BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD

Record 1980/60

CENTRAL EROMANGA BASIN PROJECT

PROGRESS REPORT, JANUARY-JUNE 1980

by

F.J. Moss (Co-ordinator)

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ABSTRACT

The Central Eromanga Basin Project commenced early in 1980. During the period January to June the main activities were review of existing geoscientific information, background research into techniques applicable to studies of the area, and preparation for surveys west of the Canaway Fault.

Samples of cuttings from Bodalla 1, Durham Downs 1 and Galway 1 were selected for pyrolysis analysis, and analytical results and vitrinite reflectance determinations of source rocks were compiled for the area of interest. A north-south lithologic cross-section was drawn from Budgerygar 1 to Bodalla 1 through the other petroleum exploration wells immediately west of the Canaway Fault over the Warrabin Trough. The availability of Landsat data for the study area was reviewed; the Landsat scenes required will not be generally avilable until later in 1980.

The main geophysical programs later in 1980 will consist of about 600 km of CDP reflection profiling mainly along four east-west traverses to investigate the sedimentary section, with reflection recordings to 20 s and seismic refraction surveys to investigate the nature of the deep crust underlying the basins. The results of previous seismic and gravity surveys were reviewed to assist in planning the seismic programs. Studies of available reconnaissance gravity data indicate fair correlation between the gravity and the basin configuration in the area. It is planned to read gravity along the proposed seismic traverses and along other key lines to investigate particular structures of interest.

Preparations were also made to record carborne magnetometer measurements along all the new traverses, and to make magnetotelluric soundings and heat flow measurements at particular sites mainly on a traverse from the shelf area east of the Canaway Fault over the Warrabin Trough to Mount Howitt 1 in the Cooper Syncline.

Aeromagnetic data from the area have been reviewed briefly and it was concluded that there is a general lack of suitable anomalies for depth calculations. Nevertheless it was recommended that digitally recorded data in the central part of the area should be studied in detail and that a test survey should be flown with a high-sensitivity magnetometer before any new major detailed surveys. A test survey is tentatively planned for 1981. Modelling studies have been carried out to investigate the applicability of electrical and electromagnetic techniques to exploration of the area. Initial results indicate that these methods are unlikely to give worthwhile results, but further feasibility studies are proposed using low-frequency sounding techniques.

Petroleum exploration companies with interests in the area have indicated their general support of the regional project and have assisted by providing seismic cross-sections and shot-point location maps for recent seismic surveys. Possible areas of cooperation discussed with the Geological Survey of Queensland include the seismic survey, seismic interpretation, and stratigraphic correlation studies.

INTRODUCTION

Regional, multidisciplinary, geoscientific investigations in the central Eromanga Basin area, which were outlined in proposals by Harrison & others (1980), commenced early in 1980.

The main objective of the project will be to determine the petroleum resource potential of the central Eromanga Basin area and assist in efficient and comprehensive petroleum exploration. Information will be required on the regional structural, depositional, and thermal histories of the area in order to determine the various petroleum prospecting plays.

The central Eromanga Basin area is taken as the area from 24° to 29°S and from 141° to 147°E. The principal area where studies will be concentrated in 1980 is from 25° to 27°S and from 141° to 144°E, lying mainly west of the Canaway Fault.

During the period January to June 1980 the main activities were review of existing information, background research into techniques applicable to studies of the area, and preparations for surveys. A number of planning meetings were held to coordinate the activities and discuss program proposals.

Discussions were also held with the Geological Survey of Queensland (GSQ) and petroleum exploration companies with interests in the area. GSQ is keen to cooperate on the project, initially by providing assistance on the proposed seismic survey in the latter half of 1980 and by examining cores from wells which are available for study at the Mines Department. GSQ has also indicated an intention to cooperate on the interpretation of seismic data and stratigraphic studies. The petroleum exploration companies have provided BMR with seismic cross-sections and shot-point location maps from recent surveys in the 1980 area of interest. The companies appear to be keen on the regional approach to the investigations proposed by BMR and have agreed to provide further information as necessary for the project.

The following contributions briefly outline the work undertaken in the January to June period and provide some information on the programs proposed for the remainder of 1980. Personnel involved in the project during the period are listed in Appendix 1.

GEOLOGY

SOURCE ROCKS AND MATURATION: E. Nicholas

Wells sampled for source-rock studies in the central Eromanga Basin area west of the Canaway Fault are shown in Figure 1. Analytical results and vitrinite reflectance determinations additional to those published in Senior &

Habermehl (1980) are listed in Table 1. Durham Downs 1 and Chandos 1 (Adavale Basin sequence) were sampled for the Central Eromanga Basin Project; other source rock and maturity data listed were obtained previously as part of the continuing Australia-wide source-rock assessment program. Other wells sampled in the 1979/80 financial year in the Eromanga Basin and infra-basins outside the area shown in Figure 1 are listed in Table 2.

Samples of cuttings from Bodalla 1, Durham Downs 1, and Galway 1 were selected for Rock-Eval pyrolysis analysis. These samples will be sent to Robertson Research International Ltd, for analysis.

An interpretation of the source-rock data obtained from the Adavale Basin during 1979/80 will be presented in a paper being prepared for publication by K.S. Jackson and V.L. Passmore.

LITHOLOGY: V.L. Passmore

A lithologic cross-section A-A' (Plate 1) was drawn through six wells - Budgerygar 1, Thunda 1, Chandos 1, Chandos South 1, Cumbroo 1, and Bodalla 1 (Fig. 1). The cross-section shows the units present, basins, changes in lithology, and unit thicknesses from north to south in the area west of the Canaway Fault over the Warrabin Trough. Vitrinite reflectance values indicated in Table 1 are displayed alongside well sections to provide information on the maturity of source rocks.

All six wells intersected Eromanga Basin and Cooper Basin sediments. Thunda 1, Chandos 1, Chandos South 1, and Bodalla 1 also drilled through or bottomed in Adavale Basin sediments. Data for each well were extracted from well completion reports, and the top of each unit was determined from lithology, wire-line log character, palaeontological information, and dip meter changes. The unit picks within the Eromanga Basin sequence were those of Senior & others. (1978) for Bodalla 1.

Seismic reflecting horizons will be indicated on the cross-section A-A', and the pre-Permian sediments will be further subdivided and named when they have been looked at in more detail. It is proposed that other cross-sections will be prepared in the area to assist in lithologic and seismic stratigraphic correlations.

