springs along with a seismologist, operator and instruments from Brisbane to do this work. The cost would be about $350 per day plus explosives. The coverage should be three miles per day but will depend on the detail required and the depth of the low velocity layer. Magellan would need to provide four or five people, three vehicles and a motorised hand auger. No dozing should be required and chaining and simple surveying, if needed, can be done by Magellan personel prior to the arrival of people and equipment from Brisbane.

Respectfully submitted,

L.W. Pfitzner

L.W. PFITZNER.

Mereenie Anticline.

For the purpose of illustration, the C2 horizon ( Top of the Goyder ) has been mapped.

The thrust faults on the southern flank of the anticline are well defined by the 1973/74 seismic work. The lower trace of the C2 being noted at DP 178 on line 4.5, DP 127½ on line 4.6 and the upper trace at DP128 on line 4.7 and approximately at DP 133 on line 4.8. The data quality on line 4.9 is poor but the upper trace of the fault on the C2 is thought to pass through DP 115 just to the north of E Mereenie No.3. This would put the upper trace of the Pacoota about 300 metres to the south of the well. As E. Mereenie No.3 penetrated about half of the Pacoota formation, it appears that T.D. was not a great distance above the fault plane and that the fault zone would be penetrated in another 100 metres.

In the vicinity of line A there appears to be a break in the continuity of the fault trend, but to the west, the trend appears continuous, the fault plane flattens and the amount of overthrust increases. A second thrust fault is noted on lines 6.5 and F. This is supported by the Bouguer Gravity map in this area.

The northern flank of the Mereenie Anticline is also faulted by a high angle reverse fault. This fault is noted on lines 4.7 and 4.8 at DP 108 and 117 respectively. It is inferred as passing through the northern ends of lines 4.6 and D from disturbances on the record sections.

The northern fault crosses line 4.5 between DP 210 and DP 220. The correlation of the C2 and deeper events across the anticline is considered to be reliable (refer DP 135 to DP 265, line 4.5 unmigrated section) resulting in a drop in seismic times of .545 secs. between DPs 210 and 220. The nearby surface dips of 21 degrees are not enough to accomodate this change in depth.
The correlation of the C1 (Pacoota) across the anticline on line 4.5 shows an increase in the interval thickness C1 to C2 of .060 secs. It is also noted that on line 4.8 this interval thickens northwards .035 secs. over a short distance. This loss of section as the Mereenie Anticline is approached from the north could be of stratigraphic interest.

