COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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EAST ROMA SEISMIC SURVEY, QUEENSLAND, 1959-1960

BY

ASSOCIATED AUSTRALIAN OILFIELDS N.L.

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DEPARTMENT OF NATIONAL DEVELOPMENT

Minister: SENATOR THE HON. W. H. SPOONER, M.M.

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FOREWORD

In 1959 the Commonwealth Government enacted the Petroleum Search Subsidy Act 1959. This Act enables companies that drill for new stratigraphic information, or carry out geophysical or bore-hole surveys in search of petroleum, to be subsidized for the cost of the operation provided the operation is approved by the Minister for National Development.

The Bureau of Mineral Resources, Geology and Geophysics is required, on behalf of the Department of National Development, to examine the applications, maintain surveillance of the operations and in due course publish the results.

A seismic survey was carried out under the Petroleum Search Subsidy Act 1959 in the East Roma area of Queensland by Associated Australian Oilfields N.L. This Publication deals with that survey and contains information furnished on behalf of Associated Australian Oilfields N.L. and edited in the Geophysical Branch of the Bureau of Mineral Resources. The final report was written by W.E. Hightower, Supervisor, Austral Geo Prospectors Pty Ltd. The methods of carrying out the seismic survey and the results obtained are presented in detail.

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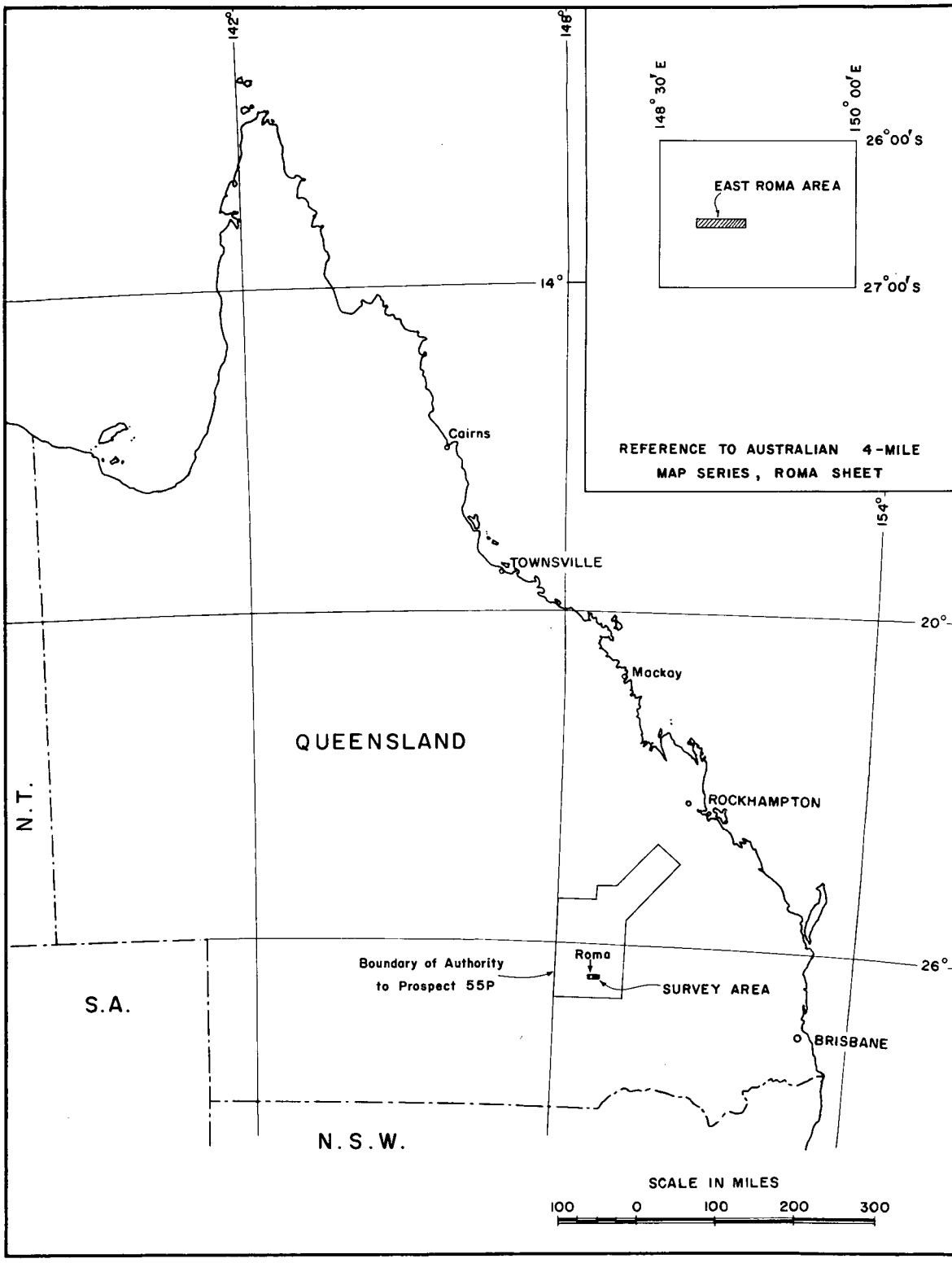

Fig. I. LOCALITY MAP

ABSTRACT

A reflection seismic survey was conducted in 1959-60, east of Roma, Queensland, on Authority to Prospect 55P, by Austral Geo Prospectors Pty Ltd for Associated Australian Oilfields N.L., through their management affiliate, Mines Administration Pty Ltd.

The primary purpose of the survey was to locate positions most favourable for the accumulation of oil and gas. One well, Timbury Hills No. 2, was drilled on a structure indicated by this survey and produced 1,250,000 cubic feet of gas per day. A second well, Pickanjinnie No. 1, tested 6,500,000 cubic feet of gas per day.

The seismic survey indicated several possible positions for future bore-holes, and there are indications of structures near the edge of the area. In order that these may be investigated fully, more extensive seismic work should be carried out.

1. INTRODUCTION

A reflection seismic survey was conducted in 1959-60 on Authority to Prospect 55P by Austral Geo Prospectors Pty Ltd for Associated Australian Oilfields N.L. through their management affiliate, Mines Administration Pty Ltd. The area covered by the survey (see Figure 1) lies between the towns of Roma and Wallumbilla and has been designated the East Roma area.

The area is gently undulating and is fairly densely timber covered except land which has been cleared for pasture and farm crops. The reconnaissance seismic lines followed dirt and gravel roads. Usually a bulldozer was used when the lines were laid for the detailed seismic work.

The area is only 300 miles from the east coast of Queensland and connected to Brisbane by surfaced roads, rail, and airline services. Commercial quantities of either oil or gas at Roma would be of considerable economic value. Since the accidental discovery of natural gas at Roma in 1900, this area has been the target of several short-lived and unsuccessful attempts to locate oil and gas in commercial quantities.

Believing that past failures had been caused by the lack of sufficient exploration to evaluate the area properly, and that chances for commercial production were good, the companies who held prospecting rights to the area decided in 1959 to carry out a comprehensive exploration programme.

2. PREVIOUS EXPLORATION

In 1900, a bore was drilled in the town of Roma near Hospital Hill to provide an artesian water supply for the town. During the drilling operations, a flow of gas was encountered in the Hospital Hill Sandstone at 3,683 ft, and thus began a history of spasmodic attempts to develop gas and oil in commercial quantities.

Gas from the first bore was allowed to waste at full flow for six years. A subsequent attempt to utilize the gas in the town of Roma was unsuccessful, possibly because of the poor techniques used in completing and producing the bore. Several additional wells in the immediate vicinity ($\pm$ 1,000 ft) of the first bore encountered appreciable gas flows. A.A.O.[1] No. 4 Well (Hospital Hill) drilled in 1954, produced 1,250,000 cu.ft per day (c.f.d.).

Up to 1959, nearly 50 wells had been drilled in the Roma district. The majority of these were drilled and tested using such questionable techniques as to cast doubts upon the reliability of the final results. Electric logs were run in very few of the wells, the drillers' logs furnished too little information to allow an accurate correlation of subsurface strata, and proper testing was not carried out in many of the wells which reported oil and gas shows. Consequently, an accurate evaluation of the area could not be made on the basis of information accumulated by previous exploration efforts. From drilling before 1959, however, came encouraging results in the following areas :

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(1) Footnote by the Bureau of Mineral Resources:

The following abbreviations are used in the text:

A.A.O. Associated Australian Oilfields N.L.
A.R.O. Australian Roma Oil Ltd.
R.B.O. Roma Blocks Oil Co. N.L.

Hospital Hill: Substantial flows (up to 1,250,000 c.f.d.) of commercial grade natural gas were obtained from wells drilled on structure. A.A.O. No. 5 and A.A.O. No. 6 Wells, drilled down-dip and off-structure, were unsuccessful.

