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EL 3409

MILANG [HOMESTEAD]

FIRST PARTIAL SURRENDER REPORT FOR THE PERIOD 25/8/2005 TO 24/8/2006

Submitted by
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2006

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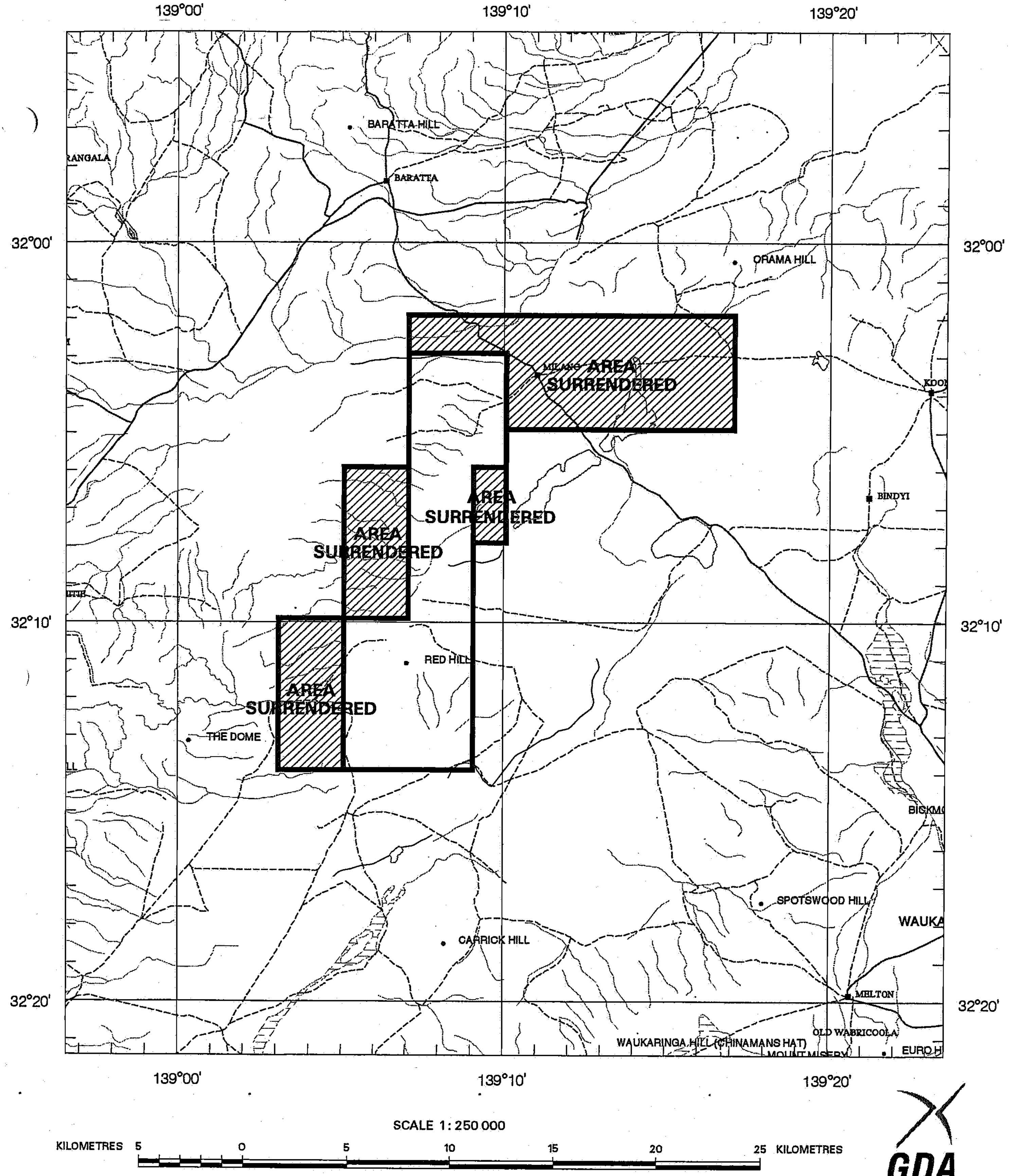
Government of South Australia
Primary Industries and Resources SA

SCHEDULE A



LICENCE GRANTED IN : DATUM AGD66

GDA GEOCENTRIC DATUM OF AUSTRALIA

APPLICANT : **MILLER D T, CARTER J C, DEUTER M, ARCHER G, DOWN UNDER AQUACULTURE PTY LTD, STEWART GEOPHYSICAL CONS**

FILE REF : **112/05** TYPE : **MINERAL ONLY** AREA : **96** km² (approx.)

1:250000 MAPSHEETS : **ORROROO**

LOCALITY : **MILANG AREA - Approximately 100 km northwest of Olary**

DATE GRANTED : **25-Aug-2005** DATE EXPIRED : **24-Aug-2006** EL NO : **3409**

Partial Surrender

REPORT OF MINERAL EXPLORATION

08/2005 TO 07/2006

EL 3409

Prepared by Dr D.T. MILLER

Date: 14/09/06

CONTENTS

1 Summary of Mineral Exploration Activities – surrendered areas

1.1 Outline of exploration targets and work completed

Exploration activities on EL 3409 during the past twelve (12) months have been orientated towards assessing the tenements prospects for gold, base metals, uranium and evaporite deposits. A literature review of past exploration, examination and reassessment of available geophysical data (including magnetic, radiometric and satellite imagery) were used to identify areas within the tenement that showed the most favourable anomalies and prospects. A stock-take of the available geologic information and a review of exploration focus indicated that a portion of the tenement could be surrendered (Figure 1). Exploration efforts have now been orientated towards alluvial gold prospects, with minor emphasis on uranium and evaporative deposits.

Specific work conducted on areas surrendered included an assessment of available exploration data, surface sampling, field checking of a radiometric anomaly, heavy mineral analysis and a brief examination of archived drill core and cuttings (DH K4A – sample provided to PIRSA for palynology examination of Cainozoic sediments).

Dr D.T. Miller submitted reports on deep basement targets within the vicinity of the tenement. The reports have yet to be reviewed. A copy is included here as an Appendix.

Palynology report by L Stoian PIRSA - See Appendix

1.2 Key words (ASCII file name EL2847_200104_Keywords.txt)

Details

Map sheets- topography:	Orama1:50 000
Map sheets- geology:	Orroroo 1: 250 000 (I 54-1 zones 5 & 6),
Location names:	Milang
Commodity sought:	Copper, Gold, Diamonds, Uranium
Exploration methods:	surface geochemistry, airborne magnetic and radiometric, gravity, heavy mineral analysis
Geological units targeted:	Neoproterozoic, Callana Group, Burra Group, Umberatana Group, Cainozoic
Prospect names:	Etina
Geological province:	Delamerian Fold-Thrust Belt, Adelaide Geosyncline, Nackara Arc
Geological ages:	Neoproterozoic, Cainozoic

Summary

Orroroo, Milang, Copper, Gold, Diamonds, Uranium, Thorium, heavy mineral analysis, playa lakes, surface geochemistry, airborne magnetic and radiometric, gravity, Neoproterozoic, Callana Group, Burra Group, Umberatana Group, Cainozoic, Delamerian Fold-Thrust Belt, Adelaide Geosyncline, Nackara Arc, Neoproterozoic

1.3 Summary of tenure details

Exploration Licence Number:	EL3409
Exploration licence grant date:	24/08/2005
Term completed:	1 year
Operator/Manager:	Miller, D.T., Carter J.C., Deuter, M., Archer, G., Arkose Pty Ltd, Stewart Geophysical Consultants.
Minerals sought:	ALL except opal
Exploration consultant:	Dr David T. Miller
Phone:	(08) 8298 4602
Fax:	(08) 8298 4602
E-mail	fredgeo.miller@bigpond.com

1.4 Location of tenement

The Tenement is situated on the north-east portion of the Orroroo 1:250 000 map. The nearest towns are Orroroo approx. 80 km to the southwest and Peterborough approx. 100 km to the south.

The topographic relief is flat open plains with areas of low ridges with scrubby vegetation mainly confined to the southern and western parts of the Tenement. Several playa lakes also occur within the surrendered areas.

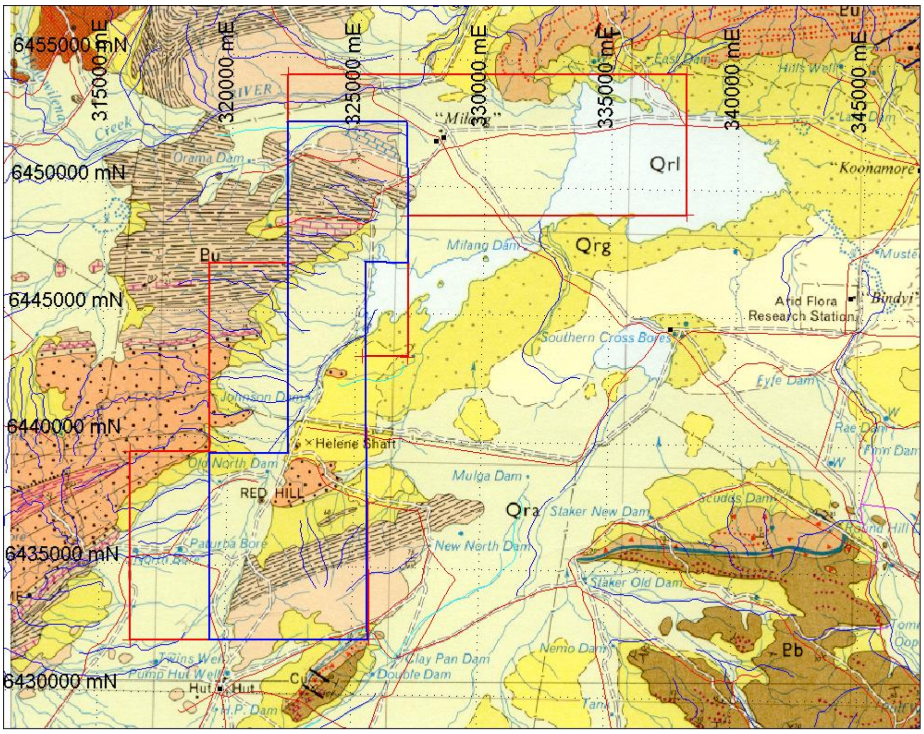


Figure 1 Red boundary is old Tenement, blue boundary is the current Tenement.

2 Geochemistry and Heavy mineral analysis

Several sediment samples were collected in the region of the tenement. A preliminary result from the analysis of a composite sample is provided here (Figure 8, Table 1).

Dune 1 - this sample was a composite of two samples (335857-6444851; 331306-6448112) collected from sand dune complexes in the northern region of the tenement. The samples were washed to remove fine clays and then panned to concentrate heavy minerals. The sample was sent to IDL (Independent Diamond labs) where a heavy liquid separation was used to collect grains of a specific gravity > 2.8g/cc. The heavy mineral fraction was examined. The results gave a mineral suite containing almandine and spessartine garnet, kyanite, tourmaline, ilmenite, rutile, magnetite, leucoxene, limonite and phosphate.

Initial thoughts are that these minerals are as a group representative of a derivation from an igneous-moderate-high grade metamorphic complex. It is highly likely that these sediments have been eroded and transported from the Curnamona Craton. This is a very interesting result and means that economic minerals within the Curnamona complex may be concentrated within the dune complexes as heavy mineral sands.

Figure 2 Playa lake adjacent to Southern Cross Bores – Th anomaly within lake sediments.

Figure 3 Sampling and Scintillometer work on Southern Cross Bore playa lake.

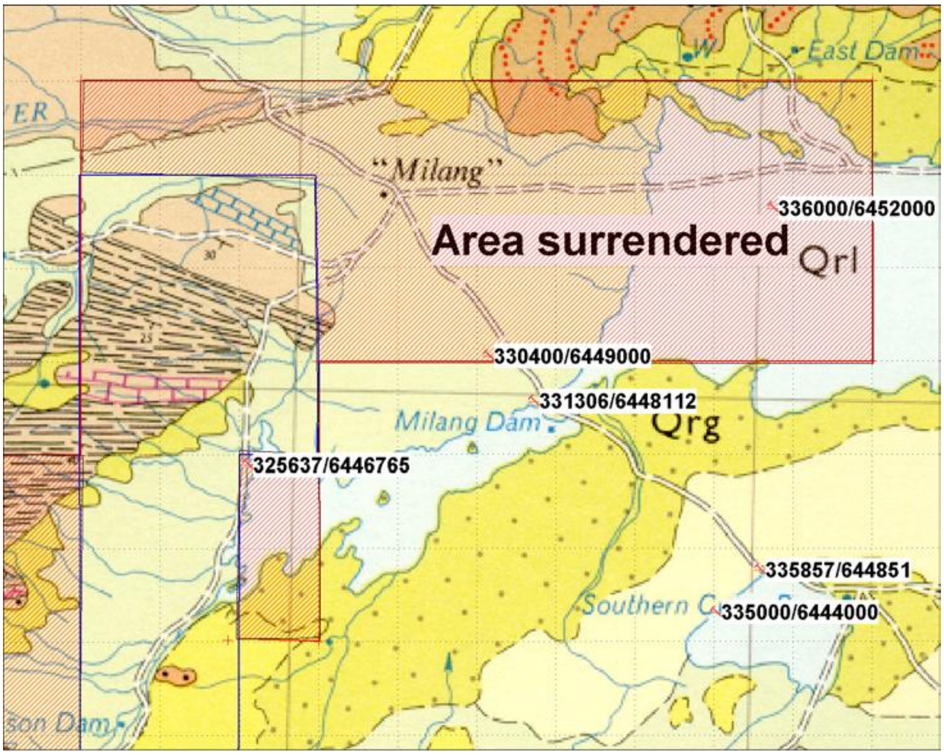


Figure 4 Location of samples within the surrendered area and samples taken as part of a regional orientation survey. Scintillometer readings were taken east of sample 335000/6444000 – slightly elevated counts. NB Sample number 335857/644851 should read 33857/6444851.

DIAMOND INDICATOR DATA

Sample No: Dune 1

Job No: 567

Date Started: 7-11-05

Processing Weights

Initial: 0.012 kg
+2mm: kg
After Tabling: kg
After TBE: 1 g

Positive [ ]
Negative [X]
Positive (Other) [ ]

Ø/mm	>2	>1	>0.8	>0.5	>0.4	>0.3	<0.3
Digest							
Mill							
HL		x	x	x	x	x	x
Mag							

Fractions Analysed(x) Observed only(o) Scanned only(s)

Ø/mm	>1	>0.8	>0.5	>0.4	>0.3	<0.3	>0.1
NM	x	x	x	x	x	s	
M4	x	x	x	x	x	s	
M3	x	x	x	x	x	s	

Kimberlite, Lamproite Indicators

Sieve Size/mm	>2	>1	>0.8	>0.5	>0.4	>0.3	>0.2	>0.1	Wear/km	Appearance
Diamond										
Chrome Diopside										
Chromite										
Phlogopite										
Picroilmenite										
Pyrope										

Detailed Descriptions

Mineral	Size/mm	Description

Other Minerals (Volume% after Heavy Liquid-HL)

Almandine	T	Orthopyroxene		Spinel		Apatite	
Andradite		Clinopyroxene		Magnetite	A	Monazite	
Grossular		Amphibole		Leucoxene	O	Phosphate	S
Spessartine	T	Biotite					
		Prehnite		Limonite	P	Rock Fragments	
Andalusite		Corundum		Pyrite(psuedo)			
Kyanite	T	Hematite		Pyrite		Zircon	
Sillimanite		Ilmenite	T	Barite		Titanite	
Staurolite		Rutile	T	Anhydrite			
Epidote		Anatase					
Tourmaline	O	Brookite		Magnesite			

P >50% A 20-50% C 10-20% S 1-10% O 20grains-1% F 5-20grains T 1-5grains

Mineralogist/Observer: JT-LG-EH

Date Completed: 11-11-05

Independent Diamond Laboratories Pty Ltd
ABN 34 005 948 185 37211

Table 1 Independent diamond lab results.

3 Geophysics

Specialists within the exploration team have re-examined the SAEI B7 airborne magnetic and radiometric data. The data has been passed through various filtering algorithms in an attempt to resolve subtle near surface features. A priority has been given to finding extensions to the Au bearing quartz reef at the Battle Mountain prospect. Further work on the data set was aimed at enhancing cross cutting features observed in earlier interpretations (see literature review). SRTM (Shuttle Radar Topographic Mission) data has been examined to aid with interpreting the modern and palaeo-drainage within the tenement area. The SRTM data has also assisted in the preliminary interpretation of the radiometric data.

4. Literature review

4.1 Geology – regional review

Exploration licence is located in the northeast arm of the Nackara Arc. The Nackara Arc is part of the Adelaide Fold Belt (Scheibner, 1974; Plummer, 1978; Jenkins, 1990; and Mancktelow, 1990) or Delamerian Fold Thrust Belt (Miller, 1994). The rocks exposed within the tenement are primarily lower Neo-Proterozoic sedimentary strata of the Burra and Umberatana Groups. These rocks contain both gold and copper mineralisation, either strata bound or in association with quartz veins or “diapirs’.

Regional geology - summary

EL 3409 lies within a region of deformation located in eastern South Australia. The strata preserved in this area consist of sedimentary deposits of Neo-Proterozoic age, large areas of which are covered by Cainozoic and Quaternary sediments. The tenement lies west of Palaeo-Proterozoic Willyama Complex including both metamorphic and granitic rocks.

The Nackara Arc represents a west-east transition from tight upright folding and low-grade metamorphism into arcuate folds, penetrative cleavage and metamorphic textures. Rocks along the eastern margin reach upper amphibolite facies (Offler and Fleming, 1968; Mancktelow, 1990, Bell, 1978; McKirdy et al, 1975). The lower Neo-Proterozoic strata of the Nackara Arc are bound by syn- and post-tectonic granites along the eastern margin of the Flinders Ranges.

Occurrences of irregular structures (Mount, 1975) composed of brecciated blocks of sedimentary, igneous and infrequent metamorphic rocks, can be found within the general area of EL. Lemon (1985) suggested that diapirism, associated with faulting, produced these domal structures and associated swarms of radiating faults.

The Adelaidean and Cambrian strata of the Fold Belt are considered to have been deformed principally during the Cambro-Ordovician Period, approximately 500 million years ago. This tectonic event is referred to as the Delamerian Orogeny (Thomson, 1969). The Delamerian Orogeny subjected strata of the Adelaide Geosyncline to at least one major meridional north-south phase of folding and faulting.

Stratigraphy of the tenement region

The landscape in the region of the tenement exposes both a Neo-Proterozoic and Palaeozoic sedimentary succession that lies unconformably on Archaean to Palaeo-Proterozoic metamorphic complexes and Meso-Proterozoic granites, volcanics and sediments. The geology within the Tenement primarily belongs to the Heysen Supergroup with most of the exposed rocks identified as lower Umberatana and Burra Groups.

The Burra Group is generally observed to be unconformable with pre-Adelaidean basement and disrupted Callanna Group. The Burra Group is composed of an alternation of siltstone, shale, sandstone and dolostone. The upper Burra Group is unconformable with the underlying Callanna Group (Binks, 1971). The upper Burra Group is composed of an alternation of shales, dolomites and sandstones, including the Undalya Quartzite and its equivalents above the Skillogalee Dolomite, and the stratigraphically higher shales of the Saddleworth and Mintaro Formations.

The lower Umberatana Group is composed of the Pualco Tillite, Benda Siltstone, Wilyerpa Formation and the Appila Tillite. The extensive and uniform Tapley Hill Formation represents the middle Umberatana Group and is found throughout the Delamerian Fold Belt (Preiss, 1987). The geology of the upper Umberatana Group is variable with numerous individual formations recognised (Preiss, 1987). Strata such as the Etina Formation, Tarcowie Siltstone and the Elatina Formation do not persist regionally and hence the lithologies of the Umberatana Group, above the Tapley Hill Formation, have been grouped together for clarity. The Elatina Formation covers much of the South Flinders Zone and Nackara Arc. The Grampus Quartzite and an unnamed siltstone of the Yerelina Subgroup represent the upper most strata of the Umberatana Group (Preiss, 1987, 1990).

Structures of the tenement region

The Tenement lies within the Nackara Arc Zone defined by Rutland et al (1981). The Nackara Arc exposes broad, open, parallel synclines and tight anticlines. The axial traces of the folds trend close to NE (Mann et al, 1986). Individual fold axes are typically long (50 to 200 km), symmetrical and parallel (Mount, 1975). The folds are double plunging and the Burra Group is well exposed in anticlinal cores. Parts of the Paratoo and Nackara Anticlines are overturned to the northwest.

The folds within the area of the tenement are composed of lower Adelaidean Burra and Umberatana Groups. The folds are curved, elongate (SW-NE) dome and basin structures with parallel fold hinges. The plunges of antiforms and synforms are moderate to shallow and generally have the same plunge direction. However, within the central portion of the tenement the folds exhibit an en-echelon pattern with opposed plunges (Figure 2).

