DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
GEOPHYSICS DIVISION

NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY
BARABBA GRAVITY LOW

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ABSTRACT

The Barabba Gravity Low in the Northern Adelaide Plains has been interpreted as a southerly dipping trough-like depression in Precambrian bedrock, infilled with Tertiary and covered by a blanket of Quaternary sediments. All margins of this feature are defined by bedrock faults, except in the south where a bedrock ridge separates this area from the Northern Adelaide Plains Proclaimed Region (Water Resources Act, 1976).

Drilling has verified the existence of aquifers similar to those further south in the Adelaide Plains. The reservoir properties of the aquifers are good but the moderate permeability of the overlying confining beds and their doubtful lateral closure against bedrock eliminate the possibility of storing natural gas in these aquifers.

Several lignite seams were found during the drilling but they are uneconomical in terms of mining. Stock water could be produced from the upper aquifer but water from the lower aquifer is too saline to exploit for most purposes. Further testing of shallow groundwater is recommended to verify the results of this investigation and to explore for groundwater suitable for irrigation.

Future exploration should be concentrated south of this area, where a more suitable gas storage structure is believed to exist.

INTRODUCTION

Exploration for underground structures suitable for storing natural gas was initiated in 1964, following the proposed utilisation of natural gas from the Moomba-Gidgealpa gasfields via a pipeline to Adelaide. The advantages of storing gas underground are:

1. Protection against breakdown in the pipeline, compressor stations or on the producing field.
2. Protection against maintenance stoppages in the above.
3. Ability to meet peak demands.
4. Provision of a base for the expansion of facilities over and above that which transmission facilities alone can deliver.
5. Storage capacity is less expensive than an equivalent amount of transmission or surface installation capacity.
6. Operation of transmission facilities under optimum steady state conditions at higher load factors and lower unit costs.

The main constraints placed on the location of underground gas storage targets are the proximity to Adelaide and the proximity to the pipeline. The storage targets themselves are restricted to sedimentary environments in which a reservoir unit is both vertically and laterally confined. Considering these constraints, the obvious region in which to start exploration for underground gas storage targets is the Northern Adelaide Plains of the St. Vincent Basin. The size of target required for suitable storage is in the order of 7 km^2, assuming a reservoir thickness of 10 m at 20% porosity and storage pressure of 300 p.s.i. This represents a storage capacity of 230 million m^3 (8 BCF) or approximately 30 days gas supply to Adelaide.

In 1964, L.W. Parkin, then Deputy Director of Mines, suggested that a closed structure within the Cainozoic succession within what is now called the Inkerman coalfield, may be a suitable storage structure. Important in this consideration was the fact that structural reservoirs are simpler to locate and evaluate than stratigraphic reservoirs. However, due to the shallow nature of this structure, it was decided that exploration in the Northern Adelaide Plains south of the Inkerman area might find other, deeper structures, more suitable for underground gas storage.

Accordingly, exploration began in 1964 with a seismic reflection survey in the Port Gawler-Two Wells area, followed by the drilling of a stratigraphic bore, Light No. 1. On the completion of this survey, it was recommended that a detailed gravity survey be conducted over the area to detail the bedrock configuration. Interest in the project apparently flagged at this stage and the project lay dormant until 1975.

Interest was rejuvenated when a gravity high in the Mallala-Wasleys area indicated a possible dome structure within the Tertiary succession. However, more detailed examination revealed that this high was caused by an uplifted bedrock block with only thin Cainozoic cover. On the other hand, the study did indicate that the gravity low immediately west and northwest of this high was due to a basin-like structure filled with Tertiary sediments. Underground gas storage potential was thought to exist in this structure, in the form of confined Tertiary aquifers trapped against the supposed Redbanks Fault, delineating the eastern margin of the structure.

This report deals mainly with the examination of this feature, designated the Barabba Gravity Low, in terms of possible underground gas storage. During the investigation, special consideration was also given to exploration for usable underground water resources and extensions of Tertiary lignite seams from the Inkerman coalfield into the area. The area was also of interest from a stratigraphic point of view because it lies midway between the two well documented outcrop sections in the St. Vincent Basin, viz., Willunga Embayment and Yorke Peninsula.

GEOGRAPHY

The Barabba Gravity Low is located in the Northern Adelaide Plains of South Australia (Fig. 1). The area of the gravity low is outlined in Fig. 2 and the shape of the bedrock feature associated with it is shown in Fig. 3. The approximate geographic boundaries are marked by Erith in the north, Korunye in the south, Long Plains in the west and Owen in the east. The area under investigation includes parts of the hundreds of Balaklava, Dalkey, Dublin, Grace and Port Gawler.

Relief is moderately low and gently undulating, and gradually increases toward the Mt. Lofty Ranges in the east. In the northern part of the area northwest trending sand dunes up to 10 m high are common.

Most of the natural vegetation has been cleared for cereal crop and mixed farming and only small pockets and strips of woodland remain. The main service town in the area is Mallala, with a population of 386 and an annual rainfall of 407 mm (Chattermole, 1977).

The main drainage system is the River Light in the southeast of the area. The only other major water supply is the Redbanks Reservoir in the east.

GEOLOGICAL SETTING

The Barabba Gravity Low is located in the northern part of the Cainozoic St. Vincent Basin. The succession in the basin generally thickens from north to south; near Erith it is less than 30 m thick but beneath Adelaide it is up to 700 m thick. An erosional unconformity occurs between the Tertiary succession and the underlying Proterozoic bedrock. The late Eocene to Pliocene beds are mainly marine, while the basal Eocene units are non-marine. The Tertiary succession is generally covered by an ubiquitous veneer of Quaternary sediments, which are generally less than 100 m thick and of non-marine, alluvial origin (Fig. 4).

In the area of the gravity low three main structural domains can be recognised (Fig. 2). From Bowmans northward, the dominant tectonic regime is one of block faulting, the predominant set of faults trend north-south and most others trend approximately east-west (Meyer, 1976). The distinction between this northern area and the central area, in which the Barabba Gravity Low occurs, is the absence of east-west trending faults, and a tendency for some of the north-south faults to deviate to the east.

The southern area is separated from the central area by an east-west trending structure, probably a bedrock ridge near Two Wells. The major faults are continuous into this southern area but their orientation is northeast-southwest. Little is known about the structures beneath the Gulf of St. Vincent except for the work of

Stuart and Von Sanden (1971).

As the Barabba Gravity Low is located in the central area, the main structural controls are the north-south faults (Fig. 2). Between the Whitwarta and Redbanks-Owen Faults lies a southerly dipping trough containing a Cainozoic sequence about 60 m thick in the north to over 200 m thick in the south. The Barabba Gravity Low is located in the eastern half of this zone. In the western half of this trough the Cainozoic succession becomes much thinner, probably due to a tectonic zone in the centre of the area having a similar orientation to the faults.

West of the Whitwarta Fault is a basement high known as the Pt. Wakefield Platform. To the east, between the Alma and Redbanks-Owen Faults, there is a thin wedge of Cainozoic sediments. The thin nature of this wedge is indicated by the outcrop of Proterozoic and Tertiary rocks, especially towards the north. The Alma Fault delineates the eastern margin of the St. Vincent Basin and the western margin of the Proterozoic Mt. Lofty Ranges in this region.

PREVIOUS GEOPHYSICAL WORK

The area under investigation forms part of the Adelaide 1:250 000 map sheet which has been covered by numerous gravity surveys, most of which have been tied together, and plotted to produce the ADELAIDE 1:250 000 gravity sheet, as yet unpublished. These data indicate the outlines of the Tertiary basins but accurate interpretation of the thickness of the Cainozoic succession is hampered by the effects of density changes within the bedrock. Part of this sheet is reproduced here as Fig. 2, which includes work by Bennett (1970) and Rowan (1967).

Aeromagnetic maps also exist for the area, but these are difficult to interpret in terms of depth to Adelaidean or Cambrian bedrock due to the lack of magnetic susceptibility contrast, let alone to horizons within the Cainozoic succession.

Exploration for suitable structures in the Northern Adelaide Plains for underground gas storage began with a seismic reflection survey in the Port Gawler-Two Wells area in July, 1964. The results of this survey as well as several short reflection traverses completed in 1959 are presented in a report by Seedsman (1967). In particular, one event was correlated extensively and interpreted as originating from the bedrock surface. The contoured map of this event, converted to depth, shows a bedrock high north and east of Lower Light at a depth of about 150 m below MSL. The deepest section found was near Port Gawler where depths were of the order of 340 m below MSL. Reflections originating from within the Tertiary succession were not extensive, but those recorded showed gentle southerly dips and a wedging of the lower part of the succession against the bedrock ridge in the north. Seedsman concluded that the Tertiary sediments were little disturbed by folding or faulting.

A stratigraphic borehole, Light No. 1 was drilled 3 km south of Lower Light in conjunction with this survey to provide geological control for the seismic interpretation. The well completion report (Cornish, 1964) should be read in conjunction with Lindsay (1969) and Cooper (1977a, b) who have revised the stratigraphy. A detailed gravity survey over the area was recommended to define the bedrock configuration, but was never carried out.

RECENT GEOPHYSICAL INVESTIGATIONS

A. GRAVITY SURVEY, DECEMBER 1975

Interest in the project was renewed in December, 1975, and as a result J. McG. Hall conducted a gravity survey between Mallala and Wasleys, to examine a closed positive anomaly indicated by a regional gravity survey. Also he specifically investigated the possibility of this anomaly being caused by a structure within the Tertiary succession suitable for gas storage. The data confirmed the presence of the anomaly and detailed its extent. However, the cause of the anomaly was interpreted as an uplifted block of Adelaidean bedrock on the eastern side of a north-south trending fault (considered to be the Redbanks Fault), covered by a thin layer of Cainozoic sediments. This structure was therefore unsuitable as a gas storage target. The throw of the fault was estimated at 200 to 250 m, with bedrock on the downthrown side covered by at least this thickness of Cainozoic sediments. B.E. Milton recommended further investigation in the area to examine the remote possibility of a confined Tertiary aquifer being trapped against this apparent fault.

B. RESISTIVITY PROBES, MARCH-MAY, 197

In March, 1976, R.G. Nelson carried out two electrical resistivity depth probes, MS1 being on the high, eastern side of the fault and MS2 on the low side (Fig. 3). The interpreted depth to bedrock on the low side was of the order of 130 to 160 m, and on the high side about 40 m. The resistivity of the sediments above bedrock averaged 6 ohm-metres at MS2, implying high porosity and saline water in these sediments. At MS1 the sediment resistivity was approximately 27 ohm-metres, indicating less saline water in the sediments, assuming similar or higher porosity due to the closer proximity to the source of the sediments.

D.C. Roberts continued the investigation in May, 1976.

Resistivity probes were spaced approximately 1.5 km apart along the traverse line east from the Calomba R.S. on which MS1 and MS2 had been located (Fig. 3). These probes, MS3 to MS8, together with MS1 and MS2 showed a basin-like section with bedrock highs in the east and the west, with the deepest bedrock 187 m below MSL at MS5. Interpretation at this stage indicated that the Redbanks Fault was a complex fault zone, rather than a single fault. Probes MS9 and MS10, a few kilometres to the north, confirmed the gravity interpretation of a basinal feature extending to the north.

C. SEISMIC SURVEYS, OCTOBER, 1976 - JANUARY, 1977

Further details on the Calomba line were obtained from a seismic refraction traverse in October, 1976. The velocity distribution interpreted from these data is shown in Table 1.

TABLE 1

VELOCITY DISTRIBUTION ALONG THE CALOMBA LINE

Layer	Velocity (m/s)	Thickness (m)	Rock Type
1	500-600	15-20	soil and clay
2	1700-1900	up to 200	water saturated sands and clays.
3	5 240	?	bedrock.

On the high side of the Redbanks structure there is a weathered bedrock layer with a velocity of 2770 m/s and a thickness of 15 to 20 m. If this layer is continuous into the deeper parts of the basin, it would form a seismic "hidden layer" which cannot be resolved by conventional first-break refraction analysis unless its thickness exceeds 100 m. Therefore, there is some uncertainty in depths to both weathered and unweathered bedrock because of this. Appendix I elaborates this point. Nevertheless, this bedrock highs in the east and the west, as shown in Fig. 5.

A seismic reflection test probe halfway along the refraction traverse on the Calomba line gave a moveout velocity of 1710 m/s and a depth to bedrock of 225 m which agrees with the refraction interpretation. Further test work on the east-west Pinery line in December, 1976 and the north-south Hermitage line in January, 1977 (Fig. 3), showed that the Tertiary-bedrock contact was an excellent reflector which could be easily mapped. On the Pinery line, bedrock depths and depths to a possible Tertiary reflector were calculated from field records. Part of the Hermitage line, designated SV-77-A, was processed by Seismograph Service (U.K.) Ltd. The resulting section suffers from lack of control of static corrections and the fact that only single-fold coverage was shot. However, it has been used to calculate depths to bedrock, together with calculations made from the field records where no processed time section exists. Figure 6 shows the results of these two traverses.

D. DETAILED GRAVITY SURVEY, DECEMBER, 1976

A gravity survey was carried out in December, 1976 by P. Williams and P. Hough to provide a more detailed picture of the basinal feature as indicated by the regional gravity data. The survey verified this picture and also indicated an apparent thickening of Cainozoic sediments to the north (Williams, 1977). However, quantitative interpretation was hampered by the poor quality of the data, limited geological control and variations in bedrock density. Modelling of the data in the area of the supposed Redbanks Fault indicated that this feature was either a series of step faults or of a monoclinal or erosional nature, in agreement with the seismic and resistivity evidence. Fig. 7 shows the Bouguer gravity contours of this survey but with dubious survey loops omitted and a Bouguer density of 2.0 g/cc used.

E. SEISMIC REFRACTION PROBES, FEBRUARY, 1977

In February, 1977, a series of refraction probes, R1 to R5 were carried out at scattered locations throughout the northern part of the area to provide bedrock depth control for the gravity interpretation (Fig. 3). Table 2 summarises the results of these probes.

TABLE 2

DEPTHS TO BEDROCK INTERPRETED FROM REFRACTION PROBES R1 TO R5

Probe	Line End	Bedrock Depth (m below MSL)	Line End	Bedrock Depth (m below MSL)
R1	E	129	W	150
R2	NE	73	SW	67
R3	N	45	S	61
R4	NW	62	SE	84
R5	N	14	S	42

The apparent thickening of the Cainozoic section to the north indicated by the gravity contour map (Fig. 7) conflicted with the thinning indicated by these probes. This indicates that the density of either the Cainozoic sediments or, more probably, the bedrock decreases towards the north. Thus, further quantitative interpretation of the gravity data would require a knowledge of density distribution within the bedrock and probably to a lesser extent, the Cainozoic sediments, if erroneous results were to be avoided.

Integration of all these data including the sparse amount of borehole information available in and around this area was made at this stage by R.G. Nelson, and a preliminary bedrock topography contour map was constructed. The picture that emerged was one of a basinal structure flanked by bedrock highs to the east and west with an overall gentle southerly dip. This basinal feature was called the Barabba Gravity Low, after Barabba Hill in the north of the area.

F. SEISMIC REFRACTION SURVEY, MAY 1977

With the Barabba Gravity Low defined and the possibility of it containing confined Tertiary aquifers, drilling was recommended to examine the possibility of storing gas within an aquifer. Between March and June, 1977, seven holes were drilled in the area, the results of which are discussed later in this report.

During the drilling programme in May, 1977, a seismic refraction survey was carried out by C.D. Cockshell in the northeastern part of the area to test for closure to the north (Fig. 3). Three traverses were made, R6 to R8, with R7 being shot over Barabba No. 5 borehole so as to give geological control to the interpretation (Hawkins, 1961). The interpreted depth sections are shown in Fig. 8. Line R6 shows the general trend of a bedrock high in the west gradually deepening to the east with the bedrock contact appearing similar to an erosional surface. There appears to be a slightly higher relief in the zone with bedrock velocity 4130 m/s which indicates a possible change of rock type into material more resistant to erosion but with a lower seismic velocity. Line R8 shows a thicker Cainozoic section in the north and a generally flat lying bedrock contact to the south, indicating that the Barabba Gravity Low has a more pronounced northwest-southeast trend component in its northern extremity (Fig. 3). At the cross-over point of lines R6 and R8 there seems to be possible velocity anisotropy associated with the edge of the western bedrock high. Bedrock in all holes was siltstone except in Barabba No. 4 where an arkose was encountered. This suggests that a possible major structural feature may be present along the eastern edge of the western bedrock high. If such a north-south feature exists, one would expect seismic velocities parallel with it to be higher than those perpendicular to it. Such anisotropy may be indicated by bedrock velocities along line R8 being greater than those along R6.

G. SEISMIC REFLECTION SURVEY, JUNE 1977

In June, 1977, an experimental seismic reflection survey was carried out by R.G. Nelson on the east-west road south of Mallala on which Barabba No. 7 was located (Fig. 3). The records of this SV-77-B line were processed by Seismograph Service (S.A.). Pty. Ltd. The processed time section and interpreted depth section are shown in Fig. 9. The section shows an excellent reflector at the top of the bedrock and possible minor reflectors within the Tertiary which are probably siliceous or calcareous cemented units. East of Barabba No. 7 there appears to be an erosional channel cut into the bedrock. Along the section the bedrock appears to be undulatory and to have the appearance of an erosional surface.

H. SUMMARY OF RESULTS

The Barabba Gravity Low is bounded by the Redbanks Fault in the east, a probable major north-south tectonic zone in the west and is separated from the Northern Adelaide Plains Proclaimed Region by an east-west bedrock ridge. The northern margin is difficult to define as the bedrock slopes gently upward in this direction but an east-west fault south of Balaklava probably separates this area from the Whitwarta coalfield in the north. The trough-shaped feature investigated was apparently initiated by relative downthrow of bedrock along the Redbanks Fault and the major tectonic zone in the west. The surface of the bedrock has been eroded probably prior to the faulting while the fault scarps have been eroded afterwards. The trough was then infilled by Cainozoic sediments which appear to have been little deformed after deposition.

DRILLING AND GEOPHYSICAL LOGGING

A. GENERAL

Between March and June, 1977, seven fully cored holes were drilled by the South Australian Department of Mines Mechanical and Drilling Branch in the Barabba Gravity Low area. The purpose of the drilling programme was to ascertain the reservoir properties of aquifers in the region, the suitability of overlying units as gas impervious seals, to examine for lateral closure of these aquifers, and to provide geological control for geophysical intepretation.

Barabba No. 1 was drilled in the deepest part of the structure as indicated by geophysical evidence. This was done to verify the maximum depth of the structure and to obtain the most complete Tertiary section for the area. Barabba Nos. 2 and 3 were positioned to examine the eastern margin of the structure in the vicinity of the Redbanks Fault. Barabba Nos. 4 and 5 were sited to explore the northern and northwestern margins, and Barabba Nos. 6 and 7 the southern and southeastern part of the structure.

B. DRILLING OPERATIONS

Barabba No. 1 was spudded on 4th March, 1977, and the rig was released from Barabba No. 7 on 16th June, 1977. The total programme time was therefore 105 days (15 weeks), of which there were 52 days of actual drilling.

A total of 913.8 m were drilled in the programme including 139.5 m of rotary drilling and 774.3 m of HQ coring. 591.0 m of 61.1 mm diameter core were recovered, giving a recovery of 76.3%. The low recovery was due to the poorly consolidated and very sandy and gravelly nature of most sections. Progress rates were 17.6 m per day for actual drilling time and 8.7 m per day for total programme time.

For most holes, the target depth to bedrock interpreted from seismic data was deeper than that encountered during the drilling. This is attributed to the presence of a 5 to 25 m thick weathered bedrock zone which forms a seismic "hidden layer" (Appendix I).

Barabba Nos. 1 to 5 were completed as water observation bores with 1 m screens set at the cleanest part of the main aquifer of each hole as indicated by the geophysical logs. In Barabba No. 6 the screen was dropped, and subsequent fishing operations proved unsuccessful: the hole was therefore plugged and abandoned. Barabba No. 7 was plugged and abandoned. Additional well data are presented in Appendix II.