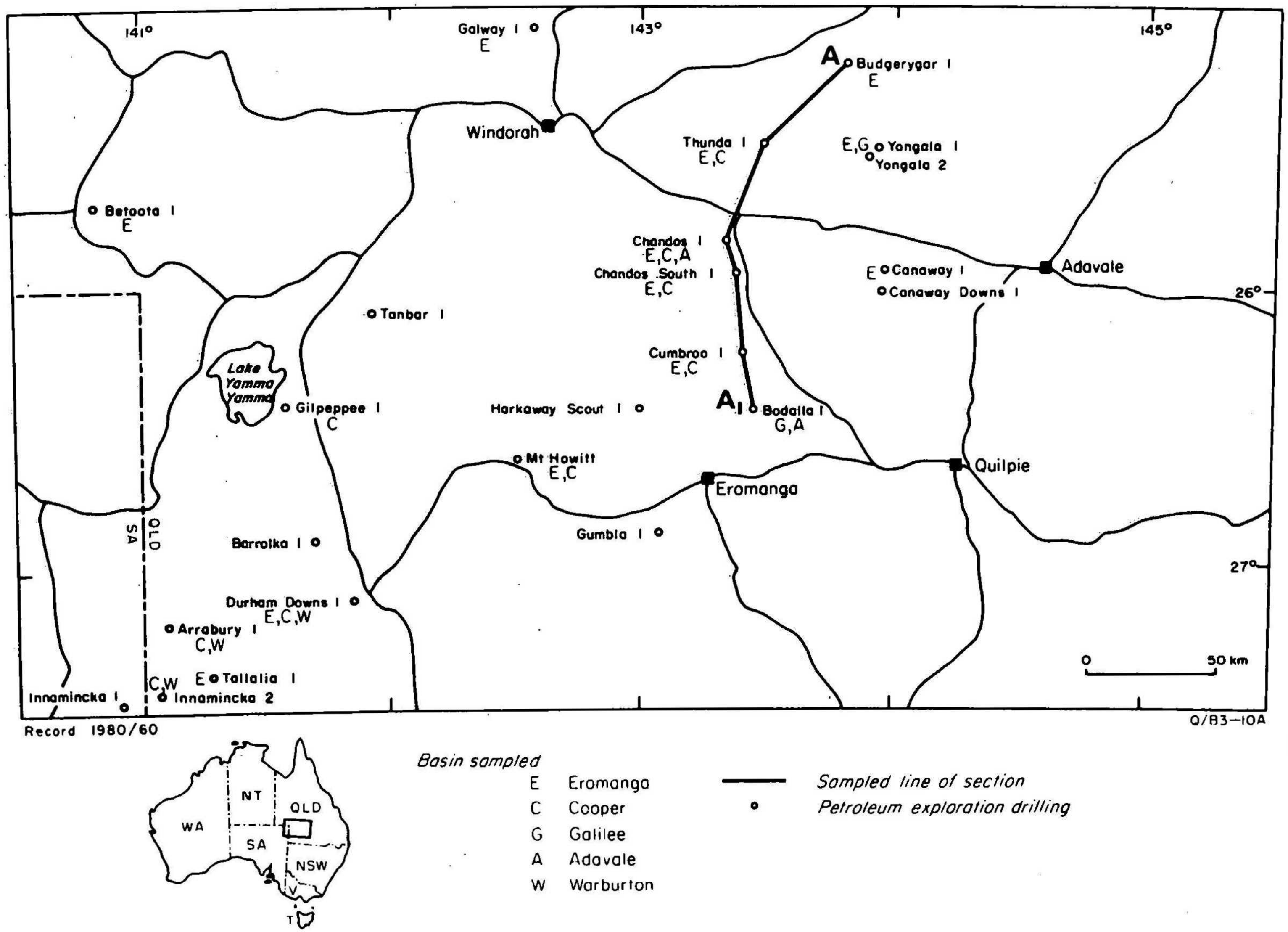

Fig. 1 Wells sampled for source rock studies

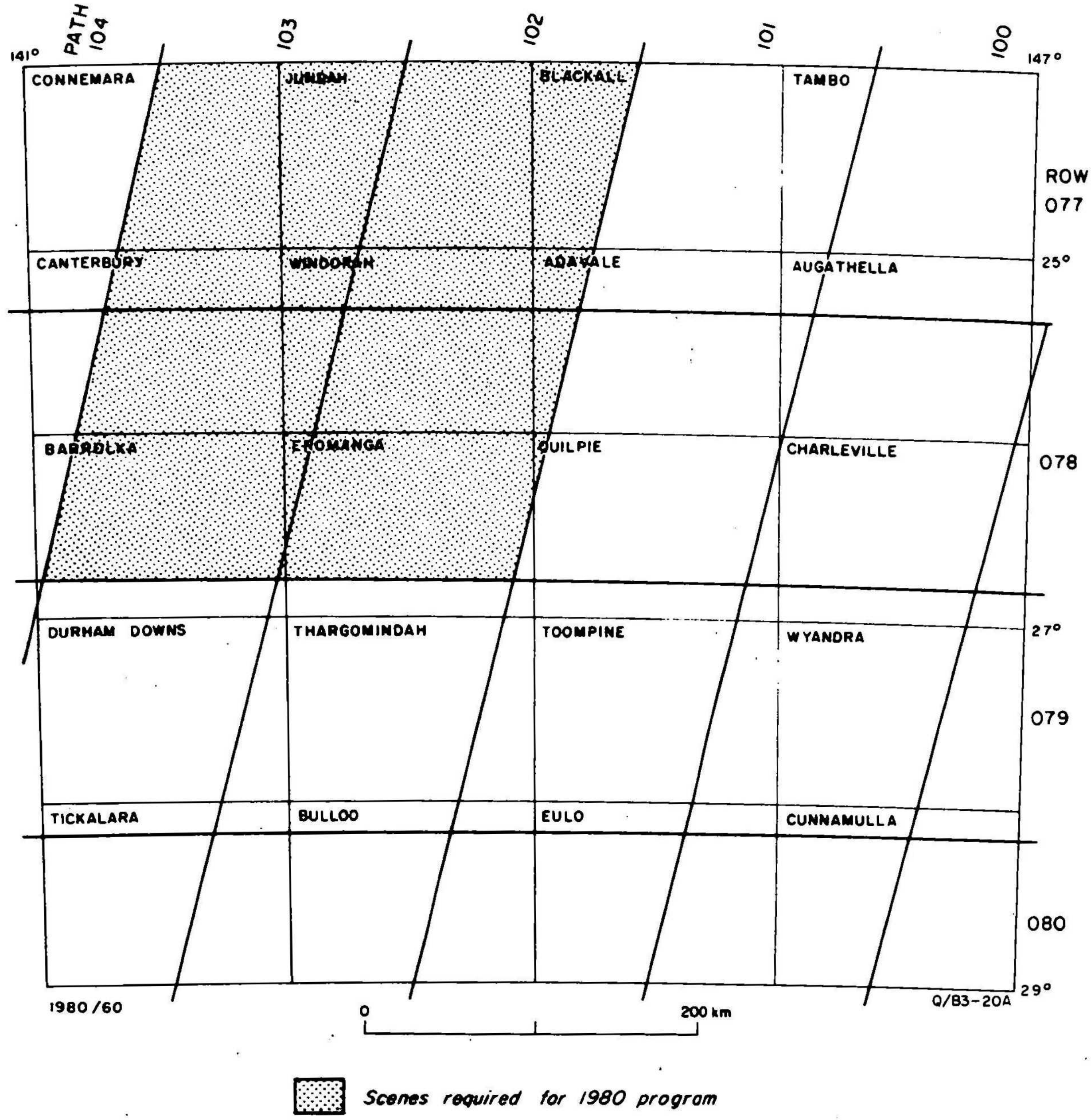

Fig. 2 Landsat coverage

HYDROGEOLOGY: M.A. Habermehl

A theory of hydrocarbon migration under hydrodynamic conditions and entrapment of possible economic hydrocarbon accumulations alongside faults transverse to groundwater flow in the Eromanga Basin sequence in the central Eromanga Basin area was proposed by Senior & Habermehl (1980). Those authors also discussed the maturity and source-rock potential of the Jurassic and part of the Cretaceous of the Eromanga Basin sequence and the Cooper Basin sequence.

Preparations were made to commence a review of hydrogeological data in the project area during the second half of 1980. Some deep water wells will be sampled for chemical analysis, including hydrocarbon content, to assist in studies of possible hydrocarbon migration and stagnation near structural and stratigraphic traps in the area west of the Canaway Fault.

LANDSAT STUDIES: C.J. Simpson

The LANDSAT path-row map for the project area is shown in Figure 2. LANDSAT scenes required for the proposed analysis, to determine the importance of faults and fault induced folds as potential hydrodynamic petroleum traps, are listed in Table 3.

The lineament analysis did not commence because suitable imagery for the project area was not readily available. CSIRO's Division of Mineral Physics, which rewrites the LANDSAT magnetic tapes obtained from the United States to produce high-quality imagery on computer-compatible tapes, has coverage available for only four of the 15 scenes required for study. Only one of the available scenes falls within the 1980 proposed study area.

Current reports indicate that the AUSTRALIAN LANDSAT STATION will be producing high-quality imagery by the end of August 1980. Orders will be placed with the station for all scenes required for the project. The data should be available for study by the end of September 1980.

GEOPHYSICS

SEISMIC REFLECTION STUDIES: J. Pinchin

Seismic reflection recordings will be made on a regional survey west of the Canaway Fault in the central Eromanga Basin area during July-November 1980. The main objective of the survey will be to provide new information on the structural and depositional history of the Eromanga Basin, the underlying Cooper

Basin, and the Devonian-Carboniferous Warrabin Trough and possible adjacent troughs of similar age. The seismic results obtained will be integrated with the results from previous seismic surveys in the area to provide a better understanding of the petroleum prospectivity of the area.

Seismic shot-point location maps of the proposed survey area were hand-drawn to produce a preliminary set of maps for planning purposes. A more accurate set of location maps is being produced from a computerised data bank of shot-point information.

Several poor-quality seismic cross-sections from previous surveys in critical areas were selected for reprocessing. The data were transcribed from analogue to digital form at BMR and sent to a contractor for processing. Processing of one of the lines from Phillips-Sunray's, Welford survey (Ref. 72, Table 5, Harrison & others, 1980) was completed and showed considerable improvement over the original seismic cross-section. Arrangements are now being made to reprocess other seismic cross-sections.

A brief selective review of existing seismic data was made to assist in planning the 1980 survey. Good-quality seismic cross-sections available were used, ties were made to wells in the southwest of the proposed survey area, and interpretative line sketches were drawn along key sections. Further reviews are being made of data in the northeast and southeast of the Cooper Basin.

The seismic traverses proposed for 1980 are shown in Figure 3. The program consists of four regional east-west traverses, each about 150 km long, and some short north-south lines. The coverage these traverses provide will be extended by good-quality results from existing and proposed private company seismic traverses. The traverses will be shot mainly using 6-fold CDP recording techniques with a 48-channel DFSIV system, 83 1/3 m geophone station interval and single shot-holes generally about 40 m deep. Parts of some of the traverses, e.g. the western part of Traverse 1 towards Mount Howitt 1, will be shot with 41 2/3 m geophone station interval and correspondingly closer shots in attempts to improve resolution of seismic data over several possible small faults within the Eromanga sequence as postulated from studies of Landsat imagery (Senior & Habermehl, 1980).

Reflection recordings will all be made to 20 s record time and processed in attempts to determine the deep crustal structure of the area. Wide-angle deep crustal reflection recordings (Fig. 5) will be made in conjunction with refraction recording on Traverse 1 in attempts to provide vertical velocity information.