A regional NE striking axial plane cleavage is clearly observable in the Burra and Umberatana Groups (Bell, 1978). The axial plane cleavage is typically steep and tends to fan across the fold structures. Slaty cleavage is well developed across the Nackara Arc and is strongly developed in all fine-grained rocks (Bell, 1978; Preiss, 1987). The cleavage commonly dips to the east at low to moderate angles (Bell, 1978) but is also observed to dip to the west in many locations (Preiss, 1987). This author has found that documented cleavage measurements are inadequate to determine a regional bias for the cleavage dip. The textures of the rocks in this region tend to have a well-developed schistosity and/or a strongly penetrative cleavage striking north-south. Evidence of disharmonic folding is observed in adjacent competent and incompetent units (Binks, 1971).

A strong angular unconformity exists between the Burra Group and Umberatana Groups in several locations. This relationship is best developed in the Carrieton and Yednalue Anticlines.

4.2 Env 9760 Waukaringa EL2670, 1998

A report by consultant Dr D.T. Miller describes the geology and geophysics of the general region including EL3409. The following summary was derived from the report. The tenement boundary for EL3409 has been added to the figures for clarity of discussion.

Structural interpretation

Using the limited structural data and interpretation of the geophysical data sets it was possible to extend geological boundaries into regions covered with Quaternary sediments.

The structural pattern reflects complex folding developed during the Delamerian Orogeny. The traces of fold axes are parallel, tending ENE. The style of folding from west to east is transitional from parallel, similarly plunging folds to en-echelon, elongate, oppositely plunging folds. The dome and basin pattern suggests at least two episodes of deformation. Fold trends and patterns can be traced into the Olary Block basement inliers evidencing Palaeo-Proterozoic basement complex re-activation.

Opposing plunge directions directly across parallel fold trends (Figure 2) suggests a component of rotation in the ENE trending fold axial planes. The rotation or second generation (overprinting) folding is likely to have imparted a component of stress, the strain probably accommodated within the Farina Subgroup. This proposal is supported by faults mapped at a low angle to bedding within siltstone of the Farina Subgroup (Olary 1:250000 geology sheet) and also by the occurrence of numerous small-scale parasitic fold structures located directly east of the opposed fold plunges (Figure2). It is interesting to note that the Manna Hill and Waukaringa gold fields lie within the Farina Subgroup.

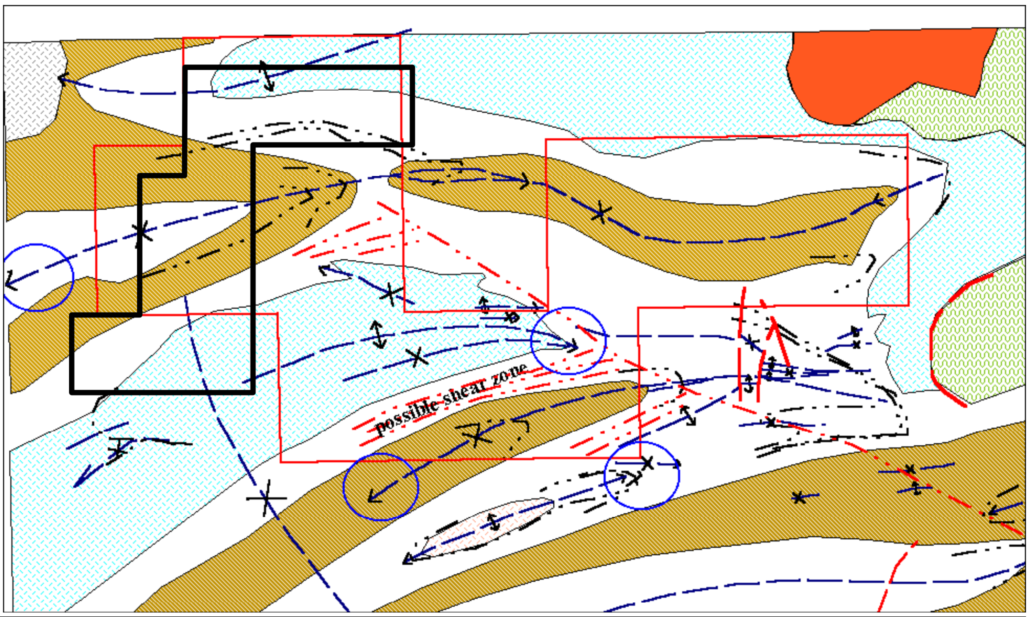


Figure 5 – Structural interpretation based on exposed geology. (Blue circles highlight plunge directions), black boundary EL3409.

Geophysical Interpretation

An initiative by Mines and Energy SA (SAEI & BHEI) has provided airborne magnetic and radiometric data over a large part of eastern South Australia. The exploration area under investigation here is contained within survey areas B7. Magnetic images derived from the data have been utilised to interpret the structure and geology within the Tenement. The integrated interpretation of geophysical and geological data has been used to select exploration targets within the Tenement boundary.

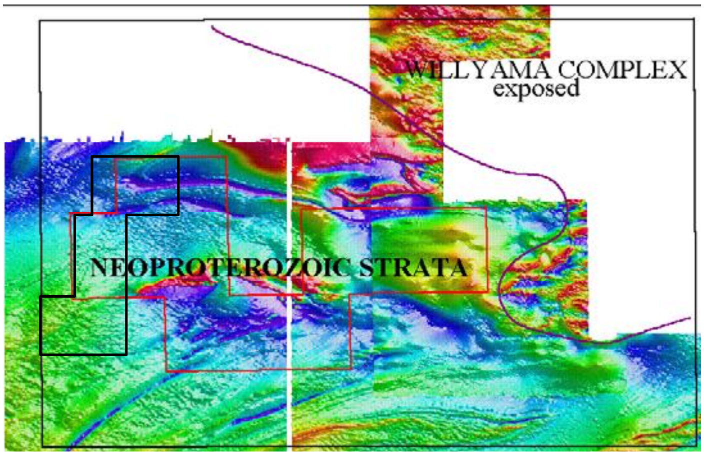


Figure 6 – General distribution of exposed Neo-Proterozoic and Palaeo-Proterozoic Geology (EL3409 – black boundary).

Magnetic provinces in the region of EL3409

Two broad but distinct magnetic provinces can be identified in the region of EL 3409 (Figure 3). The pattern of magnetic intensity located northeast and east of the tenement boundary reflects a response from exposed Willyama Basement Complex rocks. The remaining magnetic features generally reflect responses from Neo-Proterozoic sedimentary strata. The region between the two magnetic provinces, partially obscured by Quaternary sediments, has a magnetic response from possible shallow Willyama Complex.

Magnetic properties and characteristics of the Tenement geology

Neo-Proterozoic strata

Linear magnetic anomalies located in the Nackara Arc generally correlate with Adelaidean strata (Tipper and Finney, 1965; Tucker, 1972). Strong linear magnetic anomalies associated with Neo-Proterozoic strata are due to magnetic units such as the Holowilena Ironstone and the Pualco/Appila Tillites. These rocks have values from 150 to 58000 x10^{-6} cgs units (Tucker, 1972). In-situ magnetic susceptibility measurements by this author show that the Ulupa Siltstone and units in the lower Umberatana Group within the Nackara Arc are strongly magnetic.

The linear anomalies identified within the tenement area have been used to trace and locate geological structures in areas obscured by Quaternary sediments.♦

♦ **The correlation of linear aeromagnetic anomalies with Adelaidean stratigraphy or in areas of Cainozoic cover has been applied carefully. Shallow exploration drilling, conducted by the South Australian**

Linear anomalies

Linear anomalies within the area of the tenement can be categorised into 3 groups: NW trending, NE trending and those linear anomalies associated with Neo-Proterozoic strata.

Linear anomalies associated with Neo-Proterozoic strata: Numerous well-defined linear magnetic anomalies occur within the tenement area and have been used to identify the location of magnetic units from the Farina and Yerelina Subgroups, Holowilena Ironstone and the Pualco and Appila Tillite beneath Quaternary cover. The results of this interpretation are shown in Figure 4. Displacements of the linear anomalies indicate the presence of several fault structures.

NW trending linear anomalies: A number of discontinuous NW trending linear anomalies have been located in the western portion of the tenement. These narrow magnetic features possibly represent mafic dykes (some of the shorter linear anomalies have similar trends to local creeks and may reflect magnetic sediments). Their orientation is similar to kimberlite/lamprophyre dykes located south (Terowie region) and south west of the tenement.

A more distinct anomaly is located in the eastern side of the tenement (Plumbago survey area). This particular linear anomaly is continuous for some 20 to 30 km. This feature is tentatively correlated with Neo-Proterozoic strata in the middle to upper Umberatana Group. It is also possible that this magnetic anomaly is related to interpreted shallow basement (see following sections).

NE trending linear anomalies: A cluster of NW trending anomalies has been identified at the eastern side of the tenement. The linear magnetic features are most prominent along the south-eastern tenement boundary and are coincident with a broader NE trending magnetic feature. The linear anomalies extend to the SW and NE. No surface expressions of the magnetic features are indicated on the surface geology. There is also some indication that the lineaments fan out from the eastern nose of the "Waukaringa" syncline (Figure 6, 9 & 10). The anomalies may reflect a basement foliation or shear zone. It is interesting to note that the linear features are juxtaposed with two semi-circular magnetic anomalies in the vicinity of the Waukaringa gold field.

Circular anomalies

The largest structure is located in the eastern portion of the tenement (Figure 6, indicated in blue). The circular shape is most obvious in the merged TMI image (MESA, 1996 – Olary, part Curnamona and part Orroroo 1:250000) with a sun angle of 315 degrees. The merged image contains the Plumbago data set, which has a questionable history, and hence the anomaly may be in part artificial. However, the data is sufficiently reliable to indicate the presence of a semi-circular structure possibly representing a shallow basement inlier, the southern portion of which is most prominent.

Department of Mines and Energy, have identified horizons of high magnetic susceptibility (500 - 3000 x 10^{-6} cgs units) within the Cainozoic sediments (Janz, 1993). The sediments are magnetite enriched.

The presence of smaller isolated circular anomalies requires a different interpretation. These small (2 – 4km diameter), subtle anomalies are located in the southern and western parts of the tenement (Figure 4). Shallow exploration drilling of similar circular anomalies (Howard, 1985) south west of the tenement (Terowie) has revealed an assortment of mafic rocks such as gabbro and basalt. The similarity in magnetic signal and structural setting suggests that the structures within the tenement area may be related to mafic intrusives or basement inliers that contain magnetic sources such as those within disrupted Callanna Group (Diapiric Inliers, Cowley et al, 1997).

One of the circular magnetic features is located in the northwestern corner of the tenement. Another of these (SE of the tenement boundary) correlates with a radiometric anomaly (elevated Th) located close to several water bores (Southern Cross bores). This is an intriguing correlation that requires further investigation.

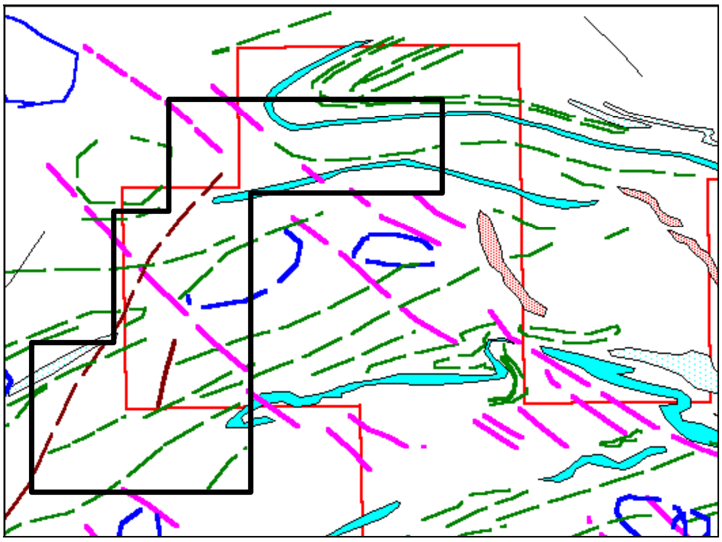


Figure 7 – Interpretation of airborne magnetic surveys, SAEI B7.

<u>Radiometric survey – basic interpretation</u>

The total count radiometric data (U,Th, K) were examined to identify anomalies, stratigraphic boundaries and to search for correlations with magnetic anomalies. Figures 5a and b show the radiometric data and interpretation.

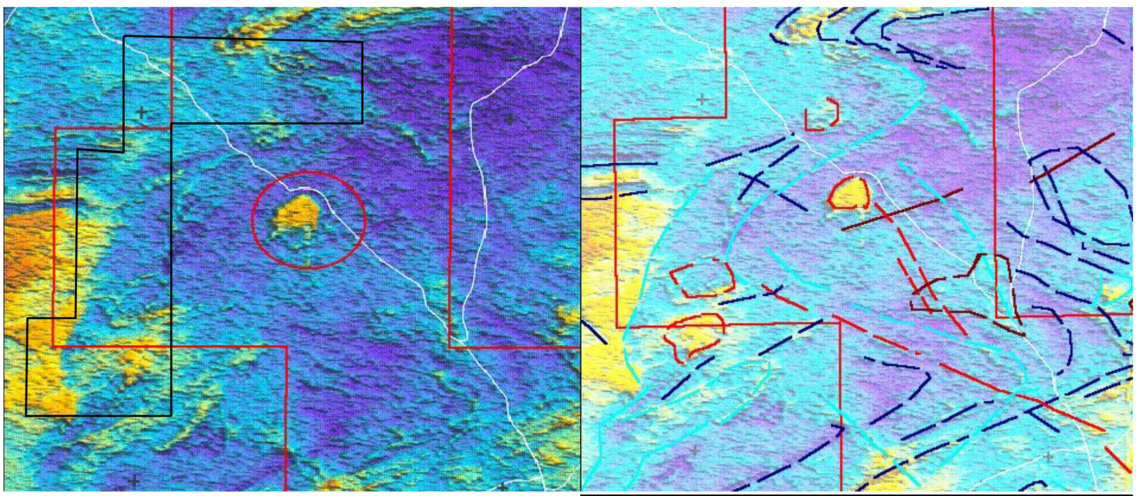


Figure 8 (a) and (b) – Radiometric total count, note anomalous feature highlighted in red circle.

The most striking radiometric anomaly, shown in Figure 5a red circle, is located southwest of the “Southern Cross Bores”. It is probable that the elevated count at this location is related to radioactive elements in fine lake sediments. It is possible that the bores source ground water from strata containing minerals elevated in K and Th (U level is not as elevated). The sediments at this location may reflect a shallow primary source or material washed in. An inspection of the site established the elevated count rate but did not locate the source.

The majority of linear radiometric features within the tenement correlate with the local drainage system and represent radioactive minerals derived primarily from Neo-Proterozoic strata.

Several linear features with a NW strike can't be correlated with Neo-Proterozoic strata or the local drainage pattern (Figure 8b). The most extensive linear anomaly originates in the vicinity of the Waukaringa Gold Field, this NW trend is similar to those of kimberlite dyke to the west of this area.

Gravity Interpretation

Gravity data within the area of the tenement consists of widely spaced gravity readings (> 2km) and hence the usefulness of the data is limited (Figure 9).

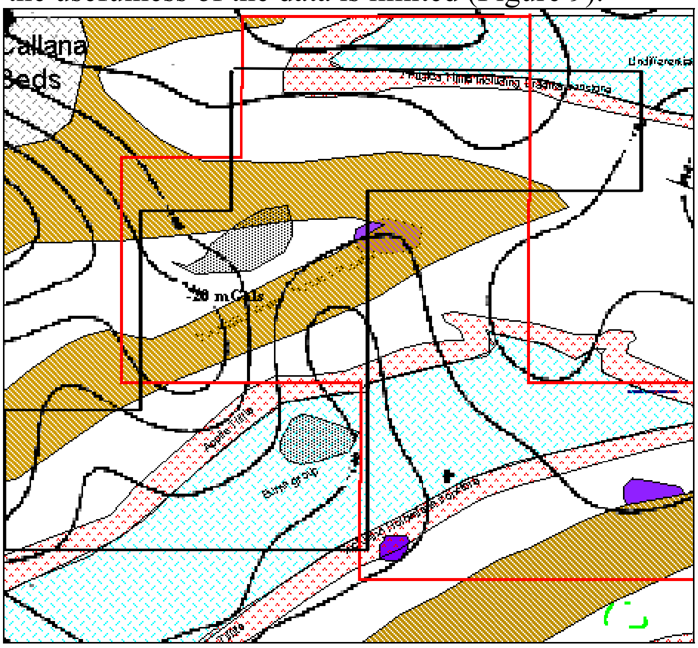


Figure 9 - Gravity contours overlaying interpreted geology (MESA data set, 1991).

Geological Interpretation

The application of geophysical interpretation and structural analysis has culminated in a model (Figures 10) for the surface and near surface geology for the tenement area. This model is by no means unique but is a starting point for further development. The model attempts to predict the structure and geology beneath an extensive area of Quaternary sediments within the tenement and to identify geological structures not realised during previous mapping exercises in this region. The model also incorporates the possible location of shallow Willyama basement complex and intrusive features.

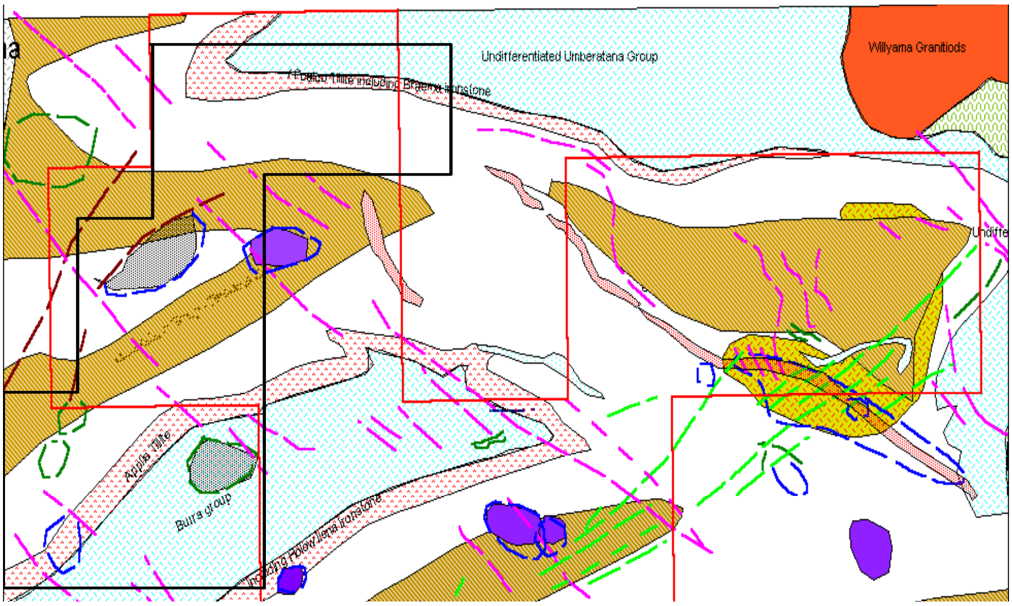


Figure 10 – Geological interpretation based on composite of exposed geology, airborne magnetics and structural interpretation including probable intrusives.

4.3 Env 9401 Lynas Gold, 1998

Lynas Gold completed a regional survey of various areas within the Nackara Arc. Consultants visited one site, Helene Shaft, within the bounds of the current exploration program. The consultants (*Shelton*, 1998) stated: "

Helene

Helene is a single shaft located at the contact between massive ironstone and bleached laminated siltstones in the Ulupa Siltstone of the Wilpena Group. The ironstone crops out over 100m, oriented about NE-SW. Of all the workings through the tenement areas, Helene is the only example associated with ironstone (Fig. 24). Ten kilometres S of Helene are three small (0.5m deep) fault bounded unnamed Cu workings, located within grey laminated siltstones 5m below the contact with pink, well-bedded dolomitic siltstones. Above the dolomites are quartz-veined quartzites overlain by tillite. The bounding faults trend 148° with about 20m of right lateral displacement, and characterised by breccia, quartz veining and milled rock.

".

4.4 Env 8970 Equinox resources, 1995

Equinox Resources, as part of a regional exploration program along the western edge of the Curnamona, Craton and Nackara Arc sampled the Erina and Helene Shaft area for gold anomalism. Equinox had identified the Erina prospect and Helene Shaft as prospective for economic gold. Their summary of the geology at this site is as follows:

The Erina Prospect in the Red Hill tenement comprises a well laminated quartz vein up to 0.5m thick, containing minor ferruginous and gossanous patches with occasional malachite staining. The stratabound vein dips 30^0 to the north, strikes at least 1.1km, and is hosted by dolomite and fine grained siltstone and silty sandstone (near Tapley Hill Formation and Tarcowie Sandstone contact?). Stretching lineations are mostly down dip. This vein has broad similarities with the Waukaringa and Ajax mineralised veins but is far less gossanous and less deformed. No drilling has been carried out at this prospect.

The Helene Shaft is located 2-3km to the west and along strike from the Erina Prospect. A prominent ironstone vein up to 3m wide, with varied orientation, outcrops at the surface.

The ferruginous quartz vein at the Erina Prospect is weakly anomalous in Au - maximum of 0.21ppm. The same anomalous sample assayed 12,000ppm Cu.

A maximum assay of only 1.2 ppb Au was recorded from a stream north of the Moneo Ridge Prospect. The strong heavy mineral concentrate stream anomalies at both the Moneo Ridge and Erina Prospects, previously defined by Battle Mountain Australia, were not repeated during the BLEG orientation sampling. BLEG sampling is likely to be a more reliable technique and give more meaningful results than heavy mineral concentrate sampling (which is very dependent on the quality of the trap site and the quality of the sampler).