C. FORMATION SAMPLING

All holes were rotary drilled from the surface to approximately 20 m with chip samples being collected and preserved for each 2 m interval. All holes were then continuously cored to total depth using a Longyear HQ triple tube wireline core barrel. Due to the unusual nature of the bedrock in Barabba No. 4, HQ double tube diamond drilling was used to core more of the very hard bedrock. The diamond bit was also needed to drill the siliceous Gull Rock Member equivalent in Barabba Nos. 5 and 7. In zones of core loss, sludge samples were often collected and preserved with the core. All core, sludge and chip samples are stored at the South Australian Department of Mines Core Library.

Some poor quality water samples were collected by air lifting during the programme, but better samples were collected by pump testing and bailing after the drilling programme was completed.

D. GEOPHYSICAL LOGGING

All holes were geophysically logged by the South Australian Department of Mines. The three logging units used were the Failing Logmaster 6 000 foot model, the Failing Logmaster 3 000 foot model, and the Neltronic 300 metre model. The geophysical logs run during the drilling programme are shown in Table 3.

Electric logs were not run in Barabba No. 6 as the hole collapsed after removal of the drill rods, through which the nuclear logs were run. Density logs were not run in Barabba Nos. 2 to 4 as the probe was not available at the time of

TABLE 3

GEOPHYSICAL LOGS RECORDED

Log Recorded	Barabba Hole No. 1	2	3	4	5	6
Gamma Ray	X	X	X	X	X	X
Neutron-neutron	X	X	X	X	X	X
Gamma-gamma (Density)	X				X	X
Self Potential (S.P.)	X	X	X	X	X	
Point Resistance (P.R.)	X	X	X	X	X	
16" Normal Resistivity	X	X	X	X	X	
64" Normal Resistivity	X	X	X	X	X	
6' Lateral Resistivity	X	X	X	X	X	
Caliper	X		X		X	
Temperature		X	X			

the logging. Caliper logs were difficult to obtain due to premature opening of the arms, caused by washouts and obstructions triggering the release mechanism. Temperature logs were rarely run due to probe malfunctions, insufficient available logging time and poor quality of the records due to stirring of the mud column by the other probes. (The temperature log was run after the other logs, contrary to accepted practice, due to the importance of obtaining electric log information and the very unstable nature of most holes).

An uphole seismic velocity survey was carried out at Barabba No. 1 using an S.I.E. P19 seismic recorder and a Mark Products 3-inch well geophone. Records were obtained at 25 m intervals from 134 m upwards. Mudcell resistivity tests were performed for all holes except Barabba No. 6.

STRATIGRAPHY

A. INTRODUCTION

The Cainozoic geology of the Mallala/Barabba area of the St. Vincent Basin has been little studied. Outcrop in the region is limited and a few investigations of the subsurface geology as revealed by drilling had been undertaken prior to the present work.

The area adjoins the northern end of the region studied intensively by Lindsay (1965, 1967b, 1969) as part of the groundwater investigation of the Northern Adelaide Plains. It lies south of the Inkerman Coalfield, which has been studied in detail by Meyer (1976) and reassessed stratigraphically by Cooper (1977a).

The only outcrop of pre-Quaternary strata in the area occurs on the banks of the Light River, 5 km east of Mallala. This was described and illustrated by Howchin (1912) and was subsequently investigated by Ludbrook (1957, 1959) and Lindsay (1969). A preliminary account of the Quaternary geology west of Mallala was provided by Walker (1968, 1969) with preliminary mapping of the Dublin 1:63 360 sheet. The surface geology east of Mallala was mapped by Dickinson and Coats (1957). Figure 4 shows the surface geology of the area.

B. STRATIGRAPHIC NOMENCLATURE

The stratigraphic units recognised in the Mallala-Barabba area during this investigation are, from youngest to oldest:

Post-Miocene Units	(?Pliocene-Recent)
Port Willunga Formation	(Oligocene-Early Miocene)
Ruwarung Member	
Rogue Formation	(Late Eocene)
Gull Rock Member equivalent	
Clinton Formation	(Late Eocene)
Bedrock	(?Cambrian-Precambrian)

Fig. 10 shows that the late Eocene to early Miocene strata in this area can be compared with formally defined units found elsewhere in the St. Vincent Basin.

The stratotypes of most Tertiary stratigraphic units in the St. Vincent Basin occur in the Willunga Embayment (Reynolds, 1953; Lindsay, 1967a; Cooper, 1977b) and on Yorke Peninsula (Stuart, 1970; Harris, 1966) and the stratigraphic units used for the Tertiary in this report originate from these areas.As the Mallala-Barabba area is some distance from the type areas, this region is one of nomenclatural overlap between the Eocene-Miocene stratigraphic units proposed for the Yorke Peninsula on one hand and the Willunga Embayment on the other. This problem is further aggravated by the apparent absence of most of the thin lithostratigraphic marker horizons (viz. Tortachilla Limestone, Chinaman Gully Formation, Port Julia Greensand, Throoka Silts) known in the St. Vincent Basin.

The siliceous unit of Oligocene age recorded in Barabba Nos. 1, 6 and 7 is most difficult to assign to an appropriate stratigraphic unit. Siliceous beds were described by Stuart (1970) from stratotype Rogue Formation, and were assigned to this unit in the Inkerman Coalfield (Cooper, 1977a). However, in the present investigation they have been assigned to the siliceous Ruwarung Member of the Port Willunga Formation (Cooper, 1977b). This decision results from the nearby identification of the Ruwarung Member in the Dublin area (Lindsay, 1967b), and because it is convenient to recognise the significant lithological change near the base of this interval as the boundary between the Ruwarung Member (above) and the Rogue Formation (below).

The post-Miocene units have not been assigned to formally defined units found elsewhere in the St. Vincent Basin as it is difficult to separate lithologies. However, it is suggested that an upper clayey zone is comparable to the Hindmarsh Clay (early Pleistocene age) and a lower sandy zone may be compared with the Carisbrooke Sand (?Plio-Pleistocene age).

Fig. II shows the spatial distribution of the units recognised from the drilling.

C. DESCRIPTION OF STRATIGRAPHIC UNITS

Composite well logs for Barabba Nos. 1 to 7 are presented in Appendix III and core log descriptions in Appendix IV. A palaeontological report forms Appendix V.

(1) Bedrock

The bedrock is an indurated laminated siltstone in all holes except Barabba No. 4. Barabba No. 7 was not drilled to bedrock. In Barabba Nos. 1, 2, 3, 5 and 6, up to 22 m of brown-grey clayey laminated siltstone characterise the weathered zone while the underlying unweathered zone comprises less clayey, sandy blue/grey laminated siltstone. The rock is commonly micaceous and pyritic and has rare quartz veins. The laminations are less than 1 mm thick, vary in dip from subhorizontal to 80^{o} and are commonly slightly crenulated by a strong cleavage. Rare nodular siderite concretions are present in some holes. The correlation of this unit with the Precambrian of the Adelaide area is uncertain. The fine laminations suggest Tapley Hill Formation but the lithology is also similar to parts of the River Wakefield Sub-group (Forbes B.G., pers. comm., 1977).

The bedrock in Barabba No. 4 is a pinkish grey, very coarse arkose with an interbed of green pebbly diamictite. The upper weathered arkose is greenish grey, very clayey, rich in pink feldspar and very coarse grained. Vertical streaks of carbonaceous material indicate the presence of Tertiary root systems within the bedrock. The interbedded diamictite is a fine grained green sandstone with sparsely scattered quartz and pink feldspar pebbles and common pyrite. The fresh arkose comprises rounded to subangular very coarse sand to pebble sized grains of pink and white feldspar and quartz with a green mineral, probably chlorite. A weak bedding plane at 35^{o} to the core axis is present. The stratigraphic position of this unit is also uncertain, but it is suggested to be part of the Appila Tillite, derived from a granitic basement (Forbes B.G., pers. comm., 1977).

(2) Clinton Formation

Black/brown carbonaceous silty sands and sandy silts interbedded with thin bands of clayey lignite characterise this unit. It is commonly micaceous, pyritic and has an abundance of fossil plant remains.

The formation is thickest in the south and west, but wedges out eastwards towards the Redbanks Fault. It is absent in Barabba Nos. 2 and 3 where it was probably not deposited while the thickest intersection recorded is 56 m in Barabba No. 1. Where present this unit unconformably lies on bedrock. Barabba No. 7 was not drilled deep enough to intersect this formation.

(3) Rogue Formation

This formation comprises grey silty sands often grading to clayey silts down section with rare clays near the base. It is carbonaceous, glauconitic and commonly calcareous, while pyrite and mica are common in most sections.

The occurrence of marine fossils is sporadic, although sponge spicules are common and turretted gastropods are often encountered. Diagenetic leaching of the carbonate content has taken place in some sections where only moulds and casts of the calcareous fossils are evident. The unit has been strongly bioturbated giving rise to a mottled appearance. In Barabba Nos. 5 and 7, a hard cemented sandstone occurs which is probably equivalent to the Gull Rock Member of the Blanche Point Formation.

Apparently the formation was not deposited over the Redbanks Fault scarp in the east as indicated by its absence in Barabba No. 2. In the remaining holes the Rogue Formation varies in thickness from 5 m to 24 m, being greatest in the central and southern parts of the trough.

The base of the Rogue Formation is marked by the down-hole change from glauconitic, calcareous, bioturbated dark grey sandy silts, to the brown/black very carbonaceous silty sands of the Clinton Formation.

(4) Port Willunga Formation

The Port Willunga Formation comprises calcareous sands and silty sands with common hard calcareous and siliceous cemented bands at the base of the formation. The formation is predominantly green, but may be fawn or yellow where limonitic It is richly glauconitic and fossiliferous. The clay and silt content gradually increases towards the base, with a subsequent decrease in gravel and grit content. The sands are mainly fine grained but become coarse towards the east (Barabba Nos. 2 and 6), as the margin of the depositional basin is approached.

At the base of the formation in holes No. 1, 6 and 7, a series of hard silicified bands represents a marginal development of the Ruwarung Member in the area.

The formation thickens to the south and west, being 58 m thick in Barabba No. 7 and absent in Barabba No. 5. Consequently the northern part of the area includes the margin of the depositional basin or an area where erosion has removed the unit. The Redbanks Fault appears to have little effect on the spatial distribution of the Port Willunga Formation in this area.

The Rogue/Port Willunga Formation contact is generally sharp and is recognised in this study by the first uphole occurrence of siliceous/chert nodules characteristic of the Ruwarung Member of the Port Willunga Formation, or by the rapid upsection change into richly fossiliferous, markedly calcareous silty sands having a green, fawn or yellow colour.

(5) Post-Miocene Succession

A thin, 30 cm bed of fossiliferous Late Pliocene Hallett Cove Sandstone is known from a small outcrop 5 km east of Mallala (Ludbrook, 1959). However, only unfossiliferous Post-Miocene strata were obtained in the bores drilled during this investigation.

Lithologically, the sediments found in the borehole sections are orange silty sands grading to mottled red-brown and grey clays upsection. The lower sands are possibly part of the ?Plio-Pleistocene Carisbrooke Sand while the upper clays are probably referable to the Hindmarsh Clay of early Pleistocene age. Most sandy layers are micaceous and limonitic, contain common granules and pebbles and are unconsolidated. The clays are more consolidated but commonly well fractured with slickensides on joint surfaces.

The Post-Miocene succession forms a 50 to 70 m blanket over the entire area, the lower sands being 10-20 m thick and the upper clays 40-60 m thick.

The base of the Post-Miocene succession is clearly marked by the abrupt downward change to fossiliferous calcareous silty sands of the Port Willunga Formation which are glauconitic in most sections.

D. SUMMARY OF BOREHOLE SECTIONS

(1) Barabba No. 1 - Stratigraphic Summary

Age	Stratigraphic Unit	Top (m)	Base (m)	Thickness (m)
Post Miocene		0	64.0	64.0
Early Miocene - Oligocene	Port Willunga Formaation	64.0	92.0	28.0
	Ruwarung Member	90.2	92.0	1.8
Late Eocene	Rogue Formation	92.0	111.5	19.5
Late Eocene	Clinton Formation	111.5	167.6	56.1
Cambrian/ Precambrian		167.6	+187.0	+19.4

(2) Barabba No. 2 - Stratigraphic Summary

Age	Stratigraphic Unit	Top (m)	Base (m)	Thickness (m)
Post Miocene		0	53.0	53.0
Early Miocene - Oligocene	Port Willunga Formation	53.0	79.7	26.7
Cambrian/ Precambrian		79.7	+88.8	+9.1

(3) Barabba No. 3 - Stratigraphic Summary

Age	Stratigraphic Unit	Top (m)	Base (m)	Thickness (m)
Post-Miocene		0	63.2	63.2
Early Miocene - Oligocene	Port Willunga Formation	63.2	81.6	18.4
Late Eocene	Rogue Formation	81.6	105.8	24.2
Cambrian/ Precambrian		105.8	+128.8	+23.0

(4) Barabba No. 4 - Stratigraphic Summary

Age	Stratigraphic Unit	Top (m)	Base (m)	Thickne (m)
Post-Miocene		0	54.9	54.9
Early Miocene - Oligocene	Port Willunga Formation	54.9	59.4	4.5
Late Eocene	Rogue Formation	59.4	65.0	5.6
Late Eocene	Clinton Formation	65.0	76.4	11.4
Cambrian/ Precambrian		76.4	+95.2	+18.8

(5) Barabba No. 5 - Stratigraphic Summary

Age	Stratigraphic Unit	Top (m)	Base (m)	Thickne (m)
Post Miocene		0	53.6	53.6
Late Eocene	Rogue Formation	53.6	66.3	12.7
	Gull Rock Member equivalent	62.5	66.3	3.8
Late Eocene	Clinton Formation	66.3	77.5	11.2
Cambrian/ Precambrian		77.5	+99.7	+22.2

(6) Barabba No. 6 - Stratigraphic Summary

Age	Stratigraphic Unit	Top (m)	Base (m)	Thickne (m)
Post Miocene		0	60.2	60.2
Early Miocene - Oligocene	Port Willunga Formation	60.2	104.6	44.4
	Ruwarung Member	97.6	104.6	7.0
Late Eocene	Rogue Formation	104.6	122.1	17.5
Late Eocene	Clinton Formation	122.1	142.9	20.8
Cambrian/ Precambrian		142.9	+162.8	+20.2

(7) Barabba No. 7 - Stratigraphic Summary

Age	Stratigraphic Unit	Top (m)	Base (m)	Thickness (m)
Post Miocene		0	72.1	72.1
Early Miocene - Oligocene	Port Willunga Formation	72.1	130.8	58.7
	Ruwarung Member	119.3	130.8	11.5
Late Eocene	Rogue Formation	130.8	+151.2	+20.4
	Gull Rock Member equivalent	149.2	+151.2	+2.0

E. PETROGRAPHIC EXAMINATION OF CORE SAMPLES

Eleven core samples were submitted to the Australian Mineral Development Laboratories for petrographic examination. The samples were selected in an attempt to represent the major rock types of the main stratigraphic units. The report of this work forms Appendix VI.

Although there is generally good agreement between the petrography and the core logging (Appendix IV), there is some discrepancy in the identification of the very fine grained mineral components. Therefore, before the major rock types are reclassified, further work is necessary on a larger selection of samples.

UNDERGROUND GAS STORAGE APPRAISAL

A. INTRODUCTION

In the Northern Adelaide Plains Proclaimed Region, there are three main aquifers, designated Aquifers A, B and C (Hydrogeology Section, 1968), which are defined as follows. Aquifer A comprises the Carisbrooke Sand/Hallett Cove Sandstone/Dry Creek Sand and the middle Miocene Port Willunga Formation confined by the overlying Hindmarsh Clay. Aquifer B is that part of the Port Willunga Formation which is confined by the Munno Para Clay Member of this formation, and Aquifer C is the

Maslin Sands/Clinton Formation confined by the Blanche Point Formation. A similar overall scheme was expected for the Mallala/Barabba area.

Drilling in the Barabba Gravity Low region has shown that the Munno Para Clay Member is absent in the area, thus there is no separation between Aquifers A and B. This single combined aquifer, hereby designated Aquifer A-B, comprises the ?Carisbrooke Sand and the Port Willunga Formation overlain by the Hindmarsh Clay. Aquifer C comprises the Clinton Formation overlain by a sandy equivalent of the Blanche Point Formation referable to the Rogue Formation.

B. CALCULATION OF RESERVOIR PROPERTIES

The two most important gas reservoir properties besides physical dimensions are porosity and permeability. In this investigation drill core analysis and electrical geophysical logs (supplemented by visual estimation) have been used to estimate typical values of porosity and permeability for each unit.

The nuclear geophysical logs run in the holes, gamma-gamma and neutron-neutron, are uncalibrated at present and therefore cannot be used quantitatively. Observation bores Barabba Nos. 1 and 2 were pump tested for hydrological work. However, the data obtained from these tests appear difficult to interpret in terms of aquifer permeability, and therefore are not used in this context.

Eleven core samples submitted for petrographic examination by the Australian Mineral Development Laboratories were also analysed for porosity and permeability. The results of these analyses are included in Appendix VII.

Porosity estimates have also been derived from the electric logs of the drillholes. A standard Schlumberger interpretation method was used (Schlumberger, 1972a, 1972b). Calculations were only made for thick clean sands in each unit so as to reduce clay content and bed thickness effects on the S.P. and resistivity logs. However, the accuracy of these calculations is expected to be low due to:

1. lack of a resistivity tool to measure the mud invasion zone characteristics;
2. difficulty in assigning a "clay-line" to each S.P. log;
3. broad assumptions used in the interpretation; and
4. assumptions used in the interpretation method.

C. INVESTIGATION OF AQUIFER A-B

As the ?Carisbrooke Sand collected during the drilling programme was unconsolidated, no samples were submitted for analysis. Also, loss of electric log information on this unit occurred in most holes due to casing of holes. However, one log evaluation of porosity was possible for a gravelly bed in Barabba No. 4. The value obtained was 52% which agrees with the visually estimated 35-45%, considering that gravelly beds will tend to have higher porosities than the sands normally encountered. The permeability of this unit is expected to be high as it is generally unconsolidated silty fine to medium sands. However, intercalations of clays and silts in many sections would reduce both the porosity and permeability of the unit as a whole.

Porosities for the fossiliferous sands of the Port Willunga Formation range from 22-28% (derived from electric logs) but increase up to 50% in the porous fossiliferous limestones. The porosities of the cemented bands varies with cement content from 1.3-14% (electric logs). However, a porosity of 20-30% seems to be typical of the unit as a whole. As seen in Appendix VII, the permeability of this unit varies from very high in the porous units to extremely low in the cemented bands. Overall, the Port Willunga Formation has high to very high permeability, even though grain size decreases with depth. Thus, for Aquifer A-B as a whole, a porosity of 25-35% is expected along with a high permeability.

The thickness of this aquifer varies from 10 m in the north to over 70 m in the south and is overlain by 20 to 50 m of Hindmarsh Clay. This clay appears to be moderately indurated although core analysis indicates a porosity of 29.9%. The core analysis of permeability appears to be very high but this may be partly explained by the presence of a well developed system of slickensides and that gas movement through such material would probably be greater than water movement. Dessication of the core during transport may also have affected the results. The presence of common intercalations of sands and gravels, especially to the north, would also increase the permeability.

As the depth to the base of the Hindmarsh Clay is less than 60 m, the effective confining thickness of this unit will often be affected by topography.

D. INVESTIGATION OF AQUIFER C

The Clinton Formation in this area is up to 56 m thick in Barabba No. 1, and is similar in reservoir properties to the Maslin Sands in the Willunga Embayment. Porosities of 19-23% for clean sands have been derived from the electric logs, but the lignitic and clayey nature of most of the sections indicates that 15-20% would be more acceptable for the unit as a whole. From core analysis a moderate to high permeability could be expected for this aquifer.