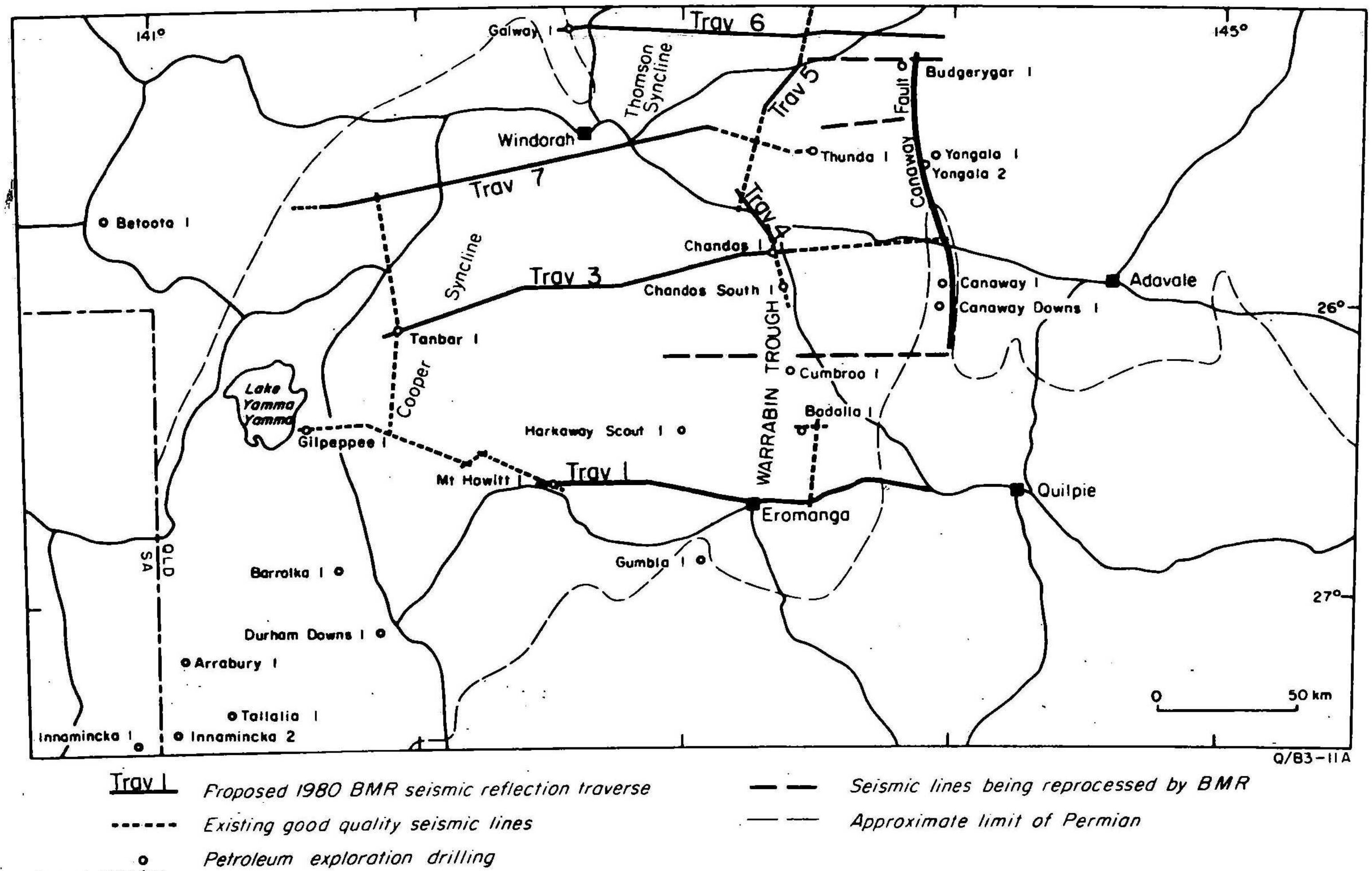

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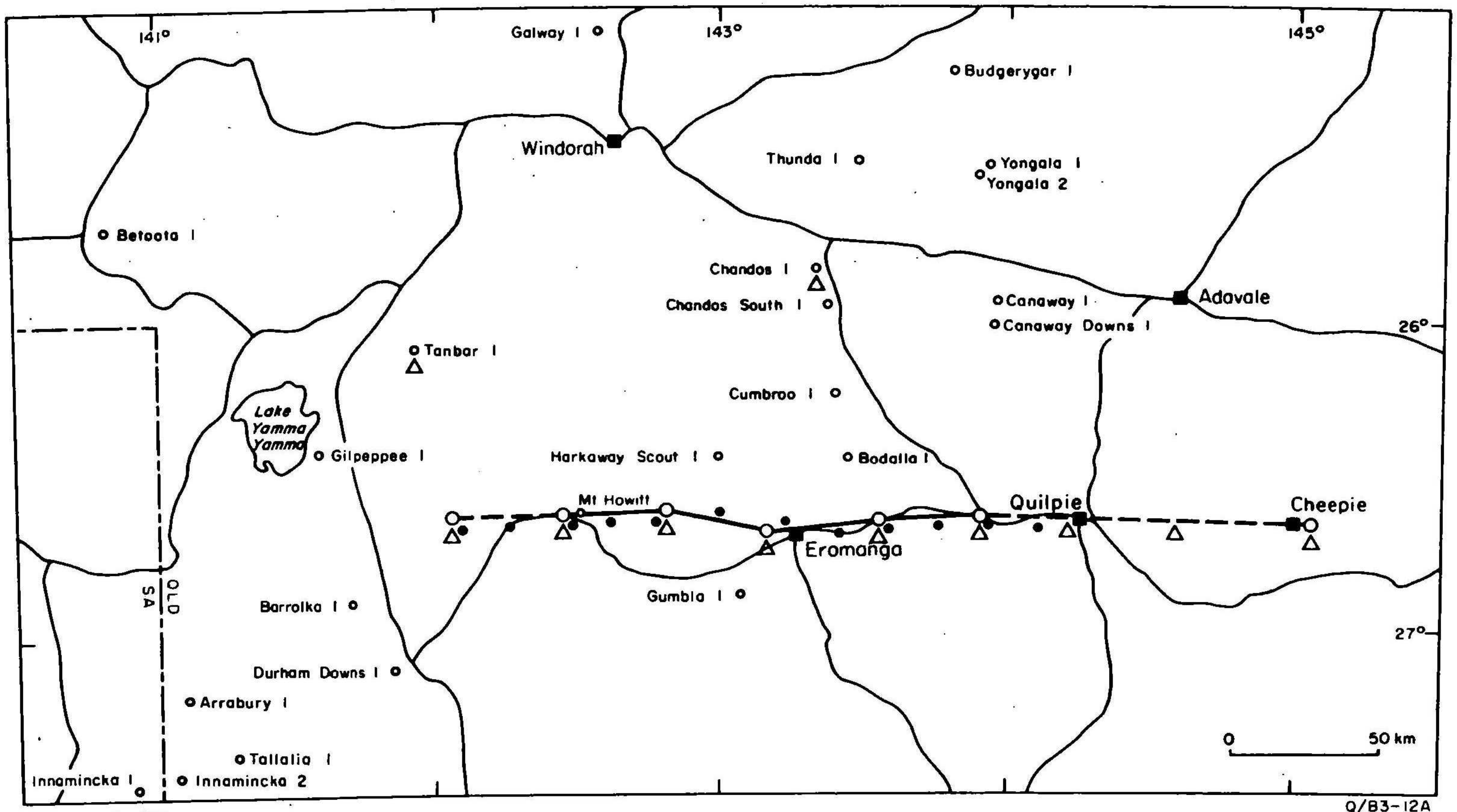
Fig. 3. Proposed seismic reflection traverses, 1980



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○ Refraction shot
△ Heat flow hole
∘ Petroleum exploration drilling
• Magneto-Telluric site
—— Refraction recording line 1·875 km spacing
— — Refraction recording line 7·5 km spacing

Fig. 4 Proposed locations of seismic refraction shot-points, heat flow holes and M-T sites

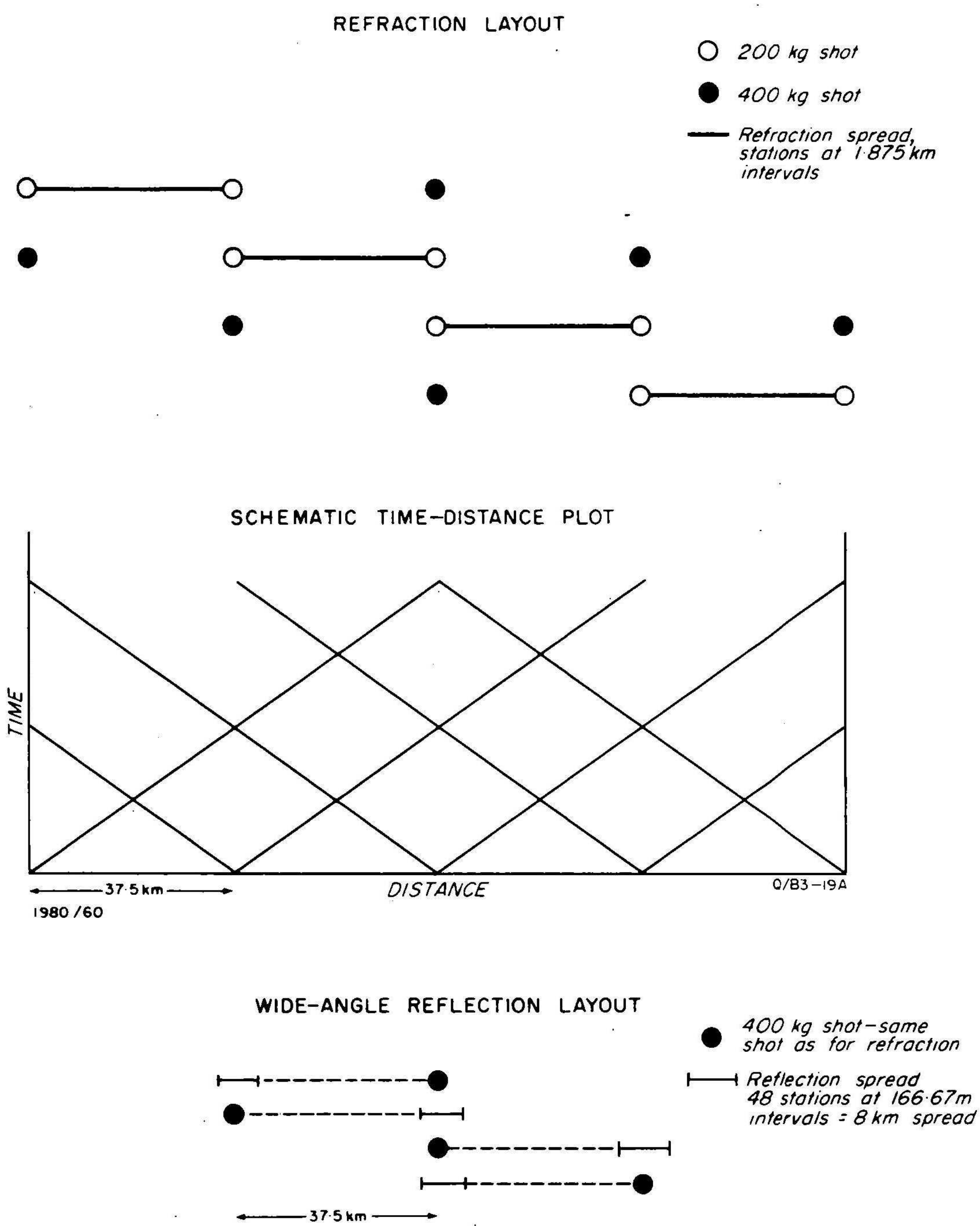


Fig. 5 Detailed refraction and wide angle reflection recording layout

DEEP CRUSTAL SEISMIC INVESTIGATIONS: C.D.N. Collins

Long-range seismic refraction recordings will be made to determine the deep crustal structure and the velocity-depth profile of basement beneath the basins in the central Eromanga Basin area. Recordings in 1980 will be made along a 300 km east-west traverse (Fig. 4) crossing the Quilpie Trough, Canaway Ridge, Warrabin Trough, and part of the Cooper Syncline.

Detailed planning of the survey has been completed. It is convenient to divide the refraction recording into two phases. The first will involve refraction recording along the 150 km part of the traverse covered also by deep crustal vertical and wide-angle seismic reflection recording (Fig. 5). The second phase will involve recording on a traverse of 300 km along which heat flow and magnetotelluric measurements will also be made.

In the first phase, the 150 km traverse will be divided into four 37.5 km traverses, placed end to end. 200 kg shots will be fired at the ends of each traverse and a 400 kg shot will be fired 37.5 km from each end. Recordings will be made at 21 stations, 1.875 km apart along each traverse. This will effectively provide four adjacent reversed traverses each 37.5 km long and three overlapping reversed traverses 75 km long, all recorded at 1.875 km spacing.