Block 16: The R.B.O. No. 1 Well (1929), drilled on a small anticlinal nose and higher structurally than other Block 16 wells, produced approximately 600 gallons of oil. In three subsequent wells on Block 16 (1938, 1952, and 1953) only traces of oil and gas were encountered.

Warooby: The Warooby Well, drilled in 1934, reported a flow of 600,000 c.f.d. of gas with "considerable amounts of water". It is not known if the water came from the gas producing horizon or if the higher artesian aquifiers were not successfully cemented off.

Blythdale: Both oil and gas shows were reported in several wells drilled near the town of Blythdale, approximately 10 miles east of Roma (see Plate 1).

Wallumbilla: Before 1960, one well, A.R.O. No. 19, had been drilled near the town of Wallumbilla, approximately 25 miles east of Roma. It was suspected that the lower part of the section in this well was pre-Mesozoic. The Permian age of this lower section has been established by recent palynological studies. While the other wells discussed above reported shows only from the Lower Triassic rocks, the A.R.O. No. 19 Well had shows from both the Lower Triassic and the deeper Permian sedimentary rocks.

Reflection seismic, gravity, and magnetic surveys were conducted in the Roma area prior to the time of the reflection seismic survey described in this Publication. A detailed comparison of the results of the various exploration methods is not presented here because there is little agreement between the results of the gravity or magnetic surveys and the results of the detailed seismic work. It appears that neither gravity nor magnetic survey methods are sufficiently accurate to locate positions where oil would be most likely to accumulate.

A detailed reflection seismic survey (Dooley, 1954) was conducted by the Bureau of Mineral Resources in an area north and east of Roma during 1949 and 1950. Associated Australian Oilfields N.L., subsequently drilled A.A.O. No. 1 at a position which appeared on the cross-sections as a seismic "high". The well encountered only a small show of gas and was abandoned.

In 1952-53, additional traverses (Williams, 1955) were mady by a seismic team from the Bureau of Mineral Resources. Briefly stated, the results of these surveys failed to show any pronounced association between anticlinal structure and the areas wherein wells had encountered appreciable shows of gas and oil. It should be pointed out, however, that sufficient seismic points were not located near the Hospital Hill wells and the Warooby Well to determine the position of these two areas with respect to anticlinal structure.

In July, 1958, a very short reflection seismic survey was conducted in the Block 16 area by Foreign Oil Exploration, Inc. using personnel from Geo Prospectors, Inc., of Tulsa, Oklahoma, U.S.A. The results indicated that anticlinal nosing did exist near R.B.O. No. 1 Well but that if the Block 16 wells are on an anticline, they are far down on its flank. No critical reversal in dip was established.

Prior to 1959, various geophysical methods had been tried and numerous wells had been drilled, but there is no evidence to show that a really concentrated or well-organized exploration programme had ever been conducted in the Roma area.

3. GEOLOGY (Based primarily on information from wells)

The stratigraphic sequence (2) of rocks in the East Roma area presented below is based on the log of A.A.O. Pickanjinnie No. 1 Well drilled in June-July, 1960.

CRETACEOUS	Roma Formation	mudstone, shale, limestone streaks	365 ft
JURASSIC	Blythesdale Group	sandstone, shale	1063 ft
	Walloon Coal Measures	shale, sandstone, thin coal beds	1407 ft
TRIASSIC	Bundamba Group	sandstone	550 ft
	Moolayember Formation	mudstone, shale, sandstone	737 ft
PERMIAN		shale, sandstone	650 ft
AGE UNKNOWN	Timbury Hills Formation	hard, dense sandstone	378 + ft

The Pickanjinnie No. 1 Well was bottomed in the Timbury Hills Formation (3) at 5213 ft. The Timbury Hills Formation was defined from the section in A.A.O. Timbury Hills No. 2 which penetrated 557 feet of this formation. The formation is generally correlated with the 'metamorphic basement' or 'slate series' reported in the older wells. The rocks consist of very dense, hard shale and sandstone. Dips of between 60° and 80° were encountered in the Timbury Hills Well, but the same formation showed little or no dip in the Pickanjinnie Well. No definite age determination has been made, but is believed that the Timbury Hills Formation is pre-Permian.

Rocks of Permian age were encountered in the Pickanjinnie Well from 4185 ft to 4835 ft. Shows were encountered at Pickanjinnie in the Permian rocks at 4482-90 ft (15,000 c.f.d. wet gas, no water) and at 4797 - 4810 ft (core bleeding oil and gas).

(2) Footnote by the Bureau of Mineral Resources:

Recent palaeontological evidence, especially from microfloral studies, has shown that the Transition "beds" of the Blythesdale Group are Cretaceous and the remaining units of the Group are Jurassic; the evidence also shows that the Bundamba Group is of Jurassic age and the Moolayember Formation is Jurassic as well as Triassic in age.

(3) Footnote by Associated Australian Oilfields N.L.

A table of depths to formation tops in the wells in the Roma - Blythdale area is shown on Sheets 1 of Plates 1 to 6 inclusive. Studies of well-logging data which were incomplete at the time of compilation of the Final Report indicate that "basement" in A.A.O. Wells Nos 1, 4, 5, and 6 and R.O.C. Wells Nos 1 and 2 is the Timbury Hills Formation rather than Permian as suggested on the Plates.

The Moolayember Formation (Triassic) contains three sandstones that are potential oil-producers. The uppermost of these, the Hospital Hill Sandstone, tested 5,700,000 c.f.d. in the Pickanjinnie Well. Approximately 30 ft thick, the Hospital Hill Sandstone is the best potential oil-producer discovered in this area. In both the Timbury Hills and Pickanjinnie Wells, the Links Sandstone (approximately 10 ft thick) was encountered 15 - 20 ft below the Hospital Hill Sandstone. In the Timbury Hills Well this sandstone produced a show of gas but was mainly water filled. In the Pickanjinnie Well the Links Sandstone tested 1,000,000 c.f.d. of gas. The Showground Sandstone [4] (10 - 25 ft thick and located near the base of the Moolayember Formation) is not present in all wells drilled in this area. The Showground Sandstone usually provides shows of oil or gas. This sandstone tested approximately 25,000 c.f.d. on drill-stem test in Pickanjinnie No. 1.

No petroliferous rocks have been found in the post-Moolayember strata.

In general, the thickness of the sedimentary rocks increases from Roma towards the east and south-east. Wells at Block 16 penetrated the Triassic rocks and immediately encountered granite or granite wash. The Warooby Well was reported to have encountered granite directly below the Triassic, as were all the wells at Blythdale except A.R.O. No. 11, which is located down-dip from the other Blythdale wells. The A.R.O. No. 11 Well was reported to have penetrated approximately 150 ft of pre-Triassic [5] (probably of Permian age or belonging to the Timbury Hills Formation) sedimentary rocks before encountering granite basement. The Hospital Hill wells possibly bottomed in the Timbury Hills Formation, which probably can be considered basement near Roma. Near Wallumbilla, A.A.O. Pickanjinnie No. 1 had not encountered granite at a total depth of 5213 ft; and, at Wallumbilla, the rocks at the total depth of 4968 ft in A.R.O. No. 19 were Permian sedimentary rocks.

It would appear that basement (granite or Timbury Hills Formation) knobs exist in portions of the area, and that pre-Triassic sedimentary rocks, which originally existed over these knobs, have since been eroded from many of them. It is also possible that some lower Moolayember sedimentary rocks (such as the Showground Sandstone) pinch out over the "highs" of the basement. Information from wells indicates that the Hospital Hill Sandstone is present over all of this area.

The information from wells and evidence from seismic work suggests that the thickness of the sedimentary rocks (in particular, the Permian rocks) continues to increase east and south of the East Roma area.

4. METHODS OF OPERATION AND INTERPRETATION

Field Procedures

The survey was conducted using the continuous profile method. The complex subsurface geology revealed by the initial lines indicated that a detailed survey was necessary in order to obtain an accurate map of the subsurface.

(4) Footnote by the Bureau of Mineral Resources:

New microfloral evidence points to the fact that the Showground Sandstone may not be a member of the Moolayember Formation as shown in outcrop.

(5) Footnote by the Bureau of Mineral Resources:

Spores of Lower Jurassic age have been identified from cores taken 30 ft above the granite.

Other items of field procedure are outlined in statistical form in an appendix to this report.

Progress Maps

Progress maps were used to select the site of two wells drilled by Associated Australian Oilfields N.L. in 1960; i.e. Timbury Hills No. 2 and Pickanjinnie No. 1. Refinements were made in computations before calculating the data for the maps which accompany this report. In no instance have these adjustments resulted in any significant change in the original interpretation. The refinements are discussed in the following paragraphs.