The sandy nature of the Rogue Formation reduces its suitability as a confining bed for the underlying Clinton Formation. Core analysis gives a porosity of 46% for one sample of the Rogue Formation but this appears high considering the moderate permeability of the sample and its petrographic description. Electric logs indicate a porosity of 24% for a clean sand zone but an average of 10-20% is expected for the whole unit. The permeability of the unit is moderate, decreasing towards the south of the area due to decreasing grain size. The presence of the cemented Gull Rock Member equivalent in some sections will reduce the overall porosity and permeability of this unit. In the centre of this area the Rogue Formation is up to 24 m thick.

E. OTHER POSSIBLE RESERVOIRS

The possibility of gas storage in sand and gravel lenses within the Hindmarsh Clay was also considered but due to their very shallow depth (less than 40 m) and small storage capacity, they were not investigated.

The possible use of clay, lignite and cemented interbeds within the Tertiary succession as confining beds was also examined. However, as they are thin (generally less than 4 m) and have variable lateral extent, effective vertical sealing and lateral closure would not be achieved.

F. LATERAL CLOSURE

The well-indurated siltstone comprising the fresh bedrock, as well as the granitic arkose in the western part of the area, is characterized by very low porosity and permeability. Core analysis indicates that the overlying weathered bedrock zone, up to 22 m thick, has a high porosity and a moderately high permeability. However, desiccation of the core during transport may have seriously affected the analytical results. The target for lateral closure in this investigation was the overlapping of an upper confining bed onto bedrock, thus wedging out the reservoir bed.

Closure of the Hindmarsh Clays against bedrock to the east is doubtful due to the outcropping of Pliocene sands east of the Redbanks Fault, indicating substantial thinning of the Hindmarsh Clays in that direction. Similar doubt must also be placed on the northern closure, where the clays become heavily intercalated with sands and gravels, as shown in Barabba Nos. 4 and 5. Closure to the north is important due to the general southerly dip of the bedrock in this area (Figure II).

Eastern closure of the Clinton Formation is very good in terms of overlap of the overlying Rogue Formation onto bedrock. As shown in Fig. II the northern closure does not appear to be so good as there is apparent simultaneous thinning of all Tertiary units in this direction. However, the actual confining properties of the Rogue Formation are poor which discriminates against the use of the Clinton Formation as a gas storage zone.

LIGNITE DEPOSITS

A. GENERAL

The Clinton Formation in the St. Vincent Basin is characterised by carbonaceous sediments and common lignite seams. In the northern St. Vincent Basin these lignite seams are thick enough and shallow enough to be considered economic deposits (Clinton, Whitwarta and Inkerman coalfields).

B. DRILLING RESULTS

Lignite seams 0.5 to 1.3 m thick were intersected in Barabba Nos. 1, 4 and 6 (Table 4). No lignites were intersected in Barabba Nos. 2 and 3 as the Clinton Formation was probably not deposited in their vicinity. Lignite seams were not recorded in Barabba No. 5, but very carbonaceous

TABLE 4

LIGNITE SEAM INTERSECTIONS

Hole Barabba No.	Lignite Intersection from (m)	to (m)	Thickness (m)	Cumulative Thickness (m)	Overburden/ Cumulative Thick Ratio
1	115.1	115.6	0.5		
1	130.0	130.6	0.6		
1	132.6	133.3	0.7	1.8	64
4	65.0	66.3	1.3	1.3	50
6	122.1	122.7	0.6		
6	132.2	132.8	0.6	1.2	102

sands with abundant plant remains indicate the proximity to the margin of vegetation accumulation. Barabba No. 7 was not drilled deep enough to intersect the Clinton Formation.

The presence of a seam in Barabba No. 4 suggests possible continuity of the lignite seams across the basement high from the Inkerman coalfield into the Barabba Gravity Low. However, the much thinner seams in the Barabba area indicate a much less favourable environment for vegetation accumulation than the Inkerman area. Lignites in the Barabba area are best developed in the deeper sections and generally thin towards the south.

Two lignite samples were analysed by the Australian Mineral Development Laboratories and the results are included in Appendix VII. These results are typical of South Australia Tertiary lignites and are similar to those of the Inkerman and Clinton coalfields, except for their low sodium and ash content and low sodium/ash ratio. These results are also similar to those obtained from Leigh Creek lignites although the sulphur content is higher.

These lignite seams are believed to extend over an area of 200 sq km which indicates that 350 million tonnes of lignite are present in the Barabba Gravity Low. However, the thin nature of these lignite seams and their high overburden/cumulative thickness ratios make them uneconomical at present.

UNDERGROUND WATER RESOURCES

A. INTRODUCTION

In the area covered by the investigation there is very little use of underground water, probably due to the lack of information available on this resource. Therefore special consideration was given during the investigation to the exploration for usable underground water. The main aquifers in the region were expected to be similar to those in the Proclaimed Region of the Northern Adelaide Plains (Hydrogeology Section, 1968) and have been defined in previous sections of this report.

B. DRILLING RESULTS

The drilling confirmed a similar hydrogeological environment in the Mallala/Barabba area to that known from regions further south. However, there is no separation between Aquifers A and B in this area which causes the formation of a single Aquifer A-B. Aquifer C is similar to that known in areas to the south. The porosities and permeabilities of the aquifers and their confining beds have been discussed in previous sections of this report. Therefore, this section will mainly be concerned with the pump and bailer testing of the holes drilled during the investigation.

Of the seven holes drilled, Barabba Nos. 1 to 5 were completed as observation bores, details of which are shown in Table 5, while Barabba Nos. 6 and 7 were plugged and abandoned.

TABLE 5

SCREEN PLACEMENT IN OBSERVATION BORES

Barabba Hole	Depth to Screen From(m)	To(m)	Aquifer	Stratigraphic Unit
No. 1	118.53	119.53	C	Clinton Formation
No. 2	75.60	76.60	A-B	Port Willunga Formation
No. 3	62.61	63.61	A-B	?Carisbrooke Sand
No. 4	74.04	75.04	C	Clinton Formation
No. 5	65.00	66.00	-	Rogue Formation

On completion of each observation bore, the screen area was developed by water circulation and air lifting. Samples collected on completion of this operation were analysed for salinity by the electrical conductivity method. After several months, pump tests were carried out on Barabba Nos. 1 and 2 and bailer tests were carried out on Barabba Nos. 3 and 5. The salinity analysis of samples collected on completion of these tests as well as those from the air lifting operation are presented in Table 6.

The results of full chemical analysis of the final samples from Barabba Nos. 1, 2 and 5 are displayed in Appendix VII. The very high salinity of 12 618 mg/l in Barabba No. 1 indicates that Aquifer C would be too saline to exploit for most purposes. However, the airlift sample from Barabba

TABLE 6

SALINITY TEST RESULTS

Barabba Hole	Air Lift Samples Salinity (mg/l)	pH	Pump/Bailer Test Samples Salinity (mg/l)	p
No. 1	10 936	7.8	11 924	6.
No. 2	2 143	8.5	2 397	7.
No. 3	535*	7.6	3 444	10.
No. 4	2 297	8.1	-	-
No. 5	407	9.2	1 798	9.

Note: * denotes only one sample taken.

No. 4 shows a salinity of 2 297 p.p.m. which may indicate that the shallower parts of Aquifer C are much less saline than the deeper sections, and may even be fresh enough to be exploited for stock water. This situation may be compared to the eastern part of the Adelaide Plains, east of the Para Fault, where Aquifer C contains relatively shallow, fresh exploitable water.

The analysis for Barabba No. 2 indicates that water in the Port Willunga Formation has a salinity of 2 472 mg/l. Although Barabba No. 3 was not pump tested, bailing indicates a salinity of 3 444 p.p.m. for the ?Carisbrooke Sand. Therefore, by weighting the indicated salinities according to bed thickness, salinities in the order of 2 500 to 3 000 mg/l are expected for the Aquifer A-B. Such water could well be used for stock water for most animals. Although this water could also be used for irrigation of more salt tolerant pastures, the lack of drainage in the clay soils covering most of the area would cause rapid salt build-up in the soil.

The screen in Barabba No. 5 was placed in a partly silicified zone in the Rogue Formation, which may explain the relatively low salinity but very high pH of the sample analysed. The very low production rates expected for this unit would eliminate the possibility of exploiting it for any water production. In the less silicified parts of this unit, the clay content would cause similar low production rates.

The drawdown data obtained from the pump testing of Barabba No. 1 and 2 are difficult to interpret quantitatively, probably due to flushing of clay and silt material during the test. However, as the pumping rate was approximately 4.5 Kl/hr (1 000 gal/hr), it was estimated that a water production bore could produce at a rate of 7-9 Kl/hr (1500-2000 gal/hr) from both aquifers, A-B and C. It should be noted that the low production rates estimated from these tests may, in part, be due to the use of screens only 1 m long.

PALAEOGRAPHY AND TECTONIC HISTORY

The geophysical surveys and drilling carried out during this investigation have given a clear picture of the bedrock configuration of the Barabba Gravity Low. The eastern margin of this basinal feature is delineated by the Redbanks Fault, along which relative upthrust of the eastern bedrock high of approximately 200 m has occurred. The western bedrock high has a relative upthrow of approximately 80 m along what appears to be a major tectonic zone. The basinal feature is shallow in the north, separated from the Whitwarta coalfield by a probable east-west fault, and gently dips to the south where it is separated from the Proclaimed Region of the Northern Adelaide Plains by an east-west bedrock ridge.

Stratigraphic evidence from many areas in the St. Vincent Basin suggests that the first main period of faulting occurred during the earliest Tertiary, prior to the deposition of Cainozoic sediments. The Mallala/Barabba area is probably similar in tectonic history to most other areas in the basin, at least with respect to the main phase of faulting. The eroded form of the entire bedrock surface in this area suggests that a major river system was developed prior to the faulting. The trough-shaped nature of the feature and the apparent enlargement of river channels to the south, as indicated by processed seismic reflection sections, indicates that this river system matured from the north to the south. Subsequent to faulting, erosion of the upfaulted areas provided sediments to the downfaulted regions (i.e. the Barabba Gravity Low) during the late Eocene. This erosion was concentrated on the fault scarps and caused the reduction of relief across these faults (i.e. the Redbanks Fault). This is in contrast to other faults in the St. Vincent Basin (e.g. the Para Fault) where contemporaneous faulting and sedimentation has produced a marked fault scarp, as indicated by gravity profiles (Rowan, 1967).

Following early Tertiary faulting in this area, erosion continued to supply sediments to infill the trough. The Tertiary units (Oligocene and younger) overlapped the remnants of the fault scarps and the bedrock highs in the east and west with Quaternary sediments forming a blanket cover over the entire area. There appears to have been minimal deformation of the Cainozoic sediments after deposition, suggesting that probably only one phase of faulting has occurred in the area. This single phase of faulting is in contrast to some other areas of the St. Vincent Basin (e.g. Noarlunga and Willunga Embayments).

CONCLUSIONS

The drilling programme confirmed the existence of two, rather than three, gas storage targets in the Barabba Gravity Low: the absence of the aquiclude which separates Aquifers A and B in the Proclaimed Region of the Northern Adelaide Plains to the south results in a single, thick Aquifer A-B in this area. Aquifer C is similar to that known in the Proclaimed Region.

The porosity of Aquifer A-B is 25-35% and the permeability is expected to be high. However, the confinement of this aquifer by the overlying Hindmarsh Clay is not good. This is due to the apparent high porosity and gas permeability of this unit, the presence of common intercalations of sands and gravels, and the poor lateral closure against bedrock, especially to the east. Shallow depth to base and effects of topography also make this unit unsuitable as a confining bed. Therefore Aquifer A-B would not make a suitable underground gas storage zone.

Aquifer C has a porosity of 15-20% and a moderate to high permeability in this area, thus making it an attractive reservoir target. However, the moderate porosity, 10-20%, of the overlying Rogue Formation and its moderate permeability make this unit a poor confining bed for Aquifer C. Lateral closure of this aquifer to the east is good and a similar situation is expected to the west. However, the northern closure is more doubtful due to simultaneous thinning of all Tertiary units in this direction. Therefore, Aquifer C would also be unsuitable as an underground gas storage zone.

The drilling has shown that at least one lignite seam appears to be continuous from the Inkerman coalfield into this area, and that the composition of the lignites of both areas is similar. However, the seams are much deeper and thinner in this area, and therefore would be uneconomical in terms of mining.

Water salinities of 2500-3000 mg/l for Aquifer A-B indicate that stock water could be produced from this source. However, low production rates would necessitate slow pumping, such as windmill pumping. Although salt tolerant pastures could be irrigated with such water, lack of good drainage of the clay soils covering most of the area would cause rapid build-up of salt in the soil. Salinity of the order of 12 000 mg/l can be expected from the deeper parts of Aquifer C, which excludes exploitation of this water for most purposes. Where this aquifer becomes shallow, lower salinities can be expected, but water use would be restricted to stock water.

RECOMMENDATIONS

It is recommended that no further exploration for underground gas storage targets be carried out in the region of the Barabba Gravity Low. However, further testing of the groundwater quality from Aquifer A-B should be carried out to verify the results indicated by the limited testing done during this investigation. More work is needed to explore for shallow groundwater suitable for irrigation of the clay soils covering most of the area.

Future exploration for underground gas storage targets and Aquifer C be made the reservoir target. Reasons for this suggestion are:

1. sediments will become more typical of the Willunga Embayment sequence, thus the Blanche Point/Rogue Formations will be less permeable and make a more suitable confining bed for the Maslin Sands/Clinton Formation (Aquifer C);
2. probability that the bedrock ridge separating the area covered in this investigation from the Northern Adelaide Plains Proclaimed Area to the south will form a northern closure for the southerly dipping Aquifer C;
3. the Redbanks Fault will continue to the south and provide an easterly closure for Aquifer C;
4. possible presence of clays and sands beneath Aquifer C, thus providing a second reservoir target;
5. thicker Tertiary sections indicated by drilling and gravity data;
6. lack of use of Aquifer C as a water producer due to high salinity; and,
7. unfavourability of Aquifers A and B as reservoir targets due to shallow depth, doubtful lateral closure and high groundwater production.

The features essential for lateral closure which need detailing are the east-west bedrock ridge and the part of the Redbanks Fault lying south and east of this ridge. The intersection point of these two features will need to be closely studied as it is of paramount importance in lateral closure. Drilling would be required to evaluate reservoir and confining bed properties as well as to give geological control to geophysical interpretation.

BIBLIOGRAPHY

American Geological Institute, 1960 : Dictionary of Geological Terms. Dolphin Books, 545 p.

Bennett, C.J., 1970 : A Gravity Survey of portion of the ADELAIDE 1:250 000 Map Area. Mineral Resour. Rev. S. Aust. 128, pp. 99-103.

Bowering, O.J.W. and Selby, J., 1977 : Underground Water in the Adelaide Metropolitan Region. Mineral Information Series, S.A. Dept. Mines, 16 p.

Chattermole, A.J., 1977: Pocket Year Book of South Australia, No. 60. Australian Bureau of Statistics, Adelaide, 192 p.

Cooper, B.J., 1977a: Tertiary Stratigraphic Nomenclature in the Inkerman-Balaklava Coalfield. Q. geol. Notes, geol. Surv. S. Aust., 61, pp. 2-6.

Cooper, B.J., 1977b: New and Revised Stratigraphic Nomenclature in the Willunga Embayment. Q. geol. Notes, geol. Surv. S. Aust. 64, pp. 2-5.

Cornish, B.E., 1964: Light No. 1 - Well Completion Report. Unpublished Report S.A. Dept. Mines, Rept. Bk. 59/113.

Dickinson, S.B. and Coats, R.P., 1957: Kapunda 1:63 360 Geological Map Sheet. Geol. Surv. S. Aust.

Dobrin, M.B., 1960: Introduction to Geophysical Prospecting. McGraw-Hill, New York, 446 p.

Green, R., 1974 : The Seismic Refraction Method - A Review. Geoexploration V12, pp. 259-284.

Harris, W.K., 1966 : New and Redefined Names in South Australian Lower Tertiary Stratigraphy. Q. geol. Notes, geol. Surv. S. Aust. 20, pp. 1-3.

Hawkins, L.V., 1961 : The Reciprocal Method of Routine Shallow Seismic Refraction Investigations. Geophysics, Vol. XXVI, No. 6 (November, 1961), pp. 806-819.

Howchin, W., 1912 : On an outlier of older Cainozoic rocks in the River Light near Mallala. Trans. R. Soc. S. Aust., 36, pp. 14-20.

Hydrogeology Section, 1968 : Northern Adelaide Plains Groundwater Study to May, 1968. Vols. I and II. Unpublished Report S.A. Dept. Mines, Rept. Bk. 67/123.

Lindsay, J.M., 1965 : Stratigraphy and Micropalaeontology of three deep bores, Hundred Port Gawler. Unpublished Report S.A. Dept. Mines, Rept. Bk. 60/51.

__________, 1967a : Foraminifera and Stratigraphy of the type section of the Port Willunga Beds, Aldinga Bay, South Australia. Trans. R. Soc. S. Aust., 91, pp. 93-109.

__________, 1967b : Adelaide Plains Sub-Basin Stratigraphy and Micropalaeontology. Summary Report No. 4. Unpublished Report S.A. Dept. Mines, Rept. Bk. 64/6.

__________, 1969 : Cainozoic Foraminifera and Stratigraphy of the Adelaide Plains Sub-Basin, South Australia. Bull. geol. Surv. S. Aust. 42, pp. 1-60.

__________, and Bennett, J., 1973 : Tertiary Stratigraphy of three deep bores in the Waikerie area of the Murray Basin. Rep. Invest. Dept. Mines S. Aust. 38, pp. 1-33.

Ludbrook, N.H., 1957 : The Molluscan fauna of the Pliocene strata underlying the Adelaide Plains. Part IV Gastropoda (Turritellidae to Struthiolariidae). Trans. R. Soc. S. Aust. 80, pp. 11-58.

__________, 1959 : A widespread Pliocene Molluscan fauna with Anodontia in South Australia. Trans. R. Soc. S. Aust. 82, pp. 219-233.

Meyer, G.M., 1976 : Tertiary Brown Coal Deposits in the northern St. Vincent Basin, South Australia. Unpublished Report S.A. Dept. Mines, Rept. Bk. 796.

Parkin, L.W. (editor), 1969 : Handbook of South Australian Geology. Geol. Surv. S. Aust., Adelaide 268 p.

Reynolds, M.A., 1953 : The Cainozoic succession of Maslin and Aldinga Bays, South Australia. Trans. R. Soc. S. Aust. 76, pp. 114-140.

Rowan, I.S., 1967 : Gravity Survey of the Northern Adelaide Plains. Mining Review 120, pp. 132-137.

Schlumberger, 1972a : Log Interpretation Volume 1 - Principles. Schlumberger Ltd., New York, 113 p.

__________, 1972b : Log Interpretation Charts. Schlumberger Ltd., New York, 92 p.

__________, 1972c : The Essentials of Log Interpretation Practice. Services Techniques Schlumberger, France, 58 p.

Seedsman, K.R., 1967 : Reflection Seismic Survey - Northern Adelaide Plains, 1964. Mining Review 121, pp. 56-59.

Shepherd, R.G., 1968 : The hydrogeology of the Northern Adelaide Plains Basin. Mining Review 125, pp. 8-20.

__________, 1973 : The hydrogeology of the Northern Adelaide Plains Basin. Mineral Resour. Rev. S. Aust. 134, pp. 52-61.

__________, 1977 : Underground Water-Occurrence and Use in South Australia. Mineral Information Series, S.A. Dept. Mines, 16 p.

Sheriff, R.E., 1973 : Encyclopedic Dictionary of Exploration Geophysics. Society of Exploration Geophysicists, Tulsa, 266 p.

Stuart, W.J., 1970 : The Cainozoic stratigraphy of the eastern coastal area of Yorke Peninsula, South Australia. Trans. R. Soc. S. Aust. 94, pp. 151-178.

__________, and Von Sanden, A.T., 1971 : The Palaeozoic history and structural development of the St. Vincent Gulf and environs, South Australia; for Beach Petroleum. S.A. Dept. Mines open file env. 1899, unpublished.