Equinox also complete a BLEG stream sediment sampling program that included a reassessment of Battle Mountain 1987 work (positive Au results). They were unable to repeat the results.

Sample number	Easting	Northing	Tenement	Locality	Description lithology	Dip	Dip direction
239	320923	6435238	Redhill EL1962	Helene shaft	Highly goss – dump spoils	60	330
240	320923	6435238	Redhill EL1962	Helene shaft	Weakly goss outcrop Fe-stone vein	60	330
241	320923	6435238	Redhill EL1962	Helene shaft	Weakly Fe lam qutz vein – dump spoils	60	330
242	321031	6435678	Redhill EL1962	Erina Prospect	Goss Fe-stone vein 10-15cm stratabound	87	150
243	323704	6435268	Redhill EL1962	Erina Prospect	Lam Fe quartz vein 50cm stratabound, cut by small fault	30 35	355 345 lineation
244	323952	6435275	Redhill EL1962	Erina Prospect	Lam Fe quartz vein 50cm stratabound	35 85	355 325 cleavage
245	323947	6435272	Redhill EL1962	Erina Prospect	Highly Fe quartz vein 50cm stratabound	22	355 bedding

Table 2 results from Equinox.

Sample No	Au ppm	Ag ppm	As ppm	Bi ppm	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Mn ppm	Mo ppm	Ni ppm	P ppm	Pb ppm	V ppm	Zn ppm
239	0.01	-1	54	5	5	59	84	165	19.1	5300	6	91	6100	35	63	500
240	-0.01	2	92	15	3	61	57	48	29.5	700	8	190	8800	35	84	800
241	-0.01	-1	4	-5	-2	-2	300	25	0.74	110	-3	6	100	15	4	18
242	0.02	-1	46	15	-2	-2	29	24	30.0	300	6	33	900	50	120	100
243	0.13	-1	52	60	-2	7	180	1900	15.6	200	4	33	1100	400	27	300
244	0.10	2	38	125	-2	3	200	700	5.6	115	-3	18	500	110	23	91
245	0.21	6	83	190	-2	20	200	12000	11.2	500	4	51	500	500	26	400

Table 3 results from Equinox.

Sample No	Easting	Northing	Tenement	Prospect	Trap description	Au ppb	Cu ppm
301	320638	6432001	EL1962	Erina S	Sand-silt, poorly defined channel (20cm deep) within a larger wash area	0.8	3.8
302	320425	6432689	EL1962	Erina S	Clay & silt, poorly defined crk 20cm deep 100cm wide	0.9	3.1
303	323735	6435437	EL1962	Erina	Crse sand –boulders, likely trap, high energy crk 2-3m deep 5m wide	0.5	1.1
304	323640	6435437	EL1962	Erina	Crs sand-cobbles, high energy crk 2-3m deep 4m wide	0.6	1.4
305	323018	6434981	EL1962	Erina	Crs sand-cobbles, minor high energy crk 2m deep 2-3m wide	0.2	1.25
306	323018	6434981	EL1962	Erina	Crs sand-cobbles, poss trap site, minor crk 1m deep 1-2m wide	0.3	1.6
307	323013	6434726	EL1962	Erina	Crs sand-cobbles, likely trap site, sml crk 1m deep 0.5-1m wide	0.6	1.65
308	323013	6434726	EL1962	Erina	Silt-sand minor pebbles, poorly defn minor crk 0.5-1m deep 1 m wide	0.1	1.95
309	323364	6434215	EL1962	Erina	Sand-silt, minor crk 1-3m deep, 1m wide at head of drainage	-0.1	1.75
310	323364	6434215	EL1962	Erina	Sand-silt, minor crk 1-2m deep, 1m wide at head of drainage	0.1	1.45
311	323311	6434554	EL1962	Erina	Silt-sand minor cobble, minor crk 1m deep, 1 m wide at near head drainage	0.7	1.5
312	324013	6434866	EL1962	Erina	Crse sand to cobble, trap site, minor crk 1m deep 1-2m wide	0.2	2.3
313	324013	6434866	EL1962	Erina	Crse sand to cobble, possible trap site, minor high energy crk 1-3m deep, 3m wide	0.4	1.85

Table 4 results from Equinox.

4.5 Env 6926 Battle Mountain, 1987

NB Summary from Equinox literature review.

3.1 Tenements

The Erina Project comprises EL1418 which was explored in 1987.

3.2 Exploration Program

Exploration comprised:

-stream sediment sampling, assaying 82 heavy mineral concentrates;
-soil sampling; and
-rockchip sampling.

3.3 Discussion

Reconnaissance work located a 1km long quartz vein with abundant limonitic boxworks and malachite staining. The vein dips moderately north, cutting stratigraphy at about 10°, and is hosted in the base of the Tarcowie Siltstone. Rockchip sampling of the vein produced a maximum Au value of 0.32ppm Au. Several other veins with similar orientations were located within the tenement. The vein is apparently along strike from a marked working, "Helene Shaft", approximately 1km due west.

Stream sampling highlighted a zone 7km long parallel to the main vein, with visible gold in samples draining from the central vein.

BMA considered the low grade rockchip values the source of the large stream anomaly and no further work was done.

3.4 Conclusions

BMA located a slightly discordant, extensive mineralized quartz vein within EL 1418.

BMA's negative response was based principally on the results of surface rockchip values, from oxidized and gossanous samples. No fresh material has been sampled. The size of the vein indicates a large system is developed, with potential for large tonnages and possibly high grade pods, which have not been adequately tested. Further work is required.

4.6 ENV 2948 Mines Administration P/L, 1979

Mines Administration conducted resistivity surveys in the search for tertiary palaeo-channels and associated sedimentary uranium deposits. Several drill holes were placed in the vicinity of EL3409. The following relevant information was extracted from the report for further review.

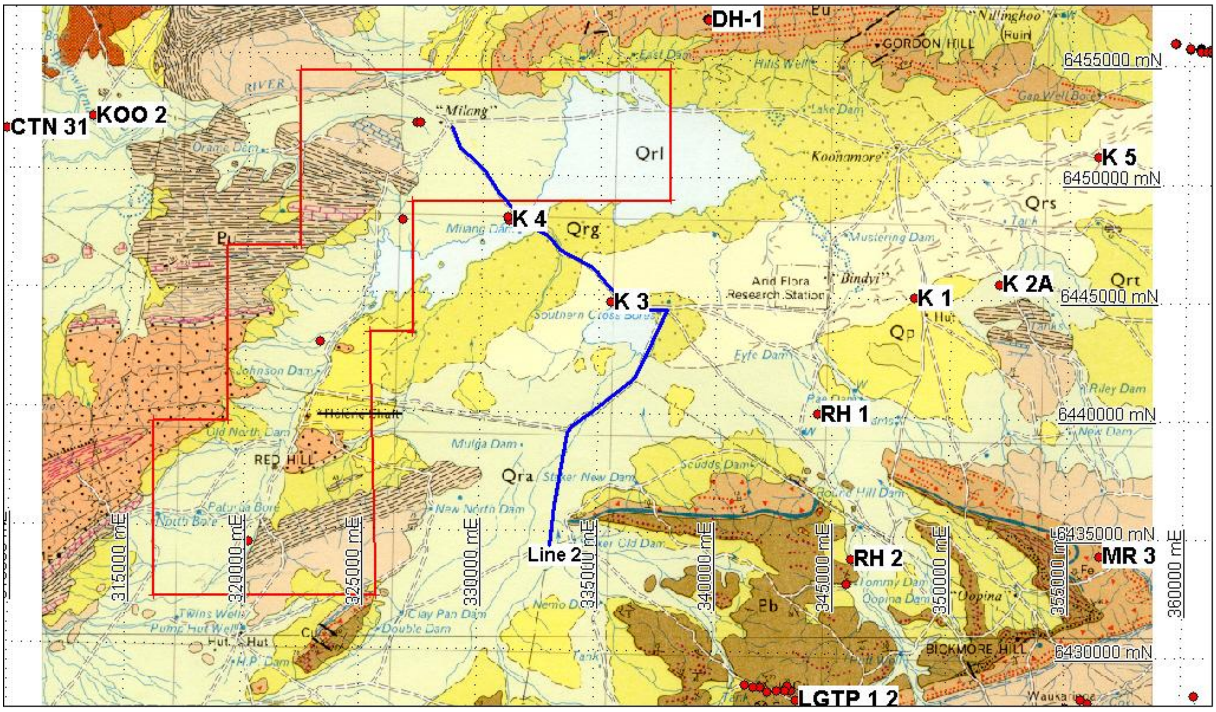


Figure 11 Location of drill holes and resistivity survey line 2.

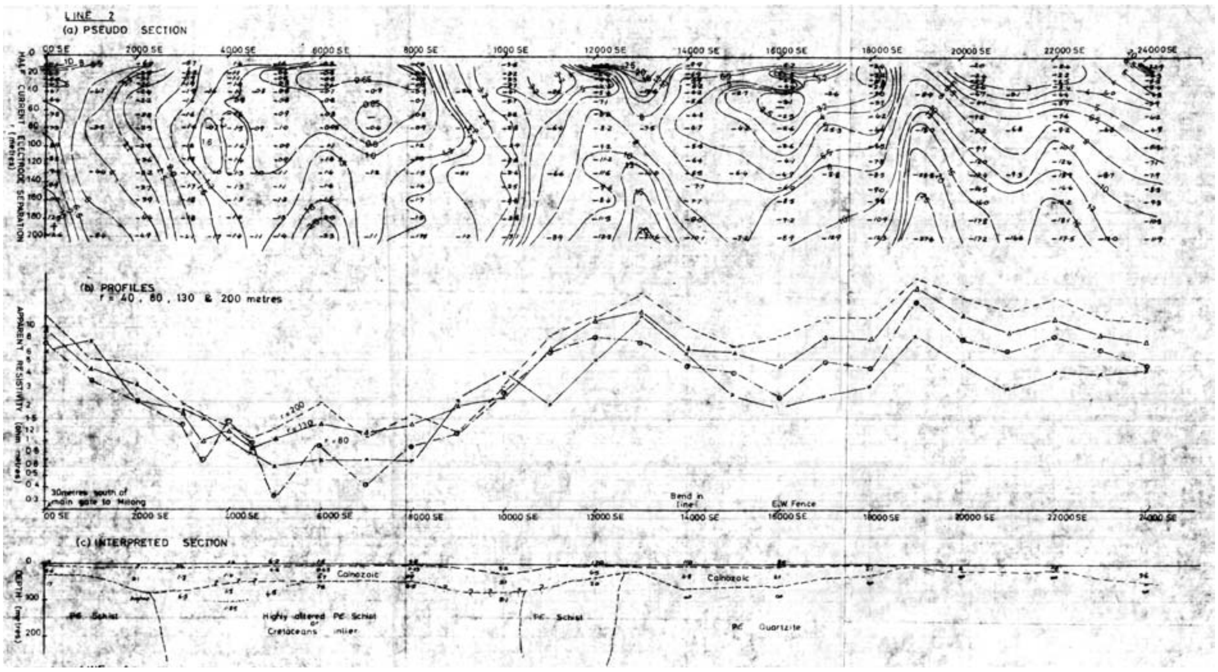


Figure 12 resistivity survey line 2 results.

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The survey outlined two main areas of interest within the EL. In the northeast corner, a sinuous, northerly trending "palaeochannel" has been located; approximately one mile wide and 130 metres to basement. In the southwest of the area up to 70 metres of Cainozoic section has been located, which also may be prospective.

I. SUMMARY

The Koonamore Plains form part of the south-western margin of the Frome Embayment. The presence of early Tertiary sands in the Willochra and Walloway Basins to the south and in the Frome Embayment to the north led to the suggestion the Koonamore Plains may also have been a site of early Tertiary sedimentation. (Binks 1971) These fluvial sands host significant uranium mineralisation in the southern part of the Frome Embayment.

The possibility of early Tertiary sands preserved in an intermontane basin setting adjacent to the Mt Victoria - Crocker's Well uranium province was sufficient for MTA and Carpentaria Exploration to acquire an Exploration Licence over the area.

Literature research and a reconnaissance resistivity survey indicated the possible presence of Tertiary palaeochannels in the northeastern sector and an isolated depocenter in the west of the tenement. An investigatory rotary drilling programme failed to encounter any significant uranium mineralisation within the Cainozoic sequence. The entire section was strongly oxidised and displayed a low level of radioactivity. The Cainozoic section was represented by a thin interval of Pliocene-Recent sediments derived mainly from the Adelaidean deformed sediments. No early Tertiary sediments were present.

Literature review and field reconnaissance has shown the north eastern portion of the tenement has been thoroughly examined previously in the search for large low grade uranium deposits.

Based on these results, relinquishment of the tenement is recommended.

III. GEOGRAPHY

The undulating Koonamore Plains are characterised by low shrubland (mainly saltbush) with limited areas of low open woodland. Climatic conditions are harsh with low annual rainfall (average 200 mms) and high annual evaporation (2400 - 2750 m ms). The low topographic relief and low rainfall result in poorly developed ephemeral stream networks which can be catagorised as (i) drainage into a large saltpan lake area near "Milang" for the western part of the tenement and (ii) drainage of the eastern part of the tenement by a shallow channel system which contributes to the Siccus River to the northwest. The region is suitable only for sheep grazing for which supplies of poor quality water are obtained from fractured basement rocks.

The Exploration Licence area is located approximately 80 kilometers north of Yunta on the upgraded gravel highway between "Frome Downs" and Yunta. Access within the tenement is excellent and no grading of station tracks prior to drilling operations was required. "Koonamore", "Mt Victor" and "Curnamona" are the main properties within the Licence area.

IV. REGIONAL GEOLOGY.

The Olary upland province separates the Mesozoic and Tertiary depositional features of the intracratonic Frome Embayment to the north and the Murray Basin to the south. The Koonamore Plain may represent a Tertiary depocenter in the upland region connecting with the Frome Embayment via channelways to the north and west. (Figure 2).

The Olary province consists of Precambrian rocks readily divisible into an older ?Archaean - Carpentarian basement complex and a younger Adelaidean sedimentary sequence. The basement complex, the Willyama Block, consists of lower amphibolite to granulite facies regional metamorphics with granitic intrusions. The main phases of deformation, metamorphism and plutonism were associated with the Carpentarian Olarian orogeny. The higher grade metamorphics and granitic bodies may in part represent older, possibly Archaean, continental basement. These rocks consist of granite gneiss, migmatite, migmatised schist, granite and pegmatite. As the metamorphic grade decreases away from the central high grade core, chiastolite and mica schist, quartzitic schist and quartzite are the dominant lithologies.

Primary uranium mineralisation, mainly davidite and brannerite is noteably associated with pegmatite veins and albitised high grade metamorphics. The most significant deposits are at Radium Hill and Crocker's Well where soda metasomatism of the host gneisses is a prominent feature. Thorium-rich minerals are generally associated with the potassic-rich igneous intrusives. The Willyama Block is undoubtedly a highly uraniferous province and is the most probable source for the uranium mineralisation present in the basal Tertiary sediments of the southern Frome Embayment. The Crocker's Well and Mt. Victoria deposits are located immediately east of the Koonamore area.

The younger Adelaidean sequence of marine and glacigene sediments was deposited in a broad geosyncline (Adelaide Geosyncline) east of the continental Gawler Block. Although significant contemporaneous tectonism, diapirism and faulting is reflected in the sedimentary section, the main tectonic activity was associated with the early Palaeozoic Delamerian orogeny resulting in elongate parallel fold structures with a general north to north east trend.

Within the Koonamore region, the Adelaidean sediments consisting of a thick sequence of boulder tillite, lithic and feldspathic sandstone, and siltstone with minor dolomitic and ironstone horizons, have been assigned to the Umberatana Group (Thomson et al 1964, Binks 1971). Adjacent to the Willyama Block, these sediments have been subjected to low grade metamorphism which is reflected by the presence of fine mica flakes and variable cleavage development. The contact between these relatively unmetamorphosed sediments and the older basement complex is largely fault controlled (e.g. MacDonald Fault and its possible extension north of Ethiudna Hill). Elsewhere the sequences are separated by a high angular unconformity.

The Adelaidean sequence constitutes basement over the bulk of the Koonamore tenement with only limited exposures of the granitic suite of the Willyama Block along the northeastern tenement boundary.

All drill holes in the present exploration terminated in variably metamorphosed Adelaidean units.

Palaeozoic sediments are not present within the Koonamore area but have been preserved in synclinal centres within the Adelaide Geosyncline section and in the Arrowie Basin to the north. Similarly, Mesozoic sediments are present in the Frome Embayment and isolated structurally-favourable sites within the Olary province (e.g. Triassic sediments in the Springfield and Boolcunda Basins). Uplift of the Willyama Block and the Adelaide Geosyncline by Tertiary block faulting has removed virtually all pre-Tertiary (Phanerozoic) sedimentation from the Olary province.

Scattered remnants of Tertiary sediments are present within the Olary province. Lacustrine sediments containing lignitic sands found in the Willochra and Walloway Basins have been dated as middle-upper Eocene time equivalent to the highly prospective Eyre Formation of the Frome Embayment. It was considered these sediments may also be present in the Koonamore area. Elsewhere, patchy outcrops of silcreted and ferricreted sands and gravels of probable Pliocene age are thought to be the remnants of previously extensive Tertiary sedimentation.

Quaternary deposits extend over the Koonamore area between the Precambrian rock outcrops. These deposits consisting mainly of mottled clays overlain by silts, sands and gravels which are occasionally calcreted probably represent reworked Tertiary sediments. Recent flood plain, slope and gypsiferous lake deposits veneer various parts of the Konnamore area.

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The survey indicated the area immediately south of "Killawarra" was the most prospective with the possible identification of a meandering channel over which the depth to basement was approximately 130 metres. This area was examined previously by C.R.A. Drilling revealed depths to basement in the order of 50 metres. It was considered possible CRA's identification of in-situ weathered basement was erroneous and in fact, a thicker Tertiary section may be present at this locality. A second area of interest was outlined in the Koonamore lakes area southeast of "Milang". Cainozoic section upto 70 metres thick was thought to be present. No connection between these depositional lows was postulated as shallow basement was indicated throughout the intervening area. (Enclosure 1).

The western region centres on the Koonamore lakes. A thin veneer (<2 metres) of reddish brown aeolian silts and fine sands in conjunction with flood plain deposits of fine to medium grained, poorly sorted sands and clays, cover most of the area. In drill hole K-3 below the Recent sediments, a calcreted sandy gravel was encountered overlying weathered siltstone - sandstone basement rocks. This gravel unit has been correlated with the Pleistocene Telford Gravel. The gravel consisted mainly of well rounded to oval, variably magnetic ironstone pebbles (up to 2 cm. diameter) with subrounded to well rounded quartzite and shale fragments. Drill hole K-4A further to the west encountered a much thicker section (approximately 70 metres) beneath the Recent aeolian and flood plain deposits. However, at this locality no calcreted horizon was present and an alternating sequence of gravels and redbrown silty clays was intersected. The composition of the gravels was again dominated by grit to pebble sized, well rounded to oval ironstone. In general, the section was more gravelly below 48 metres and this basal interval may be equivalent to the Telford Gravel unit in drill hole K-3.

Red ochrous clay was noteable near the base. The section in this western area appears to reflect periodic erosion of an older Tertiary laterite surface and redeposition in a channelling-flood plain environment.

The central tenement area between "Koonamore" and "Mt. Victor" stations is characterised by a thin section of either yellowish and reddish brown aeolian sands and silts or poorly sorted fluvial sands and clays with calcrete overlying weathered basement rocks. Travertine or calcrete deposits are currently forming in the drainage system. Siltstone, shale and minor fine grained sandstone constitute basement for the central and western parts of the tenement. Low grade metamorphism of these rocks in reflected by the presence of very fine mica flakes and the variable development of slaty cleavage. Crosscutting quartz veins are common. Based on lithological and stratigraphic considerations, these argillaceous sediments are assigned to the lower section of the Upper Umberatana Group, probably the Tapley Hill Formation. Drill holes K1, 2A, 5, 6 and 7 were sited within the central area.

The northeastern tenement area was considered the most prospective prior to drilling. High grade metamorphics and anatectic granites form the eastern margin of the area. A previous CRA drill hole TY13 encountered a thick sand gravel section between 27 - 44 metres subsurface which was apparently derived from a granitic - high grade metamorphic provenance. The 1977 resistivity survey outlined possible Cainozoic channelling south of "Killawarra" homestead. Nine drill holes K8 - 16 were completed to examine the distribution of the postulated channelling and any associated anomalous radioactivity.

Throughout the area a veneer of reddish brown aeolian sands and silts mantle Recent low angle slope deposits and the channel-flood plain deposits. The maximum thickness of these recent sediments (29.8 metres) was encountered in drill hole K13. With the exception of drill holes K9 and K15, a thin section of pebbly sand was present beneath the surface sands and silts. The lithology of the gravel indicated derivation mainly from the Adelaidean outcrops but with some contribution of sediment from the Willyama Block. In drill holes K11, 13 and 14, a light brown clayey silt interval separates the upper gravel from a basal gravel noteably composed of oval ironstone grit and pebbles together with fragments of Adelaidean sediments. A silcrete horizon is commonly present at the top of this basal gravel unit which may thus correlate with the Pleistocene Telford Gravel.