Modelling studies, using existing refraction data and postulated velocities and depths for deep structure, indicate that all refractors down to and including the basement should be recorded as first arrivals within the 37.5 km range of each traverse. The basement is expected to have a velocity of about 5.9 km/s (Bigg-Wither & Morton, 1962; Alliance, 1966; British Petroleum, 1966). It is estimated to be about 5 km deep in most basin areas. The basement comprises lower Palaeozoic rocks of the Thomson Fold Belt (Kirkegaard, 1974). Deep seismic sounding in the Permo-Triassic Bowen Basin on the eastern margin of the Thomson Fold Belt (Collins, 1978) showed a sub-basement refractor of 6.4 km/s at a depth of about 6 km. If this refractor exists in the Eromanga Basin area, arrivals from it would be observed beyond about 30 km and would mask basement arrivals; it was therefore decided to keep the individual traverse lengths below about 40 km. If it is absent, the basement refractor may be recorded at greater distance and the 75 km traverses would then provide better coverage.

The second phase of recording will be along two 150 km traverses, end to end, designed to record arrivals from refractors down to and including the Upper Mantle. 750 kg shots will be fired at the ends of each traverse and a 2500 kg shot will be fired at a distance of 150 km beyond one end (i.e. at the farther end of the adjacent traverse). Recording will be made at 41 stations with a station interval of 7.5 km. This will effectively provide a reversed traverse of 300 km and within this traverse two adjacent reversed traverses 150 km long, all recorded at 7.5 km station spacing.

Preparation of equipment has been started for the recording, which is due to commence in late August. Surveying of shot and recording sites by the Australian Survey Office has already started.

GRAVITY INVESTIGATIONS: K.L. Lockwood

Bouguer gravity anomaly contour maps were produced for the area west of the Canaway Fault, covering the Canterbury, Windorah, Barrolka, and Eromanga 1:250 000 map sheets (Fig. 6). The data were obtained from the BMR gravity data bank used to compute the Gravity Map of Australia (Anfiloff & others, 1976). Structural information included in Figure 6 is based on that presented for the central Eromanga Basin area by Senior & others (1978).

The gravity information was reviewed in light of the proposed seismic program to be carried out later in 1980 in order to identify problems with the existing coverage and to recommend new gravity programs. New, more detailed gravity programs could assist in providing information on the structural evolution of the area and its petroleum potential.

The correlation between regional gravity and structural features is generally fair throughout the study area as was discussed previously by Harrison & others (1980). Gravity measurements at 500 m intervals are proposed along the BMR 1980 seismic traverses. As the traverses will cross major regional features, gravity modelling will help the seismic interpretation to resolve the regional structural picture.

The detailed gravity surveys proposed may also provide useful information on minor faulting indicated primarily by LANDSAT imagery and airphotos (Senior & Habermehl, 1980).

HEAT FLOW: D.M. Finlayson

Problems in interpreting existing data on geothermal gradients in the Eromanga Basin (Senior & Habermehl, 1980; Harrison & others, 1980) arise from fluid flow in the holes in which measurements were made and from lack of thermal conductivity measurements on rock samples. Generally, abosolute measurements are difficult at depths of less than 500 m, but relative measurements may be determined in holes as shallow as about 100 m (Cull, 1979).

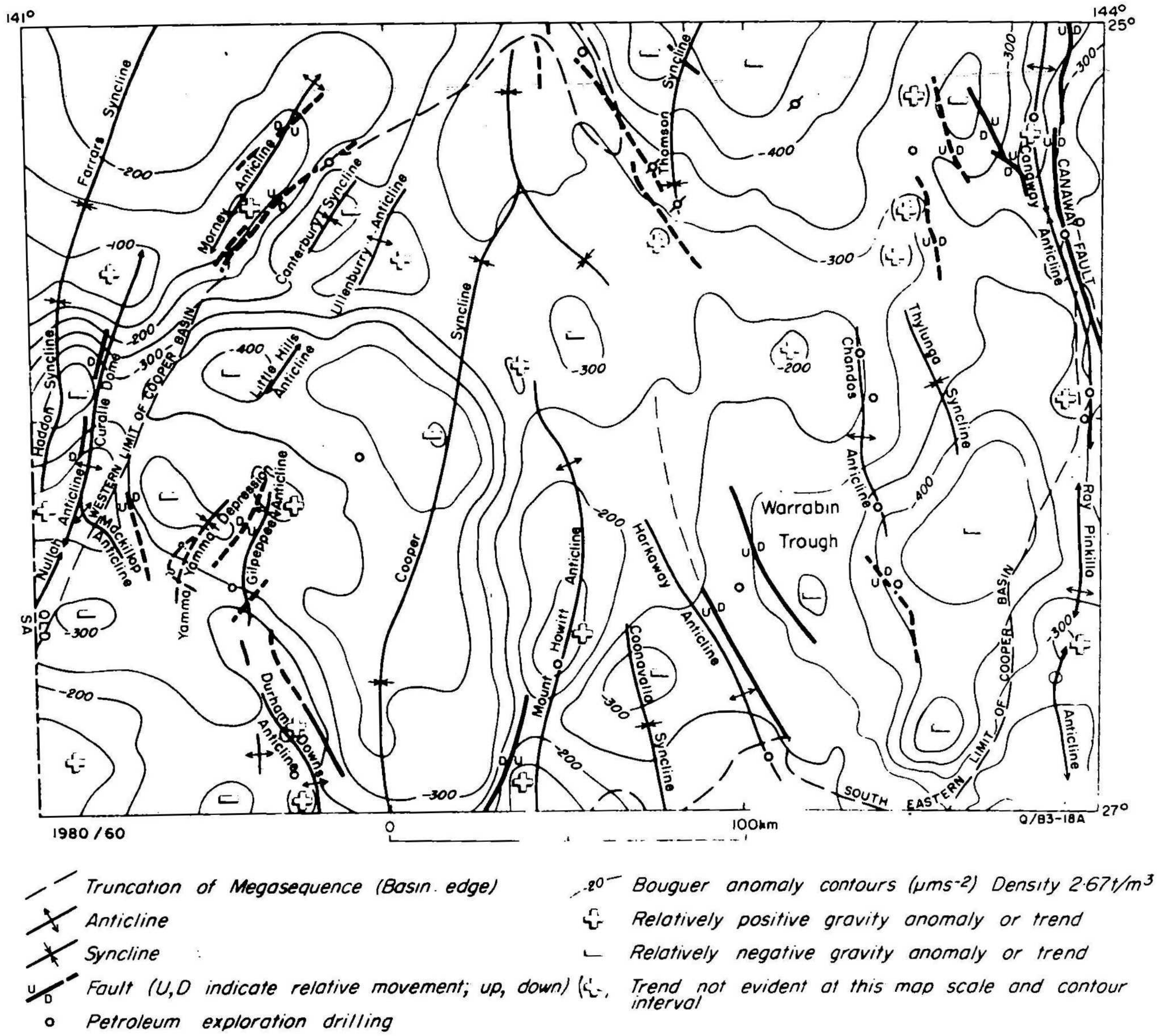


Fig. 6 Bouguer anomalies and structural features

It is planned to determine the variation of heat flux across part of the central Eromanga Basin in the second half of 1980 by making relative heat flow measurements. Gradient probes as described by Cull (1979) will be used in eleven holes drilled to depths of 100 m at places shown in Figure 4.

The heat flow measurements will be made mainly along the line on which seismic reflection, seismic refraction, and magnetotelluric recordings will also be made.

Gradient probes are being constructed using 4 m lengths of plastic electrical conduit tubing with three thermistors each 2 m apart sealed in each probe and with 110 m of conducting cable attached. The probes are being weighted with lead. The thermistors were calibrated against a platinum resistance thermometer standard before assembly and the completed probes were tested to a depth of 100 m in a drill hole 200 m southeast of the BMR building, Canberra.

A 3.1 m bottom core will be taken in each hole for determination of thermal conductivity within the section intersected by the gradient probes. The probes will be placed in position by the drillers and will be left for 6-8 weeks before measurements are made with a precision resistance bridge. The probes will not be recovered; repeat measurements may be made in 1981.

MAGNETOTELLURIC SOUNDINGS: A.G. Spence

Magnetotelluric soundings will be made in the latter part of 1980 along a traverse (Fig. 4) crossing three different geological environments in the central Eromanga Basin area, viz. a shelf zone of the Eromanga Basin between the Quilpie and Warrabin Troughs, Adavale Basin sediments in the Warrabin Trough, and Cooper Basin sediments at the western end of the line. The line is that along which seismic reflection, seismic refraction, and relative heat flow measurements will also be made. The electric responses obtained in the different areas will be analysed to assist in extracting stratigraphic, structural, and porosity information.

Attempts are being made to predict the likely magnetotelluric response of the area by 'forward' modelling. The main limitations to forward modelling are the availability of adequate electric-log data to produce valid geo-electric sections, and the assumption of one-dimensionality in the subsurface. Only two wells in the area of the proposed magnetotelluric survey, Mount Howitt 1 and Bodalla 1, have useful information for modelling purposes. Though of limited application, magnetotelluric response curves are being modelled for these two sites.

A further indication of the results to be expected may be obtained, for the Cooper Basin at least, by extrapolating the results of magnetotelluric work in the South Australia portion of the Cooper Basin (Moore & others, 1977). From that work it may be concluded that the lack of resistivity contrasts will make it unlikely that any of the boundaries of the upper sedimentary layers other than the base Cretaceous will be resolved; a major conductivity change should be discernible at a depth of about 90 km; and variations in the vertical magnetic field observed at large lateral distances from faults (Tipper information) should be useful in detecting such faults.

The equipment is now being prepared for the survey, which is due to take place from mid-August to the end of October 1980.