Walker, N.C., 1968 : Preliminary report on the stratigraphy of the Dublin 1:63 360 map area. Unpublished Report S.A. Dept. Mines, Rept. Bk. 66/73.

__________, 1969 : Cobra Drilling in the Dublin and Vincent 1:63 360 areas. Unpublished report S.A. Dept. Mines, Rept. Bk. 68/84.

Williams, P., 1977 : Barabba Gravit, Survey Student Project. Unpublished Report S.A. Dept. Mines, Rept. Bk. 77/20.

APPENDIX I

EFFECT OF WEATHERED LAYER ON SEISMIC REFRACTION INTERPRETATION

Includes Figure 12: Time-Distance Graphs of Refraction Spread CAL10E (Drawing No. 78-106)

Effects of weathered layer on interpreted depths to bedrock from seismic refraction records

Generally, bedrock is easily recognised in drill core, even though it is weathered. However, weathering, even slight weathering, of the bedrock may affect the seismic velocity and cause problems in interpreting depth to bedrock where geological control is not available.

On the bedrock high east of the supposed Redbanks Fault it has been estimated from seismic refraction data that there is a zone of weathering some 15 to 20 m thick, with a velocity of 2 770 m/s overlying unweathered bedrock which has a velocity of approximately 5 000 m/s. Unless there is a sharp transition from weathered to unweathered bedrock, the velocity in the weathered zone will gradually increase to that of the unweathered bedrock. However, where the weathering zone exists, it is assumed that the velocity is constant throughout the zone and that the 2 770 m/s can be taken as an average velocity for this zone.

The effects of having a weathered layer as a hidden layer (Green, 1976) on a refraction interpretation in the deeper parts of the structure is clearly shown by the time-distance graph for CAL10E, a refraction probe shot along the Calomba line. Three layers are apparent in Figure 1(a) which correspond to velocities of 760 m/s (Quaternary sediments), 1 935 m/s (mostly Tertiary sediments) and 4 820 m/s (bedrock). As there is no information available on hidden layers such as a weathered bedrock layer, the seismic interpretation must be based on the layering apparent in the time-distance graphs. Thus, in this case the seismic interpretation is of three layers with the following thicknesses and velocities.

LAYER	VELOCITY (m/s)	THICKNESS (m)	DEPTH (m)
1	760	32	0
2	1 935	139	32
3	4 820	?	171

Thus the predicted depth to bedrock is 171 m.

Now consider the following cases, each of which would produce the same time-distance graph of first breaks.

CASE 1

There is no weathered layer present (Figure 1(a)).

In this case the seismic interpretation would be valid and the drill should strike bedrock at 171 m.

CASE 2

There is a weathered layer 20 m thick with a velocity of 2 770 m/s (Figure 1(b)).

It can be shown that this layer will not be evident on the time-distance graph because refractions from this layer will arrive after refractions from, initially, the 1 935 m/s velocity layer and then from the 4 820 m/s velocity layer. This model gives the following thicknesses and depths.

LAYER	VELOCITY (m/s)	THICKNESS (m)	DEPTH (m)
1	760	32	0
2	1 935	127	32
3	2 770	20	159
4	4 820	?	179

Assuming that weathered bedrock is recognised as bedrock the drill will be deemed to have entered bedrock at 159 m. This is 12 m shallower than the prediction of 171 m made using the three layer model.

CASE 3

The weathered layer has the maximum thickness it can achieve and still remain a hidden layer (Figure 1(c)).

It can be shown that this thickness is 97 m and the model is as follows.

LAYER	VELOCITY (m/s)	THICKNESS (m)	DEPTH (m)
1	760	32	0
2	1 935	79	32
3	2 770	97	111
4	4 820	?	208

In this case the drill will be deemed to have entered bedrock at 111 m, 60 m shallower than predicted from the three layer model.

It should be noted that while the presence of a hidden layer will generally cause depths to refractors below this layer to be underestimated, the fact that the weathered bedrock forms a hidden layer and is recognisable as bedrock will cause depths to bedrock to be overestimated.

APPENDIX II

SUPPLEMENTARY WELL DATA

SUPPLEMENTARY WELL DATA

A. DRILLING EQUIPMENT

Drilling Rig

Make/Type:	Mayhew 1000
Rated Capacity:	1000 feet @ 4½" (305 m @ 108 mm)
Motor/Power:	Cummins C175 Diesel, 175 HP

Mast

Make/Type:	Gardner-Denver tubular 4-way taper
Rated Capacity:	15.875 tonnes

Pump

Make/Type:	Gardner-Denver 5 x 6 FG-FXG-R
Size:	5 x 6
Motor/Power:	Rig Powered

Coring Pump

Make/Type:	John Bean Triplex model 435
Size:	$2^3/4$
Motor/Power:	Lister SR 3, 23 HP

B. BARABBA NO. 1

State Number:	375049001
Location:	Latitude 34°22'29"S Longitude 138°29'59"E Hundred of Grace, adjacent section 490
Map Reference:	ADELAIDE 1:250 000 Wakefield 1:100 000
Access:	Gravel road 8 km north of Mallala
Ground Elevation:	45 m above MSL Pt. Adelaide
Total Depth:	187.0 metres
Drilling Commenced:	4th March, 1977
Drilling Completed:	14th March, 1977

Rig Released:	21st March, 1977
Status:	Completed as water observation bore with 80 mm galvanised pipe and a 1 m stainless steel screen set at 118.53 to 119.53 metres.
Hole Size:	194 mm to 45.0 m 120 mm to 131.0 m 105 mm to 187.0 m
Casing:	125 mm black steel to 45.0 m 80 mm galvanised steel to 118.53 m

Bit Record:

No. Used	Size	Type	Make
1	194 mm	Tricone roller	Varel
1	120 mm	Tricone roller	Varel
2	105 mm	HQTT tungsten	D of M

Drilling Muds:	Rotrol, Supergel, Round MD, CMC Hivis.
Water Supply:	E. & W.S. Water Mains.
Coring:	HQTT coring from 20.0 m to 187.0 m at 70.7% recovery.

C. BARABBA NO. 2

State Number:	375021601
Location:	Latitude 34°23'31"S Longitude 138°32'27"E Hundred of Grace, adjacent section 216
Map Reference:	ADELAIDE 1:250 000 Kapunda 1:100 000
Access:	Gravel road 6 km northeast of Mallala
Ground Elevation:	69 m above MSL Pt. Adelaide.
Total Depth:	88.8 metres
Drilling Commenced:	21st March, 1977
Drilling Completed:	25th March, 1977
Rig Released:	30th March, 1977
Status:	Completed as a water observation bore with 80 mm galvanised pipe and a 1 m stainless steel screen set at 75.60 m to 76.60 m.

Hole Size:	194 mm to 6.5 m 120 mm to 80.0 m 105 mm to 88.8 m
Casing:	80 mm galvanised steel to 75.6 m

Bit Record:

No. Used	Size	Type	Make
1	194 mm	Tricone roller	Varel
1	120 mm	Tricone roller	Varel
1	105 mm	HQTT Tungsten	D of M

Drilling Muds:	Rotrol, CMC, Romud MD
Water Supply:	E. & W.S. Water Mains.
Coring:	HQTT coring from 19.8 m to 88.8 m at 84.6% recovery.

D. BARABBA NO. 3

State Number:	375021501
Location:	Latitude 34°23'32"S Longitude 138°31'47"E Hundred of Grace, adjacent section 215
Map Reference:	ADELAIDE 1:250 000 Kapunda 1:100 000
Access:	Gravel road 6 km north-northeast of Mallala.
Ground Elevation:	65 m above MSL Pt. Adelaide.
Total Depth:	128.8 metres
Drilling Commenced:	31st March, 1977
Drilling Completed:	12th April, 1977
Rig Released:	16th April, 1977
Status:	Completed as a water observation bore with 80 mm galvanised pipe and a 1 m stainless steel screen set at 62.61 m to 63.61 m.
Hole Size:	194 mm to 39.0 m 120 mm to 70.0 m 105 mm to 128.8 m

Casing:	127 mm black steel from 13.0 to 39.0 m 80 mm galvanised steel to 62.61 m

Bit Record:

No. Used	Size	Type	Male
1	194 mm	Tricone roller	Varel
1	120 mm	Tricone roller	Varel
2	105 mm	HQTT tungsten	D of M

Drilling Muds:	Rotrol, CMC, Romud MD
Water Supply:	E. & W.S. Water Mains.
Coring:	HQTT coring from 19.0 m to 128.8 m at 85.0% recovery.

E. BARABBA NO. 4

State Number:	330042802
Location:	Latitude 34°17'51"S Longitude 138°25'35"E Hundred of Dalkey, adjacent to section 428.
Map Reference:	ADELAIDE 1:250 000 Wakefield 1:100 000
Access:	Gravel road 3 km northwest of Pinery.
Ground Elevation:	40 m above MSL Pt. Adelaide.
Total Depth:	95.2 metres
Drilling Commenced:	16th April, 1977
Drilling Completed:	23rd April, 1977
Rig Released:	28th April, 1977
Status:	Completed as a water observation bore with 80 mm black pipe and a 1 m stainless steel screen set at 74.04 m to 75.04 m.
Hole Size:	194 mm to 19.5 m 120 mm to 80.0 m 105 mm to 95.2 m
Casing:	80 mm black steel to 74.04 m

Bit Record:

No. Used	Size	Type	Make
1	194 mm	Tricone roller	Varel
1	120 mm	Tricone roller	Varel
2	105 mm	HQTT tungsten	D of M
1	105 mm	HQW/L diamond	Diabort

Drilling Muds:	Rotrol, CMC, Romud MD
Water Supply:	E. & W.S. Water Mains
Coring:	HQ coring from 19.7 m to 95.2 m at 70.1% recovery.

F. BARABBA NO. 5

State Number:	330041002
Location:	Latitude 34°16'05"S Longitude 138°26'35"E Hundred of Dalkey, adjacent section 410.
Map Reference:	ADELAIDE 1:250 000 Wakefield 1:100 000
Access:	Gravel road 10 km west of Owen, 5 km north of Pinery.
Ground Elevation:	51 m above MSL Pt. Adelaide
Total Depth:	99.7 metres
Drilling Commenced:	28th April, 1977
Drilling Completed:	6th May, 1977
Rig Released:	11th May, 1977
Status:	Completed as a water observation bore with 80 mm black pipe and a 1 m stainless steel screen set at 65.0 m to 66.0 m.
Hole Size:	194 mm to 25.0 m 120 mm to 70.0 m 105 mm to 99.7 m
Casing:	80 mm black steel to 65.0 m

Bit Records:

No. Used	Size	Type	Make
1	194 mm	Tricone roller	Varel
1	120 mm	Tricone roller	Varel
1	105 mm	HQTT tungsten	D of M
1	105 mm	HQW/L diamond	Diabort

Drilling Muds: Rotrol, CMC, Romud MD

Water Supply: E. & W.S. Water Mains.

Coring: HQ coring from 21.0 m to 99.7 m at 75.1% recovery.

G. BARABBA NO. 6

State Number: 375005502

Location: Latitude 34°27'10"S
Longitude 138°32'05"E
Hundred of Grace, adjacent section 55

Map Reference: ADELAIDE 1:250 000
Kapunda 1:100 000

Access: Gravel road 3 km southeast of Mallala

Ground Elevation: 43 m above MSL Pt. Adelaide

Total Depth: 162.8 m

Drilling Commenced: 12th May, 1977

Drilling Completed: 21st May, 1977

Rig Released: 2nd June, 1977

Status: Plugged and abandoned after unsuccessful fishing attempts to recover lost screen.

Hole Size: 194 mm to 38.5 m
105 mm to 162.8 m

Casing: Casing recovered after loss of screen.

Bit Record:

No. Used			
1	194 mm	Tricone roller	Varel
1	120 mm	Tricone roller	Varel
1	105 mm	HQTT tungsten	D of M

Drilling Muds: Supergel, Rotrol, Hydropol

Water Supply: E. & W.S. Water Mains.

Coring: HQTT coring from 20.0 m to 162.8 m at 74.1% recovery.

H. BARABBA NO. 7

State Number: 375057001

Location: Latitude 34°27'30"S
Longitude 138°29'39"E
Hundred of Grace, adjacent section 570

Map Reference: ADELAIDE 1:250 000
Wakefield 1:100 000

Access: Gravel road 3 km southwest of Mallala

Ground Elevation: 35 m above MSL Pt. Adelaide

Total Depth: 151.2 m

Drilling Commenced: 2nd June, 1977

Drilling Completed: 16th June, 1977

Rig Released: 16th June, 1977

Status: Plugged and abandoned

Hole Size: 120 mm to 20.0 m
105 mm to 151.2 m

Casing: Casing recovered on completion of drilling

Bit Record:

No. Used	Size	Type	Make
1	120 mm	Tricone roller	Varel
1	105 mm	HQTT tungsten	D of M
1	105 mm	HQW/L diamond	Diabort

Drilling Muds: Supergel, Rotrol, Hydropol

Water Supply: E. & W.S. Water Mains.

Coring: HQ coring from 20.0 m to 151.2 m at 78.6% recovery.

APPENDIX III

COMPOSITE WELL LOGS

FIG. 13

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. I

STATE: SOUTH AUSTRALIA   1:250000 MAP SHEET: ADELAIDE   1:100000 MAP SHEET: WAKEFIELD

BASIN: ST. VINCENT   WELL STATUS: OBSERVATION BORE

LOCATION Lat 34° 22' 29" S
Long 138° 29' 59" E
HUNDRED GRACE
SECTION ADJ. 490

ELEVATION 45 m. above MSL

DATE SPUDDED 4 th. MARCH 1977
DATE DRILLING STOPPED 14 th. MARCH 1977
DATE RIG RELEASED 21 st. MARCH 1977
TOTAL DEPTH 187·0

HOLE SIZE	MILLIMETRES	FROM (m)	TO (m)
	194	0	45·0
	120	45·0	131·0
	105	131·0	187·0

CASING	MILLIMETRES	FROM (m)	TO (m)
	125	0	45·0
	80	45·0	118·53

SCREEN SET FROM 118·53 TO 119·53 m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	0·4	185·4	1:200
NEUTRON NEUTRON	0·7	185·6	1:200
GAMMA GAMMA (DENSITY)	0·6	185·6	1:200
SELF POTENTIAL	45·0	186·0	1:200
POINT RESISTANCE	45·0	186·0	1:200
16" NORMAL RESISTIVITY	41·2	186·0	1:200
64" NORMAL RESISTIVITY	44·0	136·0	1:200
6' LATERAL RESISTIVITY	40·0	134·4	1:200
CALIPER	40·0	63·0	1:200
CALIPER	101·4	132·8	1:200

MUD RESISTIVITY 11·5 Ohm-metres at 20°C

OTHER Velocity survey at 25 m. interval from 134 m. upwards

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Q Quartz	Ca Carbonate fragments
Silt, siltstone	Py Pyrite	F Fossiliferous
Sand, sandstone	V Micaceous	Feldspathic
Calcite, limestone	Carbonaceous	Gypsiferous
Coal, lignite	Fe Ferruginous	Mn Manganese
Granules, pebbles	Glauconitic	Hum Humic
Lignite pods	Siliceous	Lg Lignitic
Lignitic clay	Calcareous	

LITHOLOGY C.D. Cockshell
COMPILED C.D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1008 R

LITHOLOGICAL DESCRIPTION

SURFACE - 20·8 m. CLAY. Mottled red-brown and cream with minor silt and fine sand becoming common near the base. Trace of carbonaceous material and muscovite mainly near the top.

20·8 - 44·0 m. Interbedded SILTY CLAY & CLAYEY SAND. Clay is mottled orange-red and pale green-grey and frequently finely sandy. Sand is orange and fine grained and contains rare quartz granules. In part heavily ironstained. Frequent manganese coated surfaces.

44·0 - 64·0 m. SILTY SAND & SANDY CLAY. Sand frequently mottled orange and pale grey-green, commonly clayey and medium grained. Granules and carbonaceous material common near top. Trace of opaques and muscovite. Clay is light green and white, finely sandy and near top is silty. Thin band of white calcareous sandy clay near base.

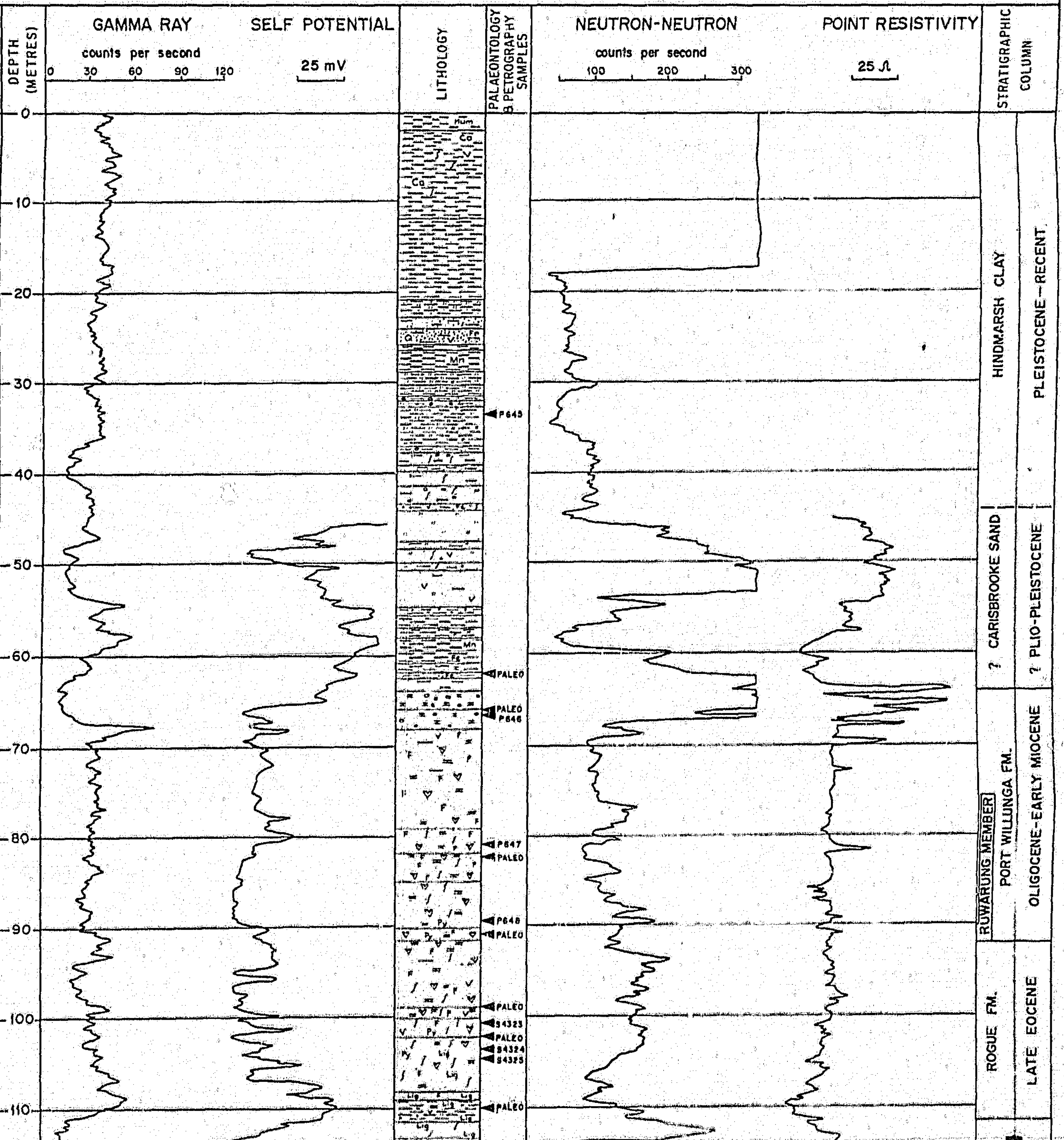
64·0 - 90·2 m. CALCAREOUS SAND. Green, highly calcareous and fossiliferous, becoming glauconitic toward base. Fine grained, common thin interbeds of hard, calcareous cemented medium sandstone. Towards base becomes clayey, ?carbonaceous and frequently pyritic

90·2 - 92·0 m. SILICEOUS CALCAREOUS SANDSTONE. Very hard and glauconitic. Grey, fine grained with common pyrite. Rare interbeds of less siliceous, softer material.