Variegated clays, silty clays and minor very fine grained sands underlie the Quaternary section. Sediment colour depends on the degree of ferruginisation and leaching and varies mainly from yellowish brown to purplish red and light bluish grey. Fine mica flakes are rarely present. These sediments are undoubtedly deeply weathered Adelaidean rock types. Whether the section represents insitu or slightly transported material is difficult to discern. Similar geophysical log character of the bluish grey - off white clay immediately underlying the Quarternary section is explainable as either a phase of sedimentation or a particular weathering horizon. The later explaination is regarded as the most probable and hence this section of clays, silts and minor sand interbeds has been included as weathered basement.

Adelaidean sandstone and siltstone (Wilyerpa Quartzite) exhibiting strong limonitic staining constituted basement throughout the area. The sandstone was generally very fine to fine grained, subrounded, quartzose with minor light brown clay maxtrix. The siltstone was typically grey green, slightly micaceous and showed slight cleavage development. A pea gravel of white well rounded quartz fragments was present within a generally more arenaceous section in drill hole K16. The metamorphic grade within the Adelaidean section appears to increase slightly towards the Willyama Block with the nearest drill hole K14 encountering talcose metapelitic basement.

(c) Alteration and Radioactivity.

A strongly oxidised profile extends throughout the Quaternary section and deep into the underlying Adelaidean sedimentary section. This profile is reflected by strong limonitic and, to a lesser degree, haematitic staining. Strong weathering with periods of laterisation are evidenced in the Recent sediments by the pervasive red brown clays and silts and by significant amounts of well rounded to oval ironstone laterite grit and pebbles within the channel gravels and associated flood plain deposits. This environment is not considered favourable for the accumulation or preservation of sedimentary type uranium deposits.

No significant radiometric anomalies were intersected. The Quaternary section exhibited only background values in the range of 15 - 30 c.p.s. The penetrated basement section revealed slightly higher background values generally (25-35 cps) but once again no anomalous values were recorded.

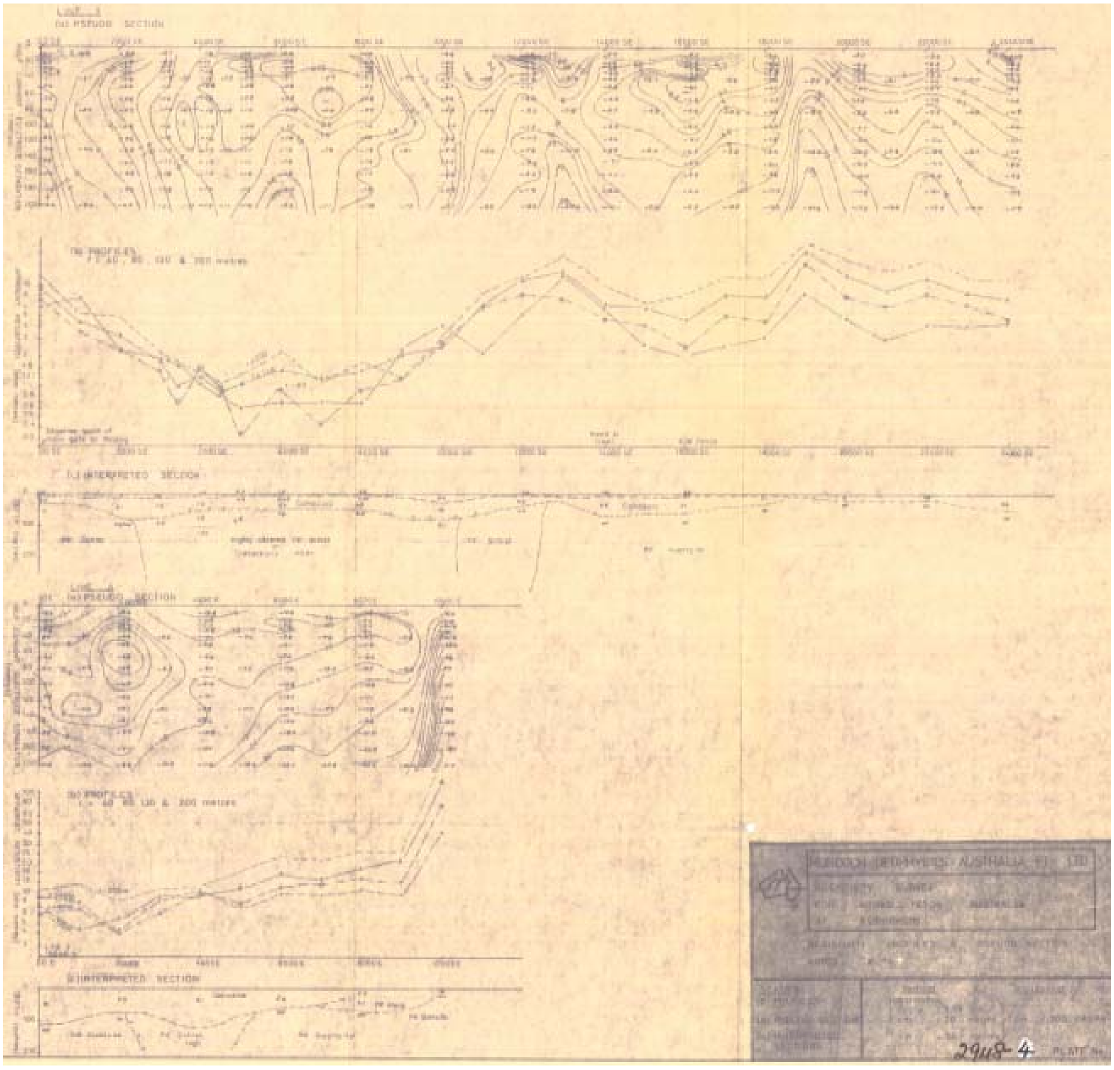


Figure 13

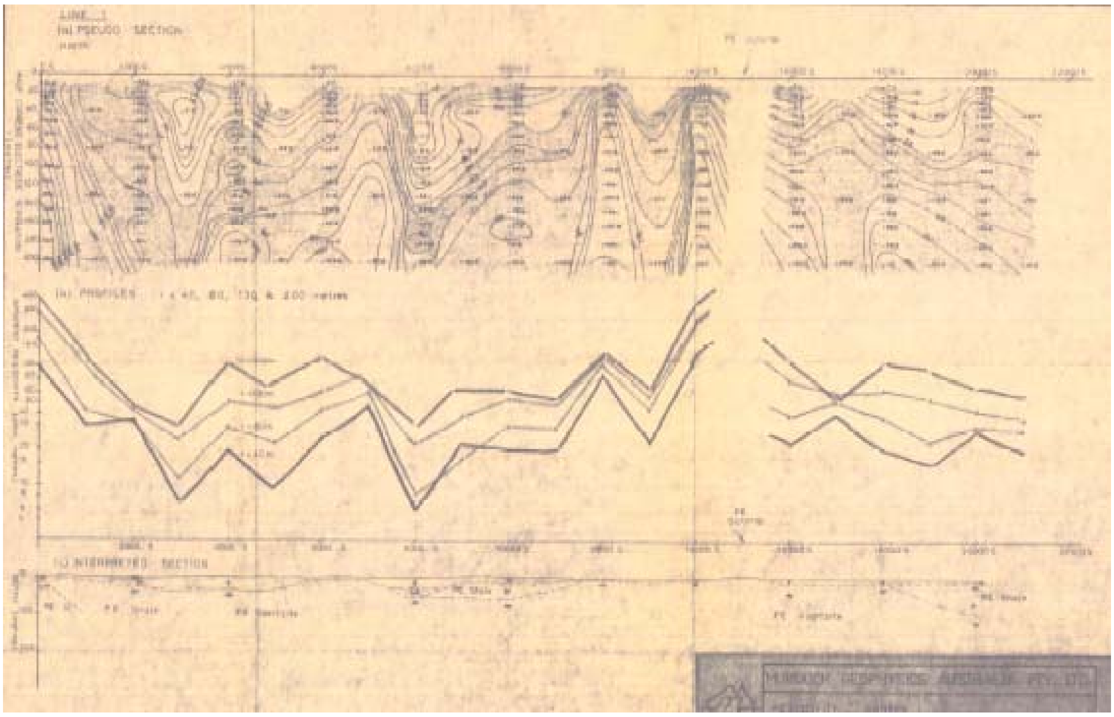


Figure 14

	N. (METRES)	E. (METRES)	HEIGHT (METRES)
Koonamore Hill.	947,928.3	216,261.8	318.12
K1	939,274.8	213,973.1	224.15
K2A	939,587.2	217,594.2	221.72
K3	939,121.4	201,185.4	189.96
K4	942,887.1	196,783.6	198.40
K4A	942,909.0	196,784.9	198.37
K5	944,885.0	221,960.8	220.20

Table 5

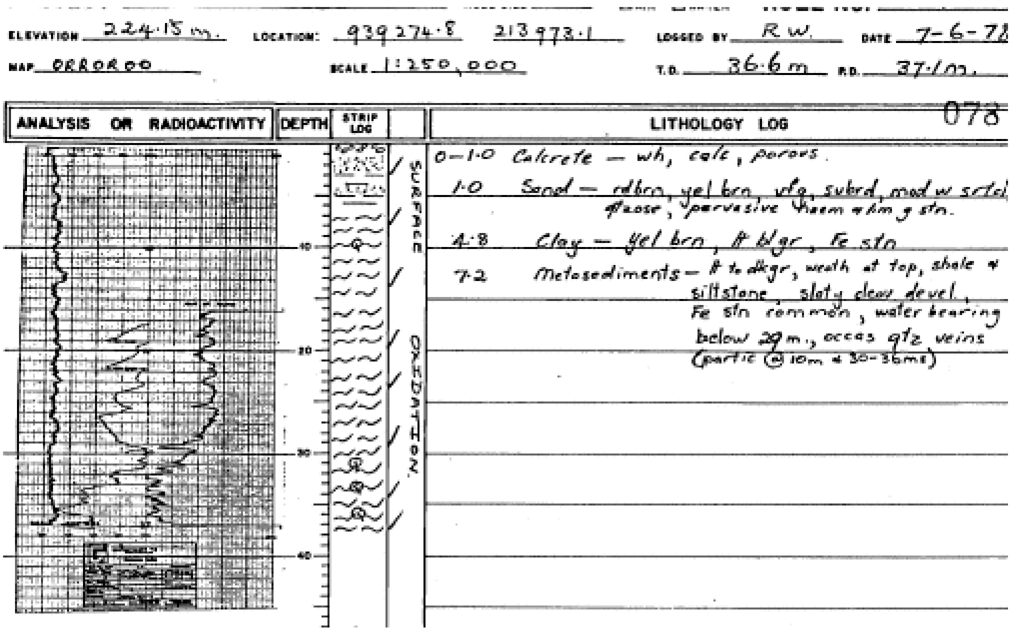
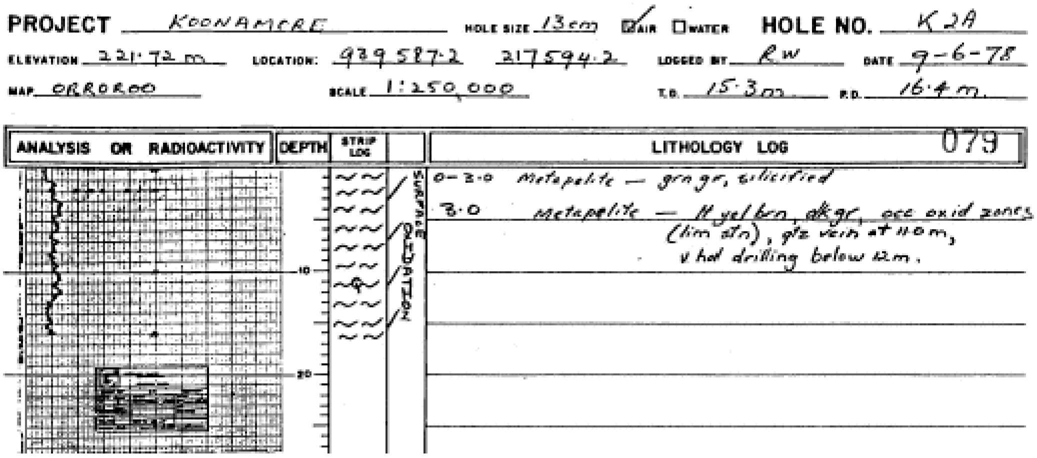


Table 6



PROJECT KOONAMORE HOLE SIZE 13cm ☑ AIR ☐ WATER HOLE NO. K2A
ELEVATION 221·72 m LOCATION: 939 587·2 217594·2 LOGGED BY RW DATE 9-6-78
MAP ORROROO SCALE 1:250,000 T.D. 15·3m P.D. 16·4 m.

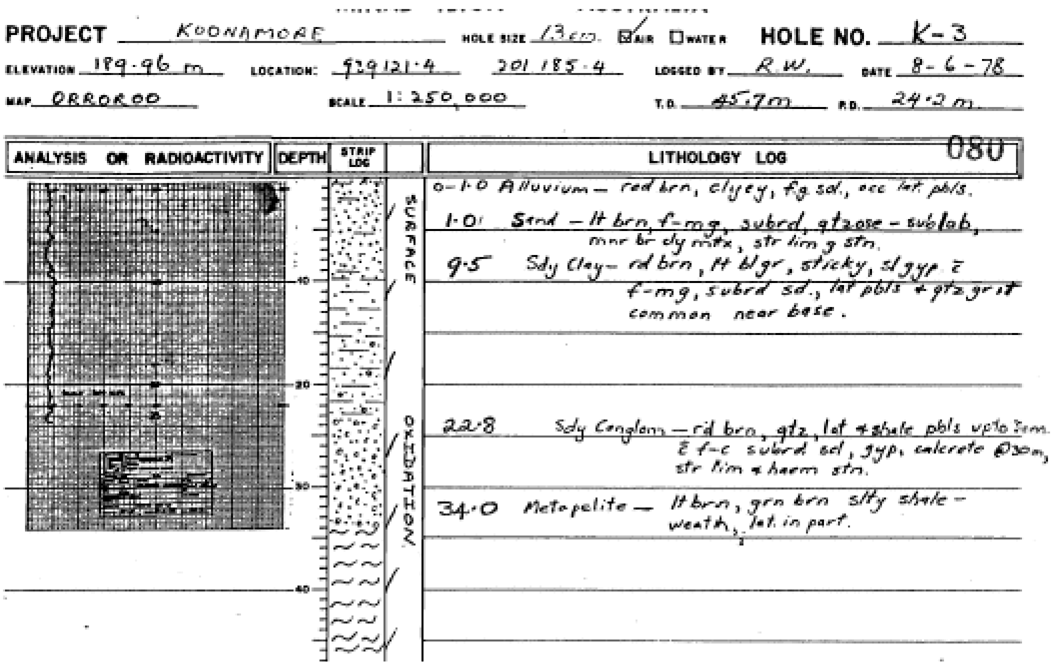
ANALYSIS OR RADIOACTIVITY | DEPTH | STRIP LOG | | LITHOLOGY LOG 079

SURFACE OXIDATION

0-3·0 Metapelite — grn gr, silicified

3·0 Metapelite — lt yel brn, dk gr, occ oxid zones (lim stn), qtz vein at 11·0 m, v hd drilling below 12m.

Table 7



PROJECT KOONAMORE HOLE SIZE 13cm ☑ AIR ☐ WATER HOLE NO. K-3
ELEVATION 189·96 m LOCATION: 929121·4 201 185·4 LOGGED BY R.W. DATE 8-6-78
MAP ORROROO SCALE 1:250,000 T.D. 45·7m P.D. 24·2 m.

ANALYSIS OR RADIOACTIVITY | DEPTH | STRIP LOG | | LITHOLOGY LOG 080

SURFACE OXIDATION

0-1·0 Alluvium — red brn, clyey, fg sd., occ lat pbls.

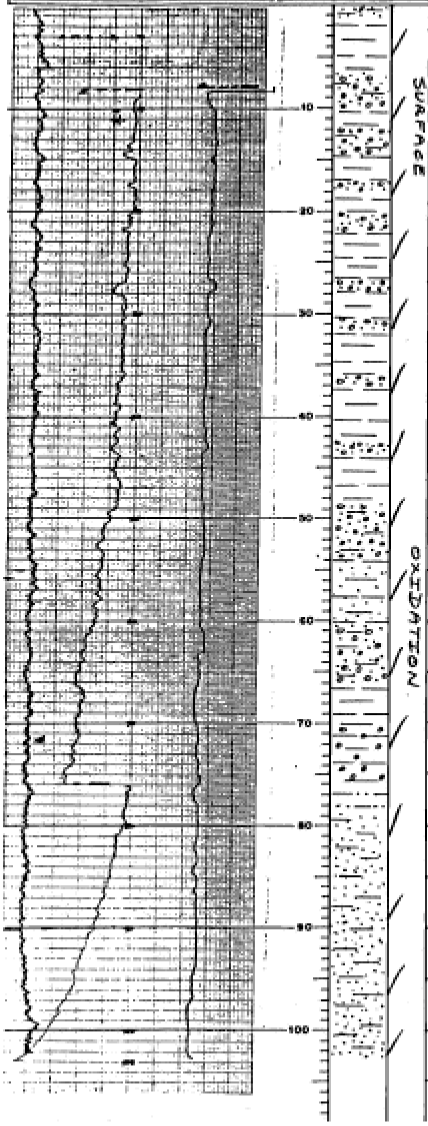
1·0 Sand — lt brn, f-mg, subrd, qtzose - sublab, mnr br cly mtx, str lim g stn.

9·5 Sdy Clay — rd brn, lt blgr, sticky, sl gyp c f-mg, subrd sd., lat pbls + qtz grit common near base.

22·8 Sdy Conglom — rd brn, qtz, lat + shale pbls up to 3cm. c f-c subrd sd, gyp, calcrete @30m, str lim + haem stn.

34·0 Metapelite — lt brn, grn brn slty shale - weath, lat. in part.

Table 8



ELEVATION 198·37 m LOCATION: 942909·0 196784·9 LOGGED BY RW DATE 8-6-78.
MAP ORROROO SCALE 1:250,000 T.D. 100·6 m R.D. 102·7 m

ANALYSIS OR RADIOACTIVITY	DEPTH	STRIP LOG		LITHOLOGY LOG
			SURFACE	0-1·5 Alluvium – rd brn, slty, sdy. 082
				1·5 Clay – rd brn, lt bl gr, sticky
				6·1 Pbly Clay – rd brn a/a w/ lat, qtzite, metased pbls upto 3 cm diam, mnr c g sd, grad to sl pbly cly at 14, 17·5, 21·7 + 25 m, part gritty w/ well rd Fest lat. pbls over 26·8 – 27·6 m.
				27·6 Clay – rd brn, oxid, occ gravel bds consisting of mainly rd lat (Fest), grit, mnr qtz + metaseds. at 31 and 43 m.
			OXIDATION	48·0 Gravel – rd brn, grit – pbls, mainly rd lat pbls w/ mnr qtz + metased pbls.
				54·0 Sdy Clay – rd brn a/a w/ vf-fg, subrd, subblebile, p.srtd sd, mnr lat grit.
				60·0 Gravel – rd brn, grit – cbls, mnly Fest lat. pbls + grit, mnr qtz + metased pbls.
				66·5 Clay – rd brn, bl gr a/a, mnr pbly bds a/a
				70·0 Pbly Clay – red, ochreous, cg + gritty lat, qtz + metased gs + pbls, str haem stn.
				76·0 Sandy Clay – gr wh, lt yel, ochreous, vf-fg subrd, (BASEMENT) qtzose, abund cly mtx, lim stn common, becoming clayey sand w/ depth + harder – weathered cly sst.

Table 9

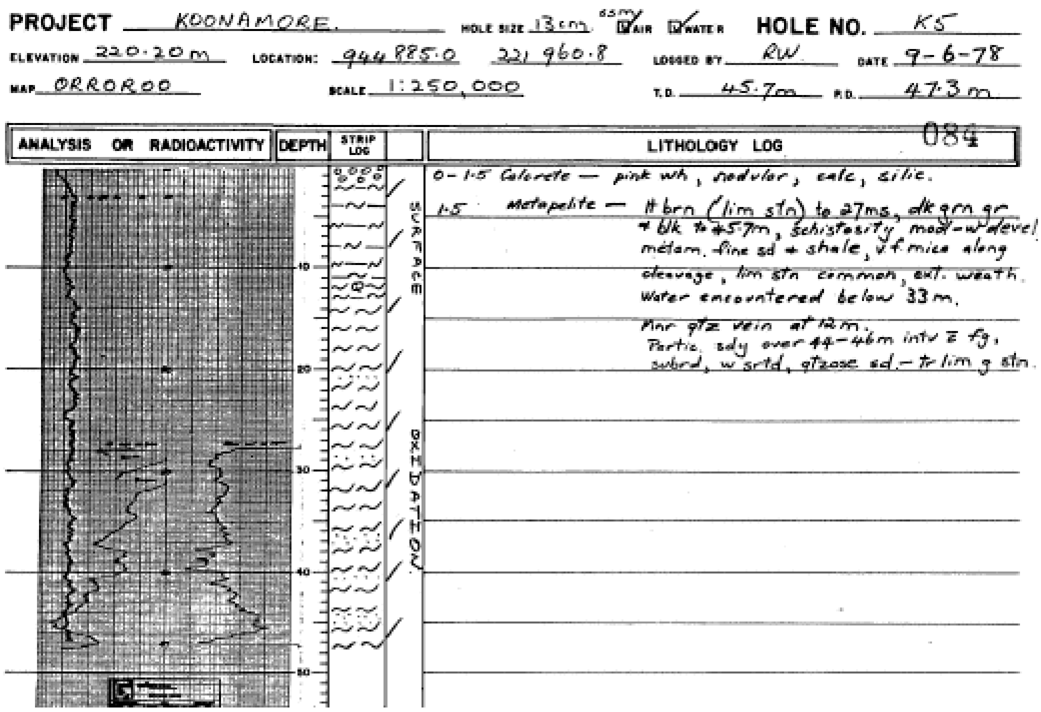


Table 10

4.7 ENV 5211 Amax Australia (Gold) P/L, 1984

A review of this report indicated a search for Telfer type stratabound gold was under taken in a broad area north and north west of manna Hill. The northwestern part of the search included EL3409. The result from geochemical sampling showed negative results within the area of EL3409.