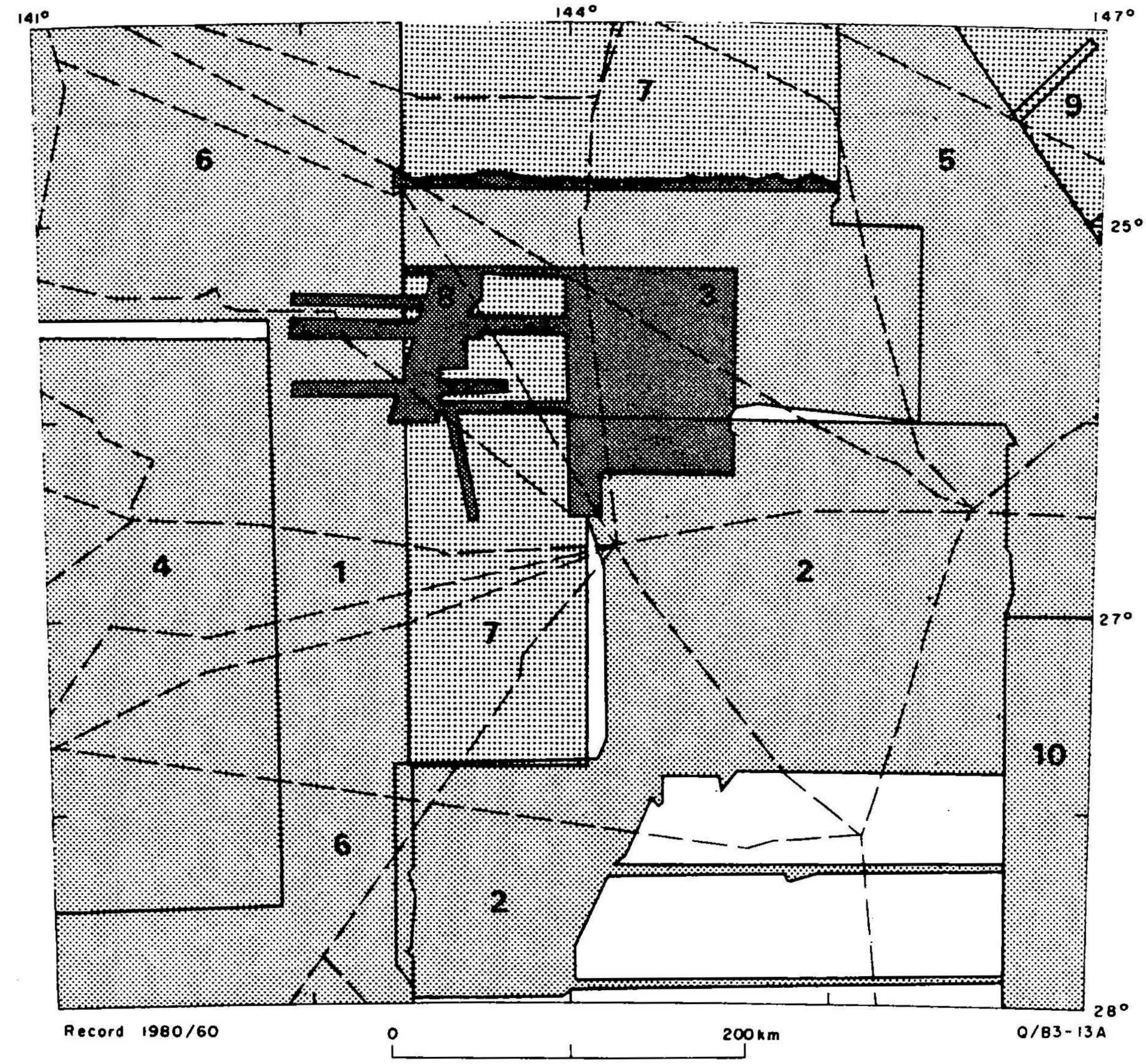
AEROMAGNETIC SURVEYS: K.R. Horsfall

The results of aeromagnetic surveys over the central Eromanga Basin area were reviewed to determine the availability and quality of the data and to assess the existing interpretations.

Ten aeromagnetic surveys provide poor to fair coverage in all areas except for the southeast part over the Cunnamulla Shelf (Fig. 7). Details of each survey are listed in Table 4. Nearly all surveys subsidised under the Petroleum Search Subsidy Act (PSSA) were flown during the 1960s and although companies were requested to provide copies of reports, results and raw data, mainly as analogue charts, the raw data often was not provided, thus making it nearly impossible to readily reinterpret the results from the particular surveys. The availability of raw data supplied by the Phillips Petroleum Company to the Geological Survey of Queensland (GSQ) is not known but a copy of the report and results has been requested. Areas where raw data is available are shown in Figure 8. BMR has raw data for 35% of the area.

The total magnetic intensity contours over the area have been compiled from 1:1 million scale reductions of the results from individual surveys (Fig. 9). Contours are not continuous from area to area since line spacing, flying altitude, and contour intervals differ from survey to survey.

The general purpose of all surveys was to establish depths to crystalline basement to define the general shape of the basins; this has been possible only in a broad sense (Fig. 10). The wide line spacing on some surveys, e.g. Cooper Creek Survey, led to calculated depths being in error because they cannot be accurately corrected for strike.



Surveys flown by subsidised companies and organisations who made data available to BMR on restricted or unrestricted basis	Area covered by both of the above
Surveys flown by or for BMR	— — Flight traverses