92·0 - 109·0 m. GLAUCONITIC SAND. Dark grey, fine grained and carbonaceous. Slightly calcareous in part with rare marine fossils. Trace of pyrite and mica.

109·0 - 111·5 m. LIGNITIC SILTY CLAY. Dark grey, slightly calcareous and finely sandy. Trace of glauconite and muscovite.

111 - 121·8 ... BONAC ... &



SURFACE - 20·8 m CLAY. Mottled red-brown and cream with minor silt and fine sand becoming common near the base. Trace of carbonaceous material and muscovite mainly near the top.

20·8-44·0 m. Interbedded SILTY CLAY & CLAYEY SAND. Clay is mottled orange-red and pale green-grey and frequently finely sandy. Sand is orange and fine grained and contains rare quartz granules. In part heavily ironstained. Frequent manganese coated surfaces.

44·0-64·0 m. SILTY SAND & SANDY CLAY. Sand frequently mottled orange and pale grey-green, commonly clayey and medium grained. Granules and carbonaceous material common near top. Trace of opaques and muscovite. Clay is light green and white, finely sandy and near top is silty. Thin band of white calcareous sandy clay near base.

64·0-90·2 m. CALCAREOUS SAND. Green, highly calcareous and fossiliferous, becoming glauconitic toward base. Fine grained, common thin interbeds of hard, calcareous cemented medium sandstone. Towards base becomes clayey, ?carbonaceous and frequently pyritic.

90·2-92·0 m. SILICEOUS CALCAREOUS SANDSTONE. Very hard and glauconitic. Grey, fine grained with common pyrite. Rare interbeds of less siliceous, softer material.

92·0-109·0 m. GLAUCONITIC SAND. Dark grey, fine grained and carbonaceous. Slightly calcareous in part with rare marine fossils. Trace of pyrite and mica.

109·0-111·5 m. LIGNITIC SILTY CLAY. Dark grey, slightly calcareous and finely sandy. Trace of glauconite and muscovite.

111·5-131·8 m. CARBONACEOUS SAND & CLAYEY LIGNITE. Sands are black and very fine grained with abundant pods of clayey lignite and plant remains. Lignites are thin, very clayey and slightly silty in part.

131·8-136·6 m. LIGNITIC CLAY & CLAYEY LIGNITE. Clay is black with abundant pods of clayey lignite and plant remains. Lignite is silty in part and black.

136·6-158·7 m. CARBONACEOUS SILTY SAND. Brown, very fine grained and rarely clayey. Common zones containing abundant pods of clayey lignite and plant remains including tree root veins. Becomes mottled brown and white near base.

158·7-167·6 m. CARBONACEOUS GRAVELLY SAND. Brown, coarse grained, slightly clayey in part. Rare clayey lignite pods near top.

167·6-169·1 m. PYRITIC PEBBLY SANDSTONE. Grey, coarse grained and very hard. Pyrite content up to 10%.

169·1 m - T.D. LAMINATED SILTSTONE. Buff-grey weathered zone at top gradually becoming blue-green, hard and fresh. Clay very common in weathered zone. Well cleaved in part and rare irregular quartz veins up to 10 mm thick. Laminations less than 1 mm thick.

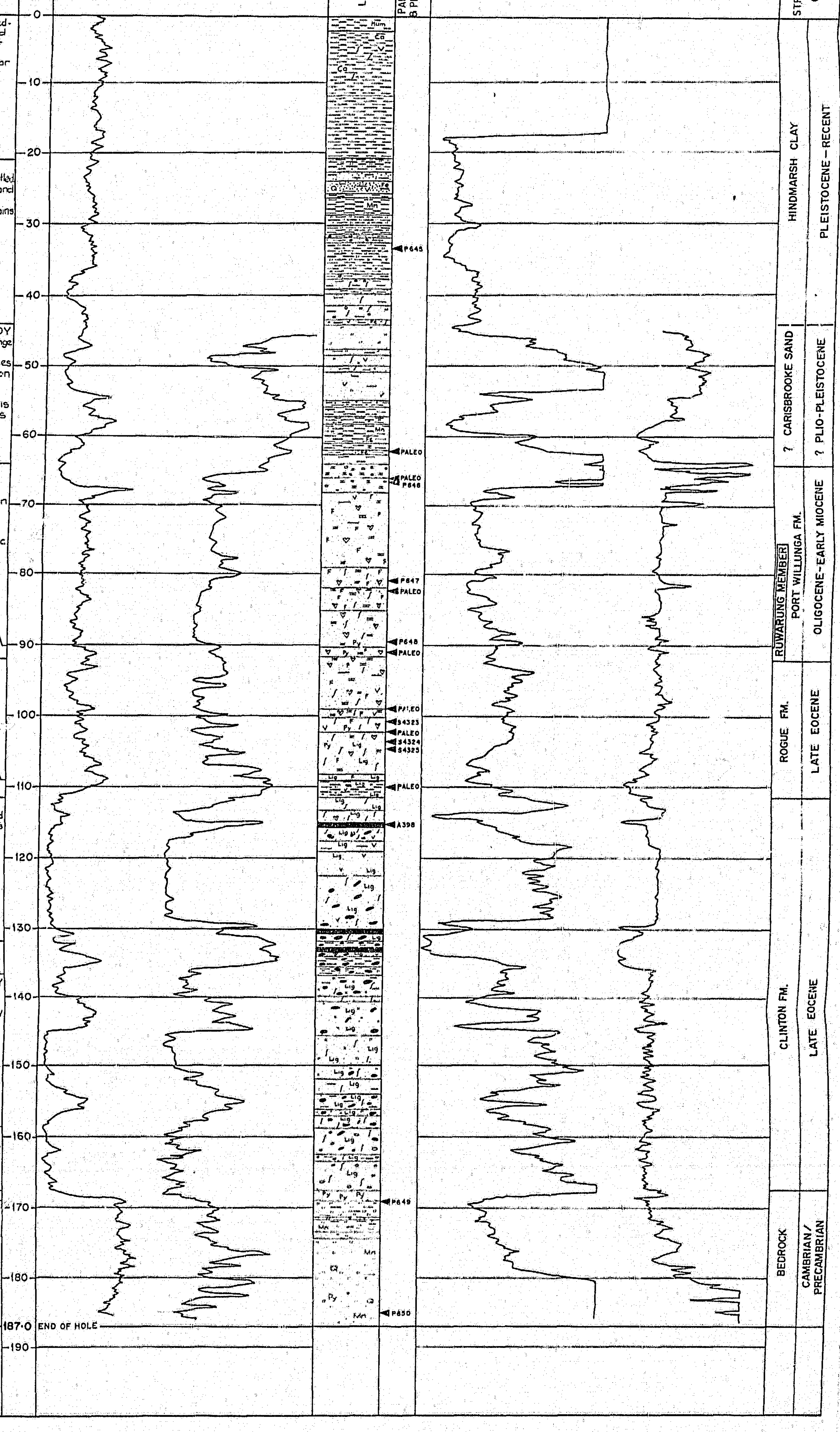


FIG. 14

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 2

STATE: SOUTH AUSTRALIA — 1:250000 MAP SHEET: ADELAIDE — 1:100000 MAP SHEET: KAPUNDA

BASIN: ST. VINCENT — WELL STATUS: OBSERVATION BORE

LOCATION Lat 34°23'31" S
Long 138°32'27" E
HUNDRED GRACE
SECTION ADJ. 216

ELEVATION 69 m. above MSL

DATE SPUDDED 21 st. MARCH 1977
DATE DRILLING STOPPED 25 th. MARCH 1977
DATE RIG RELEASED 30 th. MARCH 1977
TOTAL DEPTH 88·8 m.

HOLE SIZE

MILLIMETRES	FROM (m)	TO (m)
194	0	6·5
120	6·5	80·0
105	80·0	88·8

CASING

MILLIMETRES	FROM (m)	TO (m)
88	0	75·6

SCREEN SET FROM 75·6 TO 76·6 m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	0	88·4	1:200
NEUTRON NEUTRON	0	88·4	1:200
GAMMA GAMMA (DENSITY)	-	-	-
SELF POTENTIAL	6·0	88·6	1:200
POINT RESISTANCE	6·0	88·8	1:200
16" NORMAL RESISTIVITY	10·0	87·7	1:200
64" NORMAL RESISTIVITY	8·0	85·8	1:200
6' LATERAL RESISTIVITY	6·0	88·0	1:200
TEMPERATURE	0	88·8	1:200
CALIPER	-	-	-

MUD RESISTIVITY 6·0 Ohm-metres at 20·9°C

OTHER -

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Q Quartz	Ca Carbonate fragments
Silt, siltstone	Py Pyrite	F Fossiliferous
Sand, sandstone	V Micaceous	Γ Feldspathic
Calcite, limestone	J Carbonaceous	Gy Gypsiferous
Coal, lignite	Fe Ferruginous	Mn Manganese
Granules, pebbles	V Glauconitic	Hum Humic
Lignite pods	Si Siliceous	Lig Lignitic
Lignitic clay	I Calcareous	

LITHOLOGY C.D. Cockshell
COMPILED C.D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1009 R

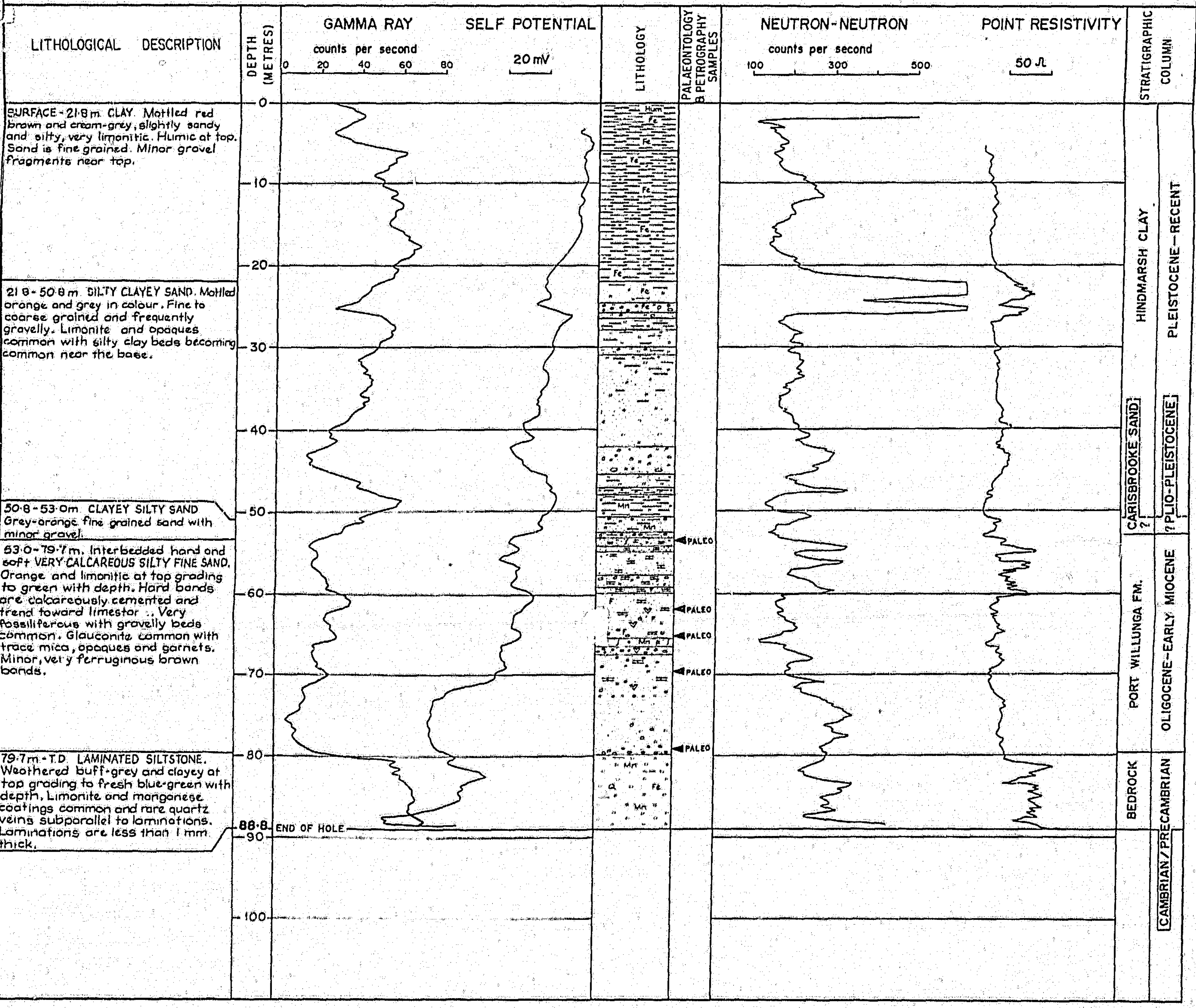


FIG. 15

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 3

STATE: SOUTH AUSTRALIA   1:250000 MAP SHEET: ADELAIDE   1:100000 MAP SHEET: KAPUNDA

BASIN: ST. VINCENT   WELL STATUS: OBSERVATION BORE

LOCATION Lat 34°23'32"S
Long 138°31'47"E
HUNDRED GRACE
SECTION ADJ. 215

ELEVATION 65 m. above MSL

DATE SPUDDED 31 st. MARCH 1977
DATE DRILLING STOPPED 12 th APRIL 1977
DATE RIG RELEASED 16 th. APRIL 1977
TOTAL DEPTH 128·8 m

HOLE SIZE	MILLIMETRES	FROM m.	TO m.
	194	0	39·0
	120	39·0	70·0
	105	70·0	128·8

CASING	MILLIMETRES	FROM m.	TO m.
	127	13·0	39·0
	80	0	62·61

SCREEN SET FROM 62·61 TO 63·61 m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	1·0	127·4	1:200
NEUTRON NEUTRON	1·0	128·1	1:200
GAMMA GAMMA (DENSITY)	-	-	-
SELF POTENTIAL	11·0	128·0	1:200
POINT RESISTANCE	11·0	128·8	1:200
16" NORMAL RESISTIVITY	11·0	128·0	1:200
64" NORMAL RESISTIVITY	10·0	127·0	1:200
6' LATERAL RESISTIVITY	10·0	127·4	1:200
TEMPERATURE	0	128·2	1:200
CALIPER	1·0	128·2	1:200

MUD RESISTIVITY 10·5 Ohm-metres at 19°C

OTHER -

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

	Clay, shale	Q	Quartz	Ca	Carbonate fragments
	Silt, siltstone	Py	Pyrite	F	Fossiliferous
	Sand, sandstone		Micaceous		Feldspathic
	Calcite, limestone		Carbonaceous	Gy	Gypsiferous
	Coal, lignite	Fe	Ferruginous	Mn	Manganese
	Granules, pebbles		Glauconitic	Hum	Humic
	Lignite pods	Si	Siliceous	Lig	Lignitic
	Lignitic clay		Calcareous		

LITHOLOGY C. D. Cockshell
COMPILED C. D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1010 R

LITHOLOGICAL DESCRIPTION

SURFACE - 21·5 m CLAY. Mottled red-brown commonly sandy and silty. Interbeds of gravelly coarse brown sand common. Generally limonitic but humic at top. Opaques common in sandy sections.

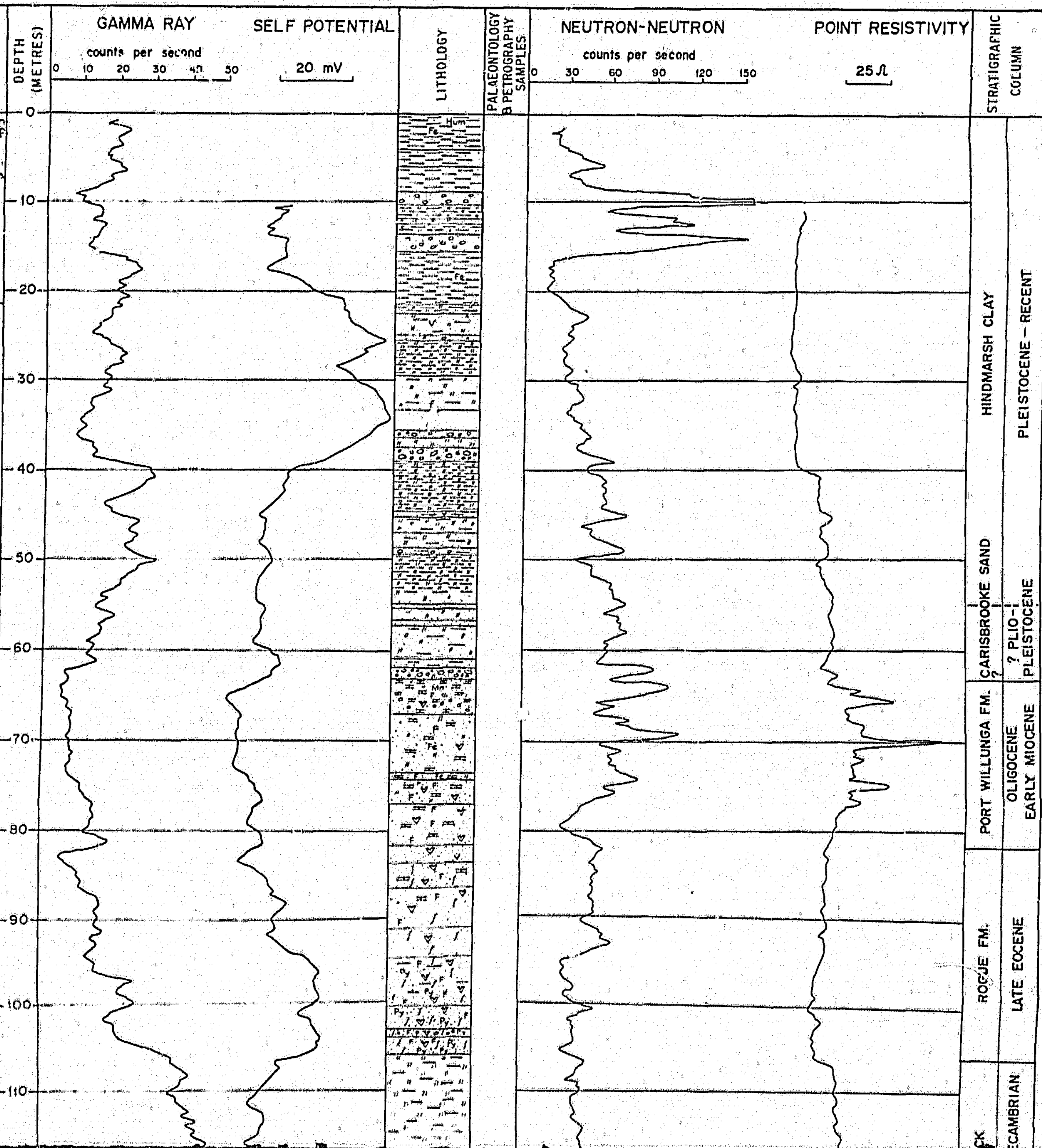
21·5 - 54·8 m CLAYEY SILTY SANDS & SANDY SILTY CLAYS Mottled orange and grey with common gravel beds. Sand is fine-medium grained. Generally limonitic with trace mica, feldspar and opaques.

54·8 - 63·2 m. CLAYEY SILTY SAND. White to orange, very fine-medium grained sand with gravel bed at base. Limonite common with trace opaques, garnets and feldspar.

63·2 - 81·6 m. VERY CALCAREOUS SILTY SANDS & SANDSTONES grading toward SANDY LIMESTONES. Fawn-yellow at top grading to brown-green towards the base. Glauconite and limonite common. Frequently very fossiliferous, common gravelly beds. Sandstones are very hard and well cemented by calcite.