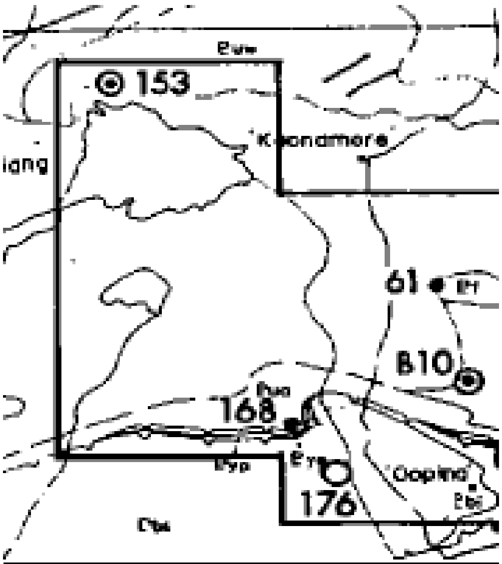


Figure 15 Sample locations.

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Appendix – Geophysical modelling – deep targets in the exploration region

Target modelling Milang area report 1 - Willyama inlier - basement target north of Teetulpa Gold field

Introduction

A significant magnetic anomaly within Exploration Target Area 1 (see previous report) has been identified as a possible shallow region of Willyama basement. The southern edge of this structure forms an east-west ridge with a prominent NE trending foliation or fracture system (magnetic lineaments). This interpreted basement ridge is possibly a fractured or foliated granite. The “granite” may have been implaced as part of a basement reactivation during the Cambro-Ordovician Delamerian Orogeny. The orogenesis is likely to have promoted mobilisation of minerals from the basement with consequent deposition in Adelaidean strata and Delamerian structures. Areas with predicted shallow basement are very prospective for economic minerals.

The magnetic anomaly is located beneath a region of exposed Neo-Proterozoic strata (Tapley Hill Formation) in the vicinity of Four Brothers Station (Figure 3). The magnetic anomaly, interpreted to be associated with crystalline basement has been modelled in an attempt to determine the depth to the basement and consequently the thickness of Neo-Proterozoic cover.

To facilitate the investigation, Line “200” was extracted from the Plumbago 80SA01 aeromagnetic data set. The location of the selected line is shown in Figure1.

Magnetic Modelling

a) Geology:

The area investigated in this report lies in the NE arm of the Delamerian Fold Thrust Belt referred to as the Nackara Arc. Exposed Meso- and Palaeo-Proterozoic basement lies approximately 20 km to the east. The exposed geology in the vicinity of the magnetic anomaly is composed of calcareous and non-calcareous siltstones of the Umberatana Group, mainly the Tapley Hill Formation. The Tapley Hill Formation in this region hosts gold in the Teetalpa gold field.

b) Magnetic sources:

The Neo-Proterozoic sequences located in the region under investigation contain several magnetic units. The most notable is the Braemar Ironstone (Burra Group). The ironstone is commonly associated with narrow linear aeromagnetic anomalies. An average value of 6000 $x10^{-6}$ cgs units is commonly associated with the Holowilena Ironstone and the Pualco (Appila) Tillite. The Tapley Hill Formation however has typical values of approximately 25 $x10^{-6}$ cgs units. Magnetic sources associated with basement rocks found in the Olary province are variable but can attain high values similar to that of the Neo-Proterozoic ironstones.

c) **Modelling Statistics:**

part Line 200 Plumbago 80SA01 data set
Line length - 29965m
Line orientation – 179^0
Sample spacing - 47m
Total data points - 643
Magnetic variation – 666 nT
Background Susceptibility – 0.00 (CGS units)
Earths Magnetic Field Intensity – 59000 nT
Earths Magnetic Field Inclination - -64.85
Earths Magnetic Field Declination – 9^0

d) **Anomaly Characteristics:**

The main anomaly is a large amplitude (approx 600nT) asymmetric feature with a half width of several 1000 metres. The southern limb of the anomaly has a steep southerly dipping gradient (Figure 2).

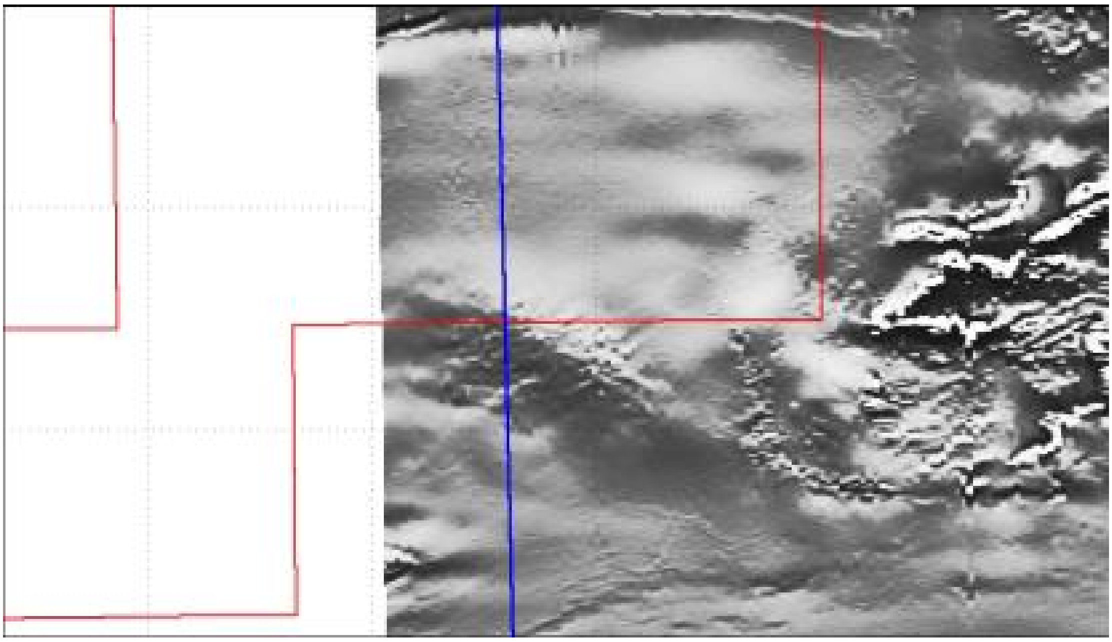

Figure 1 – location of anomaly and modelling line. (Magnetic anomaly is quite distinct in the first vertical derivative image)

e) **Modelling:**

The main anomaly was modeled using a polygon, the upper surface reflecting a geometry based on a geological structural model. The shape, orientation and magnetic susceptibility of the polygon were varied to obtain a reasonable fit. The final model is shown in Figure 2. A summary of the body parameters used in the model is given below.

Body name	Relative Magnetic susceptibility (CGS units) Background (0.00)	Strike length/ radius (metres)	Plunge/ azimuth	Possible correlation/rock type
Polygon	0.002	Approx. 20 000m	$0^0/100^0$	Granite, gneissic-granite; BIF in crystalline basement
Polygon1	0.0005	20000m	$0^0/100^0$	Tapey Hill Formation; sandstones and siltstones of middle Umberatana group

Figure 3 – Selected exploration drillhole site

f) **<u>Conclusion</u>** – depth to centre of the magnetic body lies at approx. 500 to 600 metres.

The results from modelling suggest that the main anomaly reflects the presence of a moderately magnetic body at a depth greater than 500 metres (+/- 100) metres. The body is possibly Willyama Complex geology, perhaps Palaeo or Meso-Proterozoic granite.

A possible drillhole target has been selected and marked on Figure 3.

Yours Faithfully

David Miller, 14/12/1998

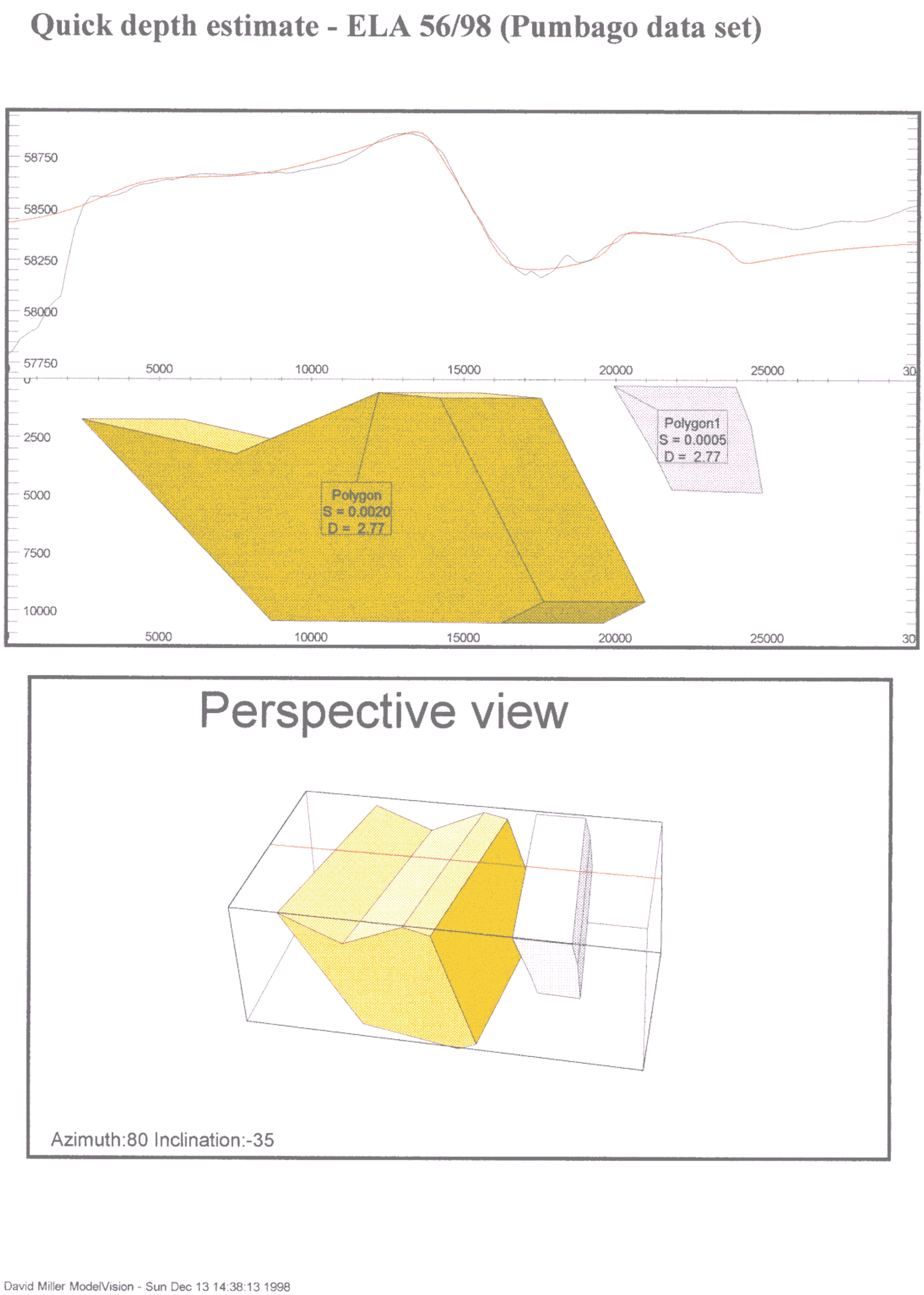

Figure 2 – Geophysical model. ***Note that the modelling has concentrated on the broader magnetic features and hence does not address the shorter wave length features or the magnetic response to the edges of the survey line.***

Target modelling report 2 - Milang region
Teetulpa geophysical anomaly

1 Introduction

A small group of magnetic anomalies have been identified within an area of exposed Neoproterozoic strata 30 km NNE of Yunta. The magnetic anomaly at 32^0 17.99' 139^0 38.53' (372163 Easting 6425519 Northing) has been modelled in an attempt to determine the depth and geometry of the magnetic bodies.

To facilitate the investigation of the anomaly, Line 20420 was extracted from the SAEI Area B2 data set. This line lies approximately 100 metres west of the area of interest.

The anomaly is situated in the NW corner of the Olary 1:250 000 Geology Sheet (Figure1).

A drillhole in the vicinity of the anomaly intersected carbonaceous limestone (approx. 100m) containing limited sulphides (Figure 1).

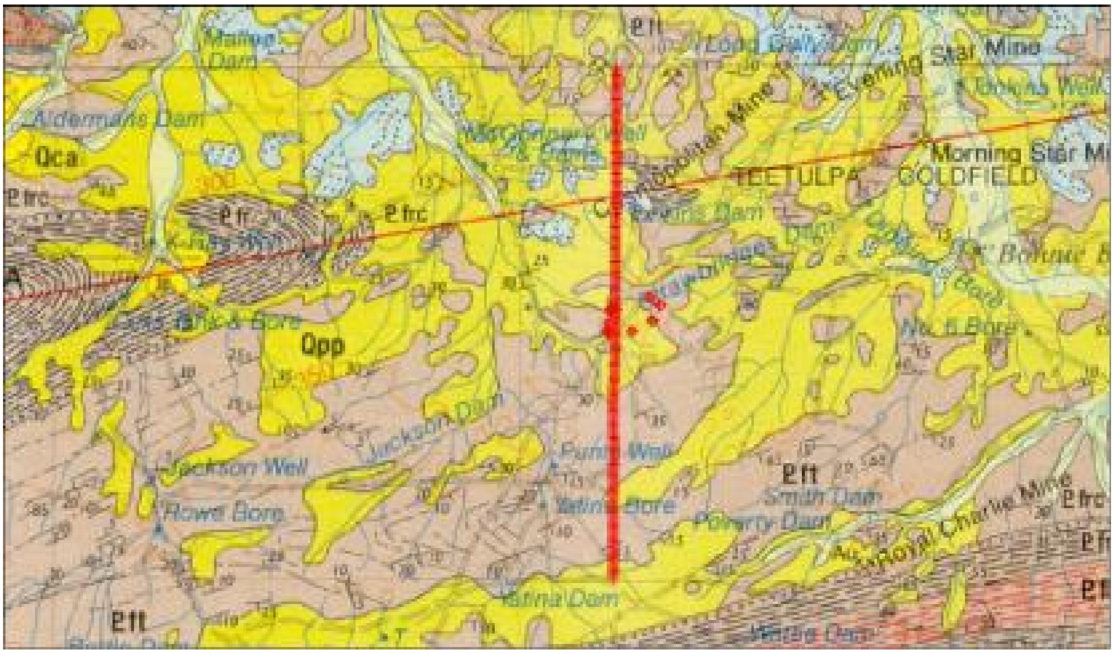

Figure 1 Location of the magnetic line for modelling and the location of preliminary exploration drill holes.

2 Magnetic Modelling

a) **Geology:** The area investigated in this report lies in the NE arm of the Delamerian Fold Thrust Belt referred to as the Nackara Arc. Exposed Meso- and Palaeo-proterozoic basement lies 20 km to the east. The exposed geology in the vicinity of the magnetic anomaly is composed of calcareous and non-calcareous siltstones (Umberatana Group Tapley Hill Formation) forming part of an anticline plunging shallowly to the west. The Tapley Hill Formation in this region has seen vigorous episodes of gold (Manna Hill Gold Field) and diamond exploration.

b) **<u>Magnetic sources:</u>** The Neoproterozoic sequences located in the region under investigation contain several magnetic units. The most notable is the Braemar Ironstone (Burra Group). The ironstone is commonly associated with aeromagnetic anomalies. Other magnetic anomalies to the SSW are associated with fragments of older Palaeoproterozoic gabbros, dolerites and basalts contained in diatremes intruded into the Neoproterozoic strata. These magnetic anomalies are typically small discrete groups similar to the one under investigation in this report.

c) **<u>Modelling Statistics:</u>** part Line 20420 SAEI B2 data set
Line length - 11018m
Line orientation – 179.9^0
Sample spacing - 34m
Total data points - 323
Magnetic variation – 225 nT
Background Susceptibility – 0.00 (CGS units)
Earths Magnetic Field Intensity – 59000 nT
Earths Magnetic Field Inclination - -64.85
Earths Magnetic Field Declination – 9^0

d) **<u>Anomaly Characteristics:</u>** The main anomaly is a small amplitude (approx 100nT) symmetrical feature with a half width of approximately 100m. The southern limb of the anomaly is complicated and is composed of a smaller positive and negative anomaly.

The regional pattern appears, from the supplied data, to be relatively flat.

e) **<u>Modelling:</u>** The main anomaly was investigated first using both tabular and spherical geometrises with different magnetic susceptibilities (example - Figure 2). Once a reasonable fit was established further refinements were developed using additional bodies to model the secondary anomalies south of the primary feature.
The final model is shown in Figure 3. A summary of the body parameters used in the model are given below.

GROUP	UNITS	Mag. susc.(cgs units)
Wilpena	Wonoka Formation, Bunyeroo Formation, Ulupa Siltstone	$100 - 400 \times 10^{-6}$
Umberatana	Yeralina Subgroup, Waukaringa Siltstone, Tarcowie Siltstone, Tapley Hill Formation (Tindelpina Shale)	100×10^{-6}
	Appila Tillite	1500×10^{-6}
	Holowilena Ironstone	$100 - 58000 \times 10^{-6}$
Burra	Cradock Quartzite, Minburra Quartzite	100×10^{-6}

Table 1 A comparison of magnetic susceptibilities for Neoproterozoic strata in the Nackara Arc.

ADELAIDEAN Stratigraphic units	Magnetic susceptibiliy $\times 10^{-5}$ SI units RANGE	AVERAGE
Pp	(10 - 15)	13
Pw	(5 - 3000)	300
Ph	(5 - 45)	11
Pf	(0 - 25)	40
Pu	(5 - 500)	110
Pb	(0 - 30)	11
Po	(0 - 30)	12
Pc	(15 - 70)	42

Table 2 magnetic susceptibility measurements collected in the general region of the magnetic modelling exercise.

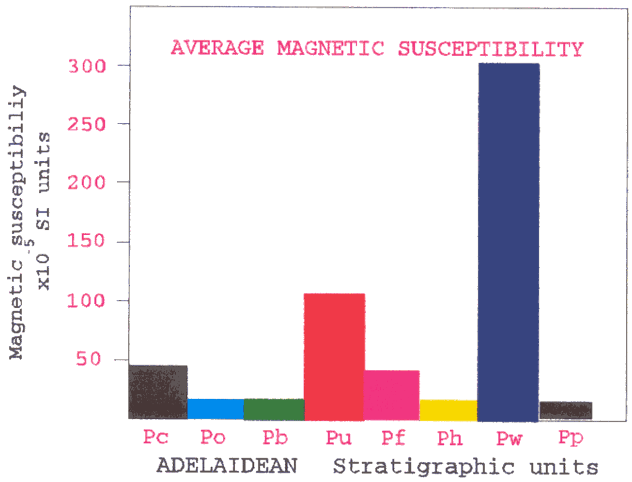

Table 3 Mean magnetic susceptibility associated with common stratigraphic units encountered in the Neoproterozoic of the Nackara Arc.

Body name	**Relative Magnetic susceptibility (CGS units) Background (0.00)**	**Strike length/ radius (metres)**	**Plunge/ azimuth**	**Possible correlation/rock type**
Polygon	-0.002	10000	$0^0/90^0$	Carbonate, sandstone of Tapley Hill formation or (remanently magnetised BIF-not investigated)
Polygon1	0.001	10000	$0^0/90^0$	Braemar Ironstone, magnetite rich sandstone in Tapey Hill Formation
Sphere	0.008	300		Basic granulite, basic intrusive, BIF
Sphere1	0.003	100		Basic granulite, basic intrusive, possibly a dyke

Table 4 Parameters used in the modelling exercise.