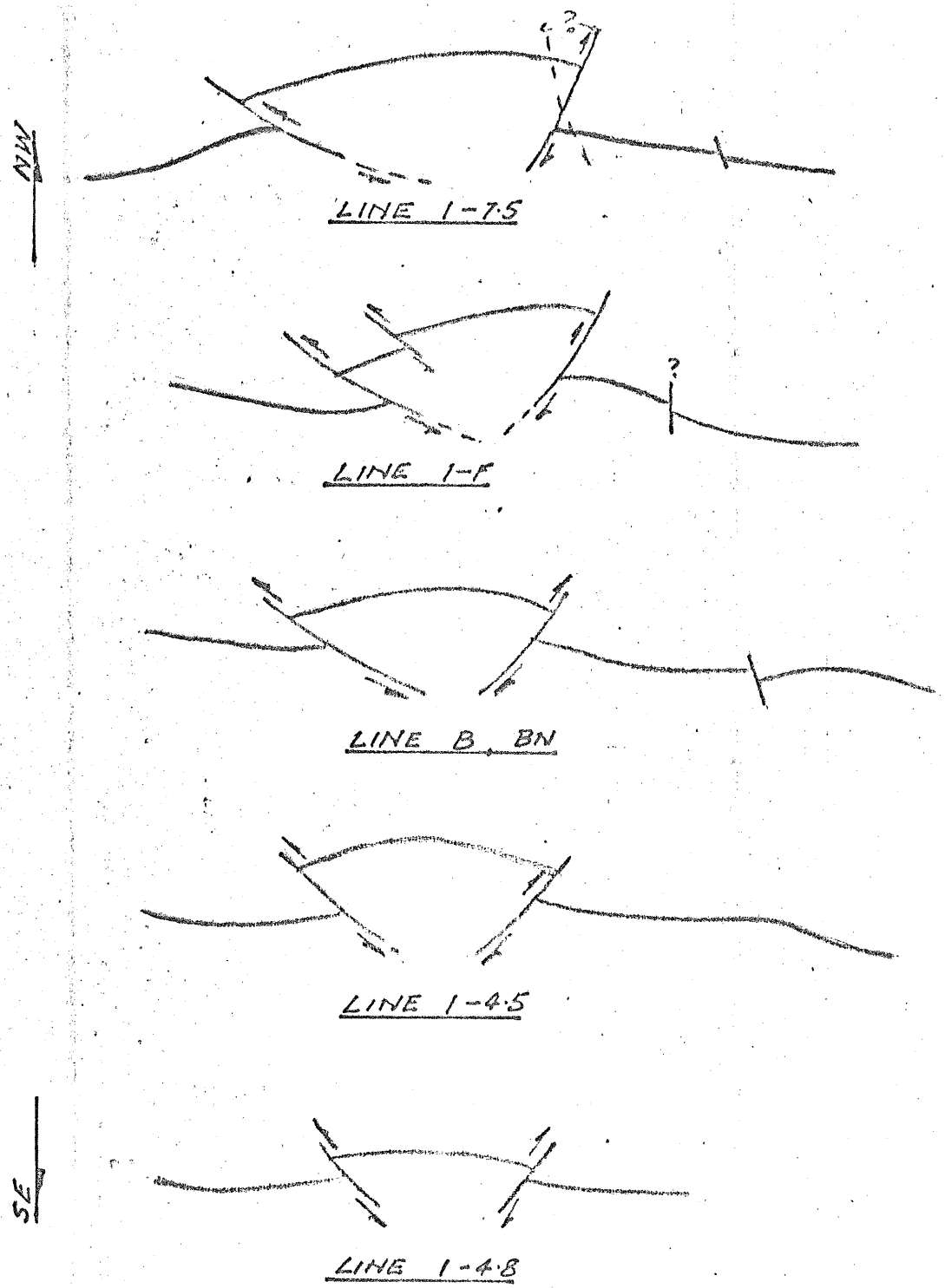
The broad terrace area northeast of W. Mereenie No.1 is bounded on the northeast by a fault down to the north. Immediately to the northeast of this fault is a minor anticline. This anticlinal trend is represented by a hinge line or fault on line 4.5 DP245. To the northwest it is noted at SP 69 on line 1.7. This could be the explanation for the Bouguer positive anomally which parallels the Mereenie Anticline. Normal faulting deeper in the northern syncline on lines M1, F and CN has not been traced for any distance and appears associated with a northeast-southwest trend across the basin.

At the southeast extremity of the Mereenie Anticline line M2 has definite indications of faulting at DPs 149, 174 and 199. All of these faults are down to the southeast. At 149 the throw is about.050 secs. and the sharpness would indicate a fault crossing nearly normal to the seismic line. This is also the case with the fault at DP 174. The fault at DP 199 is interpreted as crossing line M2 at an acute angle. It is logical that it is the continuation of the north bounding fault of the anticline. The thrust fault on the south flank of the anticline swings southward and diminishes in magnitude.

Cross faults are thought to be present elsewhere along the anticline and these indications are noted in the area between NW Mereenie No.1 and W. Mereenie No.2. The quality of this evidence is poor.

Figure 1. is a sketch of crossections through the anticline.

FIGURE. 1.




MEREENIE ANTICLINE
DIAGRAMATIC CROSSECTIONS NOT TO SCALE

Alice Springs Area.

The D2 horizon (Base of the Arumbera) has been mapped and included with this report.