81·6 - 105·8 m. GLAUCONITIC CARBONACEOUS SAND. Dark grey and fine grained, clayey, pyritic and gravelly toward base. Slightly calcareous and frequently fossiliferous. Commonly has bioturbated appearance.

105·8 m - T.D. LAMINATED SILTSTONE Weathered buff-grey and clayey at top, grading to fresh dark grey siltstone toward base. Pyrite common near base with rare quartz veins subparallel to laminations. Laminations are less than 2 mm.



BASIN: ST. VINCENT WELL STATUS: OBSERVATION BORE

LOCATION Lat 34°23'32" S
Long 138°31'47" E
HUNDRED GRACE
SECTION ADJ. 215

ELEVATION 65 m. above MSL

DATE SPUDDED 31 st. MARCH 1977
DATE DRILLING STOPPED 12 th APRIL 1977
DATE RIG RELEASED 16 th. APRIL 1977
TOTAL DEPTH 128·8 m

HOLE SIZE	MILLIMETRES	FROM m	TO m
	194	0	39·0
	120	39·0	70·0
	105	70·0	128·8

CASING	MILLIMETRES	FROM m	TO m
	127	13·0	39·0
	80	0	62·61

SCREEN SET FROM 62·61 TO 63·61 m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	1·0	127·4	1:200
NEUTRON NEUTRON	1·0	128·1	1:200
GAMMA GAMMA (DENSITY)	-	-	-
SELF POTENTIAL	11·0	128·8	1:200
POINT RESISTANCE	11·0	128·8	1:200
16" NORMAL RESISTIVITY	11·0	128·0	1:200
64" NORMAL RESISTIVITY	10·0	127·0	1:200
6' LATERAL RESISTIVITY	10·0	127·4	1:200
TEMPERATURE	0	128·2	1:200
CALIPER	1·0	128·2	1:20

MUD RESISTIVITY 10·5 Ohm-metres at 19°C

OTHER -

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Q Quartz	Ca Carbonate fragments
Silt, siltstone	Py Pyrite	F Fossiliferous
Sand, sandstone	V Micaceous	Feldspathic
Calcite, limestone	Carbonaceous	Gy Gypsiferous
Coal, lignite	Fe Ferruginous	Mn Manganese
Granules, pebbles	Glauconitic	Hum Humic
Lignite pods	S Siliceous	Lig Lignitic
Lignitic clay	Calcareous	

LITHOLOGY C. D. Cockshell
COMPILED C. D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1010 R

LITHOLOGICAL DESCRIPTION

SURFACE - 21·5 m CLAY. Mottled red-brown commonly sandy and silty. Interbeds of gravelly coarse brown sand common. Generally limonitic but humic at top. Opaques common in sandy sections.

21·5 - 54·8 m CLAYEY SILTY SANDS & SANDY SILTY CLAYS. Mottled orange and grey with common gravel beds. Sand is fine-medium grained. Generally limonitic with trace mica, feldspar and opaques.

54·8 - 63·2 m. CLAYEY SILTY SAND. White to orange, very fine-medium grained sand with gravel bed at base. Limonite common with trace opaques, garnets and feldspar.

63·2 - 81·6 m. VERY CALCAREOUS SILTY SANDS & SANDSTONES grading toward SANDY LIMESTONES. Fawn-yellow at top grading to brown-green towards the base. Glauconite and limonite common. Frequently very fossiliferous, common gravelly beds. Sandstones are very hard and well cemented by calcite.

81·6 - 105·8 m. GLAUCONITIC CARBONACEOUS SAND. Dark grey and fine grained, clayey, pyritic and gravelly toward base. Slightly calcareous and frequently fossiliferous. Commonly has bioturbated appearance.

105·8 m. - T.D. LAMINATED SILTSTONE. Weathered buff-grey and clayey at top, grading to fresh dark grey siltstone toward base. Pyrite common near base with rare quartz veins subparallel to laminations. Laminations are less than 2 mm thick and frequently finely crenulated. Frequently strongly cleaved.

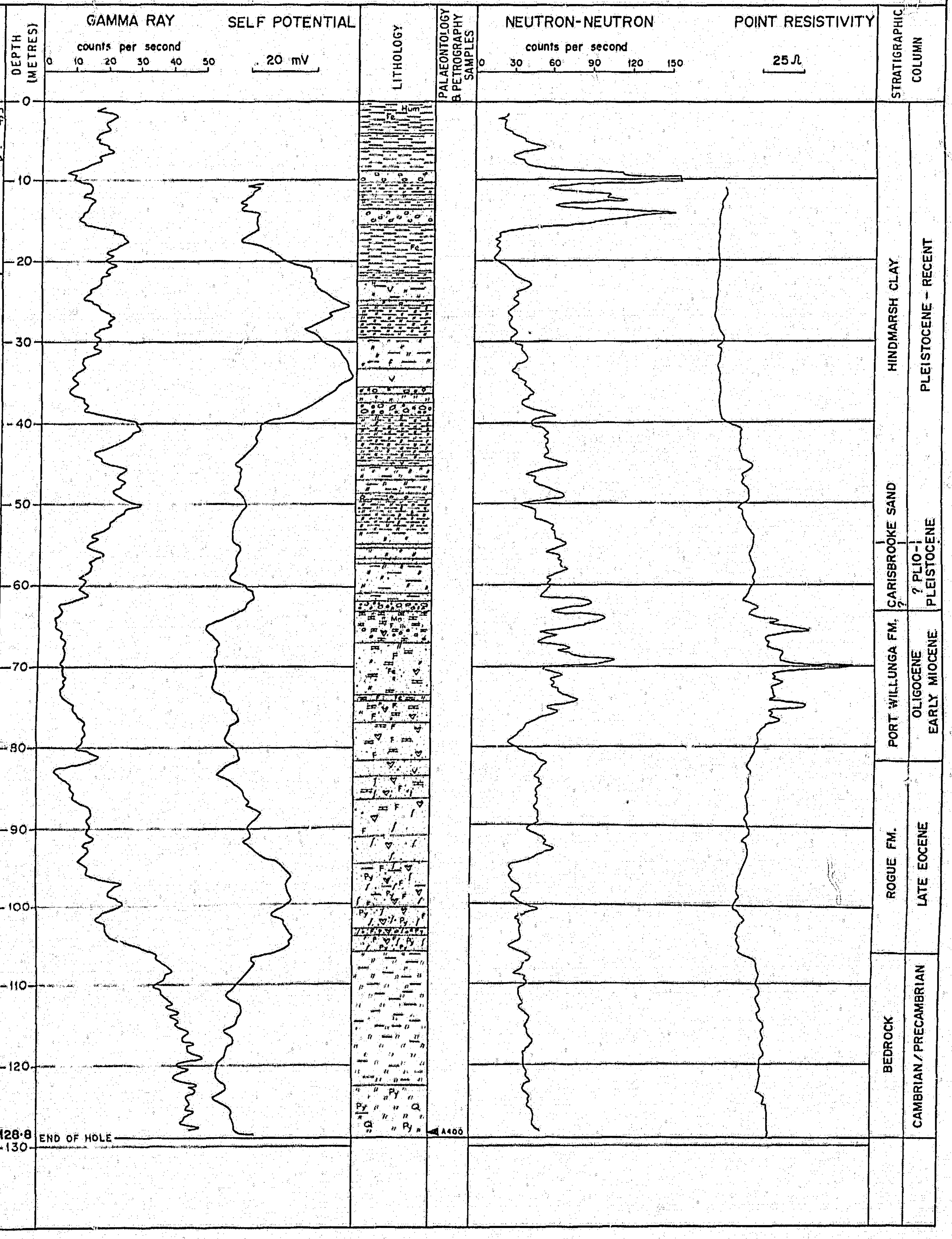


FIG. 16

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 4

STATE: SOUTH AUSTRALIA   1:250 000 MAP SHEET: ADELAIDE   1:100 000 MAP SHEET: WAKEFIELD

BASIN: ST. VINCENT   WELL STATUS: OBSERVATION BORE

LOCATION Lat 34°17'51" S
Long 138°25'35"E
HUNDRED DALKEY
SECTION ADJ. 428

ELEVATION 40 m. above MSL

DATE SPUDDED 16th APRIL 1977
DATE DRILLING STOPPED 23rd. APRIL 1977
DATE RIG RELEASED 28th APRIL 1977
TOTAL DEPTH 95·2 m.

HOLE SIZE	MILLIMETRES	FROM (m)	TO (m)
	194	0	19·5
	120	19·5	80·0
	105	80·0	95·2

CASING	MILLIMETRES	FROM (m)	TO (m)
	80	0	74·04

SCREEN SET from 74·04 to 75·04 m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	1·0	94·0	1:200
NEUTRON NEUTRON	1·0	94·0	1:200
GAMMA GAMMA (DENSITY)	-	-	-
SELF POTENTIAL	12·0	95·0	1:200
POINT RESISTANCE	12·0	95·0	1:200
16" NORMAL RESISTIVITY	12·0	95·0	1:200
64" NORMAL RESISTIVITY	12·0	95·0	1:200
6' LATERAL RESISTIVITY	12·0	53·0	1:200
CALIPER	-	-	-
CALIPER	-	-	-

MUD RESISTIVITY 7·5 Ohm-metres at 20°C

OTHER -

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Quartz	Carbonate fragments
Silt, siltstone	Pyrite	Fossiliferous
Sand, sandstone	Micaceous	Feldspathic
Calcite, limestone	Carbonaceous	Gypsiferous
Coal, lignite	Ferruginous	Manganese
Granules, pebbles	Glauconitic	Humic
Lignite pods	Siliceous	Lignitic
Lignitic clay	Calcareous	

LITHOLOGY C.D. Cockshell
COMPILED C.D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1011 R

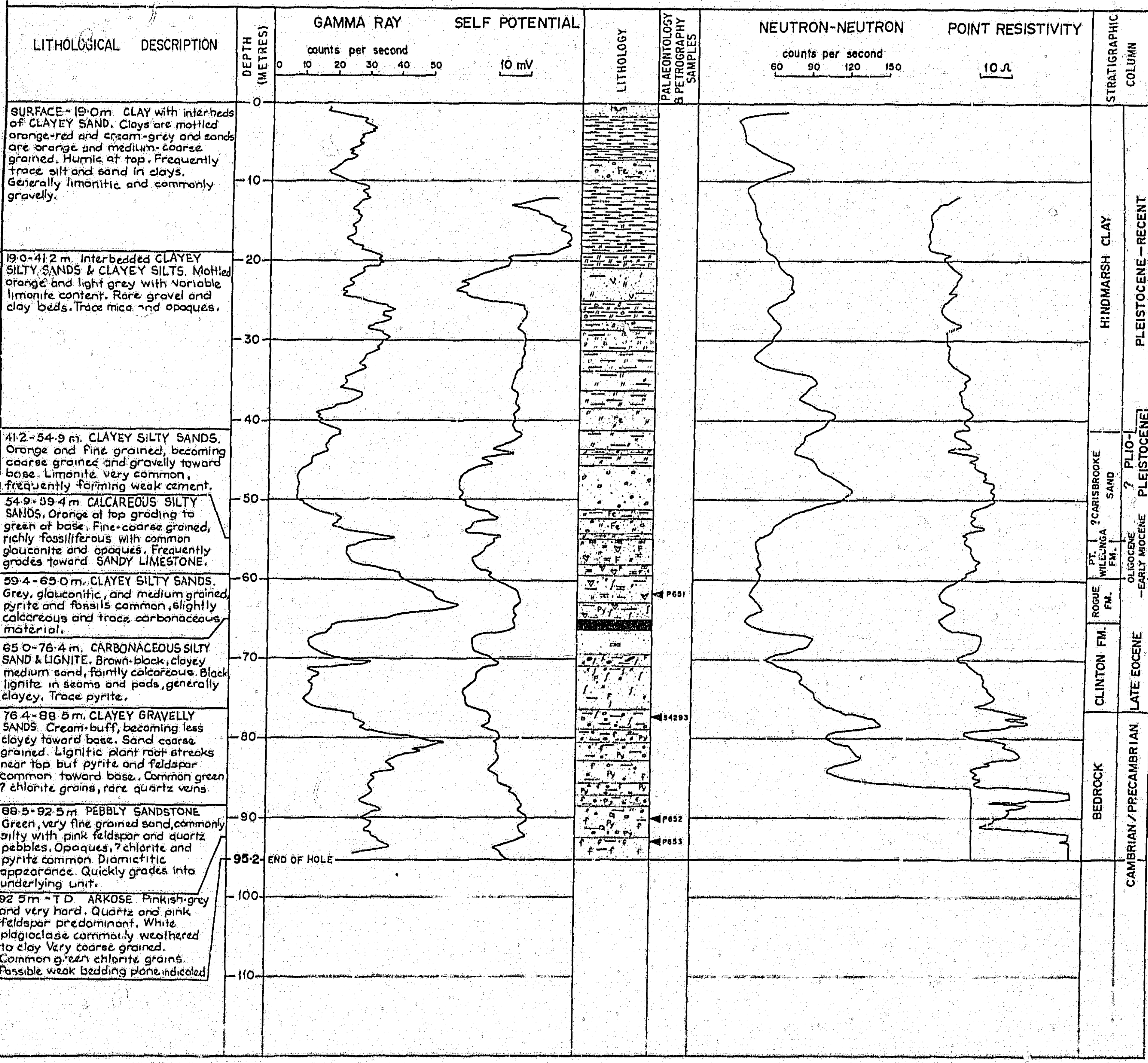


FIG. 17

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 5

STATE: SOUTH AUSTRALIA   1:250000 MAP SHEET: ADELAIDE   1:100000 MAP SHEET: WAKEFIELD

BASIN: ST. VINCENT   WELL STATUS: OBSERVATION BORE

LOCATION Lat 34°16' 05" S
Long 138° 26' 35" E
HUNDRED DALKEY
SECTION ADJ. 410

ELEVATION 51 m. above MSL

DATE SPUDDED 28 th. APRIL 1977
DATE DRILLING STOPPED 6 th. MAY 1977
DATE RIG RELEASED 11 th. MAY 1977
TOTAL DEPTH 99·7 m.

HOLE SIZE	MILLIMETRES	FROM m.	TO m.
	194	0	25·0
	120	25·0	70·0
	105	70·0	99·7

CASING	MILLIMETRES	FROM m.	TO m.
	50	0	65·0

SCREEN SET FROM 65·0m. 66·0m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	1·0	98·8	1:200
NEUTRON NEUTRON	2·0	98·8	1:200
GAMMA GAMMA (DENSITY)	6·0	98·8	1:200
SELF POTENTIAL	13·0	99·3	1:200
POINT RESISTANCE	13·0	99·3	1:200
16" NORMAL RESISTIVITY	22·0	99·7	1:200
64" NORMAL RESISTIVITY	22·0	99·7	1:200
6' LATERAL RESISTIVITY	13·0	99·7	1:200
CALIPER	2·0	99·4	1:200
CALIPER	-	-	-

MUD RESISTIVITY 10·8 Ohm-metres at 19°C

OTHER -

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Q Quartz	Cd Carbonate fragments
Silt, siltstone	Py Pyrite	F Fossiliferous
Sand, sandstone	V Micaceous	f Feldspathic
Calcite, limestone	Carbonaceous	Gy Gypsiferous
Coal, lignite	Fe Ferruginous	Mn Manganese
Granules, pebbles	V Glauconitic	Hum Humic
Lignite pods	Si Siliceous	Lig Lignitic
Lignitic clay	Calcareous	

LITHOLOGY C.D. Cockshell
COMPILED C.D. Cockshell
DRAFTED N. Sandercock.
DRAWING NUMBER 77-1012 R

LITHOLOGICAL DESCRIPTION

SURFACE - 16·0 m. CLAYS & SANDS. Clays mottled orange-red and cream, frequently sandy. Sands red-orange, medium grained, frequently gravelly. Richly limonitic.

16·0 - 42·8 m. SILTY SANDS & CLAYEY SANDY SILTS. Mottled orange to light grey by limonite content. Sands very fine - medium grained and often gravelly and slightly clayey. Opaques common. Weak limonite cementing near base. Rare clay-rich bands.

42·8 - 53·6 m. SILTY SAND. Light grey-mustard yellow, fine grained with common limonite, mica and ?carbonaceous material. Slightly ? glauconitic toward base.

53·6 - 62·5 m. GLAUCONITIC CARBONACEOUS SAND. Dark green-black, fine-medium grained, frequently clayey and silty. Gravel common with pyrite becoming common toward base. Rare mica and plant remains. Generally noncalcareous. Frequently has bioturbated appearance.

62·5 - 66·3 m. SILICEOUS SANDSTONE. Very hard, brown-dark grey, fine grained with minor softer, less siliceous intercalations. Commonly carbonaceous.

66·3 - 77·5 m. CARBONACEOUS SILTY SAND. Brown-black, very fine - fine grained, becoming gravelly toward base. Common lignitic plant remains with minor mica and hard compacted bands. Slightly mottled near base with carbonaceous content.

77·5 m. - TD CLAYEY SILTSTONE. Very weathered greenish light grey, with lignitic plant root streaks at the top. Very common contorted veins of maroon clayier siltstone up to 5 mm thick. Common manganese coatings and pyrite and mica grains. Weak laminations are contorted and truncated similar to the maroon lenses. Moderately cleaved with common multi-coloured major cleavage zones. Becomes harder and less clayey toward base.