Elevation Velocity

The progress results were originally calculated using an elevation velocity of 10,000 ft/sec. Average horizontal velocities disclosed by refracted energy from the base of the weathered zone indicated that an elevation velocity of 10,000 ft/sec was too high. This conclusion was confirmed by the velocity survey taken in the Timbury Hills No. 2 Well. Data shown on the accompanying maps have been recomputed at an elevation velocity of 8000 ft/sec. The elevation change is gentle (see Plate 1) over the prospect area and the differences in the results computed by the two methods were not sufficient to change the interpretation of the local structure.

Velocity Functions

The results were plotted on field maps as functions of time. Velocity functions for use in the time-depth conversion of data for the final maps were calculated from information obtained from the velocity survey of the Timbury Hills No. 2 Well. The survey in Timbury Hills No. 2 disclosed some very abrupt changes in velocity. No simple relationships of average velocity and depth seemed possible. A fairly simple approach to depth computations could be made provided relationships were restricted to depth, time and interval velocities.

Checks of various velocity functions against control points (drill tests) resulted in the selection of the following conversion formulae:

(i) $D_1 = 4630\ T_1 - 1324$

(ii) $D_2 = D_1 + 5710\ (T_2 - T_1)$

(iii) $D_3 = D_2 + 7280\ (T_3 - T_2)$

where D_1 is the depth below sea level of "Zone A - Within Walloon Coal Measures".

D_2 is the depth below sea level of "Zone B - Upper Moolayember".

D_3 is the depth below sea level of the top of the "Near top of Timbury Hills Formation".

T_1, T_2, and T_3 are the corrected two-way times of the Zone A, Zone B, and "Near top of Timbury Hills Formation", respectively, from a datum plane 1000 feet above sea level.

4630, 5710 and 7280 represent one half of the interval velocity between the datum plane and Zone A; Zone A and Zone B; and Zone B and "Near top of Timbury Hills Formation", respectively. 1324 represents a total correction for distance of the datum plane above sea level (1000 ft), the correction necessary to adjust the reflection picked on the record to the first impulse of reflected energy, and the intercept on the 'D' or depth axis at a datum of 1000 ft above sea level given by the linear function of formula (i).

A velocity survey was taken in the Pickanjinnie No. 1 Well by a seismic crew from the Bureau of Mineral Resources, but the information was not available at the time of writing this report.* Undoubtedly, lateral variations in velocity will exist within the prospect area because of the rapid changes in the geology. Several test wells and velocity surveys will probably be required before an accurate set of velocity functions can be devised that are applicable to the whole area.

Weathered Layer Corrections

The progress results were calculated using observed up-hole times on the assumption that all shot-holes penetrated the complete surface weathered layer and that there was single-layer weathering. In preparation of final data, graphs of refracted energy (time against distance) were plotted for all shot-points. Two-layer weathering exists over parts of the prospect area and the original corrections were modified to fit the weathered layer conditions where necessary. Changes in the corrections were of minor nature and caused no appreciable change in the contour configuration.

Probable Error

A number of computation systems and tests were applied to data before preparation of the final values. These steps were taken in an effort to eliminate as many sources of error as possible. There remain, however, two main sources of error in predicting depth that are beyond control at the present stage of prospecting.

One probable factor in depth prediction is the expected lateral changes in average velocity. Ties with wells are discussed in later paragraphs but, in general, it appears that the velocity functions chosen operate fairly accurately over all portions of the prospect except for the Block 16 area. In that area, there was no subsurface control for Zone A, but it appears probable that formula (i) yields too high a velocity to fit the existing conditions. The accuracy of all other depth predictions are dependent on formula (i). Any error made in the prediction of shallow depths is carried on to the deeper beds.

An additional, and probably the largest, source of probable error is inherent in the nature of the problem involved. Zone A is not an outstanding reflector but is only one of a number of inconsistent seismic events located within a consistently observed band of energy arriving from this general zone. The "picking point" of the Zone A reflection often appears to be composited with the amplifier tailing from other reflected events and, consequently, is often distorted in form. The amount of apparent shift in the "picking point" could be as much as 0.015 sec; consequently, probable error in predicted depth from this source alone could be as much as 70 ft on any specific location if it is compared with a control point a few miles away.

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* Preliminary velocity data in chart form were received from the Bureau of Mineral Resources at the very late stages of report preparation. Comparison of velocity data from the two tests with the velocity functions used for time-depth conversion indicates compatability at all levels other than that for the "Near top of Timbury Hills Formation" horizon. Velocity values obtained by the formulae are considerably higher than those observed, indicating that the actual sources of the "Near top of Timbury Hills Formation" reflection is higher than the Timbury Hills Formation. However, the abrupt velocity interface shown by both velocity tests at the level of the Timbury Hills Formation should provide a major reflection similar to that mapped, and the excellent agreement of observed and predicted depth at Pickanjinnie No. 1 for the Timbury Hills Formation suggests further analysis of velocity data is advisable before accepting the above conclusion as final.

Both "Zone B" and the "Near top of Timbury Hills Formation" horizons are complexly faulted. The accuracy of the maps attached are dependent on the accuracy of correlation between records taken in the different fault blocks. In the majority of instances the character of these reflecting events is such that the correlation should be accurate within one "cycle". However, a one "cycle" miscorrelation represents an error of 115 ft at the level of "Zone B" and 145 ft at the level of the "Near top of Timbury Hills Formation" even though all other steps of the calculation procedure are accurate.

Summarizing the above, one can expect formations encountered in a wildcat test within the East Roma area to vary from zero to more than 150 ft from predicted depths.

5. INTERPRETATION OF RESULTS

Presentation of Results

Results of the survey are summarized by the maps at the back of this report. Each map is in two parts with the dividing line near the centre of the prospect in order to present the necessary detail on a map of a convenient size.

The following information has been filed in the Bureau of Mineral Resources, Geology and Geophysics, and is available for future reference:

(1) Complete set of record sections;

(2) Complete set of work cross-sections;

(3) Eight sample plotted cross-sections.

Surface Elevations

Surface elevations (see Plate 1) were contoured without reference to drainage in order that a direct comparison could be made between surface elevations and subsurface data.

In general, the surface elevations disclose a gentle, but variable southward dip over the prospect area. Some slight connection exists between structure shown by Zone A and the topographic features. Any influence of the overburden on average velocities to depth was small when compared with the effect of the subsurface features. A topographic overburden factor could be included in a general velocity formula for the area.

Zone A - Within Walloon Coal Measures

A very pronounced band of reflected energy from a source in the Upper and Middle Jurassic strata appears on all the records. The individual events of the reflecting band all appear, phase, and disappear at various locations over the prospect area. No individual event provided a first-class reflecting marker. Progress maps were constructed by the use of a "phantom" horizon which averaged the dips shown within the reflecting band. A closer study of individual events for the purpose of final map construction indicated that some of the faults cutting the deeper horizons extended upward to cut Zone A. The map submitted was based on the actual reflections picked from records using approximately ninety percent of the shot-points. The remaining points have an "estimated" (E) or phantom position determined by the configuration of the nearest energy pulse or reflection.

Zone A is tentatively identified as having a source within a Jurassic formation shown by electric logs as a fairly pronounced anomalous self-potential curve. Tops are picked at the Timbury Hills No. 2 and Pickanjinnie No. 1 Wells at depths below the surface of 1785 ft and 1942 ft, or 675 ft and 873 ft below sea level, respectively. Additional electric log "picks" of questionable value are shown for Wells A.A.O. No. 4, A.A.O. No. 5, and A.A.O. No. 6 at about 780, 756, and 795 ft below sea level, respectively. The predicted depth of 843 ft below sea level at the Pickanjinnie No. 1 location, based on the velocity function determined at Timbury Hills No. 2, differs by 30 ft from the observed depth of 873 ft below sea level. This disagreement is within the limits of probable error outlined in prior paragraphs and is not considered a cause for immediate worry or for further analysis.

All of the major structures shown by the deeper horizons are reflected by Zone A to some degree. A map on this horizon could be used as a guide to wildcat drilling with some measure of success. The probable ratio of success to failure would not be favourable, however, because of the complex fault system displayed by the deeper horizons.

Favourable structure is shown by Zone A near Hospital Hill, Timbury Hills No. 2, A.A.O. No. 1, Warooby, the newly staked Well, A.A.O. Latemore No. 1 (Shot-point 370), and Pickanjinnie No. 1. A number of other features, which are only partially mapped, are suggested by the contour interpretation as being located near the edges of the survey.