1 Great Artesian Basin 1958 BMR 60/14

2 Quilpie - Charleville - Thargomindah, Phillips Petroleum Company 62/1704 (subsidy)

3 Jundah - Windorah - Blackall Adavale - Augathella 1960, Phillips Petroleum Company, Queensland Mines Department

4 Innamincka - Betoota - S A Delhi Australian Petroleum 62/1709 (subsidy)

5 Tambo - Augathella 1962 Magellan Petroleum Corporation 62/1703 (subsidy)

6 Cooper Creek 1963 Delhi Australian Petroleum 63/1705 (subsidy)

7 Central Great Artesian Basin 1968 BMR 69/33

8 East Windorah 1974 XLX NL74/220 (subsidy)

9 Bowen Basin, 1961-3 BMR 66/208

10 Surat and Bowen Basin's, Qld 1960 Union Oil Development Corporation 62/1706, 62/1715, 62/1724, (PSSA)

Fig. 7 Aeromagnetic coverage

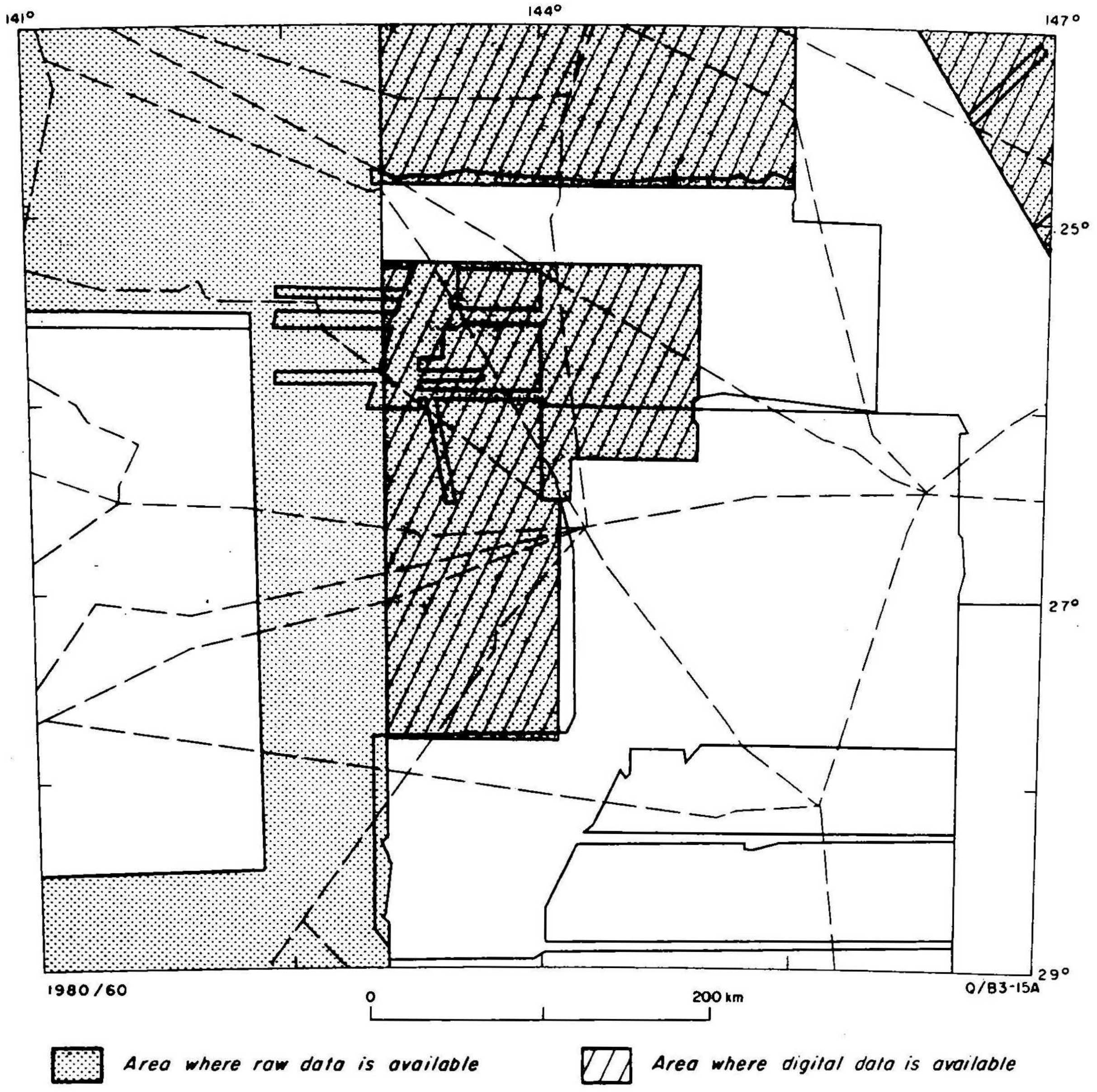


Fig. 8 Aeromagnetic data availability

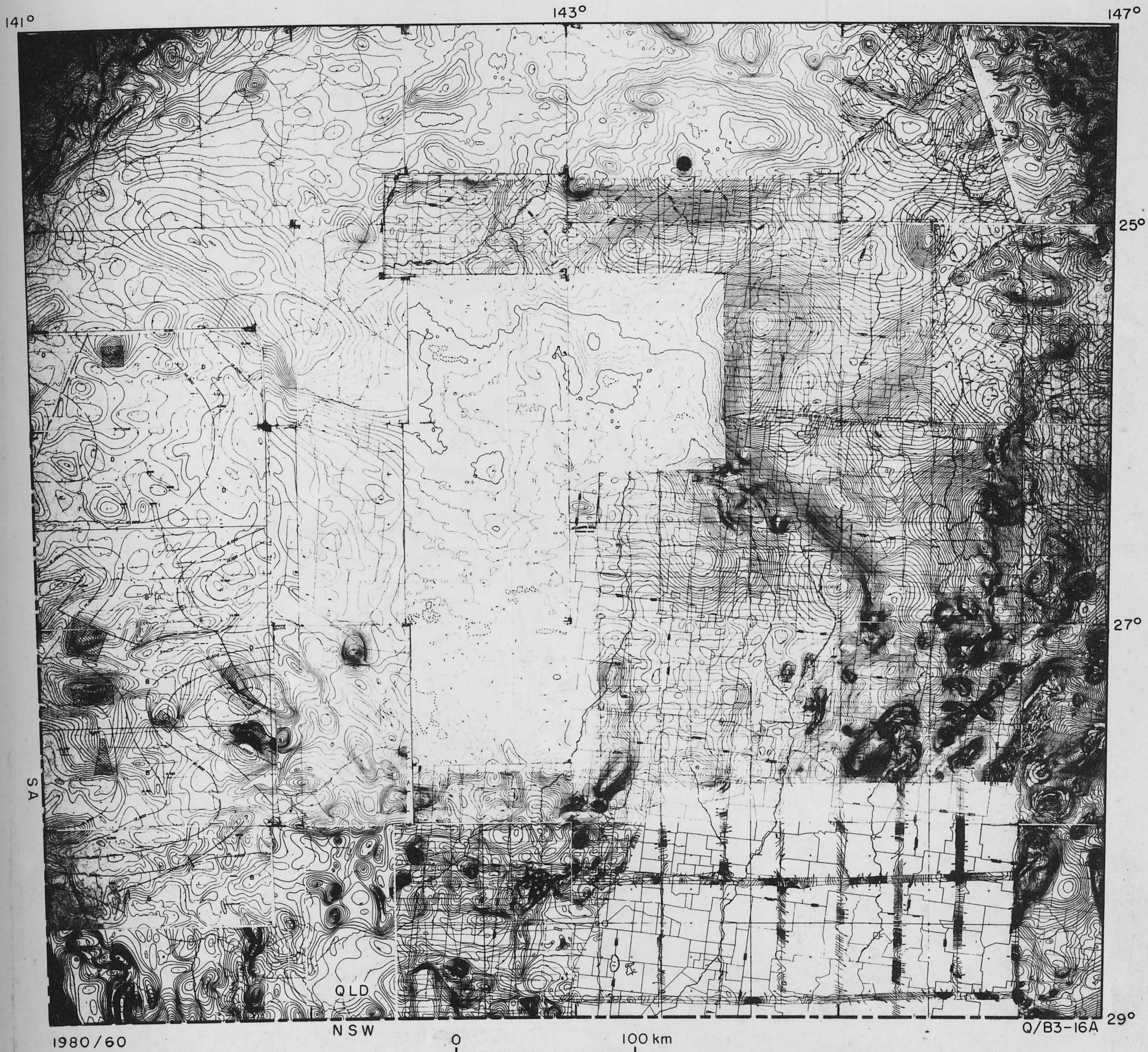
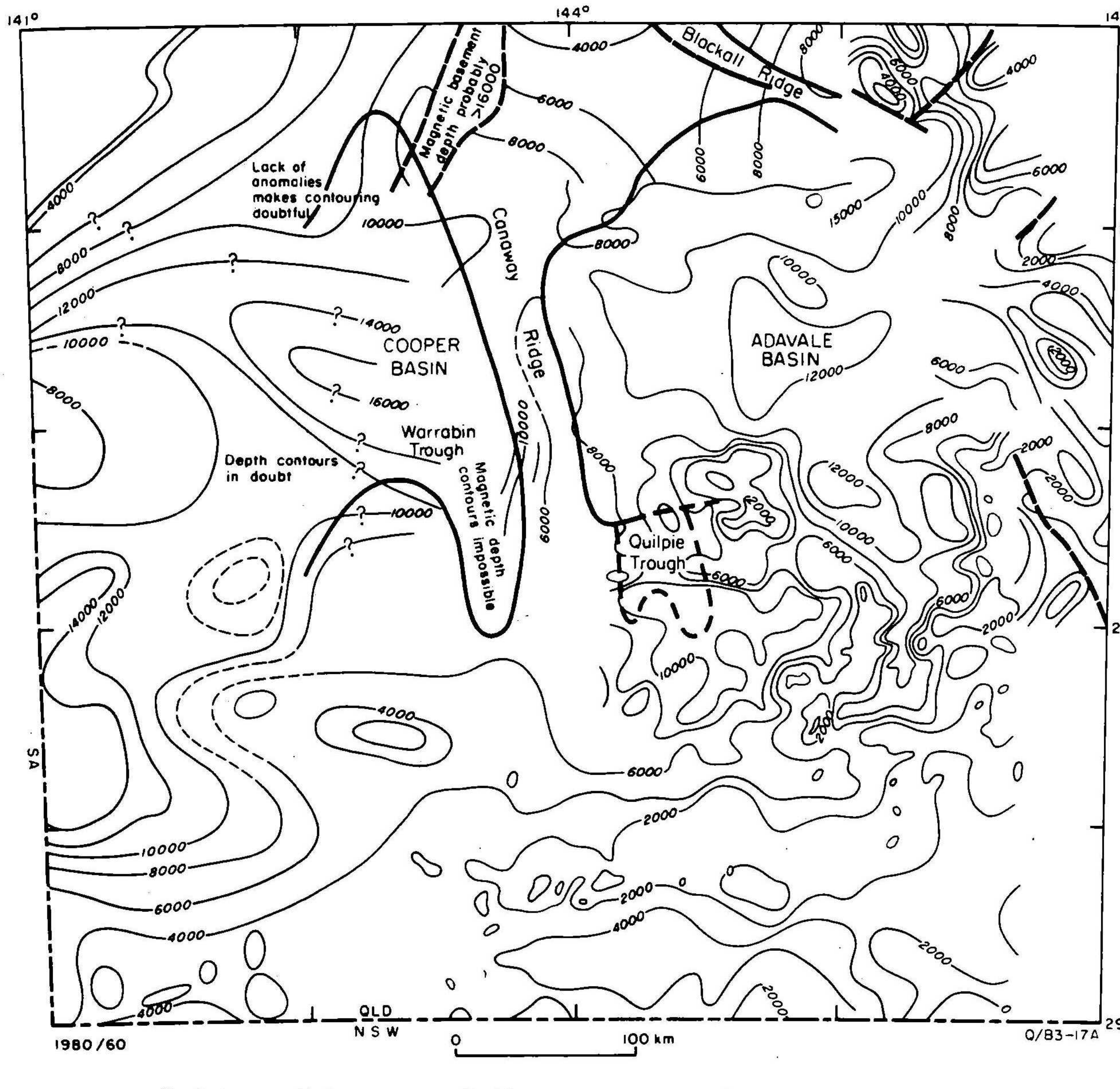


Fig. 9 Aeromagnetic contours



2000 Depth to magnetic basement compiled from individual survey reports (feet below M.S.L.)

Basin boundaries (from BMR record 1969/33, plate 7)

Fault or magnetic depth discontinuity

Fig. 10 Depth to magnetic basement

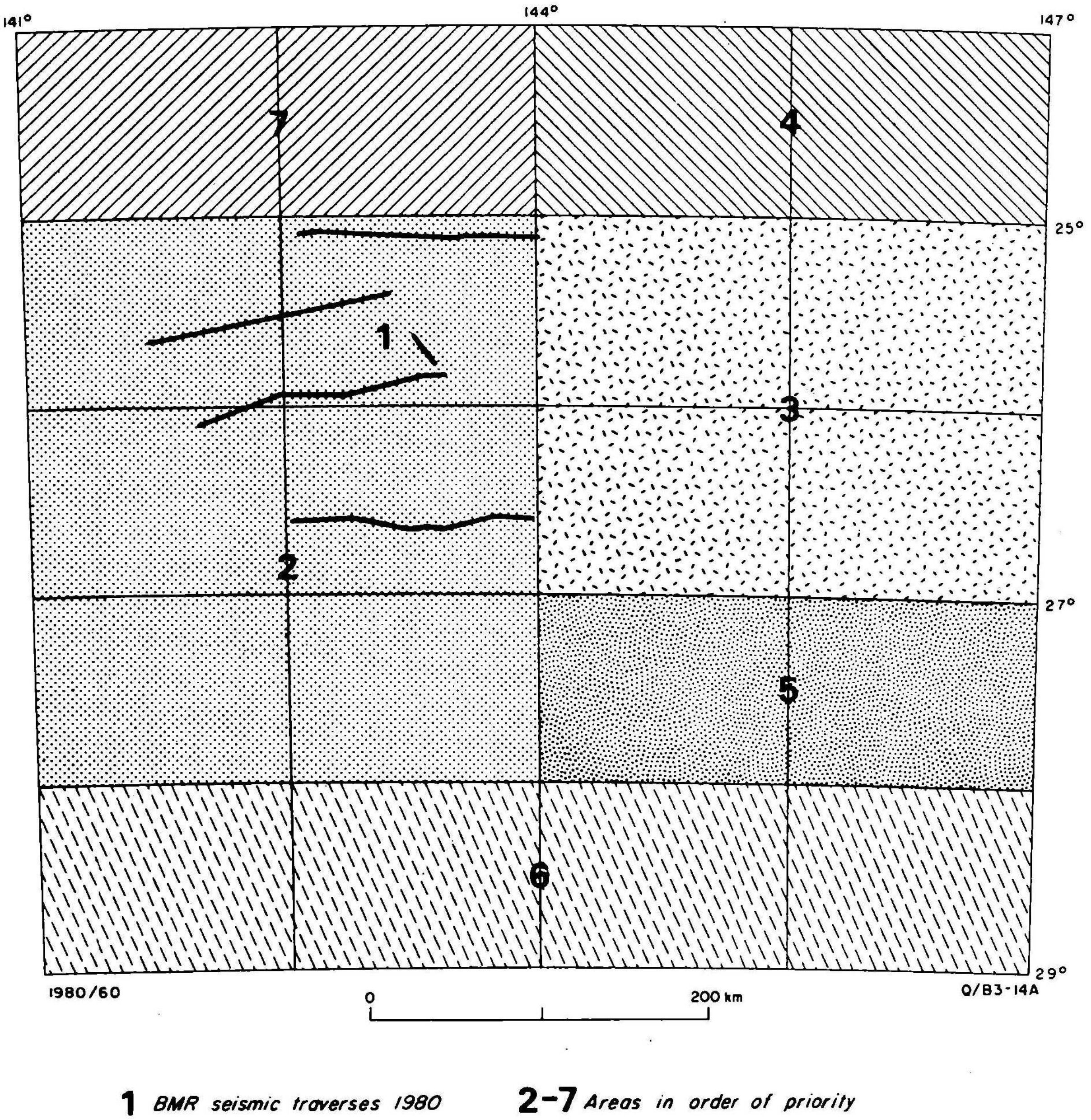


Fig. 11 Aeromagnetic survey priorities

The main area of interest for the Central Eromanga Basin Project in 1980-81 is bounded by latitudes 25°S and 27°S. The general shapes of the basins in this area have been defined but there remains some doubt on the basement configuration close to the Canaway Ridge. The Cooper Creek, East Windorah, and Central Great Artesian Basin surveys were flown in this region. The problem in analysing the results of these surveys is recognition of suitable anomalies for depth calculations.