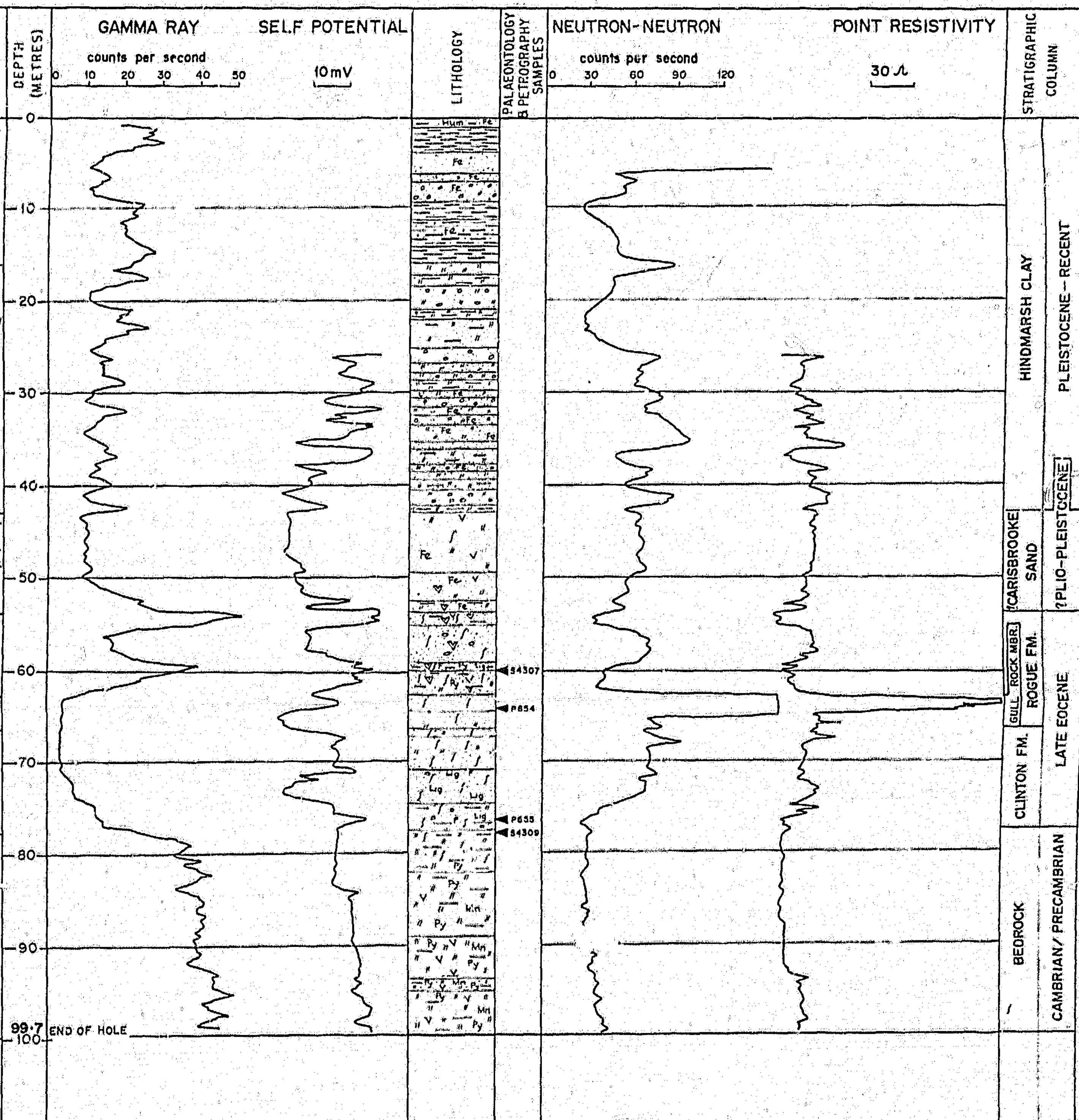


FIG. 18

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 6

STATE: SOUTH AUSTRALIA 1:250000 MAP SHEET: ADELAIDE 1:100000 MAP SHEET: KAPUNDA

BASIN: ST VINCENT WELL STATUS: PLUGGED AND ABANDONED

LOCATION LAT 34° 27' 10" S
LONG 138° 32' 05" E
HUNDRED GRACE
SECTION ADJ 55

ELEVATION 43 m. above MSL

DATE SPUDDED 12 th MAY 1977
DATE DRILLING STOPPED 21 st MAY 1977
DATE RIG RELEASED 2 nd. JUNE 1977
TOTAL DEPTH 162·6 m

HOLE SIZE [illegible]

194	0	38·5
105	38·5	162·8

CASING -

SCREEN SET -

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	0	158·8	1:200
NEUTRON NEUTRON	0	158·4	1:200
GAMMA GAMMA (DENSITY)	0	157·6	1:200
SELF POTENTIAL	-	-	-
POINT RESISTANCE	-	-	-
16" NORMAL RESISTIVITY	-	-	-
64" NORMAL RESISTIVITY	-	-	-
6 LATERAL RESISTIVITY	-	-	-
CALIPER	-	-	-
CALIPER	-	-	-

MUD RESISTIVITY -

OTHER -

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Q Quartz	Ca Carbonate fragments
Silt, siltstone	Py Pyrite	F Fossiliferous
Sand, sandstone	V Micaceous	Γ Feldspathic
Calcite, limestone	J Carbonaceous	Gy Gypsiferous
Coal, lignite	Fe Ferruginous	Mn Manganese
Granules, pebbles	▽ Glauconitic	Hum Humic
Lignite pods	Si Siliceous	Lig Lignitic
Lignitic clay	I Calcareous	

LITHOLOGY C. D. Cockshell
COMPILED C. D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1013 R

LITHOLOGICAL DESCRIPTION

SURFACE - 18·2 m CLAYS Mottled orange brown and light greenish grey Generally ferruginous Humic at top

18·2 - 45·8 m SANDY CLAYEY SILT & SILTY CLAY Silt is mottled orange-brown with green-grey clay Frequently interbedded with coarsely sandy gravel and clayey fine sand Limonite and opaques common.

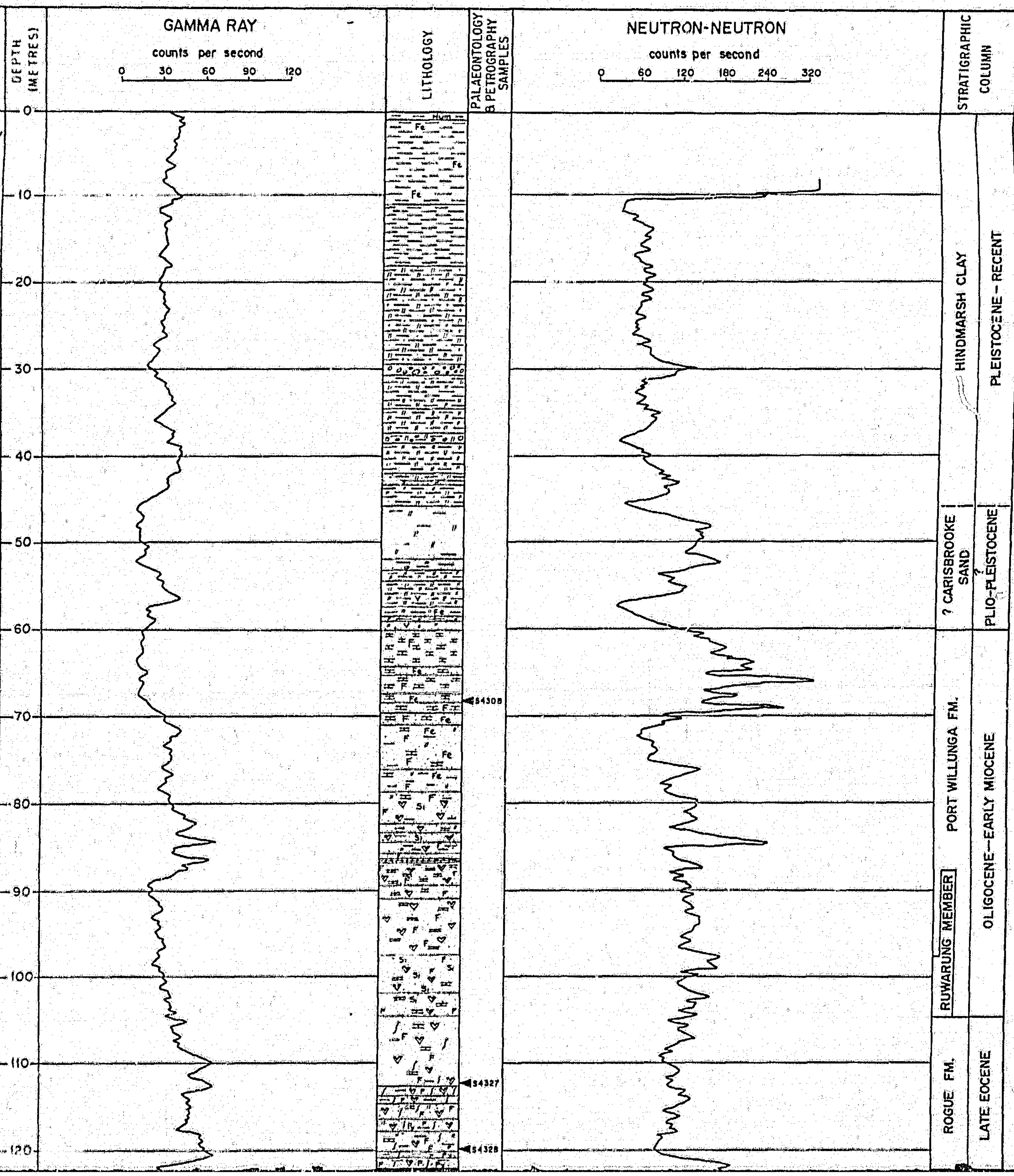
45·8 - 60·2 m CLAYEY SILTY SAND Fine grained grading from light grey at top to yellowish green at base Rare pebbly sections Common silty clays and clayey sandy silts in lower part. Limonite common with trace mica and opaques.

60·2 - 97·6 m Interbedded SILICEOUS, CALCAREOUS SANDSTONES, CALCAREOUS SILTY SANDS & SANDY LIMESTONES Sandstones and limestones are hard, siliceous and calcareous, cemented and buff-grey to fawn in colour. Sands are green, slightly clayey and very fine to medium grained. Moderately fossiliferous, glauconite becoming common toward base. Limonitic in many sections

97·6 - 104·6 m Interbedded SILICEOUS SANDSTONE & GLAUCONITIC SANDS. Grey-green, variable carbonate content, but generally moderate Moderate fossil and silt content but often variable. Sandstones are very hard and grade toward quartzite.

104·6 - 120·1 m GLAUCONITIC SILTY SANDS. Grey, carbonaceous and frequently clayey and compacted. Faintly calcareous with common fossils bioturbated appearance. Pyritic near base.

120·1 - 122·1 m SANDY SILTY CLAY. Dark grey, glauconitic and carbonaceous with fine grained CLAYEY SILTY SAND Slightly calcareous, common pyrite and mica Few fossils. Thin basal gravel bed



105 38 5 162 8

CALIPER

CALIPER

Lignite pods | Siliceous | Lignitic

Lignitic clay | Calcareous

CASING

MUD RESISTIVITY

OTHER

SCREEN SET

DRILLED BY S.A DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A DEPARTMENT OF MINES

LITHOLOGY C. D. Cockshell
COMPILED C. D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1013 R

LITHOLOGICAL DESCRIPTION

SURFACE - 18.2 m CLAYS. Mottled orange-brown and light greenish-grey. Generally ferruginous. Humic at top.

18.2 - 45.8 m SANDY CLAYEY SILT & SILTY CLAY. Silt is mottled orange-brown with green-grey clay. Frequently interbedded with coarsely sandy gravel and clayey fine sand. Limonite and opaques common.

45.8 - 60.2 m CLAYEY SILTY SAND. Fine grained grading from light grey at top to yellowish green at base. Rare pebbly sections. Common silty clays and clayey sandy silts in lower part. Limonite common with trace mica and opaques.

60.2 - 97.6 m. Interbedded SILICEOUS, CALCAREOUS SANDSTONES, CALCAREOUS SILTY SANDS & SANDY LIMESTONES. Sandstones and limestones are hard, siliceous and calcareous, cemented and buff-grey to fawn in colour. Sands are green, slightly clayey and very fine to medium grained. Moderately fossiliferous, glauconite becoming common toward base. Limonitic in many sections.

97.6 - 104.6 m. Interbedded SILICEOUS SANDSTONE & GLAUCONITIC SANDS. Grey-green, variable carbonate content but generally moderate. Moderate fossil and silt content but often variable. Sandstones are very hard and grade toward quartzite.

104.6 - 120.1 m. GLAUCONITIC SILTY SANDS. Grey, carbonaceous and frequently clayey and compacted. Faintly calcareous with common fossils, bioturbated appearance. Pyritic near base.

120.1 - 122.1 m. SANDY SILTY CLAY. Dark grey, glauconitic and carbonaceous with fine grained CLAYEY SILTY SAND. Slightly calcareous, common pyrite and mica. Few fossils. Thin basal gravel bed.

122.1 - 142.9 m. CARBONACEOUS SILTY SANDS & LIGNITES. Brown-black, often lignitic and fine grained. Common mica, pyrite and ? gypsum. Several clayey lignite and lignitic clay beds. Rare gravelly beds. Non-glauconitic and non-calcareous.

142.9 m - T.D. LAMINATED CLAYEY SILTSTONE. Upper section weathered light buff-grey. Becomes less weathered light greenish grey to pale orange with depth. Common pyrite, manganese coatings and ? siderite nodules. Rare ? gypsum pods. Finely laminated and well cleaved. Major cleavage zones are multicoloured.

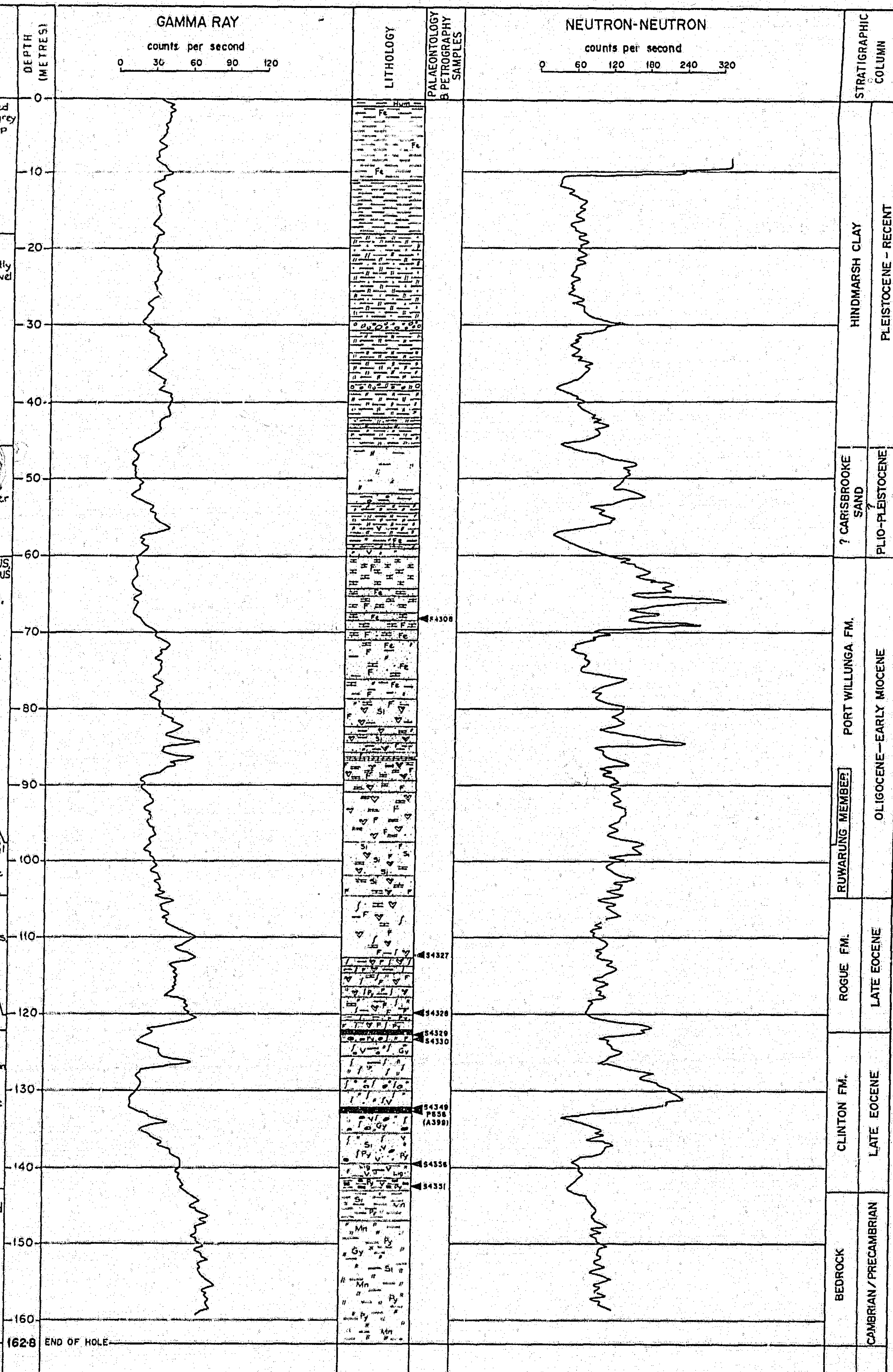


FIG. 19

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 7

STATE: SOUTH AUSTRALIA   1:250000 MAP SHEET: ADELAIDE   1:100000 MAP SHEET: WAKEFIELD

BASIN: ST. VINCENT   WELL STATUS: PLUGGED AND ABANDONED

LOCATION Lat 34°27'30"S
Long 138°29'39"E
HUNDRED GRACE
SECTION ADJ. 570

ELEVATION 35 m. above MSL

DATE SPUDDED 2 nd. JUNE 1977
DATE DRILLING STOPPED 16 th. JUNE 1977
DATE RIG RELEASED 16 th. JUNE 1977
TOTAL DEPTH 151·2 m.

HOLE SIZE

MILLIMETRES	FROM (m)	TO (m)
120	0	20·0
105	20·0	151·2

CASING — MILLIMETRES - FROM (m) - TO (m) -

SCREEN SET FROM - TO -

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	0	150·0	1:200
NEUTRON NEUTRON	0	150·2	1:200
GAMMA GAMMA (DENSITY)	0	151·0	1:200
SELF POTENTIAL	11·0	149·4	1:200
POINT RESISTANCE	11·0	149·4	1:200
16" NORMAL RESISTIVITY	20·3	150·0	1:200
64" NORMAL RESISTIVITY	19·1	148·9	1:200
6' LATERAL RESISTIVITY	11·1	150·6	1:200
CALIPER	0·2	66·4	1:200
CALIPER	-	-	-

MUD RESISTIVITY 0·45 Ohm-metres at 17·5°C

OTHER —

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Q Quartz	Ca Carbonate fragments
Silt, siltstone	Py Pyrite	F Fossiliferous
Sand, sandstone	V Micaceous	f Feldspathic
Calcite, limestone	J Carbonaceous	Gy Gypsiferous
Coal, lignite	Fe Ferruginous	Mn Manganese
Granules, pebbles	Glauconitic	Hum Humic
Lignite pods	Si Siliceous	Lg Lignitic
Lignitic clay	I Calcareous	

LITHOLOGY C. D. Cockshell
COMPILED C. D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1014 R

LITHOLOGICAL DESCRIPTION

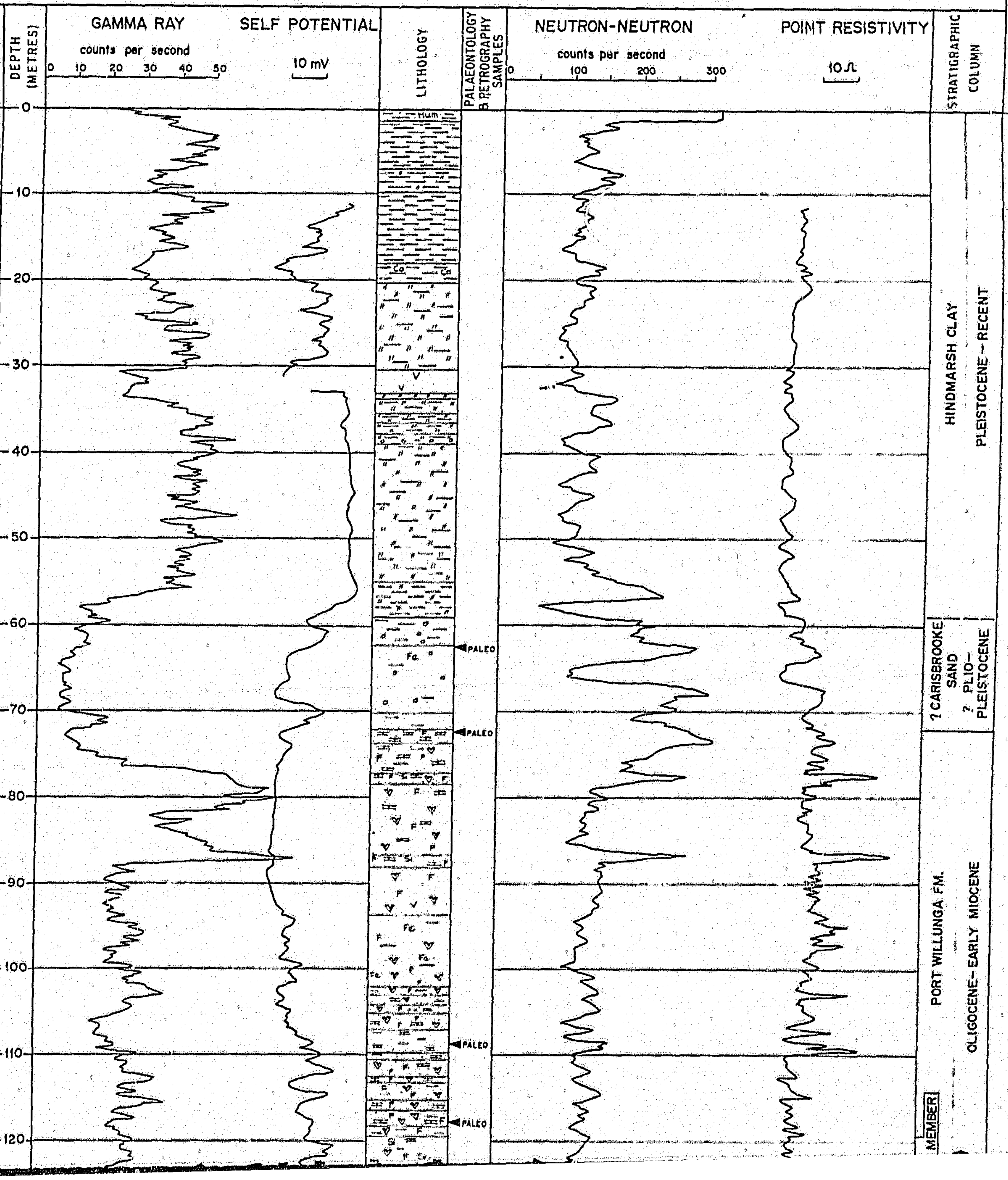
SURFACE - 20·3 m. CLAYS. Mottled light greenish grey and orange-red, in part slightly silty and sandy. Sand becoming common at base. Minor calcrete nodules at base. Humic at top. Generally ferruginous.