Faulting at Zone A level appears to have the greatest intensity in the area lying between Hospital Hill and the Warooby Well. Only one fault, north of Pickanjinnie, is shown in the eastern portion of the prospect area. Comparison of surface dips and fault projections from Zone A suggests that some of these faults may extend to the surface, or at least through the Jurassic formations if not into the Cretaceous rocks.

Zone B - Upper Moolayember

The mapping reflection designated "Zone B - Upper Moolayember" has a source from the Triassic rocks; this source is the most consistent reflecting horizon shown by records in the western half of the prospect area. The quality of this specific reflection deteriorates markedly in the eastern half of the survey. The position of the mapping reflector with respect to surrounding reflectors in the eastern part of the survey may explain this phenomenon.

The geological horizon tentatively identified as controlling the position of the "Zone B" reflection is exemplified by the electric log resistivity curve anomaly occurring at a depth of 3316 ft below the surface or at 2206 ft below sea level at the Timbury Hills No. 2 Well. Correlations of drill tests were made as follows:

Pickanjinnie	No. 1	- 3638 ft below surface or 2569 ft below sea level
A.A.O.	No. 4	- 3335 ft below surface or 2295 ft below sea level
A.A.O.	No. 5	- 3375 ft below surface or 2351 ft below sea level
A.A.O.	No. 6	- 3376 ft below surface or 2371 ft below sea level

Zone B, as tentatively identified, is somewhat conformable to the Hospital Hill Sandstone, although it varies through a range in depth interval above that formation from 320 to 390 ft at the above five locations. A fair check of the depth of the Hospital Hill Sandstone can be obtained at most of the other well locations by taking the computed depth of Zone B and adding

350 ft. The points of largest disagreement are in Block 16, at Timbury Hills No. 2, and at A.R.O. No. 11 Wells. Disagreement at Block 16 is considered to be the result of changes in average velocity (see earlier discussion). The interval between Zone B and the Hospital Hill Sandstone at the Timbury Hills Well is the largest encountered, 391 ft, and does not fit the average interval of 350 ft. The disagreement at A.R.O. No. 11 is assumed to be the result of faulting on, or just north of, the location of the well.

Assuming the above analysis to be correct, one must conclude that the map "Zone B - Upper Moolayember" should be given the greatest consideration when choosing drill locations to test the Hospital Hill Sandstone.

Structure displayed by Zone B is very complex. Dips are not steep, but structures are so highly faulted that it is difficult to arrive at any conclusions regarding a systematic fault pattern. Some of the faults are obviously normal faults. A great many of them appear to be thrust or reverse faults although the frequency of fracture is so great that the exact nature of the faulting is difficult to determine.

The fault pattern shown by the map may well be completely erroneous as it is the result of connecting all points which are in local agreement in direction of displacement. The ultimate solution, which can be determined only by an excessive amount of seismic control or a large amount of drilling, will probably be the establishment of two opposing, "en echelon" systems. If such is the case, a correct interpretation may show an even more complex fault system, but data will be more readily contoured and structural features more readily distinguishable.

Wells in the area which are now capable of producing, or which have had significant shows of oil or gas, are all located on structure. All of the old wells located off-structure were complete failures except the R.B.O. No. 1 (Block 16) which produced a reported 600 gallons of oil.

One possible exception to the above statement may be the A.A.O. No. 1 Well, which was drilled on the basis of a seismic survey made by the Bureau of Mineral Resources. This well is located near the junction point of at least two faults, and may well have intersected a fault or faults and missed all or part of the petroliferous rocks. A further analysis of samples from this well might provide encouragement for another bore-hole in the immediate area, as the feature lying just south of it looks quite attractive.

The area covered by the survey is broken into small, highly faulted, structural anomalies. The basic alignment of structural features is difficult to determine because of the limited extent of the survey. However, using the shallow map "Zone A" as a guide and making a detailed study of the deeper map, one may draw preliminary conclusions as follows:

(a) The dominant trends of anticlinal folding is north-west and individual trends mapped by this survey extend across Hospital Hill Well, Timbury Hills No. 2, Warooby, Latemore No. 1, and Pickanjinnie No. 1. The distance from crest to crest appears to be from 3 to 3 1/2 miles.

(b) A secondary system, with about the same frequency of folding, appears to cross system (a) at some yet to be determined angle (possibly 60° to 90°). The survey does not cover enough distance in a north-south direction to provide much information regarding the frequency of cross folding.

Should the above analysis regarding the anticlinal fold frequency be approximately correct, one could expect to be able to delineate a structure capable of producing gas from the

Hospital Hill Sandstone within every 3 to 3 1/2 mile square or within every nine or ten square miles of area westward from the town of Wallumbilla. The same reasoning leads to the expectation that each producing feature will be small and will not cover a great number of square miles of area.

"Near top of Timbury Hills Formation"

The reflection from which the horizon designated "Near top of Timbury Hills Formation" was mapped was the most consistent reflection over the whole prospect area. It is of outstanding quality in the eastern portion of the prospect area and of good quality in the western part. In a number of places, additional reflections appear below the mapping horizon, and there always exists the possibility of miscorrelation between fault blocks. In the majority of instances, the correlations were considered reliable.

Structural conditions at this level are quite similar to those shown at the level of Zone B. The features show more relief, a greater intensity of faulting, and more displacement between fault blocks than the shallower horizons. A favourable structural location shown by Zone B is often, but not always, a favourable location at this level. The real value of the "Near top of Timbury Hills Formation" map should be in the evaluation of the petroliferous rocks below the zone of the Hospital Hill Sandstone. Drill test locations over or near fault zones at "Near top of Timbury Hills Formation" level should be avoided if the test is designed to explore the lower formations as well as the Hospital Hill Sandstone.

The structures shown at this level have been undoubtedly subjected to severe erosion during one or more periods prior to the time of the deposition of the Hospital Hill Sandstone. However, some of the conclusions reached solely on the basis of limited subsurface control may be incorrect. The intensity, frequency, and type of faulting in the lower beds could cause an increase or decrease in the thickness of the rocks at any specific drill location.

A possible example of the effect of faulting is provided by an analysis of the Timbury Hills No. 2 and the Pickanjinnie No. 1 Wells. The Timbury Hills Formation, encountered in both wells, should provide an excellent seismic reflection interface. Velocity functions constructed from information obtained in the survey of Timbury Hills No. 2 provided an excellent prediction of the depth of the Timbury Hills Formation at Pickanjinnie No. 1 (3750 ft below sea level calculated, against an observed depth of 3773 ft below sea level). The postulated depth from contour values at Timbury Hills No. 2 (the well from which the velocity information was taken) checks very poorly the observed depth (a contour value of 3175 ft below sea level versus an observed depth of 2880 ft below sea level). Core data in Timbury Hills No. 2 showed dips of between 60° and 80°; the same type of information from Pickanjinnie No. 1 showed little or no dip. The Timbury Hills No. 2 Well is located directly over a postulated fault or faults at "Near top of Timbury Hills Formation" zone, whereas Pickanjinnie No. 1 is located from 1/4 to 1/2 mile from any of the observed fault traces. No continuous or persistent, steep dips were recorded by seismic data at any place in the East Roma area. The Showground Sandstone does not occur in Timbury Hills No. 2, but it is present in Pickanjinnie No. 1 and at other locations in various directions from the Timbury Hills No. 2 Well. The thickness between Zone B and Hospital Hill Sandstone is 391 ft in the Timbury Hills Well - approximately 50 ft more than that shown by any of the other four electric logs.

A summary of the above factors suggests that the section as disclosed by the log in Timbury Hills No. 2 is not necessarily representative of the normal section over the entire

Timbury Hills structure. The log from Pickanjinnie No. 1 should approximate a normal section for the Pickanjinnie stucture.

Interval Maps

Regional trends of interval thickening are difficult to analyse on the basis of the limited coverage furnished by the seismic survey. The analysis is further complicated by the complex fracture pattern of the deeper beds. Detailed conclusions seem impossible until more positive information is available regarding the exact nature and alignment of the fracture pattern. The conclusions in the following paragraphs are limited to those of a general nature.

(a) Zone A to Zone B.

The map representing the interval between Zone A and Zone B reflects the primary structure of Zone B. In most instances, the point of thinnest interval fails to agree exactly with the crest of the structure of Zone B. Zone A displays a southward component of regional dip or tilt which is greater than that displayed by Zone B. The thinnest interval indicated by computed data lies southward of the Warooby structure. By extreme generalization, one may speculate that a Permian age fold extended in a general north-west direction to south-east through the Warooby area. If such were the case, one could speculate further, that the points of thinnest interval would be displaced from the crest of the Zone B structure towards the south-west in those portions of the prospect lying eastward from Warooby, and toward the north-east in that portion of the area lying west of Warooby. Such a generalization seems to fit most of the data.