The East Windorah survey is the most recent and most detailed. A small susceptibility contrast between the basement and the overlying sediments is noted. Further problems arise from magnetic noise from near-surface magnetic materials accumulated by weathering processes. The data profiles from the East Windorah survey have a high-frequency noise component up to 1 nT, probably generated in the recording instruments. This is superimposed on a lower-frequency component with a half-width of 300-400 m and amplitude of 2-3 nT, probably due to noise generated by aircraft turbulence. In addition there are anomalies of about 4 nT and half-width of about 1 km, which are due to surface or near-surface sources. The data held by BMR for this survey consist of 8 mm film with fiducial numbers and corresponding magnetometer readings. It would be a very tedious task to put this data into a usable format. The survey design was good in that it attempted to tie depth calculations to drillhole data.

The scarcity of anomalies suitable for depth calculations in data from the Central Great Artesian Basin is noted by Waller (1969). The data from the survey are in digital form, and should be studied in detail. The only other survey for which there are raw data is the Cooper Creek Survey. These data are in analogue form and have a noise envelope of about 2 nT. The data are recorded at 24 nT/cm and it would be difficult to resolve small anomalies of less than 50 nT. It is doubtful if much new information can be extracted from the data.

Attempts to define low-amplitude, deep magnetic anomalies in the project area would require the use of a high-sensitivity magnetometer, with at least 0.1 nT resolution and a sample interval of the order of 20 m. This would enable processing to eliminate the effects of ground surface noise. Correlation between magnetic and seismic basement could be established with high-sensitivity surveys flown along seismic traverses with good-quality data.

If a test survey provided satisfactory results, further detailed surveys should be flown according to the priorities shown in Figure 11. These priorities are based on the current interest in the central region and probable greater prospectivity of this area for hydrocarbon exploration. Consideration will be given to possible aeromagnetic surveys in the area in 1981.

ELECTRICAL, ELECTROMAGNETIC, AND GROUND MAGNETIC INVESTIGATIONS: J.A. Major

The electrical properties of the sediments in the central Eromanga Basin area are being studied, particularly to determine the relationships between any electrical and seismic markers and to assess possible electrical methods for direct or indirect hydrocarbon detection. A literature search was made, well logs from Mount Howitt 1 and Bodalla 1 were studied, and theoretical calculations were made to assess whether techniques normally used in shallow metalliferous work can be applied to a conductive sedimentary section up to 5 km deep with resistivities of 1-100 ohm-metres and generally less than 10 ohm-metres.

From previous work by Polak & Ramsey (1977) in the Canaway Ridge area, and Moore (1975) and Moore & others (1977) in the southern Cooper Basin, it is evident that considerable difficulty will be experienced in obtaining useful electrical and electromagnetic results in the project area. These workers found new electrical and electromagnetic markers and very low near-surface resistivities (0.7-10 ohm-metres). These low resistivities will produce a rapid attenuation of electromagnetic waves, and make it difficult to get energy down to deep targets and back to the surface.

If a test survey fails to reveal any electrical response from deep within the sedimentary sequence there is still a possibility that a deep-seated feature, e.g. a fault, which is not evident at the surface may have a near-surface electrical expression associated with an oxidised or water-saturated zone. Hydrocarbon accumulations may be associated with broad zones of chemical alteration which have an IP response.

Electromagnetic coupling, which will occur when using the large arrays over conductive zones, may mask IP response and invalidate DC resistivity measures which in practice use low-frequency square waves. The coupling effect may be minimised by using low frequencies of the order of 0.01 Hz and long acquisition times together with digital stacking. The low-frequency sounding could be provided by the "AMT" system, currently being developed at Macquarie University, NSW, to determine resistivity information to depths of 500 to 1000 m. A wide-band electromagnetic sounding system developed by Professor N. Edwards, University of Toronto, Canada would be a useful tool for sounding at depths ranging from a few metres to several tens of kilometres.

Deep transient electromagnetic (TEM) soundings have been suggested by B.R. Spies of BMR, but details of the proposed soundings have yet to be worked out.

More well logs need to be examined to obtain representative geo-electric sections within the basins and on ridges and shelves in the central Eromanga Basin area. Inverse modelling is required to predict resistivity and magnetotelluric response of the geo-electric sections and the sensitivity of model parameters to changes in the observations. Computer programs are required to calculate the electromagnetic or TEM response of layered models for various electrode and loop configurations.

Fieldwork is required to determine whether existing resistivity IP, SP, or TEM equipment can be applied in the project area, and particularly to determine if deep-seated features have a near-surface electric expression. However no electrical or electromagnetic fieldwork is proposed in 1980. The possible use of AMT and/or wide-band EM sounding in 1981 is being investigated. Programs should be acquired as soon as possible to facilitate modelling.

The aim of ground magnetic surveys in the project area is to detect near-surface, short-wavelength magnetic features, which may be associated with deep structures and/or hydrocarbon accumulations, and may also provide information on deep magnetic sources. The preparation of carborne magnetometer equipment has started. The equipment will be tested to determine noise characteristics, heading error, compensation, etc. before a short survey along the proposed seismic reflection survey traverses in the area in the latter part of 1980.

APPENDIX 1

PERSONNEL INVOLVED IN PROJECT, JANUARY-JUNE 1980

GENERAL

Management	:	E.R. Smith
Coordination	:	F.J. Moss

GEOLOGY

Source rocks and maturation	:	E. Nicholas, V. Passmore, R. DeNardi, B.R. Senior
Lithology	:	V. Passmore, W.Z. Hessler
Hydrogeology	:	M.A. Habermehl, B.R. Senior
Landsat	:	C.J. Simpson, B.R. Senior

GEOPHYSICS

Seismic reflection	:	J. Pinchin, A.R. Fraser, K.L. Lockwood, S.P. Mathur, D. Pfister, K.D. Wake-Dyster, F.J. Moss
Seismic refraction	:	D.M. Finlayson, C.D.N. Collins, C.J. Rochfort
Gravity	:	K.L. Lockwood, A.S. Murray
Heat flow	:	J.P. Cull, D.M. Finlayson, J.W. Williams
Magnetotellurics	:	A.G. Spence, J.W. Whatman
Aeromagnetics	:	J.E. Rees, K.R. Horsfall
Electrical, EM and ground magnetics	:	J.A. Major, B.R. Spies, R. Curtis

SUPPORT ORGANISATIONS and staff included the following:

Petroleum Technology Section, BMR: preparation for drilling support to seismic and heat flow surveys

Interim Engineering Services Branch, BMR: preparation of equipment for surveys

Operations Branch, BMR: drafting for reports and lectures

Australian Survey Office: planning and preparation for surveying BMR traverses

Petroleum Exploration Leaseholders: provision of seismic survey plans and seismic cross-sections

APPENDIX 2

PUBLICATIONS, RECORDS AND LECTURES, JANUARY-JUNE 1980

PUBLICATIONS

SENIOR, B.R., & HABERMEHL, M.A., 1980 - Structure, hydrodynamics and hydrocarbon potential, central Eromanga Basin, Queensland, Australia. BMR Journal of Australian Geology & Geophysics, 5, 47-55.

RECORDS

HARRISON, P.L., MATHUR, S.P., MOSS, F.J., PINCHIN, J., & SENIOR, B.R., 1980 - Central Eromanga Basin Project, program proposals, 1980-1982. Bureau of Mineral Resources, Australia, Record 1980/32 (unpublished).

LECTURES

MOSS, F.J. - Plans to assess the petroleum potential of the central Eromanga Basin and underlying basins. BMR Lecture Series May 1980.

TABLE 1. SOURCE-ROCK AND MATURITY DATA FOR THE EROMANGA BASIN AND INFRA-BASINS IN SOUTHWEST QUEENSLAND

Well	Core	Depth (m)	Age	Basin	Total extract (ppm)	Aliphatic fraction (ppm)	Aromatic fraction (ppm)	Polar fraction (ppm)	Organic C (%)	Vitrinite reflectance (% Ro)
Innamincka-2	2	2182.4	Early Triassic	Cooper	53	7	10	283	0.10	1.06
"	6	2637.1	Permian	"	627	45	302	161	2.15	1.53
"	9	3022.4	Permian	"	11 033	147	2 080	1 760	87.2	2.08+
"	12	3512.5	Cambrian?	Warburton	52	11	9	22	0.15	1.97
Arrabury-1	1	2377.1	Early Triassic	Cooper	158	6	0	93	0.05	1.22
"	2	2651.5	Permian	"	36 320	1 090	11 100	2 875	53.7	1.04+
"	3	2845.0	Ordovician	Warburton	186	0	0	328	4.00	1.51
Gilpeppee-1	2	2424.4	Triassic	Cooper	1 143	31	59	110	0.65	0.93+
"	3	2869.9	Permian	"	49 638	225	960	550	77.7	1.74+
Tallalia-1	2	2317.7	Early Triassic	Cooper	3 347	164	867	177	4.45	0.88
"	4	2499.7	Permian	"	2 775	178	1 625	242	11.9	1.33
"	5	2803.2	Permian	"	332	36	109	36	2.30	1.97
"	7	3064.5	Permian	"	163	13	65	41	1.40	2.02
Bodalla-1*	1	1879.0	Permian	Galilee	48 000	8 784	7 680	7 104	62.2	0.54
"	3	2598.0	Devonian	Adavale	510	233	55	84	0.50	0.60
Chandos Sth-1*	1	2072	Jurassic	Eromanga	41 410	3 147	7 123	10 518	39.6	0.71
"	4	2341	Triassic/Permian	Cooper	894	500	89	122	0.76	0.72
"	5	2380	Permian	"	9 022	965	1 471	1 940	31.8	0.75
"	6	2386	Permian	"	8 880	1 510	1 687	2 184	50.3	0.85
Budgerygar-1*	1	1508.4	Jurassic	Eromanga	2 947	743	312	846	3.60	0.55