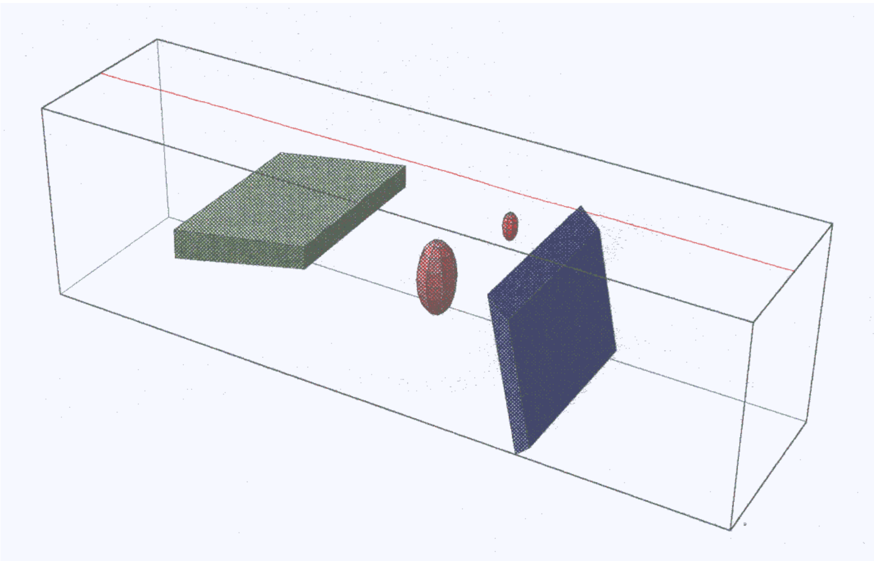

Figure 2 A 3D perspective of the model bodies.

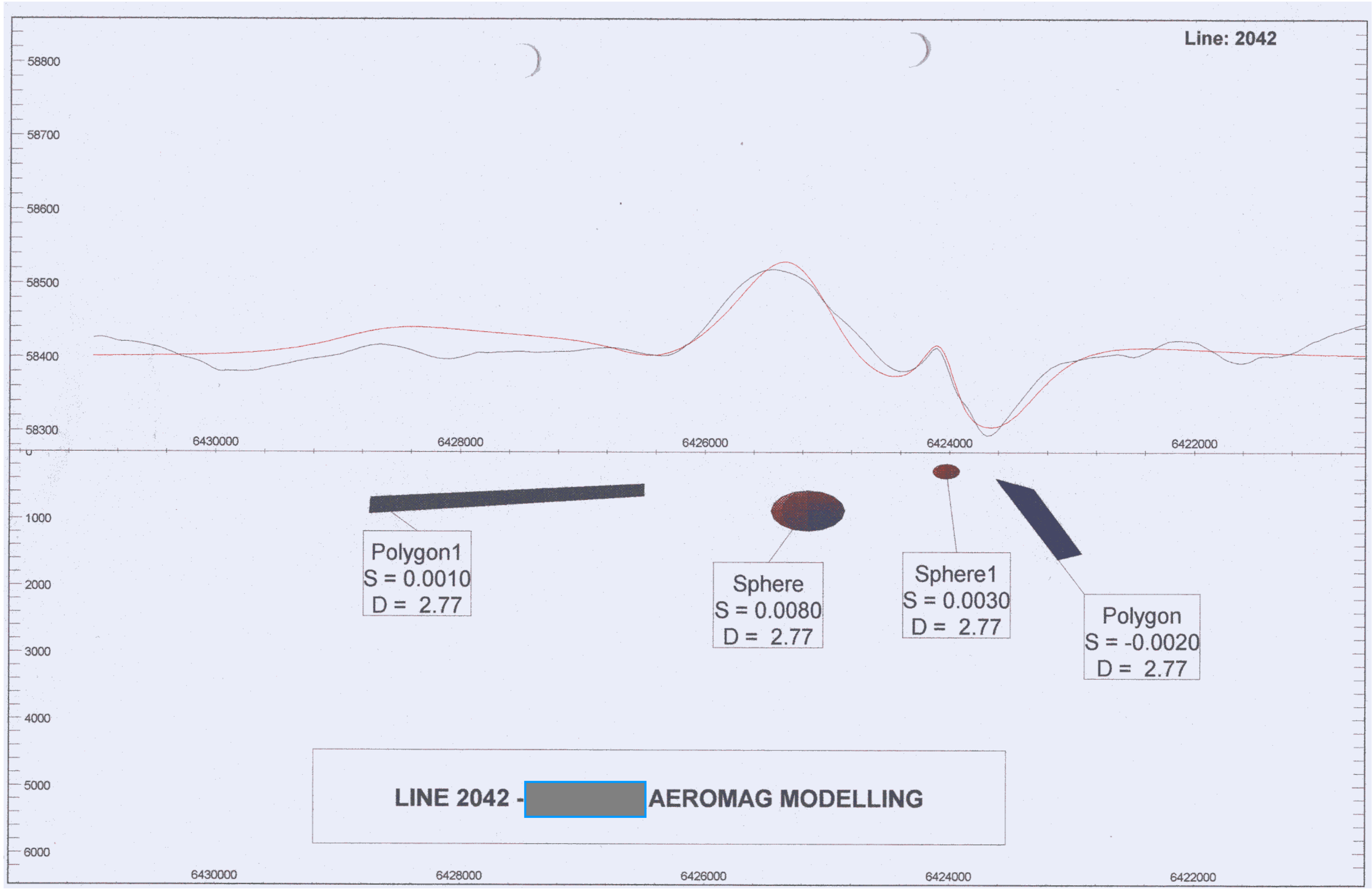

Figure 3 Modelling results.

f) **<u>Conclusion</u>** – depth to centre of magnetic bodies associated with the main anomalies.

The results from modelling suggest that the main anomaly (Sphere) reflects the presence of moderate to highly magnetic body at a depth of 800 (+/- 100) metres. The final body geometry was selected to model the limited EW strike length of the anomaly. The sphere may represent a magnetic basic intrusive perhaps contained in a diatreme. An alternative model may Willyama metamorphic complexes.

The smaller positive anomaly (Sphere 1) to the south has also been modelled as a discrete feature. The anomaly can be modelled using a small 200m wide sphere located at a depth of 200 (+/- 100) metres. The upper face of this body is likely to occur within 100 to 200 metres of the surface. This anomaly may also be related to a magnetic basic intrusive.

The symmetric magnetic low at the southern end of the line has been modelled as a non-magnetic unit (Polygon) dipping approx. 30^0 south, perhaps a unit of dolomite or sandstone within the Tapley Hill Formation. The dip of this unit correlates well with the orientation of strata mapped at this location.

The magnetic character north of the main anomaly is relatively flat. A slight to moderately magnetic body has been incorporated in the model to improve the fit of the model to the observed magnetic field. This body (Polygon1) is likely to correlate with shallow dipping Braemar Ironstone several 100 metres below the exposed Umberatana Group rocks.

In summary, the geological entities responsible for the magnetic anomalies are at a depth of approx. 800 metres for the main anomaly (Sphere) and approx. 200 metres for the southern secondary anomaly (Sphere1).

I would recommend examining the ground magnetic data to provide further depth control and model refinement.

Yours Faithfully

David Miller, 14/09/1998

CONTENTS

Introduction

This report summarises the development of a geologic model to explain the spectrometric anomaly in the vicinity of the Southern Cross Bores and to postulate possible economic associations with the anomaly.

The bores are located approximately 85 kilometres north east of Peterborough in an area of open plains and dry lakes near Koonamore Station.

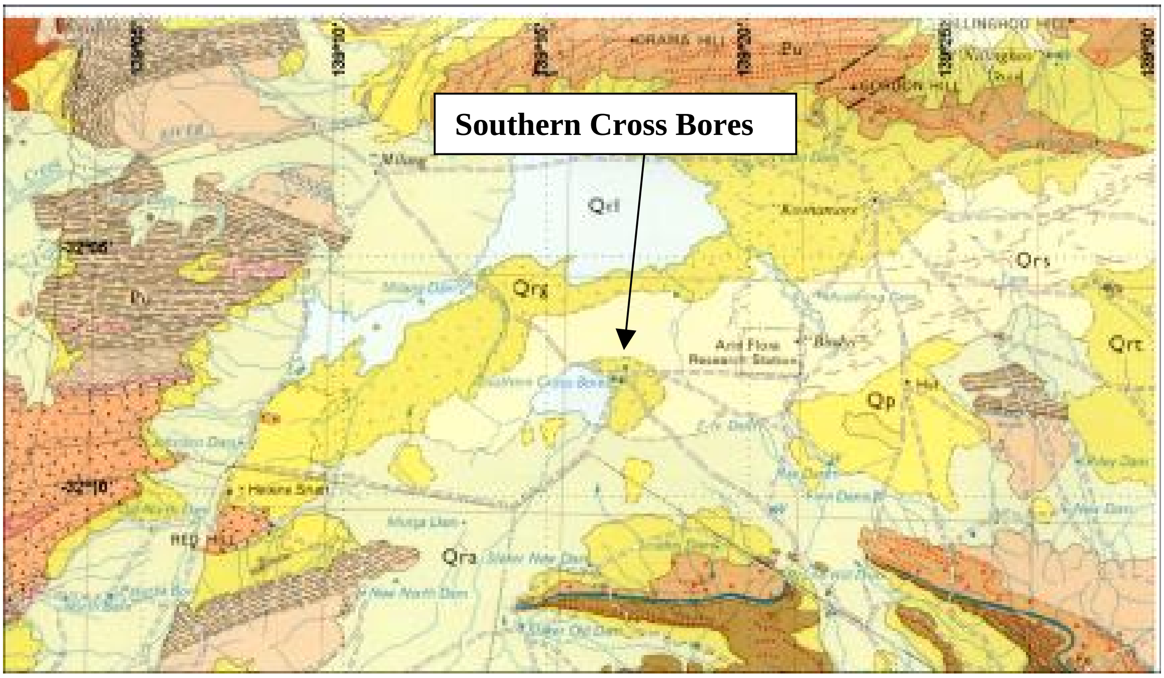

Figure 1 – Location of the Southern Cross Bore anomaly in relation to the local geology (Orroroo and Olary 1:250000 geology sheets – MESA, 1968 & 1989).

Geology

Introduction

The Southern Cross Bore anomaly is located in the north east arm of the Nackara Arc within the Adelaide Fold Belt (Scheibner, 1974; Plummer, 1978; Jenkins, 1990; and Mancktelow, 1990) or Delamerian Fold Thrust Belt (Miller, 1994). The sediments exposed within the vicinity of the Bores are composed of Quaternary lake deposits of gypseous clays, silts and quartz sands, aeolian dune systems and alluvial channels and flood plains. Basement to these sediments is primarily composed of lower Neoproterozoic sedimentary strata of the Burra and Umberatana Groups. The sedimentary succession between the Quaternary and Neoproterozoic strata is not known and may preserve Tertiary and Triassic sediments similar to sequences located to the west.

Significance of the Southern Cross Bore radiometric anomaly

The observation of a distinct radiometric anomaly[1] associated with the Quaternary lake sediments directly southwest of the Southern Cross Bores has stimulated a more detailed examination of this phenomenon. This radiometric anomaly shows some similarities to radiometric anomalies found to be associated with oil seeps (eg East Gippsland Basin, pers. comm. M. Deuter-Pitt Research, 2000), ground water discharge zones (exsolution of radon gas) and salt lakes (concentration of uranium series elements), (Dickson et al 1987, Wilford et al 1997).

The radiometric anomaly at the Southern Cross Bores corresponds with a dry lake adjacent to the Southern Cross water bores. The exposed surface sediments including gypsum dunes suggest a playa (continental sabkha) environment. The occurrence of evaporative playa lakes is a common characteristic of these environments. The lakes are typically fed by ground water seepage. The high evaporation gradient from these lakes causes super-saturation of the ground water leading to the sub-surface and surface precipitation of (magnesium and calcium) carbonates, sulphates (gypsum) and layers of calcite cement. A single drill hole[2] record from the area indicates the presence of clayey alluvium and sandy conglomerate with laterite, gypsum and calcrete layers (Mines Administration P/L, 1978).

The radiometric anomaly over the Southern Cross Bore lake sediments indicates the presence of radioactive compounds. The radioelement may have been precipitated from ground water seeps containing elevated levels of potassium and thorium or may be a result of enrichment from surface weathering including transport into the lake.

The analysis of ground water (data supplied by David Watkins) from one of the bores (depth 25 metres) did not reveal significantly elevated levels of potassium (19mg/l) and unfortunately, the Th and U levels were not available due to inappropriate detection levels used in the analysis. The ground water results were thus inconclusive.

However, the ground water analysis did show elevated levels of As (0.11 mg/l), Ba (0.26mg/l), Sr (5.46 mg/l) and S (664 mg/l). The presence of elevated arsenic and barium suggests waters circulating through an igneous source while the strontium and sulphur (as sulphate in the water) are possibly derived from carbonate strata within the playa complex sediments. The variable solubilities for the compounds involved and the unknown hydrology of the region makes the preceding comments speculative without further water analysis. It suffices to say that the ground water is unusual and may indicate the presence of mineralised zones containing minerals such as arseno-pyrite and strontianite.

Regional geology - summary

The Southern Cross Bores lie within a region of deformation located in eastern South Australia. The strata preserved in this area consists of sedimentary deposits of Neo-Proterozoic age, large areas of which are covered by Cainozoic and Quaternary sediments. The area of interest also lies west of the Palaeo-Proterozoic Curnamona Province (Willyama Inliers) that includes metamorphic and granitic rocks. Occurrences of irregular structures -

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[1] This observation was made by this author during a regional interpretation study undertaken on behalf of Wagstaff and Watkins 1998.

[2] Drill hole K3, 335612E, 6444879N, depth 46m

diapirs (Mount, 1975) composed of brecciated blocks of sedimentary, igneous and infrequent metamorphic rocks crop out in a region 25 kilometres to the northwest.

The Quaternary sediments surrounding the Southern Cross Bores rest unconformably on Adelaidean strata deformed principally during the Cambro-Ordovician Period, approximately 500 million years ago.

Stratigraphy

The basement stratigraphy underlying the Quaternary succession is composed of Neo-Proterozoic and Palaeozoic sedimentary strata of the Heysen Supergroup with most of the exposed rocks identified as lower Umberatana and Burra Groups.

The Burra Group[3] is generally observed to be unconformable with pre-Adelaidean basement and disrupted Callanna Group. The lower Umberatana Group is composed of the Pualco Tillite, Benda Siltstone, Wilyerpa Formation and the Appila Tillite. The extensive and uniform Tapley Hill Formation represents the middle Umberatana Group. The geology of the upper Umberatana Group is variable with numerous individual formations recognised (Preiss, 1987).

The Cainozoic stratigraphic succession preserved in the central and eastern Flinders Ranges includes Triassic, Tertiary and Quaternary sediments. Sub-surface information in the Southern Cross Bores area is limited to basic descriptions from shallow (approx. 25 metres) water bores. Its is possible that the preserved sediments beneath the bores are similar to those found in the Walloway Basin located directly southwest. The Walloway Basin contains a Tertiary sedimentary sequence including carbonaceous sands, silty clays and lignitic shales (DDH Walloway 1 intersected a 20 and 3 m thick coal seam, Alley and Lindsay in Drexel and Preiss, 1995).

Small Triassic Basins preserved 100 kilometres to the west have not been identified in the area of interest.

Structure

The Quaternary sediments in the central and eastern Flinders Ranges typically rest unconformably within broad, open, parallel synclines and faulted and eroded anticlines.

The Delamerian folds within the area of interest are curved, elongate (SW-NE) dome and basin structures with parallel fold hinges. The plunges of antiforms and synforms are moderate to shallow and generally have the same plunge direction.

Neoproterozoic structure beneath the Southern Cross Bores is interpreted by this author[4] to be a saddle structure formed by fold over-printing of an E-W oriented syncline (Figure 2). The approximate N-S over-printing fold axis parallels crystalline basement structures observed to the east in the Willyama Inliers.

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[3] The Burra Group is composed of an alternation of siltstone, shale, sandstone and dolostone. The upper Burra Group is composed of an alternation of shales, dolomites and sandstones, including the Undalya Quartzite and its equivalents above the Skillogalee Dolomite, and the stratigraphically higher shales of the Saddleworth and Mintaro Formations.

[4] Structural interpretation from airborne magnetics 1998.

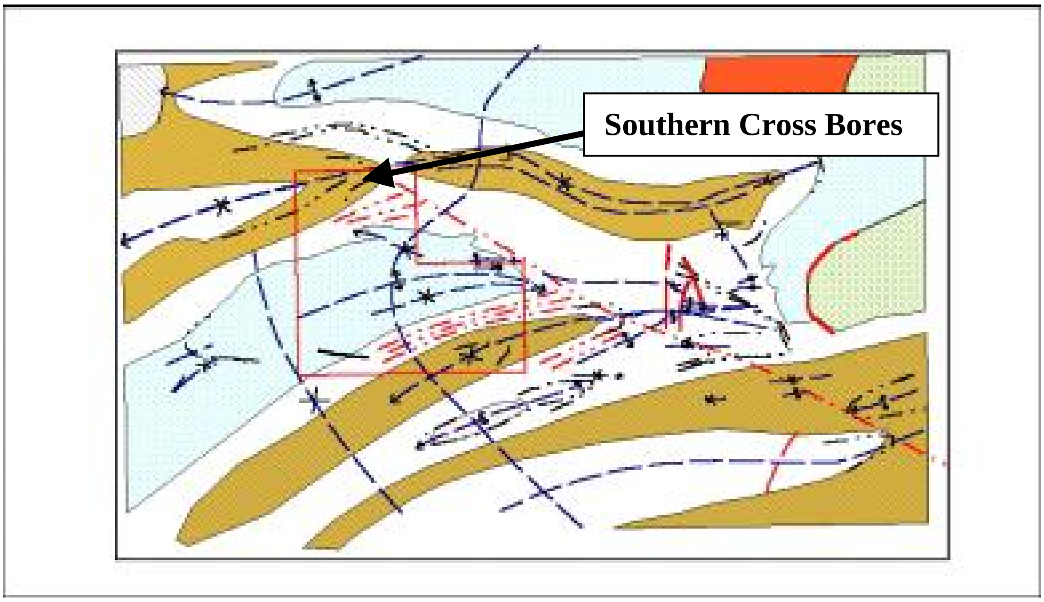


Figure 2 – Structural interpretation based on exposed geology. (Blue circles highlight plunge directions)

Geophysical Interpretation

Introduction

Geophysical features in the Southern Cross Bores region includes magnetic lineaments reflecting folded Neoproterozoic sedimentary strata, radiometric anomalies associated with Quaternary lake sediments and a broad gravity "high".

The most notable feature within this area is the elevated potassium and thorium levels shown in the radiometric survey data (Figures 4, 9, 10 and 11). This anomalous region is coincident with a region of low magnetic intensity.

The following section summaries findings produced from previous and new interpretation work. Figure 3 records the results of the interpretation superposed on the mapped geology.

Magnetic properties and characteristics

Neo-Proterozoic strata

Linear magnetic anomalies located in the Nackara Arc generally correlate with Adelaidean strata (Tipper and Finney, 1965; Tucker, 1972). Strong linear magnetic anomalies associated with Neoproterozoic strata are due to magnetic units such as the Holowilena Ironstone and the Pualco/Appila Tillites. These rocks have values from 150 to 58000 x10^{-6} cgs units (Tucker, 1972). In-situ magnetic susceptibility measurements by this author show that the Ulupa Siltstone and units in the lower Umberatana Group within the Nackara Arc are strongly magnetic.

Airborne magnetic interpretation - Southern Cross Bore area

Linear anomalies associated with Neo-Proterozoic strata: Numerous well-defined linear magnetic highs and lows define stratigraphic units from the Umberatanna and Wilpena Groups. High susceptibility units including the Holowilena Ironstone and the Pualco and Appila Tillite as well as low susceptibility strata such as dolostones can be traced beneath the Quaternary cover. Displacements of the linear anomalies indicate the presence of several fault structures

NW trending linear anomalies: A number of faint discontinuous NW trending linear anomalies cut across the Southern Cross Bores area. These narrow magnetic features possibly represent basement shears or mafic dykes (some of the shorter linear anomalies have similar trends to local creeks and may reflect magnetic sediments). It is interesting to note that their orientation is similar to kimberlite/lamprophyre dykes located to the south (Terowie region) and southwest.

Circular anomalies: A poorly defined semi-circular magnetic feature correlates with the radiometric anomaly located close to the Southern Cross water bores.