(b) Zone B to "Near top of Timbury Hills Formation".

Analysis of interval data between Zone B and "Near top of Timbury Hills Formation" is quite difficult. In some portions of the prospect, the fault patterns interpreted were deliberately made different on the maps of the two zones so as to present alternate possibilities. Many of these faults are interpreted as reverse or overthrust. In preparation of the interval map, the fault system from both horizons was placed on a single map, so that those values lying within a possible reverse fault or thrust zone could be isolated, and these data replaced by a question mark, as the use of such values would complicate analysis still further. Only the fault system of the "Near top of Timbury Hills Formation" zone was retained on the interval map for the same reason.

All the major structural features are reflected to some degree by the interval Zone B to "Near top of Timbury Hills Formation", but the connexion is not nearly so close as that displayed by the interval Zone A to Zone B. The lower interval thickens towards the east in an erratic pattern across the complex systems of faults. Eastwards from the town of Wallumbilla, the interval thickens quite rapidly. Erratic variations prevent any positive conclusions regarding trends but there is a possibility that a pre-Permian fold crossed the area in an east-south-east direction just south of the Warooby Well.

6. CONCLUSIONS AND RECOMMENDATIONS

The complex geology of the East Roma area is such that there are a multitude of positions which are favourable for the accumulation of oil and gas. Many of the areas indicated by the seismic survey are insufficiently outlined by present data to eliminate the possibility of an unfavourable structural location. There is always the possibility that an off-structure location will provide a better oil or gas reservoir than the crest of a structure, but such locations can only be predicted when the structure of the area is fully understood.

Possible locations for future drilling chosen on the basis of the present data are tabulated below:

(1) The already planned well at Shot-point 370 - A.A.O. Latemore No. 1.

(2) Shot-point 274 - located approximately one mile south-east of the Warooby Well.

(3) Hospital Hill - between Shot-points 406 and 407 - located on the old Hospital Hill structure approximately 3/4 mile south of A.A.O. No. 4.

(4) Shot-point No. 577 - located 1 1/4 miles east of the A.A.O. Latemore No. 1 location.

(5) Shot-point 362 - located approximately two miles west of the Latemore No. 1 location.

(6) Shot-point 688 or 689 - located approximately 1 1/4 miles east of Pickanjinnie No. 1 Well.

(7) Shot-point 91 - located 1/4 mile south-west of the Warooby Well.

(8) Shot-point No. 188 - located approximately one mile south of A.A.O. No. 1.

In the listings above the locations 1, 2, and 3 appear to be adequately established. The number 3 location, that at Hospital Hill, might be questioned because of the amount of gas that had been allowed to escape from this reservoir during the past sixty years. Locations 4 and 7 should be dependent on the outcome of Wells 1 and 2. Locations 5 and 6 are designed specifically to test the flank of the Latemore and Pickanjinnie features. Location 6 is chosen to occupy a position within a synclinal indentation on the steep east flank of the Pickanjinnie feature on the theory that such a structural position would provide an ideal place for maximum sand deposition. Any drilling at location 8 should be delayed until the structure is more fully outlined.

Interesting structure is suggested, but only partially outlined, on the margins of the surveyed area. A few of these areas are tabulated and discussed below:

(1) Seismic data, in the area south of Pickanjinnie No. 1, suggest that the fault block wherein this well is located is only part of a much larger feature, and that locations even more favourable than that of Pickanjinnie No. 1 are available on the same general feature.

(2) An anomalous area located just east of the town of Wallumbilla is suggested by west dip on Zone B. Zone A is flat over this same area and the "Near top of Timbury Hills Formation" shows only strong easterly dip. This area should be more fully investigated, for the data indicate thicker than average sedimentary rocks of Lower Triassic and Permian age.

(3) If it can be established that northerly dip occurs, the feature at the edge of the survey in the area to the north-east of the Latemore drilling location would be extremely attractive.

(4) Anomalies located at the edge of the area of the survey north of Pickanjinnie No. 1 Well are bounded on the west by a series of "down to the west" faults.

(5) The Warooby feature appears to be only partially mapped. The survey should be continued southward.

(6) An attractive structure is indicated at the edge of the survey north of the Warooby Well.

(7) Additional control is necessary in the vicinity of the A.A.O. No. 1 Well and the potential drill location listed as number 8.

(8) The Block 16 area is worthy of additional attention because of the type of structure shown and the strong oil show in the R.B.O. No. 1 drill test.

The East Roma area should be given first priority for continued drilling and further seismic exploration programmes. It seems certain that there is gas in commercial quantities. If a drilling programme were carried out with the intention of establishing and delineating gas reserves, such a programme would also determine the possibilities for the commercial production of oil.

ACKNOWLEDGEMENTS

Interpretations made, and conclusions drawn, from results of a modern seismic exploration programme are never the product of a single effort. The author is indebted to a number of persons. They have each made a material contribution toward the contents of this report. Their contributions include the assembly of information, the interpretation of seismic data, and the derivation of the conclusions from the final data. A few of the persons who have assisted the author in this exploration effort are: D.M. Traves and S.S. Chambers of Mines Administration Pty Ltd; J.A. Walls of Austral Geo Prospectors Pty Ltd; and H.S. Eshelman, W.B. Miller, and H.M. Thralls of Geo Prospectors, Inc., Tulsa, U.S.A.

Every oil exploration effort should represent a composite of all available information. Those individuals and organizations contributing to the total information of the East Roma area are too numerous to mention, but each must be considered as having played a significant part in the exploration for oil and gas.

REFERENCES

DOOLEY, J.C. 1954 Seismic reflection survey at Roma, Queensland. Bur. Min. Resour. Aust. Rep. 16.

WILLIAMS, L.W. 1955 Seismic reflection survey at Roma, Queensland, 1952-53. Bur. Min. Resour. Aust. Rep. 23.

APPENDIX 1

FIELD PROCEDURE

Type Geophones Used	S.I.E. S16; 18 c/s
Number per Trace	3
Connection	Series
Spacing in Group	15 ft
Type Amplifiers	Century (Modified)
Number of Channels	24
Normal Filter Setting	32 - 78 c/s
Mixed or Unmixed	Mixed and unmixed
Spreads Used	Straddle; 1320 ft
Method Used	Continuous profiling
Distance from Shot-point to Close Geophone Stations	150 ft
Relation of Far Geophone Stations to Interlocking Shot-points	At interlocking shot-points
Normal Dynamite Charge	10 lb
Difficulties	None

APPENDIX 2

CALCULATION AND INTERPRETATION METHODS

Wells Tied	Tied to 11 Wells
Correction Used	Normal up-hole correction; Two-layer weathering correction where applicable.
Interlock Ties Used	Datum-to-datum
Elevation Datum	+ 1000 ft above sea level
Weathered Layer Velocity	2500 ft per sec (estimated)
Elevation Velocity	8000 ft per sec
Horizontal Velocity	9000 ft per sec
Horizons Mapped	
Horizon	Zone A (Within Walloon Coal Measures)
Depth below Sea Level	$D_1 = 4630\ T_1 - 1324$
Time Range	0.326 to 0.629 sec
Horizon	Zone B (Upper Moolayember)
Depth below Sea Level	$D_2 = D_1 + 5710\ (T_2 - T_1)$
Time Range	0.626 to 0.886 sec
Horizon	"Near top of Timbury Hills Formation"
Depth below Sea Level	$D_3 = D_2 + 7280\ (T_3 - T_2)$
Time Range	0.695 to 1.317 sec
Intervals Mapped	
Horizons	Zone A to Zone B
Time Range	0.259 to 0.377 sec
Horizons	Zone B to "Near top of Timbury Hills Formation"
Time Range	0.063 to 0.324 sec

APPENDIX 3

LOCATION, PERSONNEL AND EQUIPMENT

Crew Headquarters	Roma, Queensland
Party Chief	W.E. Hightower
Observer	G.W. Pippin
Party Manager & Driller	G.P. Hughes
Surveyors	C.J. Morrow D.P. Kenyon A.M. Wilson
Recording Unit	One 24-trace Century recording unit, amplifiers modified to Geo Prospectors, Inc. specifications; filter frequency range of 20 to 120 c/s. Recording Instruments mounted on F-600 Ford truck. Shooting truck (F-600 Ford) included water-tank, storage compartments, for explosives, etc.
Drill Unit	One Mayhew-1000 drill mounted on F-600 Ford truck; One F-600 Ford water truck with 1000-gal tank and vacuum water lift.
Survey Unit	Plane table and alidade used for surveying; F-100 Ford pick-up used as survey vehicle.