TABLE 1 - Continued

Well	Core	Depth (m)	Age	Basin	Total extract (ppm)	Aliphatic fraction (ppm)	Aromatic fraction (ppm)	Polar fraction (ppm)	Organic C (%)	Vitrinite reflectance (% Ro)
Chandos-1*	4	1806	Jurassic	Eromanga	12 355	1 594	1 915	3 830	16.2	0.62
"	WL 5	2511.5	Devonian/Carboniferous	Adavale	466	13	3	258	0.10	-
"	WL 21	2591.1	Devonian/Carboniferous	"	736	0	4	.443	<0.05	(0.47)
Durham Downs-1	1	2522.8	Jurassic	Eromanga	1 210	104	591	179	1.75	1.10
"	2	2572.2	Permian	Cooper	10 700	663	5 580	1 940	15.3	1.05
"	3	2595.4	Permian	"	2 980	159	1 530	752	5.50	(1.05)
"	5	2684.4	Permian	"	34 100	1 840	16 500	4 450	38.3	1.04
"	6	2747.8	Early Palaeozoic	Warburton	486	51	6	173	0.45	-

(0.47) values in parentheses are more uncertain

- insufficient vitrinite present for measurement

+ maximum mean value

* Analyses by AMDEL. Remainder analysed by CSIRO

TABLE 2 - WELLS SAMPLED FOR SOURCE-ROCK STUDIES IN THE EROMANGA BASIN AND INFRA-BASINS 1979/80

Well name	Location	Basin	No. of samples	Analyst
Boree-1	24° 29' 50"S 145° 19' 52"E	Adavale	2	CSIRO
Bury-1	25° 02' 40"S 145° 36' 20"E	Adavale	1	"
Dartmouth-1	26° 08' 39"S 145° 20' 34"E	Adavale	6	"
Fairlea-1	24° 29' 50"S 145° 19' 52"E	Adavale	3	"
Jericho-1	23° 46' 19"S 146° 05' 01"E	Drummond	1	"
Leopardwood-1	25° 37' 10"S 144° 40' 13"E	Adavale	1	"
Quilberry-1	26° 25' 03"S 145° 30' 07"E	Adavale	1	"
Report No. SS289N (BMR) 1129R (CSIRO)				
Beryl-1	22° 22' 08"S 143° 58' 26"E	Eromanga	1	AMDEL
Cherri-1	29° 07' 21"S 140° 12' 45"E	Cooper	2	"
Coongie-1	27° 12' 03"S 140° 06' 56"E	Warburton	1	"
Dullingarri-1	28° 07' 55.6"S 140° 52' 30"E	Eromanga Cooper Warburton	8 7 3	"
Merrimelia-1	27° 47' 04.6"S 140° 06' 54.5"E	Eromanga Cooper	1 5	"
Report No. SS2890 (BMR) AC2117/80 (AMDEL)				
Fermoy-1	23° 08' 32"S 143° 03' 26"E	Eromanga	3	CSIRO
Mayneside-1	23° 35' 23"S 142° 31' 11"E	Eromanga	3	"
Report No. SS289N (BMR) 1129R (CSIRO)				

TABLE 3 - LANDSAT SCENES

Path/Row	Scene Name
100-007	Tambo
100-078	Augathella
100-079[1]	Wyandra
100-080	Eulo
101-077	Blackall
101-078	Adavale
101-079	Toompine
101-080	Bulloo
102-077[2]	Jundah
102-078[2]	Windorah
102-079	Thargomindah
102-080[1]	Tickalara (E)
103-077[2]	Connemara
103-078[1,2]	Canterbury
103-079[1]	Durham Downs

1. Scenes available from CSIRO, June 1980

2. Scenes required for 1980 Program

TABLE 4. AEROMAGNETIC SURVEY PARAMETERS, AND AVAILABILITY OF DATA

	SURVEY	SURVEY NO	LINE SPACING (km)	ALTITUDE (ASL)	DIGITAL/ ANALOG	DATA QUALITY	RAW DATA AVAILABLE	FLT PATH MAP AVAILABLE	TMI PROFILES	CONTOURED TMI	CONTOURED DEPTH TO BASEMENT
1.	Great Artesian Basin, 1958. BMR 60/14	187	TRAVERSES	760 m	ANALOG	FAIR NOISE 2 nT Envelope	YES	YES	YES	NO	NO
2.	Quilpie, Charleville, Thargomindah. Phillips Petroleum Co. 1961, 62/1704 (PSSA)	217	4.8	610 m	ANALOG	FAIR NOISE 2nT	NO	YES	NO	YES	YES
3.	Jundah, Windorah, Blackall, Adavale, Augathella, 1960. Phillips Petroleum Co. GSQ	218	4.8	1067 m	ANALOG	NOT KNOWN	NOT KNOWN	NOT KNOWN	NO	YES	YES
4.	Innamincka-Betoota, S.A., 1961. Delhi Australian Petroleum 62/1703 (PSSA)	246	8.0	460 m	ANALOG	NOISE 2 nT Envelope	NO	YES	NO	YES	YES
5.	Tambo-Augathella, 1962. Magellan Petroleum Corp. 62/1703 (PSSA)	254	3.2	760 m	ANALOG	FAIR 2nT Envelope	NO	YES	NO	YES	YES
6.	Cooper Creek, 1963. Delhi Australian Petroleum 63/1705 (PSSA)	266	8.0	450 m	ANALOG	FAIR 2 nT Envelope	YES	YES	NO	YES	YES
7.	Central Great Artesian Basin, 1968. BMR 69/33	346	3.2	600 m	DIGITAL	FAIR 2 nT Envelope	YES	YES	YES	YES	YES
8.	East Windorah, 1974. XLX NL 74/220 (PSSA)	412	2.0	600 m	ANALOG	FAIR	YES	YES	YES	YES	NO
9.	Bowen Basin, 1961-3. BMR 66/208	238	3.2	600 m	ANALOG	FAIR	YES	YES	YES	YES	YES
10.	Surat-Bowen Basin Area, 1960 Union Oil Development Corp. 62/1706, 62/1715, 62/1724 (PSSA)	221	1.6	600 m	ANALOG	FAIR	NO	YES	NO	YES	YES

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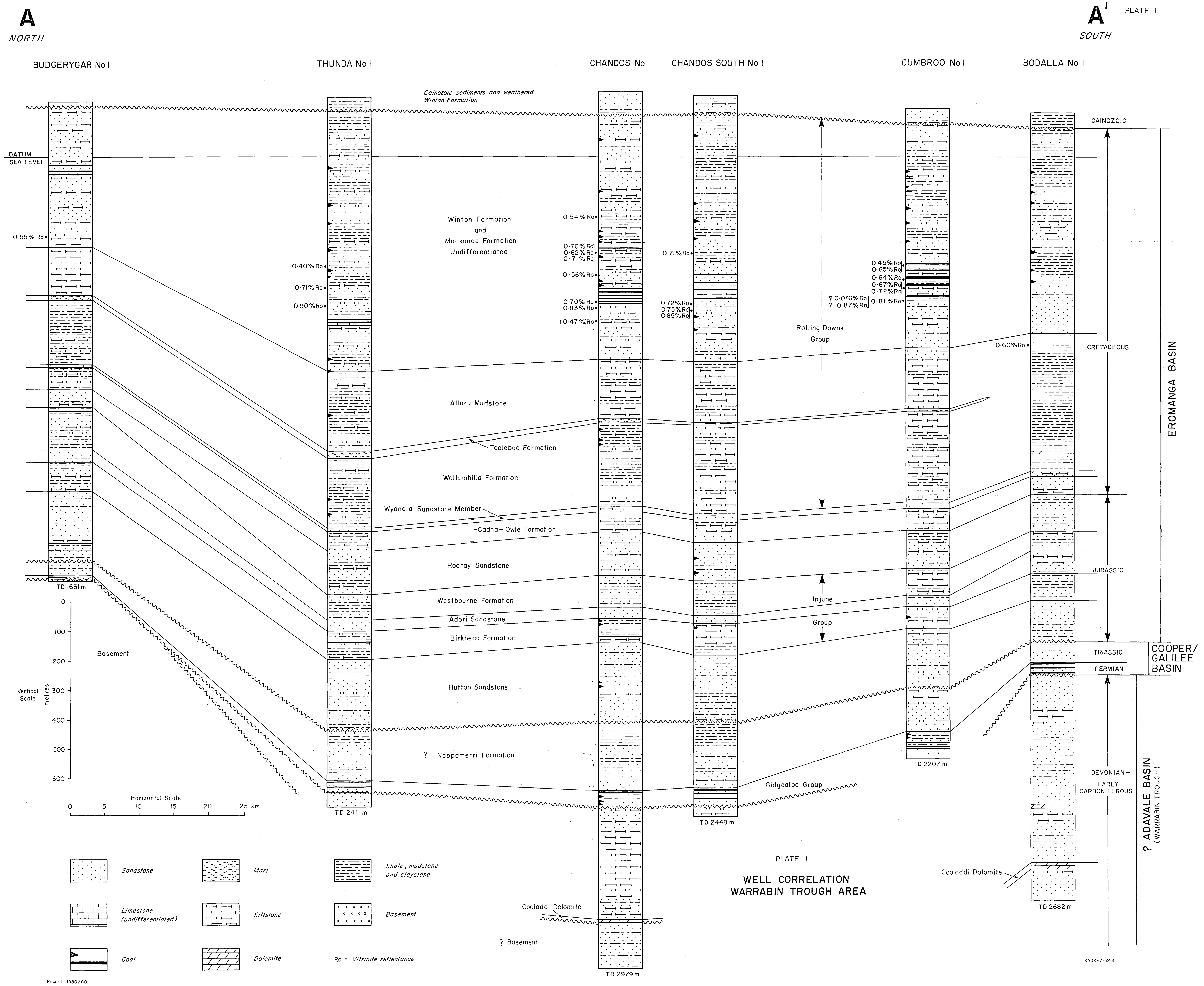

PLATE I

WELL CORRELATION
WARRABIN TROUGH AREA