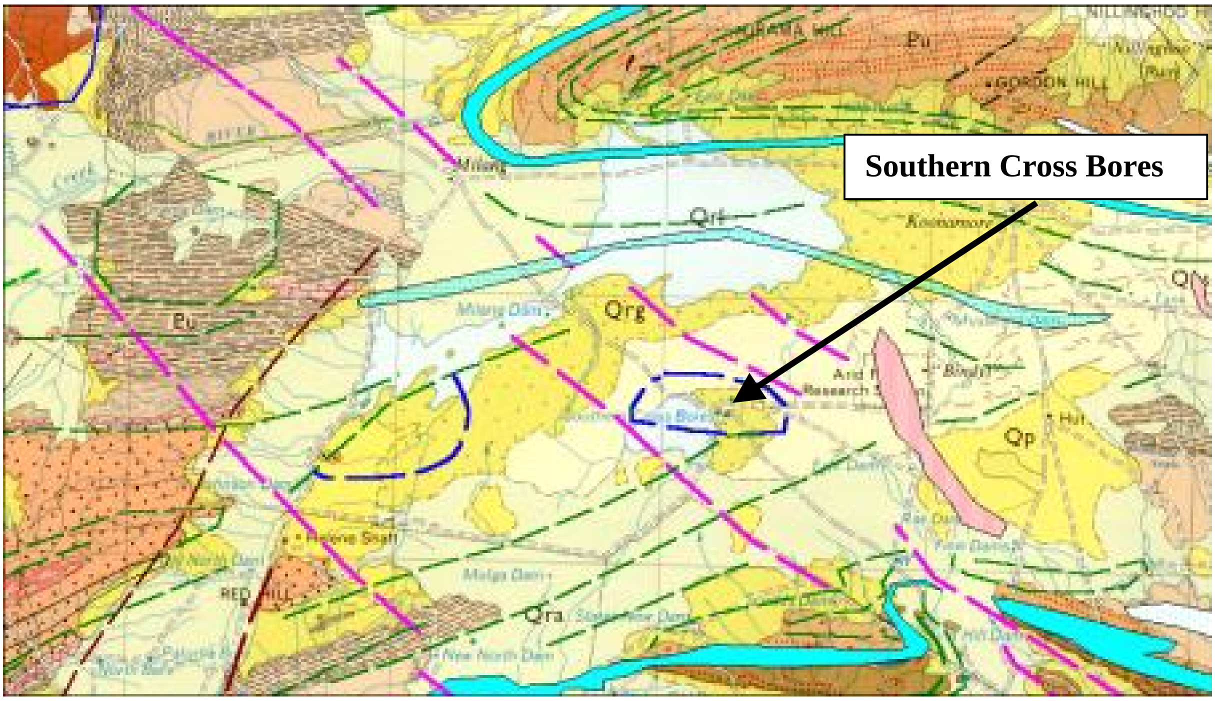


Figure 3 Magnetic interpretation on solid geology map (Map courtesy PIRSA)

Airborne radiometric interpretation - Southern Cross Bore area

The total count radiometric data (U,Th, K) was examined to identify anomalies, stratigraphic boundaries and to search for correlations with magnetic anomalies. The most striking anomaly occurs directly southwest of the Southern Cross Bores (Figure 4 anomaly "R4").

It is probable that the elevated count at this location is related to radioactive elements concentrated in fine lake sediments. It is possible that the adjacent bores source ground water from a radioactive source. The three-channel radiometric spectrum (Figure 9, 10 and 11) indicates enrichment in potassium and thorium and depletion in uranium. The higher levels of K and Th may indicate ground water or fine sediments derived from weathered ultrabasic – basic igneous geology (low U/Th). It may also reflect the mobility of the radioelements in the local environment.

It is important to note that a strong radiometric spectrum is associated with out cropping Wilpena Group shales to the west of the Southern Cross Bores. The possibility exists for the Wilpena Group strata to partially outcrop within the Southern Cross Bore lake producing a radiometric anomaly.

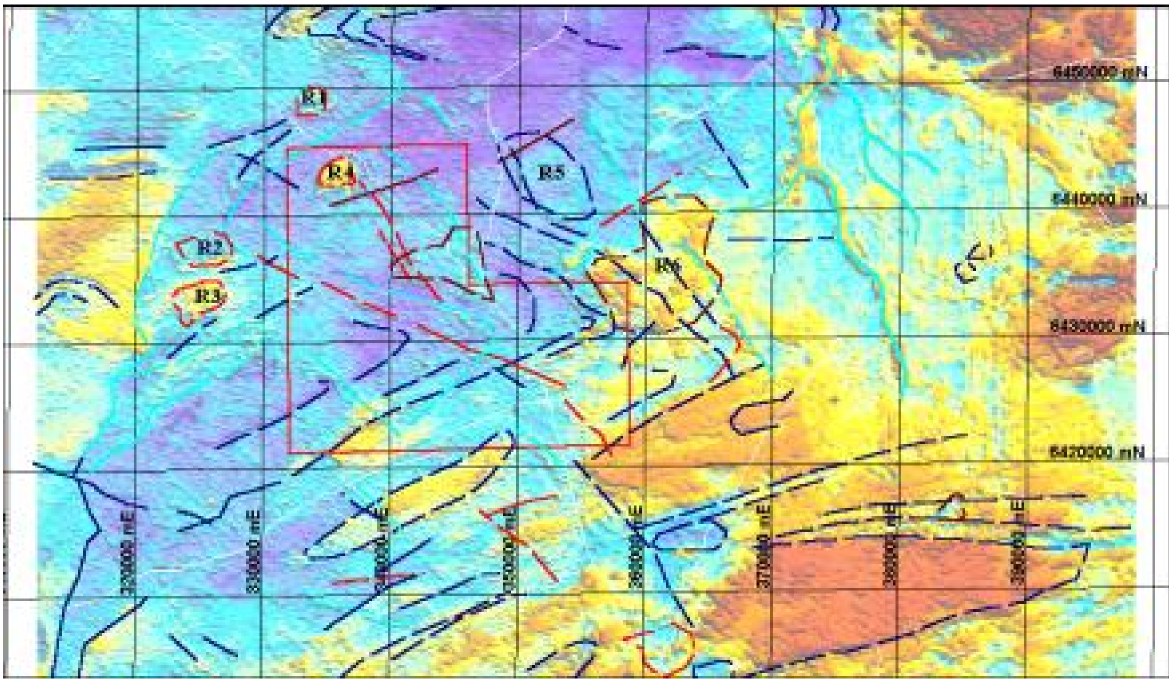


Figure 4 – Interpretation of Total count radiometrics, red features are anomalous (other lines correlate with sedimentary strata or drainage patterns).

Gravity Interpretation

Gravity data within the area of interest consists of widely spaced gravity readings (> 7km) and hence the usefulness of the data is limited. However, it is possible to conclude that the broad gravity highs and lows correlate with Meso-Proterozoic basement complexes of the Willyama Inliers.

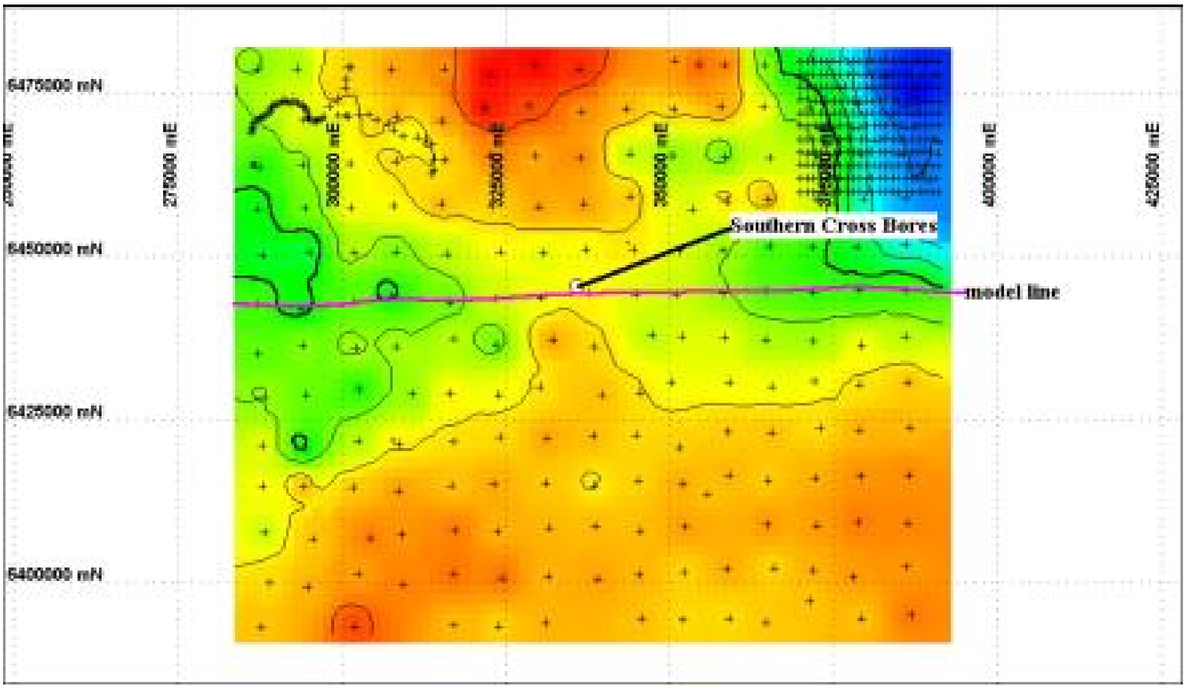


Figure 5 - Gravity contours and image (MESA data set, 1991).

Geophysical modelling

Introduction

An examination of the magnetic response across the region containing the Southern Cross Bores describes a broad low amplitude magnetic depression. The short wavelength signal corresponds with shallow Neoproterozoic strata and Quaternary drainage channels.

The limited gravity data indicates the presence of a broad gravity high beneath the Southern Cross Bore area. For the purposes of this project it was considered more efficient to attempt modelling of the sub-surface using the limited gravity data.

Gravity modelling

A line of gravity data (Figure 5) was extracted from the State gravity grid and used to develop a model for the sub-surface beneath the Southern Cross Bore region (Figures 7 & 8). The large station spacing for the gravity data has precluded modelling any detail in the near surface but has established some general ideas for the basement. A general model using density contrasts consistent with the geology encountered in the Flinders Ranges suggests that a basement high resides beneath the area of interest. This probable metamorphic basement (Willyama Complex?) has a depth of 5 to 10 kilometres below the surface. A near surface Quaternary basin analog was incorporated in the model in an attempt to constrain basement body parameters.

Geological Interpretation

The results from the gravity modelling were far from conclusive but show the possibility of a basement high underlying the Southern Cross Bores. The high is likely to have had an influence on the development of structural elements in the Neoproterozic strata during the Delemarian Orogeny and may also indicate the presence of Ordovician granitoids. Re-activation of these structures during more recent Palaeozoic to Cainozoic times may have led to the development of Triassic and Tertiary mini-basins (Figure 6). The model proposed incorporates graben and horst structures developed over a basement high during or after the Delamerian Orogeny. The fault complex is likely to have provided a depression for Cainozoic sediment accumulation and the opportunity for high organic lakes to form. The fault system may also provide a conduit for mineral enriched brines to reach suitable host lithologies within the Neoproterozoic and Cainozoic sequences.

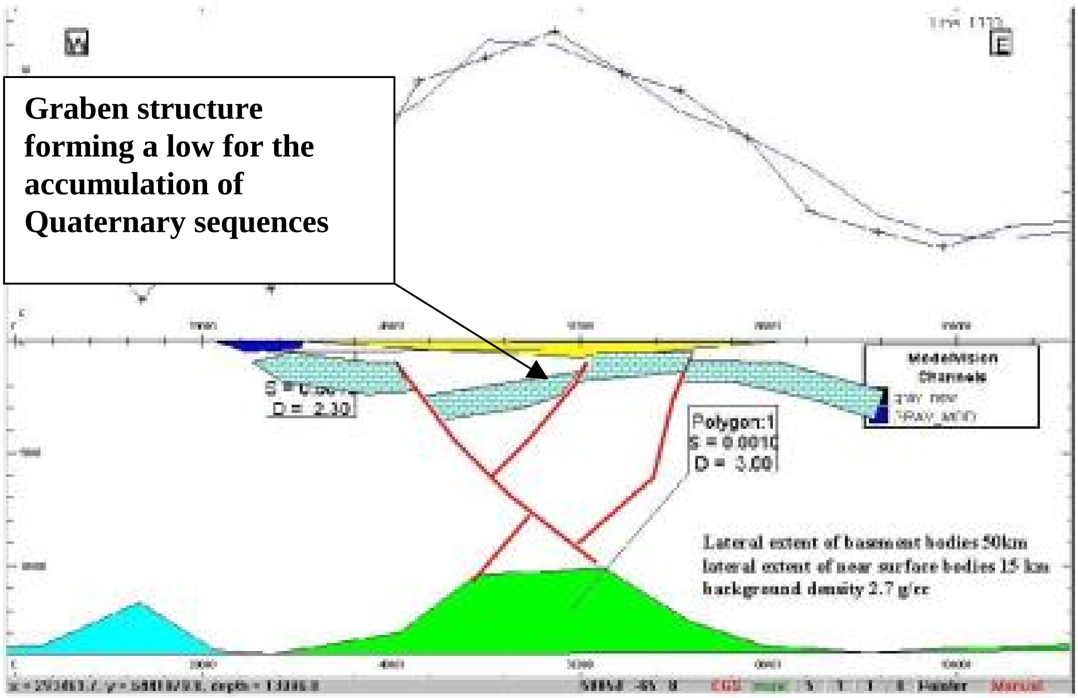


Figure 6

Conclusion

Exploration in the Southern Cross Bores area has potential to locate a variety of near surface deposits including sandstone copper and or uranium deposits, methane gas accumulations and coal deposits. Deeper targets may include base metal and gold accumulations within fault and fold traps in the Neoproterozoic strata.

The region possibly preserves Cainozoic strata including both Triassic and Tertiary sequences with possible coal seams similar to deposits located in the Walloway Basin. The existence of coal bearing strata may explain the As and S levels in the local ground water and may be responsible for the radiometric anomaly (thorium incorporated in organic matter) within the lake sediments.

In summary the radiometric anomaly associated with the Southern Cross Bore lake is likely to be a secondary source reflecting a redistribution of radioelements by weathering processes. The anomaly could be caused by radioelements incorporated in lake clays by direct precipitation or by a form of colloidal (ionic) attraction related to the playa complex environment. Alternatively mineral grains containing radioelements may have been derived externally from the playa system and deposited (eg K and Th incorporated in Fe oxides) in the lake by storm water or wind.

If ground water seepage occurs at this locality it may indicate a hydrological gradient to this point and hence the primary source of the radioelements may be proximal (within the Quaternary sediments). This scenario requires further investigation of the Quaternary playa complex. It is also possible to suggest that the ground water seepage may have originated from a deeper source. The proposed structural complex over a Willyama basement high is a likely path for up-welling metal enriched hydrothermal fluids and ground water. There is a strong likelihood that economic elements may have moved from the basement host rocks into structurally and lithologically favourable regions in the Neo-Proterozoic strata.

The lack of detailed gravity data and other geologic constraints makes it difficult to provide any estimates for the thickness of the Cainozoic strata or nature of the underlying structure.

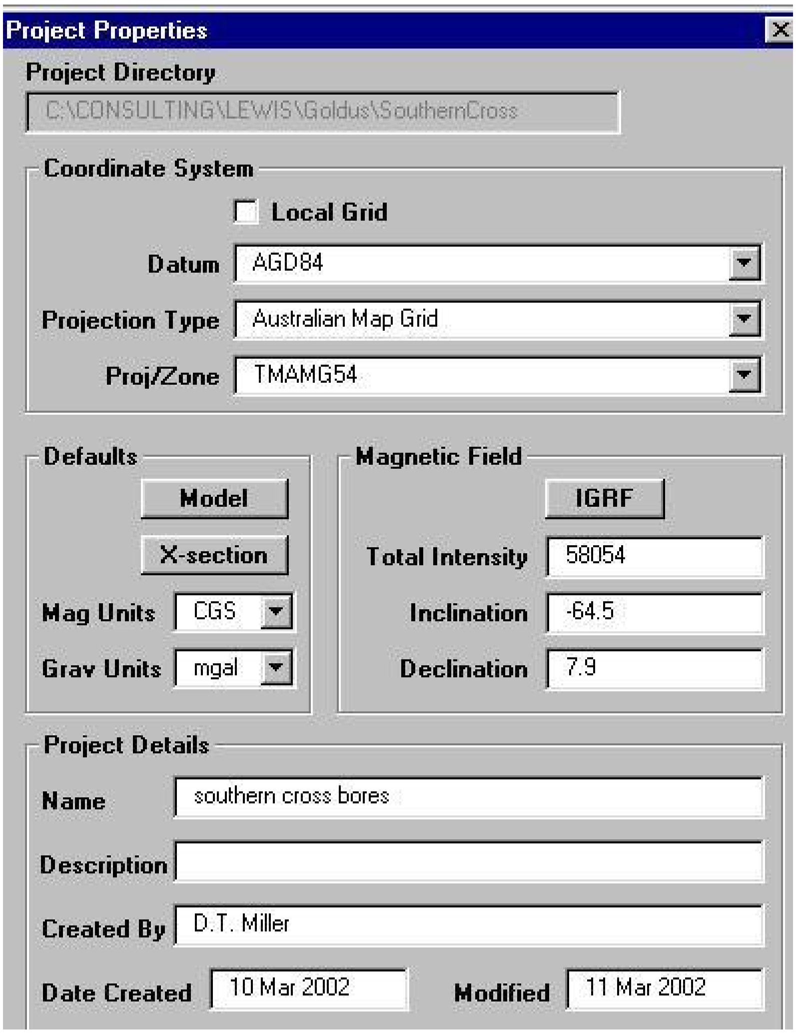
Further recommendations

The radiometric anomaly at the Southern Cross Bores requires follow up work including sampling of the lake sediments (auger holes to maximum 1 metre) and detailed geochemical testing of ground water including other water bores in the area. If the radiometric anomaly is from a sub-surface source it is important to drill an exploratory hole to test for the preservation of Tertiary and Triassic sediments. Detailed gravity surveys would establish the existence of a basin structure.

Yours Faithfully

Dr David Miller

Appendix - geophysical modelling



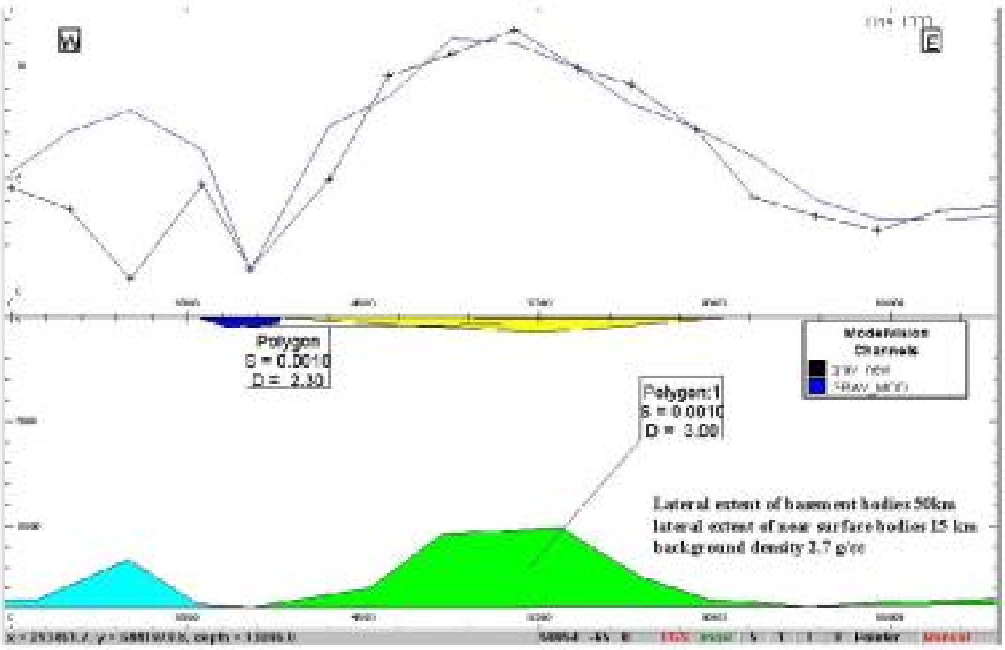


Figure 7

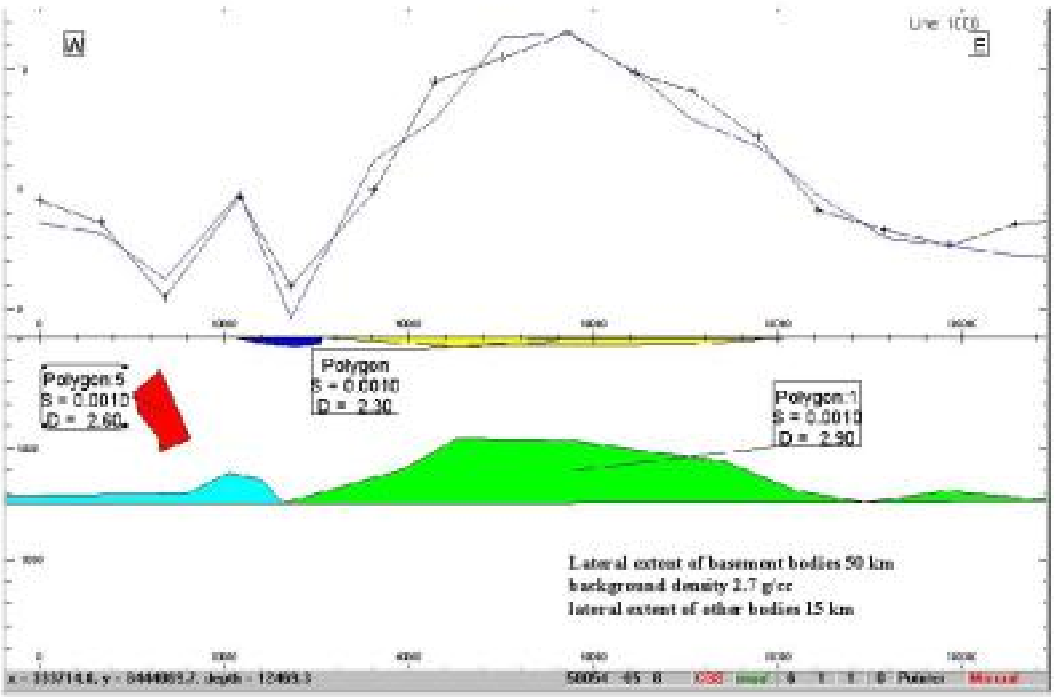


Figure 8

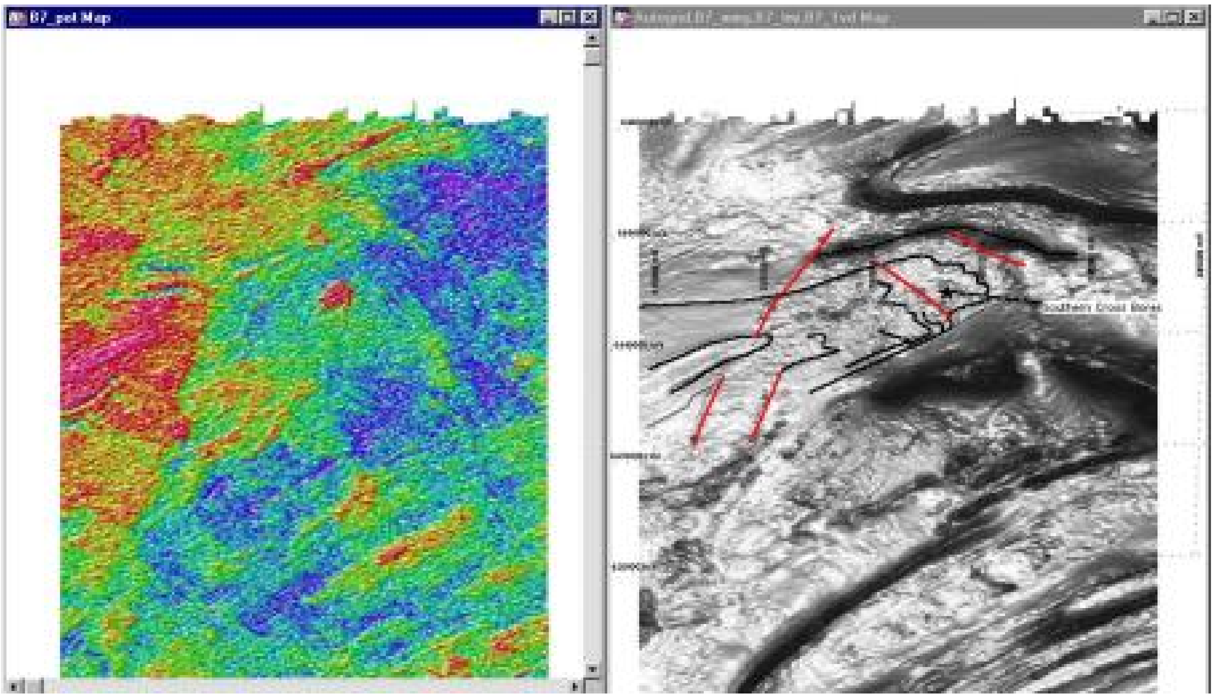


Figure 9 Intense potassium anomaly at Southern Cross Bore and basic magnetic lineament interpretation on the maximum magnetic gradient image.