Alice Springs No.1 well is located on a north-south trending feature which has been contoured as a nose plunging southwards. It is separated from the Ooraminna Anticline to the south by the eastward continuation of the intense syncline north of the Orange structure. A thrust fault shown along the flank of the Ooraminna structure is well established on line 1.6 and 1.5 and less well identified om line C.

The western flank of the nose has steep west dip probably with associated faulting. There is evidence of this faulting on line 2.2 and diffraction patterns on the southwest end of line 2.1 could indicate a fault off the end of the line. The eastern flank of the nose is less well defined.

A closed high is postulated at the southern extremity of the nose. This has been based on a study of the migrated section of line 1.1 and reduced records of lines G and J. Weathering calculations have been made on these lines from first break plots. These studies indicate variable corrections over the length of the lines - from zero to .074 secs. on line G and from zero to .062 secs. on line J.

The application of these corrections enhances the relief on the closed high. Refer to figs. 2 and2a for sketches of these sections and the weathering corrections applied.

Thrust faults have been postulated on Lines G and J. A straight line projection of these faults would indicate a similar fault immediately to the north of the Alice well. This coincides with the sudden deterioration of record quality on line 1.1 and makes the presence of such a fault a good possibility although direct evidence from the record section is not obvious.

Deeper reflections on line 1.1 continue to rise north of the Alice Springs well to a high point at DP 224. The value here for the D2 horizon is 1.080 secs. - .170 secs. higher than at the well location. This picture is somewhat confused by horizontal events which are strongest at about 1.0 secs. on the section. These events are most likely from the line-up of noise by the automatic statics program - a characteristic of this program where the signal to noise ratio is low.

The eastern flank of the nose is not sharply defined. Although there is no indication that the high feature continues eastwards or opens out to the east, the problem of low velocity layer corrections make either of these choices possible. The records on line A indicate a flatness northwest from SP 15 and an examination of the first breaks indicates that one would not expect this part of the line to be raised to any degree by LVL corrections.