APPENDIX 4

STATISTICS

Starting Date	12th August, 1959
Completion Date	23rd April, 1960
Recording Time	
Drive to and from Field	162.0 hours
Field	1053.0 hours
Move	0.0 hours
Holidays	20.0 hours
Lost due to Weather	0.0 hours
Lost due to Equipment Breakdown	0.0 hours
Holes Shot	921 holes
Miles of Traverse	220 miles
Number of Drills Used	1 drill
Drill Time	
Drive to and from Field	125.0 hours
Field	1082.0 hours
Move	0.0 hours
Holidays	20.0 hours
Lost due to Weather	0.0 hours
Lost due to Equipment Breakdown	0.0 hours
Holes Drilled	892 holes
Total Footage	64,630 ft
Bits Used	Sixty-four 4 1/2 - in. inserted 3-blade bits Six 4 1/4 - in. rock bits Two 5 5/8 - in. inserted Kelly bits
Mud Used	28 sacks bentonite
Bran Used	21 sacks

PLATE I

SHEET I

TOPS

A.A.O. No. 4		A.A.O. No 1	WAROOBY	Roc No 3	ARO No 4
El	1040	1123	1043	1020	1018
Bundamba	-1635	-1507	-1607	-1650	?
Top Moolayember	-2255	-2237	-2347	-2230	-2310
Hospital Hill Sd	-2643	-2561	-2586	?	-2666
Basement	-2842 Perm ?	-2754 Perm ?	-2721 Granite	?	-2843 Granite

A.A.O. No 5		A.A.O. No 2	Roc. No. 1	RBO No 1	ARO No 11
El	1024	1100	1040	1066	978
Bundamba	-1676	-1160	-1611	-1184	?
Top Moolayember	-2306	-1916	-2172	-1964	-2325
Hospital Hill Sd	-2675	-2330	?	-2384	-2735
Basement	-3046 Perm ?	-2500 Granite	-2830 Perm ?	-2470 Granite	-3163 Granite

A.A.O. No 6		A.A.O. No 3	Roc No 2	RBO No 4	AAO-TH No 2
El	1005	1090	1050	1090	1110 D.F.
Bundamba	-1705	-1200	-1680	-1180	-1592
Top Moolayember	-2345	-1966	-2260	-1940	-2195
Hospital Hill Sd	-2703	-2384	?		-2597
Basement	-3204 Perm ?	-2507 Granite	-2912 Perm ?	-3163 Granite	

8° Mag

REFLECTION SEISMOGRAPH SURVEY
OF THE
EAST ROMA AREA
QUEENSLAND
SHOWING CONTOURS ON
SURFACE ELEVATIONS
FOR
MINAD
BY

Austral Geo Prospectors, Inc.

Brisbane, Queensland

0 1 2 MILES

Ve= f/s Vo= f/s
CI = 25 ft SEISMIC DATUM +1000 ft MAP DATUM Sea Level
DATE August 12, 1960 INTERPRETATION BY: W E Hightower

PLATE I
SHEET 2

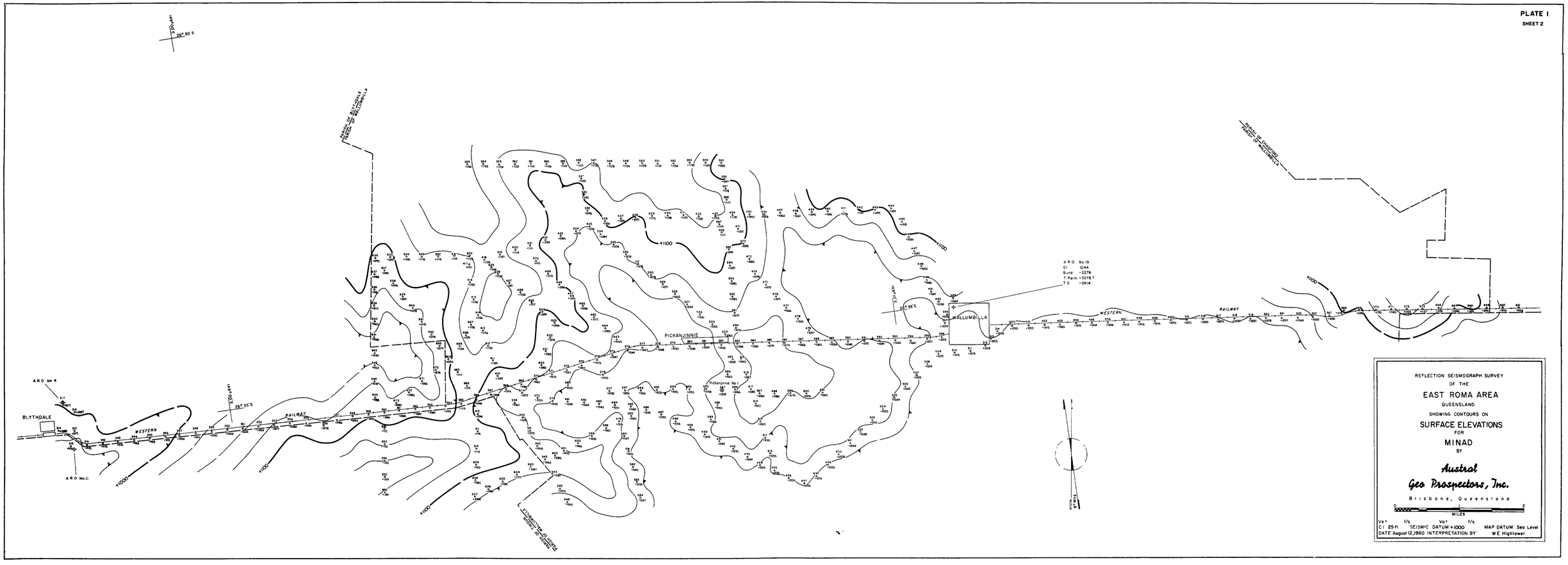


PLATE 2

SHEET 1

TOPS

A.A.O. No. 4		A.A.O. No 1	WAROOBY	Roc No 3	ARO No 4
El	1040	1123	1043	1020	1018
Bundamba	-1635	-1507	-1607	-1650	?
Top Moolayember	-2255	-2237	-2347	-2230	-2310
Hospital Hill Sd.	-2643	-2561	-2586	?	-2666
Basement	-2842 Perm.P	-2754 Perm P	-2721 Granite	?	-2843 Granite

A.A.O. No 5		A.A.O No 2	Roc No.1	RBO No 1	ARO No 11
El	1024	1100	1040	1066	978
Bundamba	-1676	-1160	-1611	-1184	?
Top Moolayember	-2306	-1916	-2172	-1964	-2325
Hospital Hill Sd	-2675	-2330	?	-2384	-2735
Basement	-3046 Perm P	-2500 Granite	-2830 Perm P	-2470 Granite	-3163 Granite

A.A.O. No 6		A.A.O No 3	Roc No 2	RBO No 4	AAO-TH No 2
El	1005	1090	1050	1090	1110 D F
Bundamba	-1705	-1200	-1680	-1180	-1592
Top Moolayember	-2345	-1966	-2260	-1940	-2195
Hospital Hill Sd	-2703	-2384	P		-2597
Basement	-3204 Perm P	-2507 Granite	-2912 Perm.P	-3163 Granite	

8° Mag

REFLECTION SEISMOGRAPH SURVEY
OF THE

EAST ROMA AREA

QUEENSLAND

SHOWING CONTOURS ON

ZONE A-WITHIN WALLOON COAL MEASURES

FOR

MINAD

BY

Austral Geo Prospectors, Inc.

Brisbane, Queensland

0 1 2
MILES

Ve= 8000 f/s Va= – f/s
C.I.= 25 ft SEISMIC DATUM +1000 ft. MAP DATUM Sea Level
DATE August 12, 1960 INTERPRETATION BY: W E Hightower

D_1 = 4630 T_1 - 1324 (Depth Below Sea Level)