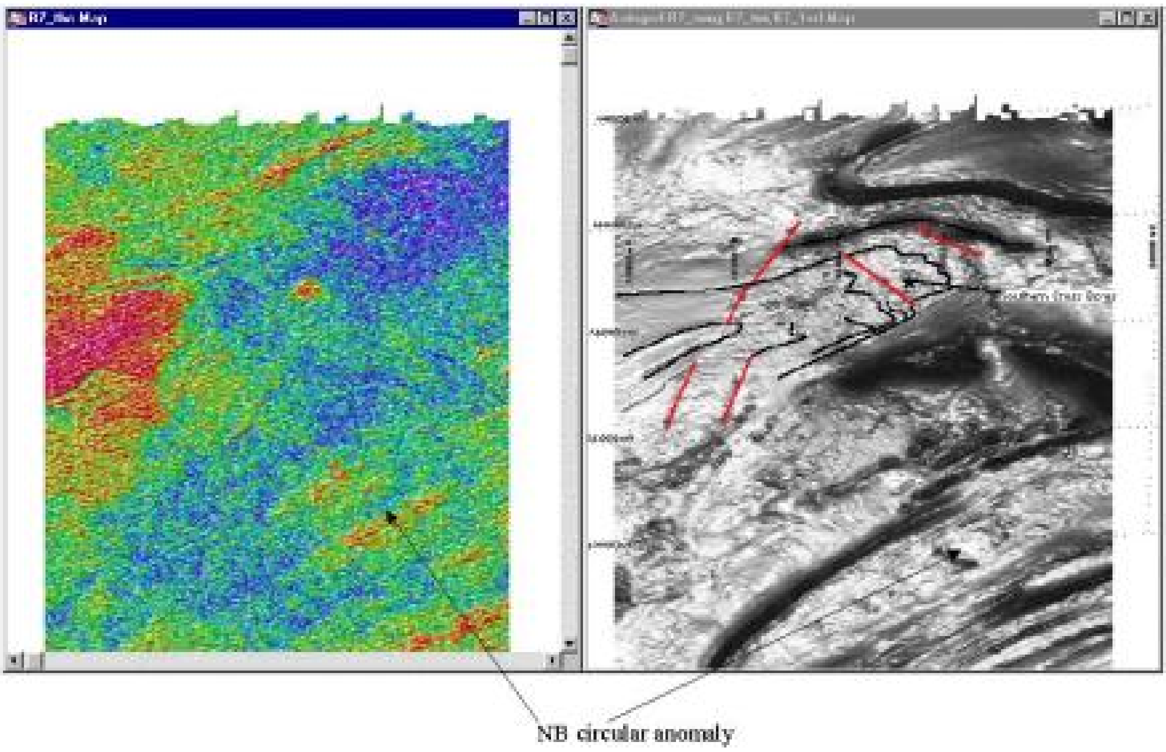


Figure 10 Thorium anomaly at Southern Cross Bores

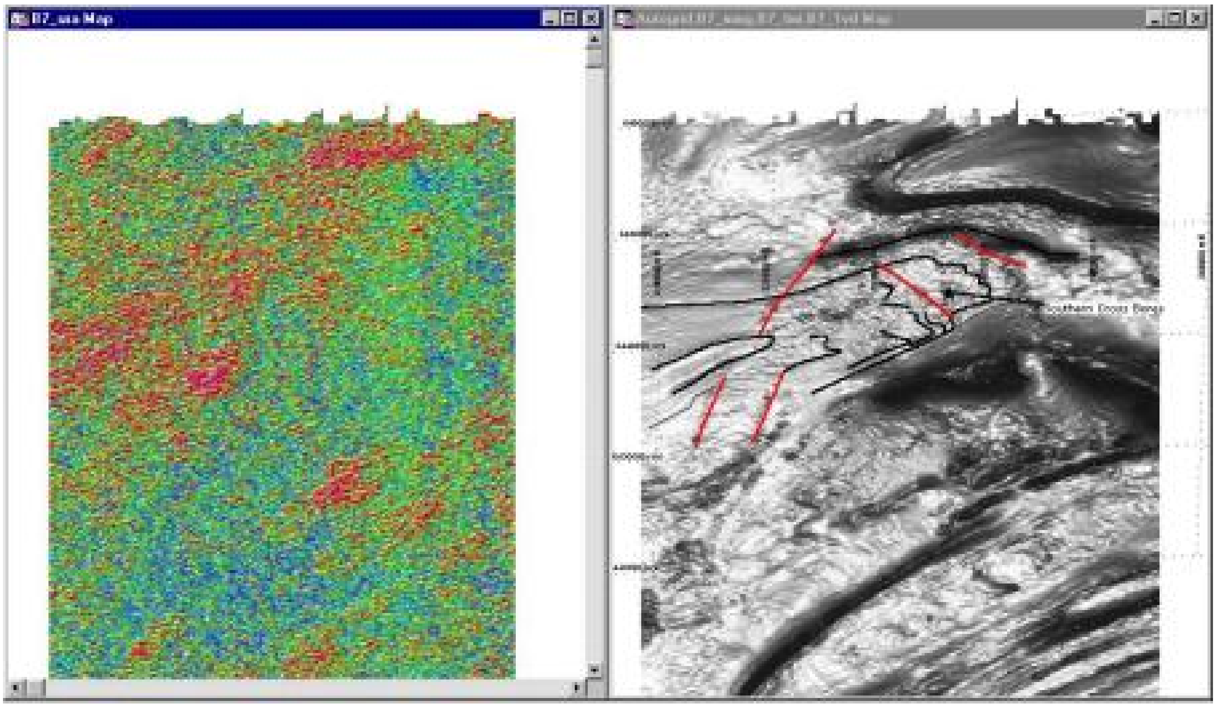


Figure 11 Uranium anomalies in the Southern Cross Bores area

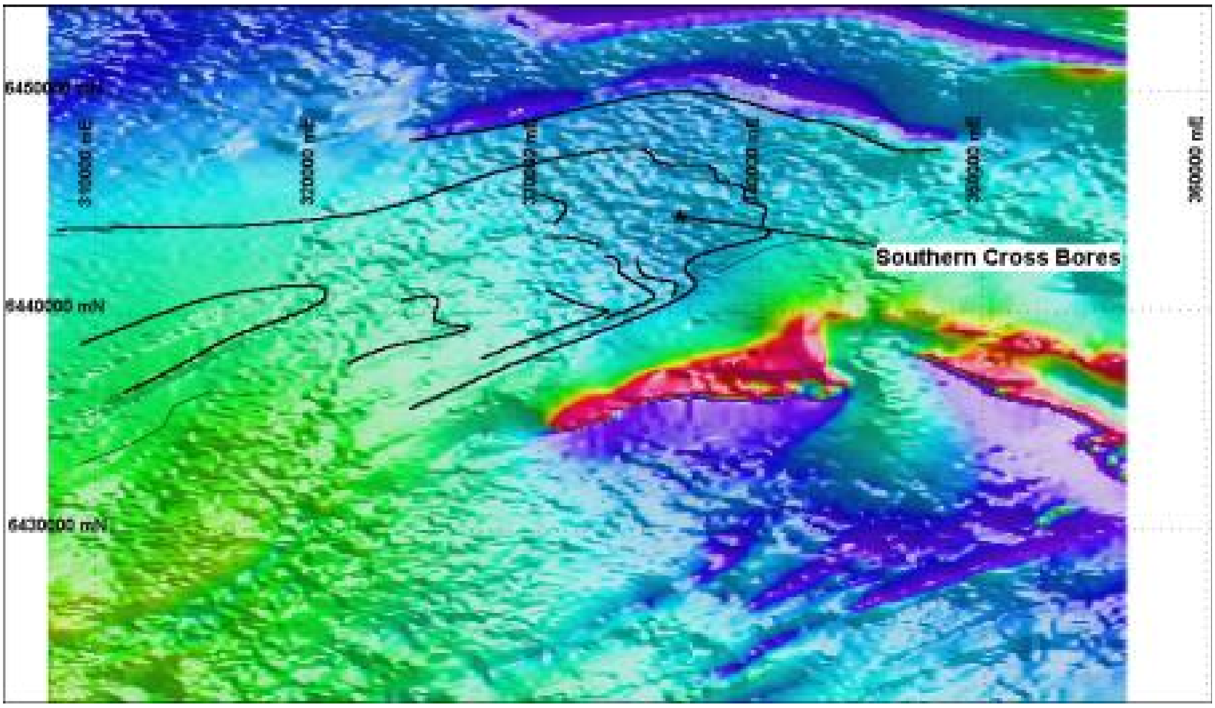


Figure 12 TMI image with magnetic lineaments outlining Neoproterozoic structures beneath Quaternary sediments.

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PALYNOLOGICAL ANALYSIS AND DATING OF SAMPLES FROM K4A AND K12 BOREHOLES, MILANG AREA, SOUTH AUSTRALIA

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A number of five samples have been submitted to PIRSA for palynological analysis and dating by David Miller, 2005. The samples were processed using standard palynological processing undertaken in the PIRSA Mineral Resources Laboratory by Lyn Broadbridge.
The samples have been scanned and analysed by the author in June 2005 and the results are presented below.

METHODS AND MATERIAL

During the last few years PIRSA developed a new exploration concept, palymineral processing. The new process extracts heavy minerals during palynological preparation so that their mineralogy and chemistry can be determined for correlation with age and origin of sediments, depositional environment and climate.

Samples are weighed (usually between 10 and 15grams), cleaned and then crushed into particles ranging in size from 150 microns to 2mm. They are then treated with hot hydrofluoric acid for one hour (or longer if necessary) followed by hot hydrochloric acid for half an hour to remove any silica gel.

At this point of processing all acids are washed out and the sample is split into two parts using heavy liquid at specific gravity:2. The light fraction containing organic matter is further processed for palynology. Various techniques are used for the removal of extraneous organic matter and other unwanted particles and the remaining sample containing pollen and spores is concentrated and mounted on slides for analysis.

The heavy fraction is then collected and washed in distilled water and dried in the oven. Once dry the sample (usually between 5 and 10 grams at this stage) is poured into a separating funnel with the solution of Lithium heteropolytungstates in water at specific gravity:2.85 and allowed to separate for approximately 40 minutes.

The heavy mineral fraction is then collected by sieving through a 10 micron sieve then washed with distilled water and dried ready for identification. All heavy liquids used in this process are recovered for reuse. All specific gravities of heavy liquids are checked and recorded prior to separations.

GENERAL COMPOSITION OF PALYNOFLORAS AND DATING

K4A, 51-54m, Cuttings, Rock sample number 682421, slide number S10539

Poor yield and good preservation of palynofloras. Organic matter is common.
Only few pollen grains are present and no counts were taken.

The taxa present include *Chenopodipollis chenopodiaceoides, Tubulifloridites simplis, Cyathidites australis* and few marine dinoflagellate cysts (*Apteodinium australiense, Hystrichockolpoma* sp.). Freshwater algae are present in low frequencies. The grass/herbs pollen as well as terrestrial lycopods and ferns present in the sample would suggest less transport or no transport of the palynomorphs.
The age is estimated to be Late Miocene-Early Pliocene, with weak marine influence.

<u>K4A, 63-66m, Cuttings, Rock sample number 682422, slide number S10540</u>

Only few palynomorphs are present and no counts were taken.
The taxa include *Cingulatisporites bifurcatus, Eucalyptus spathulatha, Tubulifloridites simplis* with marine and freswater dinoflagellate cysts and fresh water algae. Depositional environment is fresh water-lacustrine with a weak marine influence.
The age is Late Miocene-Early Pliocene and correlated with the *Cingulatisporites bifurcatus* Spore-Pollen Zone (Macphail, 1999).

<u>K4A, 78-81m, Cuttings, Rock sample number 682423, slide number S10541</u>

Only few palynomorphs are present and no counts were taken.
Cingulatisporites bifurcatus, Cyathidites australis, Chenopodipollis chenopodiaceoides, Eucalyptus spatulatha are present in low frequencies together with marine dinoflagellate cysts *Deflandrea phosphoritica.* Organic matter and plant cuticles are also present.
Depositional environment is fresh water-lacustrine with a weak marine influence.
The age is Late Miocene-Early Pliocene and correlated with the *Cingulatisporites bifurcatus* Spore-Pollen Zone (Macphail, 1999).

<u>K12, 48-51m, Cuttings, Rock sample number 682419, slide number S10537</u>

The sample is almost barren. Only two grains of *Chenopodipollis chenopodiaceoides* and *Podocarpidites ellipticus* have been recorded. A possible Late Miocene-Early Pliocene age can be assigned to the sample, in the absence of other key indicator taxa. Non-marine depositional environment prevailed.

<u>K12, 51-54m, Cuttings, Rock sample number 682420, slide number S10538</u>

Very pollen grains are present including *Acaciapollenites micaenicus, Chenopodipollis chenopodiaceoides, Haloragacidites haloragoides, Cyathidites australis.* Fresh water algae are present in low frequencies. Plant cuticles, vitrinite and organic matter are present.
Depositional environment is fresh water-lacustrine.
The age is Late Miocene-Early Pliocene and correlated with the *Cingulatisporites bifurcatus* Spore-Pollen Zone (Macphail, 1999).

<u>Minerals</u>

Rock fragments and rounded quartz grains are the only minerals identified in the samples. No heavy minerals have been separated. Quartz is dominant (97%), rounded to sub-angular, with some iron oxide staining.

DISCUSSION

Palynological analysis and dating of samples from K44 and K12 drillholes, indicate the presence of Late Miocene-Early Pliocene sediments in the Milang area, with minor marine influence. All samples have only few pollen grains and not all key taxa have been identified. They are correlated with the *Cingulatisporites bifurcatus* Spore-Pollen Zone (Macphail, 1999).

Pollen and spores components suggest that the vegetation dominance is shared between Chenopodiaceae, Asteraceae, with rare woodland of *Acacia* which developed on saline, low nutrient soils and some eucalyptus species. Forest communities are more open and dry sclerophyllous forest and coastal communities are present on both sites.

There are minor changes in vegetation and depositional environment in analysed samples. Generally there is minor marine influence throughout the entire sequence, with a prominent lacustrine-fresh water environment.

The samples from K4A and K12 drillholes can be correlated with other Late Miocene-Early Pliocene sediments which have been palynologically identified in other areas of the State including Myponga, Meadows, Willochra Basins, as well as Adelaide Hills , Chapel Hill and Pine Creek areas (Stoian, 2005). Further studies are necessary to map the area and to draw the shoreline evolution for Late Miocene-Early Pliocene marginal marine sediments.

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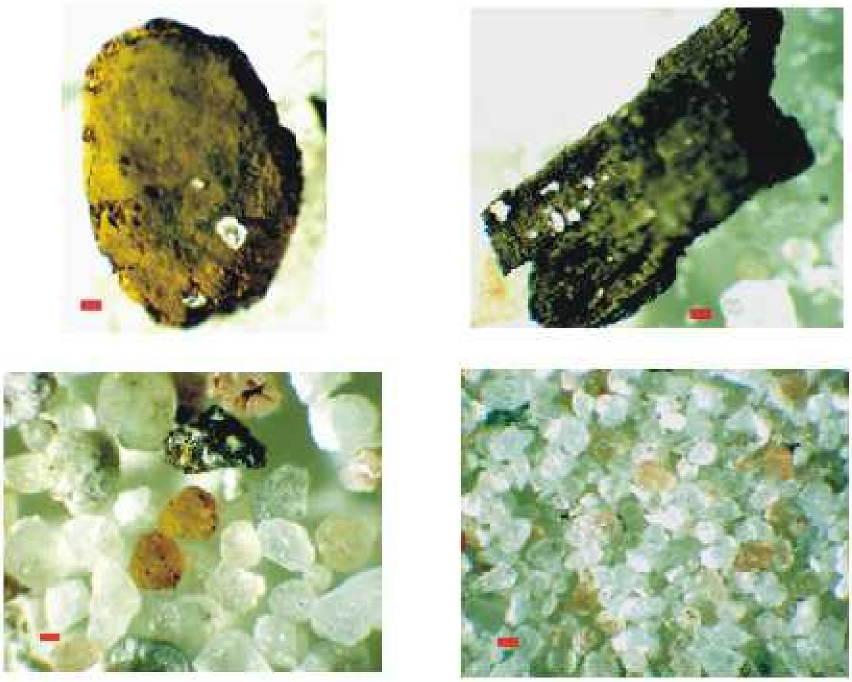
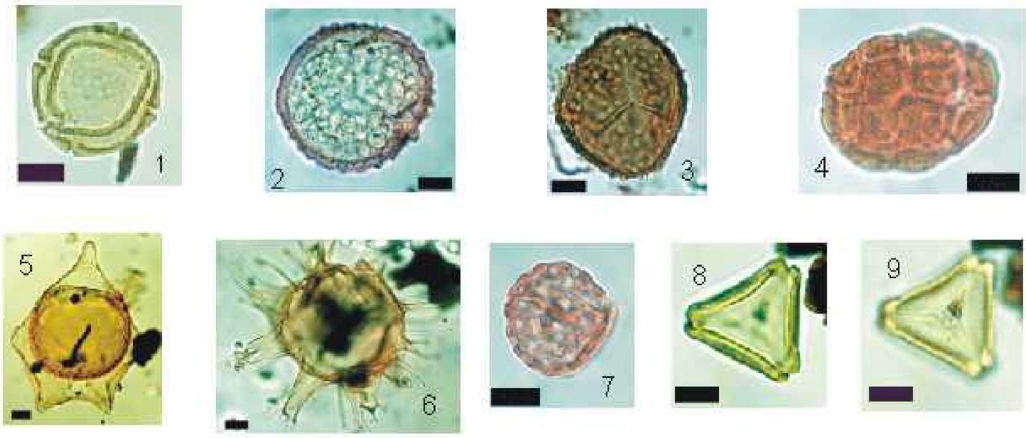
Appendix 1: Plates with minerals and pollen grains



Examples of minerals identified, mostly quartz, rock fragments and some opaque. Well rounded quartz grains with some weathering iron oxide stains suggest that the sediments have been transported far from their original source.
Photos were taken using digital video camera attached to a binocular microscope. Scale bar 50 microns.



Palynomorphs identified in analysed samples from K4A and K12 drillholes.
1. Haloragacidites haloragoides; 2-3. Cingulatisporites bifurcatus; 4. Acaciapollenites miocenicus; 5. Deflandrea phosphoritica; 5. Hystrichockolpoma sp.;
8-9: Eucalyptus spathulatha
Scale bar: 10 micron