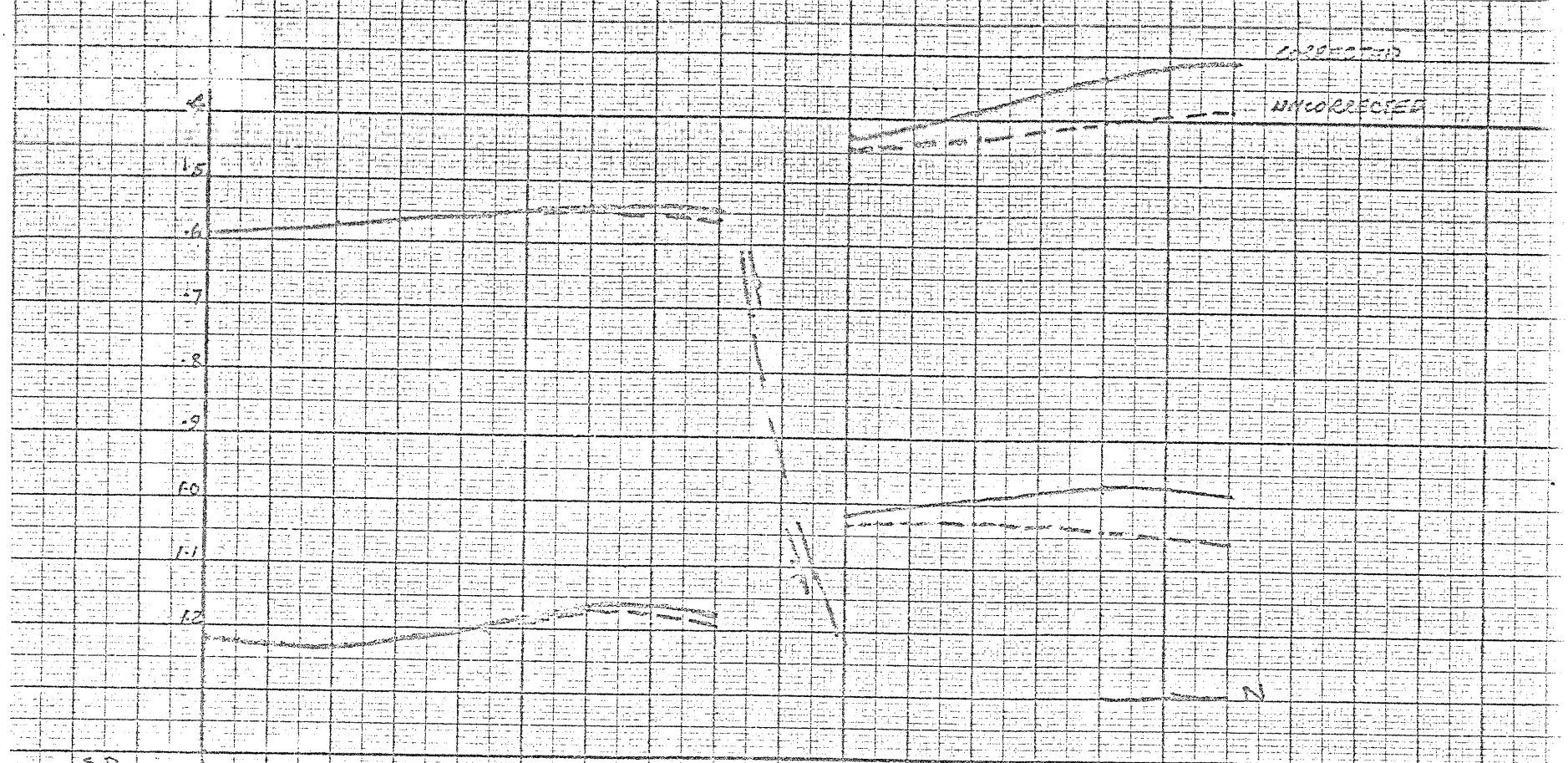
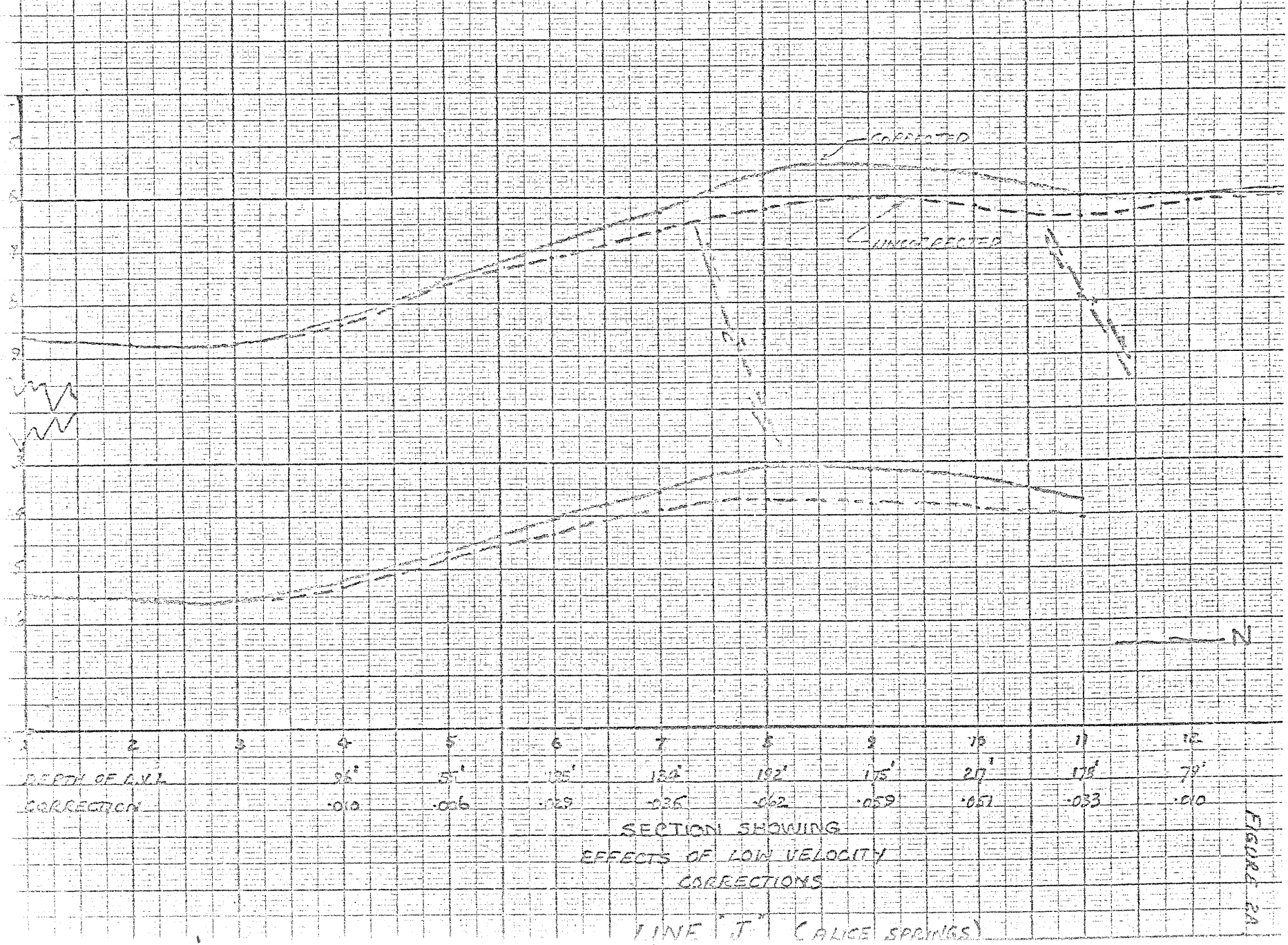