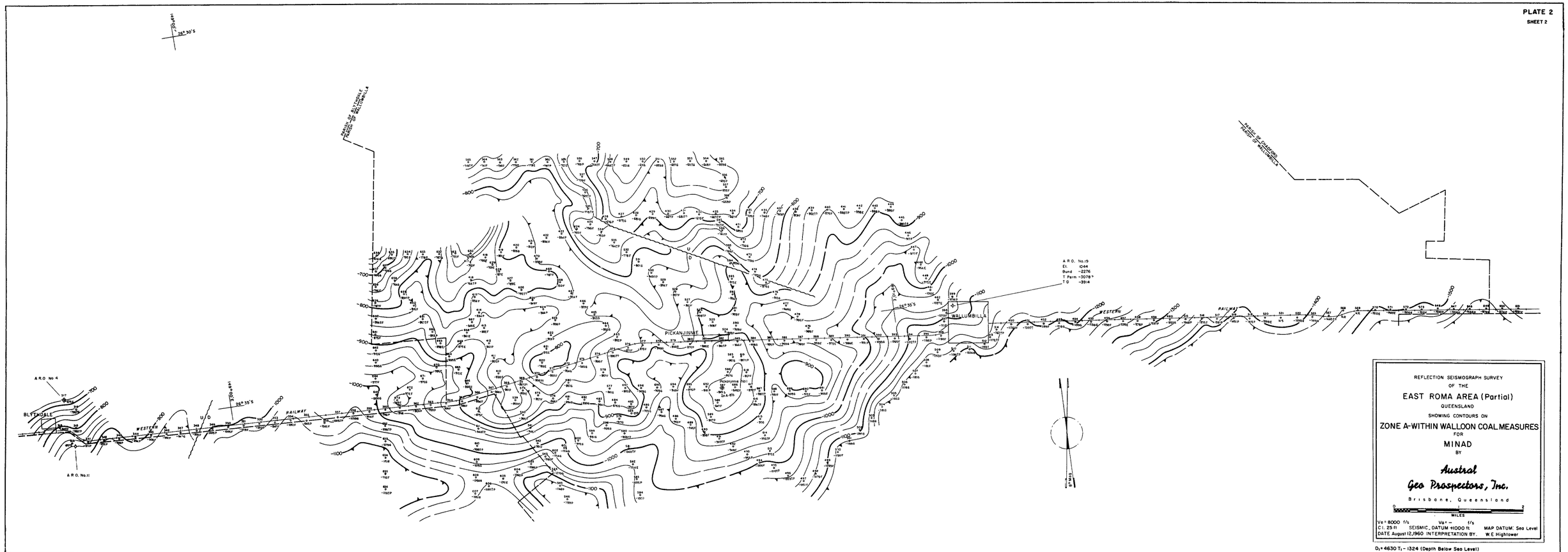

REFLECTION SEISMOGRAPH SURVEY
OF THE
EAST ROMA AREA (Partial)
QUEENSLAND
SHOWING CONTOURS ON
ZONE A-WITHIN WALLOON COAL MEASURES
FOR
MINAD
BY
Austral
Geo Prospectors, Inc.
Brisbane, Queensland
0 1 2
MILES
Ve = 8000 f/s
Vo = f/s
C.I. 25 ft
SEISMIC DATUM +1000 ft
MAP DATUM: Sea Level
DATE August 12,1960
INTERPRETATION BY.
W.E Hightower
O1 = 4630 T1 = 1324 (Depth Below Sea Level)
BLYTHDALE
PICKANJINNIE
WALLUMBILLA
WESTERN
RAILWAY
A R O. No 4
A R O. No.11
A R O. No.19
El. 1044
Bund -2276
T Perm -3078
T D -3914
PARK OF BLYTHDALE
PARISH OF WALLUMBILLA
A R O. OF FARFORD
PARISH OF WALLUMBILLA
26°30'S
26°35'S
70°49'
U
D
N
S.P.N.

PLATE 3

SHEET I

TOPS

A.A.O No 4		A.A.O No 1	WAROOBY	Roc No 3	ARO No 4
El.	1040	1123	1043	1020	1118
Bundamba	-1635	-1507	-1607	-1650	?
Top Moolayember	-2255	-2237	-2347	-2250	-2310
Hospital Hill Sd.	-2643	-2561	-2586	?	-2666
Basement	-2842 Perm P	-2754 Perm P	-2721 Granite	?	-2843 Granite

A A O. No 5		A A O No 2	Roc. No.1	RBO No 1	ARO No 11
El	1024	1100	1040	1066	978
Bundamba	-1676	-1160	-1611	-1184	?
Top Moolayember	-2306	-1916	-2172	-1964	-2325
Hospital Hill Sd	-2675	-2330	?	-2384	-2735
Basement	-3046 Perm P	-2500 Granite	-2830 Perm P	-2470 Granite	-3163 Granite

A A O No 6		A A O No 3	Roc No.2	RBO No 4	AAO-T.H. No 2
El	1005	1090	1050	1090	1110 D F
Bundamba	-1705	-1200	-1680	-1180	-1592
Top Moolayember	-2345	-1966	-2260	-1340	-2195
Hospital Hill Sd.	-2703	-2384	?		-2597
Basement	-3204 Perm P	-2507 Granite	-2912 Perm P	-3163 Granite	

8° Mag.

REFLECTION SEISMOGRAPH SURVEY
OF THE
EAST ROMA AREA
QUEENSLAND
SHOWING CONTOURS ON
ZONE B (UPPER MOOLAYEMBER)
FOR
MINAD
BY

Austral Geo Prospectors, Inc.

Brisbane, Queensland

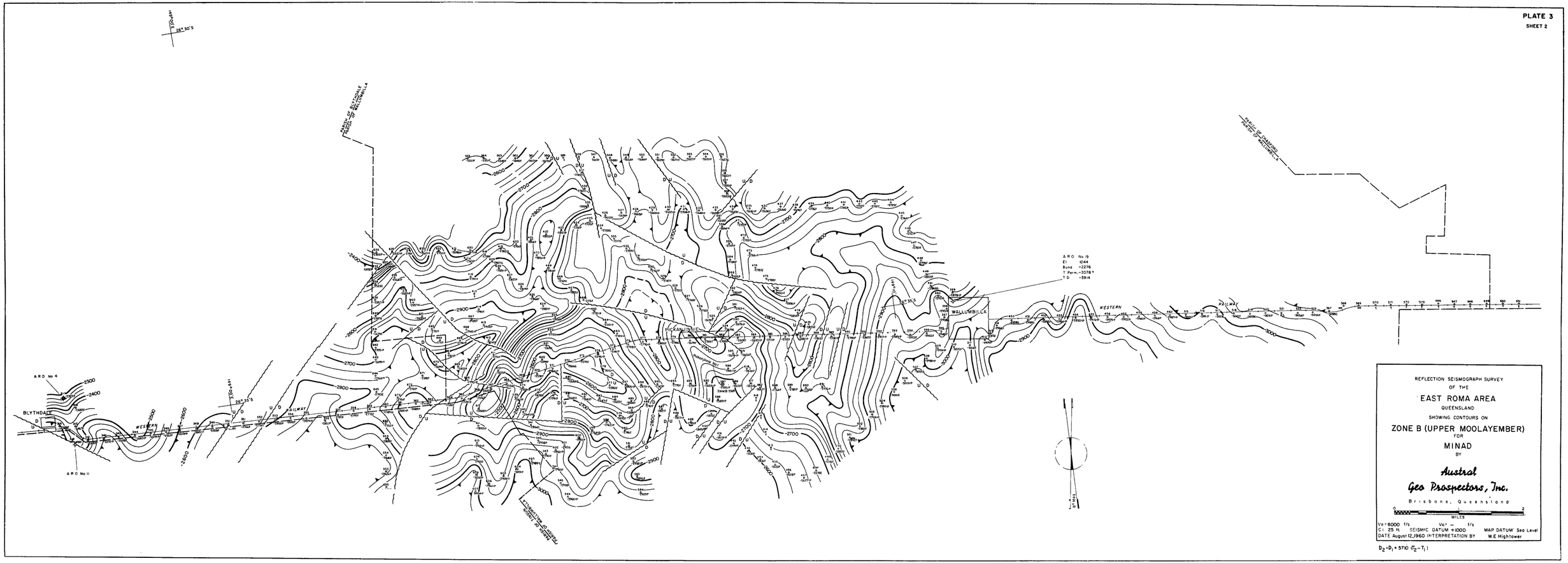
0 1 2 MILES

Ve= 8000 f/s Va= — f/s
C.I.= 25 ft SEISMIC DATUM +1000 ft. MAP DATUM Sea Level
DATE August 12, 1960 INTERPRETATION BY W. E. Hightower

$D_2 = D_1 + 5710\,(T_2 - T_1)$

PLATE 3

SHEET 2



REFLECTION SEISMOGRAPH SURVEY
OF THE

EAST ROMA AREA

QUEENSLAND
SHOWING CONTOURS ON

ZONE B (UPPER MOOLAYEMBER)

FOR

MINAD

BY

Austral
Geo Prospectors, Inc.