FIGURE 2

SECTION SHOWING
EFFECTS OF LOW VELOCITY
CORRECTIONS

LINE "G" (ALICE SPRINGS)




SECTION SHOWING
EFFECTS OF LOW VELOCITY
CORRECTIONS
LINE "J" (ALICE SPRINGS)

FIGURE 20

Shallow Refraction.

Our experience with the Weight Drop method has indicated that a serious LVL problem exists in a few areas in the Amadeus Basin. Some are local in extent ( line 3.3 S Waterhouse ) and probably represent buried river valleys. Others are more extensive such as the west end of line GA 1 Mereenie and the area north and east of the Alice Springs No.1 well. Possibly these larger areas are indicative of breached features that have been filled.

The corrections made to the current sections in the Alice Springs area are, at the best, approximations. First breaks have been plotted on lines G and J. As these were taken from filtered reduced records, they should not be considered to be highly accurate but can be considered to be a reliable indicator.
The plots show the problem to be complex with overall velocities as low as 1100 m/sec. and the plots complicated by both low and higher velocity stringers. The high speed refractor has a velocity of around 2750 m/sec.

The energy response on the Namco records is good using shallow holes a charges as low as 20 pounds. This suggests that, with emphasis on obtaining first breaks, shallow holes with coiled Geoflex or Ammonium Nitrate charges should give sufficient energy for a shallow refraction program.

A suggested makeup of a shallow refraction crew is as follows.

A 24 channel refraction recording system, two 1760' cables, 7.5 Hz refraction geophones, radios or cabling to allow offset shooting.
One motorised auger to drill 5' holes.
Explosives could be Geoflex coiled onto poles and driven into soft soil or loaded into shallow holes. Ammonium nitrate is an alternative.
Two men with a vehicle assigned to drill, load and fire charges.
Three men and a vehicle assigned to lay out cabling and geophones.
One vehicle for the Operator and instruments.
A Seismologist to work up results in the field as work progresses to determine the spread parameters necessary to obtain the required information.
The estimated cost of the seismologist, operator, instruments and recording supplies is $350 per day plus travel and living expenses. Magellan could provide all other personel, equipment and the explosives.
Program will need to be rechained. Elevations from the previous surveys should suffice providing markers can be located for direct ties.