Brisbane, Queensland

Ve = 8000 f/s Va = — f/s
Ci 25 ft SEISMIC DATUM +1000 MAP DATUM Sea Level
DATE August 12, 1960 INTERPRETATION BY W.E Hightower

$D_2 = D_1 + 5710\,(T_2 - T_1)$

TOPS

A.A.O. No 4		A A O No 1	WAROOBY	Roc No 3	ARO No 4
El	1040	1123	1043	1020	1018
Bundamba	-1635	-1507	-1607	-1650	?
Top Moolayember	-2255	-2237	-2347	-2230	-2310
Hospital Hill Sd	-2643	-2561	-2586	?	-2666
Basement	-2842 Perm ?	-2754 Perm ?	-2721 Granite	?	-2843 Granite

A A.O. No 5		A A O No 2	Roc No 1	RBO No 1	ARO No 11
El	1024	1100	1040	1066	978
Bundamba	-1676	-1160	-1611	-1184	?
Top Moolayember	-2306	-1916	-2172	-1964	-2325
Hospital Hill Sd	-2675	-2330	?	-2384	-2735
Basement	-3046 Perm ?	-2500 Granite	-2830 Perm ?	-2470 Granite	-3163 Granite

A A O No.6		A A.O. No 3	Roc No 2	RBO No 4	A A O-TH. No 2
El	1005	1090	1050	1090	1110 D F
Bundamba	-1705	-1200	-1680	-1180	-1592
Top Moolayember	-2345	-1966	-2260	-1940	-2195
Hospital Hill Sd	-2703	-2384	?		-2597
Basement	-3204 Perm ?	-2507 Granite	-2912 Perm ?	-3163 Granite	

8° Mag

REFLECTION SEISMOGRAPH SURVEY
OF THE
EAST ROMA AREA
QUEENSLAND
SHOWING CONTOURS ON
NEAR TOP TIMBURY HILLS FORMATION
FOR
MINAD
BY

Austral Geo Prospectors, Inc.

Brisbane, Queensland

0 1 2
MILES

Ve = 8000 f/s Va = — f/s
CI = 50 ft SEISMIC DATUM +1000 ft. MAP DATUM Sea Level
DATE August 12, 1960 INTERPRETATION BY W.E Hightower

$D_3 = D_2 + 7280\ (T_3 - T_2)$

PLATE 4
SHEET 2

PLATE 5

SHEET I

TOPS

A A O. No. 4		A A O No 1	WAROOBY	Roc No 3	ARO No 4
El.	1040	1123	1043	1020	1018
Bundamba	-1635	-1507	-1607	-1650	?
Top Moolayember	-2255	-2237	-2347	-2230	-2310
Hospital Hill Sd	-2643	-2561	-2586	?	-2666
Basement	-2842 Perm ?	-2754 Perm ?	-2721 Granite	?	-2843 Granite
A A.O. No.5		A A O No 2	Roc No 1	RBO No 1	ARO No 11
El	1024	1100	1040	1066	978
Bundamba	-1676	-1160	-1611	-1184	?
Top Moolayember	-2306	-1916	-2172	-1964	-2325
Hospital Hill Sd.	-2675	-2330	?	-2384	-2735
Basement	3046 Perm ?	-2500 Granite	-1830 Perm ?	-2470 Granite	-3163 Granite
A A O No 6		A A O No 3	Roc No 2	RBO No 4	AAO-TH No 2
El	1005	1090	1050	1090	1110 D F
Bundamba	-1705	-1200	-1680	-1180	-1592
Top Moolayember	-2345	-1966	-2260	-1940	-2195
Hospital Hill Sd	-2703	-2384	?		-2597
Basement	-3204 Perm ?	-2507 Granite	-2912 Perm ?	-3163 Granite	

REFLECTION SEISMOGRAPH SURVEY
OF THE
EAST ROMA AREA
QUEENSLAND
SHOWING CONTOURS ON
INTERVAL: ZONE A TO ZONE B
FOR
MINAD
BY

Austral
Geo Prospectors, Inc.

Brisbane, Queensland

0 1 2 MILES

Ve= f/s Vq= f/s
CI = 25 ft SEISMIC DATUM ft MAP DATUM. Sea Level
DATE August 12, 1960 INTERPRETATION BY. W. E. Hightower

$d_1 = D_2 - D_1$

PLATE 6
SHEET 2

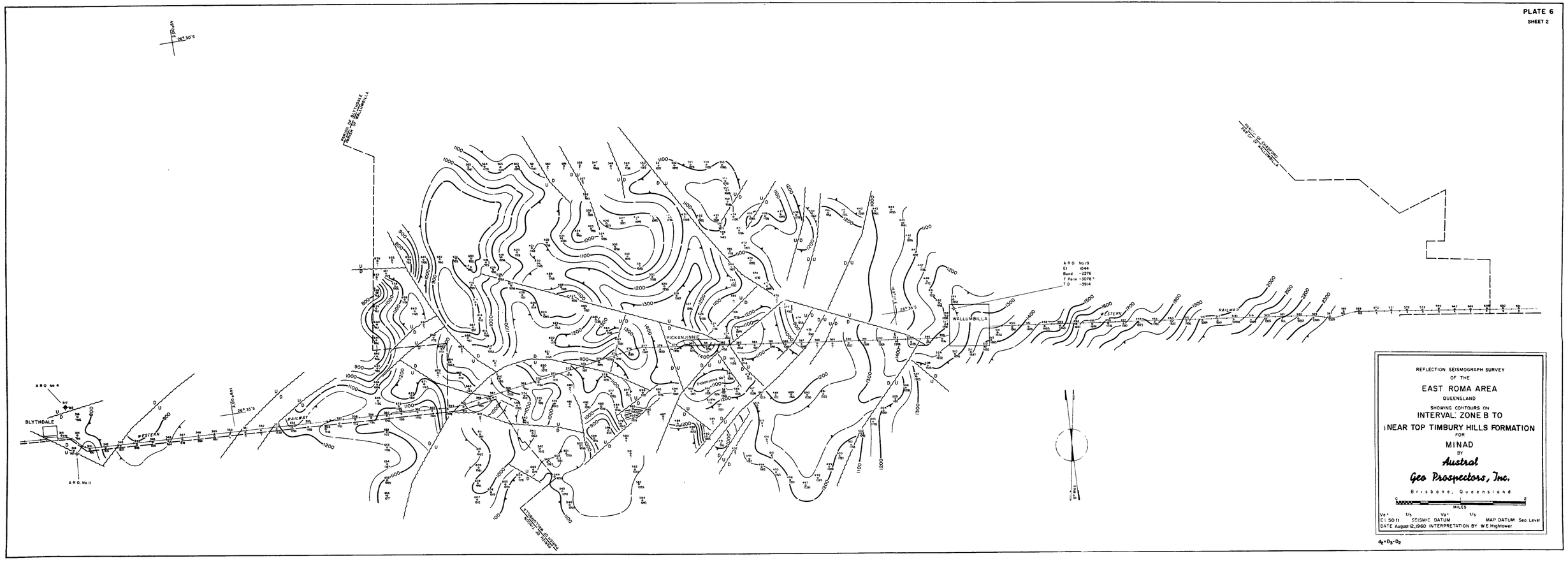


PLATE 6

SHEET I

TOPS

A A.O No. 4		A A O No 1	WAROOBY	Roc. No 3	ARO No 4
El	1040	1123	1043	1020	1018
Bundamba	-1635	-1507	-1607	-1650	?
Top Mooloyember	-2255	-2237	-2347	-2230	-2310
Hospital Hill Sd	-2643	-2561	-2586	?	-2666
Basement	-2842 Perm.?	-2754 Perm ?	-2721 Granite	?	-2843 Granite
A A O No 5		A A O No 2	Roc No 1	RBO No 1	ARO No 11
El	1024	1100	1040	1066	978
Bundamba	-1676	-1160	-1611	-1184	?
Top Mooloyember	-2306	-1916	-2172	-1964	-2325
Hospital Hill Sd	-2675	-2330	?	-2384	-2735
Basement	-3046 Perm ?	-2500 Granite	-2830 Perm ?	-2470 Granite	-3163 Granite
A A O No.6		A A O. No 3	Roc No 2	RBO No 4	AAO-T.H No 2
El	1005	1090	1050	1090	1110 D F
Bundamba	-1705	-1200	-1680	-1180	-1592
Top Mooloyember	-2345	-1966	-2260	-1940	-2195
Hospital Hill Sd	-2703	-2384	?		-2597
Basement	-3204 Perm ?	-2507 Granite	-2912 Perm ?	-3163 Granite	

8° Mag.

REFLECTION SEISMOGRAPH SURVEY
OF THE
EAST ROMA AREA
QUEENSLAND

SHOWING CONTOURS ON
INTERVAL: ZONE B TO
NEAR TOP TIMBURY HILLS FORMATION
FOR
MINAD
BY
Austral
Geo Prospectors, Inc.
Brisbane, Queensland

0 1 2
MILES

Ve= f/s Va= f/s
C.I.= 50 ft SEISMIC DATUM ft MAP DATUM Sea Level
DATE. August 12, 1960 INTERPRETATION BY: W.E Hightower

$d_2 = D_3 - D_2$

PLATE 5
SHEET 2