20·3 - 59·0 m SANDY CLAYEY SILTS & SILTY CLAYS. Mottled orange-brown and light greenish grey with minor orange to yellow fine-medium sands. Generally limonitic. Common gravelly beds. Trace mica and opaques.

59·0 - 72·1 m. SANDS. White-yellow, slightly clayey with rare granules. Generally limonitic.

72·1 - 119·3 m Interbedded SILICEOUS, CALCAREOUS SANDSTONE & CALCAREOUS SANDS. Sandstone is hard, buff-yellow and grades toward SANDY LIMESTONE. Sands are green, glauconitic and richly fossiliferous. Frequently slightly clayey. In lower parts becomes variable in glauconite clay, carbonate and limonite content. Becomes slightly clayier, finer grained and less fossiliferous toward base.

119·3 - 130·8 m. Interbedded SILICEOUS SANDSTONE & GLAUCONITIC, SILTY SAND. Grey-green, slightly ...



CALIPER

Lignitic clay — Calcareous

CASING MILLIMETRES FROM TO

SCREEN SET FROM - TO -

MUD RESISTIVITY 0·45 Ohm-metres at 17·5° C

OTHER —

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGY C. D. Cockshell
COMPILED C. D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1014 R

LITHOLOGICAL DESCRIPTION

SURFACE - 20·3 m CLAYS. Mottled light greenish grey and orange-red, in part slightly silty and sandy. Sand becoming common at base. Minor calcrete nodules at base. Humic at top. Generally ferruginous.

20·3 - 59·0 m SANDY CLAYEY SILTS & SILTY CLAYS. Mottled orange-brown and light greenish grey with minor orange to yellow fine-medium sands. Generally limonitic. Common gravelly beds. Trace mica and opaques.

59·0 - 72·1 m. SANDS. White-yellow, slightly clayey with rare granules. Generally limonitic.

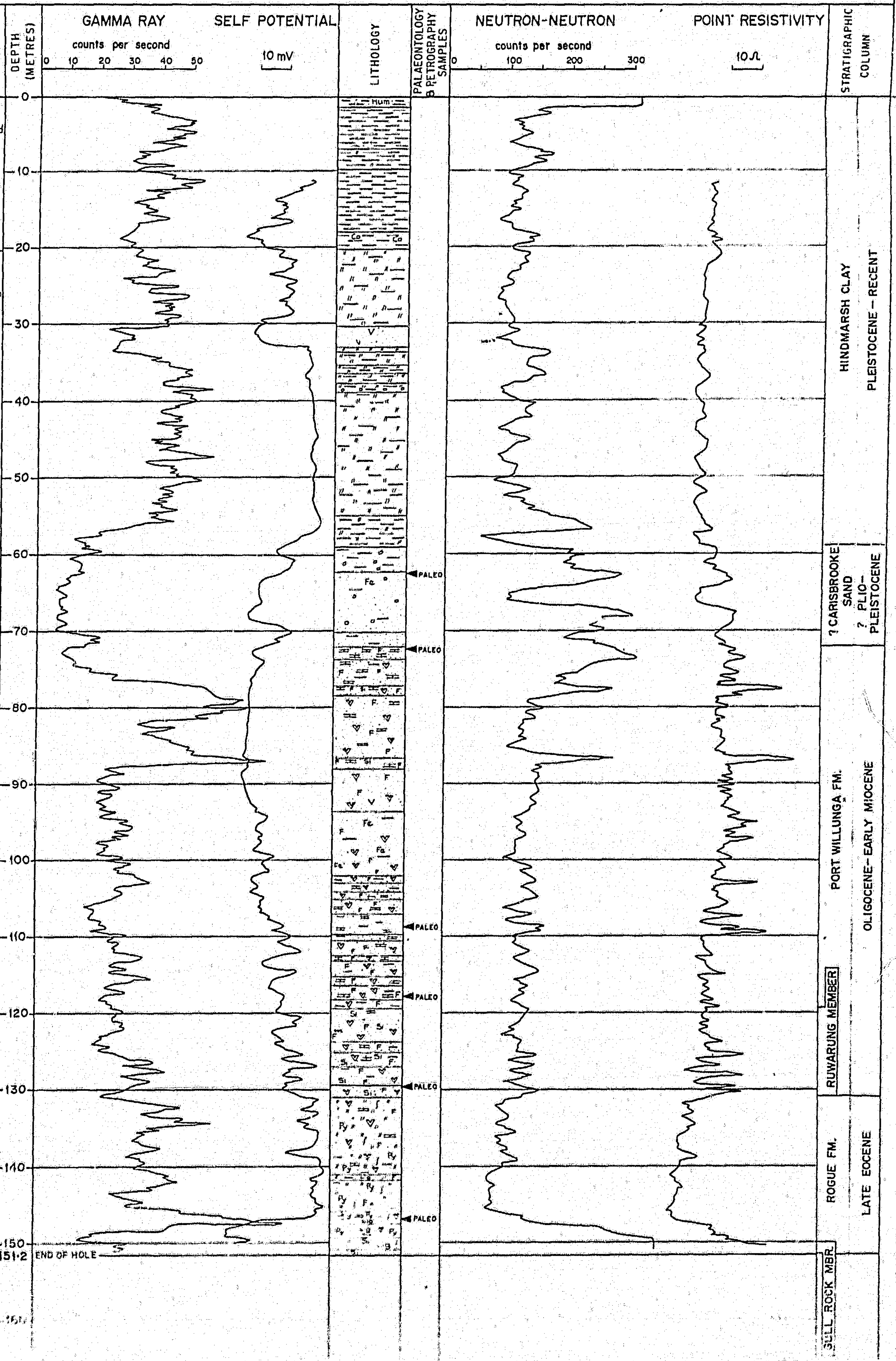
72·1 - 119·3 m Interbedded SILICEOUS, CALCAREOUS SANDSTONE & CALCAREOUS SANDS. Sandstone is hard, buff-yellow and grades toward SANDY LIMESTONE. Sands are green, glauconitic and richly fossiliferous. Frequently slightly clayey. In lower parts becomes variable in glauconite, clay, carbonate and limonite content. Becomes slightly clayier, finer grained and less fossiliferous toward base.

119·3 - 130·8 m. Interbedded SILICEOUS SANDSTONE & GLAUCONITIC, SILTY SAND. Grey-green, slightly to moderately calcareous and fine grained. Frequently clayey, lower fossil content than above. Trace pyrite toward base.

130·8 - 145·8 m GLAUCONITIC SANDY SILTS. Grey to greenish grey, common silty sand bands and slightly calcareous. Fossiliferous, carbonaceous with common pyrite. Clay content increases toward base. Bioturbated appearance. Rare lignitic bands.

145·8 - 149·2 m LIGNITIC CLAY & CLAYEY, SILTY SAND. Clays are dark grey, silty and slightly calcareous. Sands are fine grained and dark grey. Pyrite and glauconite common.

149·2 m - T.D. Interbedded SILICEOUS SANDSTONE & LIGNITIC, SILTY SAND. Sandstone is hard, vuggy, grey and quartzit[illegible] bands are dark brown, fine grained [illegible] ... [illegible] fossiliferous.



APPENDIX IV

CORE DESCRIPTIONS

WELL: BARABBA NO. 1 DEPTH: 0-50 m. LOGGED BY: C.D.COCKSHELL	DEPARTMENT OF MINES — SOUTH AUSTRALIA **CORE DESCRIPTION**	CORE No. CONTINUOUS RECOVERY (ave.70.7%) 71.3% DATE 21/3/77

DEPTH	GEOLOGICAL DESCRIPTION OF CORE
0	Brown CLAY SOIL with 5% cream clay
	Sticky mottled brown CLAY with 5% cream clay Trace calcareous granules, mica, carbonaceous material and quartz grains.
10	
	Mottled red-brown and cream CLAY, cream clay ~20% less sticky brown clay
20	Red-brown CLAY with 25% cream clay interveins, quite compact
	Orange fine silty CLAY, minor cream clay, more broken than above
	V. fine SANDY CLAY - red and cream, with minor silt
	V. clayey v. fine SAND with rare coarse sand grains.
	Clay is mainly red-brown and orange V. clayey fine-medium SAND, orange-grey with mustard and cream CLAYS Ironstained with trace muscovite and rare rounded quartz pebbles
	Orange and grey CLAY, slightly silty with rare manganese coatings
	A.A. but much less silt
	Orange and grey CLAYEY SILT with rare fine sandy sections
	Silty red CLAY with grey clay interveins
30	Quite clean grey-green and red mottled CLAY with minor silty fraction
	Silty red and grey CLAY with 5% rounded quartz granules up to 3mm
	Very CLAYEY fine-medium SAND with 7% quartz granules & 40% grey and red clay
	Silty red, mustard and grey CLAY, with minor medium sand grains slightly indurated with some slicken- sided surfaces. Rare siltier bands.
	Dark green and red mottled SANDY CLAY with 10% quartz granules up to 3mm.
	Very CLAYEY fine-medium SAND with 10% quartz granules up to 4mm, and grey and green clay
40	Orange-brown clean coarse SAND with 2% carbonaceous material (thin very clayey band 38.6 - 38.7 metres)
	Very clayey coarse SAND with rare quartz pebbles up to 10mm, 30% green clay, 3% carbonaceous material, 2% opaque minerals
	Quite clean medium-coarse SAND 2% opaques, trace mica and ?carbonaceous material, orange and limonitic stained becoming clayier and finer toward base
	Orange-cream coarse SILT with 10% medium sand, moderately hard, becoming slightly sandy toward base.
	Soft SILTY very fine SAND, generally clean but some slightly clayey bands. Trace mica and carbonaceous material and some medium quartz sand grains
50	

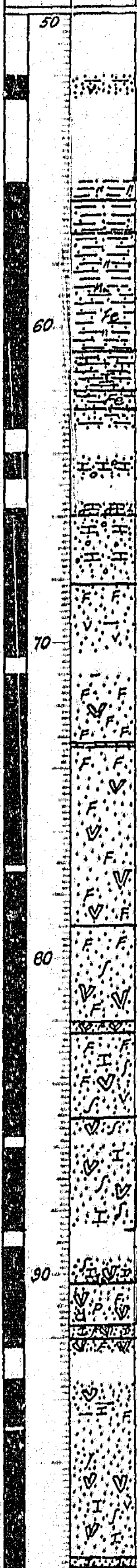
WELL: BARABBA NO. 1
DEPTH: 50-100 m.
LOGGED BY: C.D. COCKSHELL

DEPARTMENT OF MINES - SOUTH AUSTRALIA

CORE DESCRIPTION

CORE No. CONTINUOUS
RECOVERY (ave. %) 81.2 %
DATE: 21/7/73

CORE	DEPTH	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE



Orange-pale grey clean medium SAND, trace opaques and rare mica grains, very soft, some minor clayier bands, becoming coarse-very coarse grey sand toward base.

Slightly silty grey-green and mustard CLAYS with 2% fine sand grains of quartz and opaques. Moderately compact.

White fine-medium SANDY CLAY, slightly silty.

Green slightly SANDY CLAY, slightly silty in part, some manganese coated surfaces, partially limonitic. Approx. 10% sand slightly indurated and becoming moreso toward base.

As above but slightly more indurated and compacted.

White, highly CALCAREOUS slightly sandy CLAY with 5% sand. Moderately soft and sticky.

Very CLAYEY very fine SAND with 1% opaques. Mainly green but some limonitic staining.

As above but common coarse sand grains

Very CALCAREOUS medium-very coarse SANDSTONE, very hard and broken. CALCAREOUS cement ~40%. Some quartz granules up to 4 mm

As above but slightly more clay, becoming grittier and softer

Very CALCAREOUS cemented fine SANDSTONEwith some gritty bands. Very hard and broken

Dark green very fossiliferous very CALCAREOUS fine SAND, muscovite common Possible glauconite, minor clay and carbonaceous material

A hard band of grey fine sand, highly calcareous sandstone with 2% opaques and ?Glauconite, very few visable fossils

As above but fewer macro fossils and 2% glauconite.

Dark green CALCAREOUS fossiliferous fine-medium GLAUCONITIC SANDSTONE 5% glauconite, 2% muscovite, but fossil content less than above.

As above but macro fossils much more common. Local bands of very glauconitic material. Carbonaceous material quite common.

A.A. but very hard and glauconitic (10%)

Fine GLAUCONITIC SAND with much less fossil content, generally clean and very soft. Glauconite 5-10% with some carbonaceous material

Fine GLAUCONITIC SAND with low fossil content, generally clean and soft with common sulphides (mainly pyrite) Glauconite 10%

Very hard GLAUCONITIC highly CALCAREOUS fine SANDSTONE, ?siliceous, grey and very broken with occasional softer bands. Pyritic in part with 7% glauconite

Very hard GLAUCONITIC highly CALCAREOUS SILICEOUS fine SANDSTONE grey and very broken with pyrite common

Clean and soft GLAUCONITIC fine SAND with low fossil content

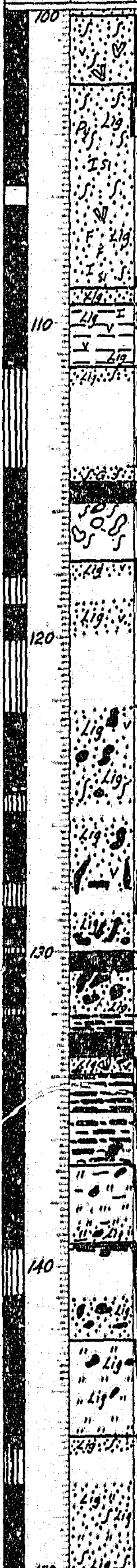
As above, geerally clean but common clayey zones

As above, darkgrey-green, common clean sand zones, pyrite less common, more carbonaceous material, 2% mica (muscovite)

A hard band of clean siliceous sandstone

WELL BARABBA NO. 1	DEPARTMENT OF MINES — SOUTH AUSTRALIA	CORE No. CONTINUOUS
DEPTH 100-150m.	**CORE DESCRIPTION**	RECOVERY (ave. %) 69.4%
LOGGED BY: C.D. COCKSHELL		DATE: 21.3.77

CORE | DEPTH | GRAPHIC LOG | GEOLOGICAL DESCRIPTION OF CORE



Soft generally clean fine SAND with GLAUCONITE (10%), pyrite (2%), carbonaceous material (up to 10%), mica (2%), occasional molluscs, colour varies from light grey (clean) to very dark grey (carbonaceous) difficult to distinguish dark clay from carbonaceous material.

Dark grey as above but carbonaceous material 10-20%

As above but very dark grey to black, CARBONACEOUS material 15-25%, lignitic and slightly clayey in parts rare bands of hard, silica and carbonate cemented sandstone fossils becoming less common, slightly more indurated, harder and less friable than above, sand becoming very fine grained, with less glauconite and pyrite.

Very dark grey-black lignitic sand, slightly more fossiliferous

Dark grey LIGNITIC SILTY CLAY, sandy in part with common mica slightly calcareous. INTERBEDDED with silty lignitic very fine sand with common mica grains and ? glauconite. Possibly bioturbated.

Black, LIGNITIC non-calcareous medium-coarse SAND with common garnets. 25% lignitic material.

Black CARBONACEOUS very fine SANDS with common pink-red garnets, carbonaceous material ~15%

Black LIGNITE, very light & fractured, very common plant remains Generally non-greasy with a brown streak.

Dark brown-black CARBONACEOUS very fine SANDS with lignite fragments up to 10mm (5-10%) Lignite and carbonaceous content 10-40% Trace mica

Generally soft and friable Generally clean very fine SAND, slightly lignitic (<2%), trace mica numerous fine elongate gypsum crystals. Small bands of slightly more lignitic material.

As above but with numerous veins and small pods of lignite, brown and extremely soft and friable

As above but slightly more compact and less friable.

As above but grades quickly into black LIGNITE similar to that above but slightly more sandy. Common elongate ?gypsum crystals.

Grades gradually into very carbonaceous, LIGNITIC very fine SANDS, similar to above.

Brown very LIGNITIC CLAY with very common plant remains

Black slightly SANDY LIGNITE very light and fractured

Very LIGNITIC very fine SAND with glauconite, mica and lignite fragments

Brown-dark brown very LIGNITIC CLAY with common lignite fragments and slicken-sided surfaces

Light brown-brown LIGNITIC SILTY CLAY with up to 20% lignite fragments, common plant remains

Grades slowly to CLAYEY SILT and then to SILTY very fine SAND and a corresponding decrease in amount of lignite fragments. Buff to dark brown, soft and clayey, lignite fragments ~5% but common bands much richer in lignite

As above but sand is medium-coarse grained with slightly less clay

Brown slightly sandy very LIGNITIC CLAY with abundant lignite fragments, soft

Dark brown lignitic to very lignitic silty very fine sand with up to 10% lignite fragments.

Gradually grades into slightly lignitic light brown SILT with some very fine sand, minor lignite fragments.

Grades back into very LIGNITIC and CARBONACEOUS dark brown SILTY very fine SAND Carbonaceous and lignitic content ~30% sludge samples are similar but with less carbonaceous content

WELL: BARABBA No.1

DEPTH: 150-187 m.

LOGGED BY: C.D. COCKSHELL

DEPARTMENT OF MINES — SOUTH AUSTRALIA

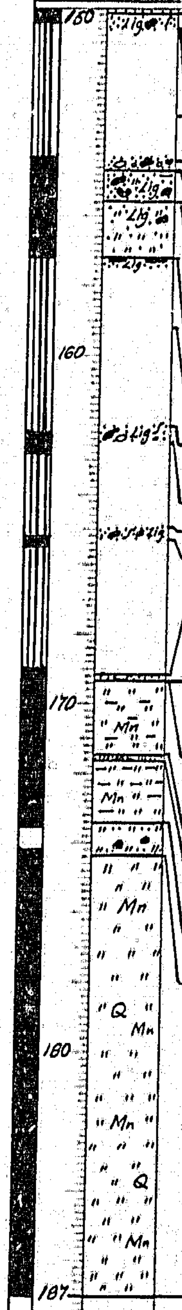
CORE DESCRIPTION

CORE No. CONTINUOUS

RECOVERY (ave. %) 57.6 %

DATE: 21.3.77

CORE	DEPTH	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE



Light grey gritty medium-very coarse SAND with 1% fine garnets.

Dark brown and white LIGNITIC fine-medium SAND, silty in part with common lignite fragments. Mottled by clean sand and lignite.

Sludge sample: light brown medium-coarse SAND slightly lignitic, with less common lignite fragments.

Sludge sample: light brown fine-medium SAND, very slightly lignitic, very few lignite fragments.

Light brown GRITTY fine-very coarse SAND, LIGNITIC with common lignite fragments, 15% grit up to 3 mm.

Brown and white mottled very LIGNITIC very fine-fine SAND, lignite fragments very common (up to 20%) as tree and plant remains, veins and small pods. mottled by lignitic and clean silty sand components.

Very fine SANDY coarse SILT, very slightly lignitic with very few lignite fragments. Buff coloured with gradational upper boundary.

Very LIGNITIC fine-medium SAND with common lignite fragments & garnets.

Sludge sample: as above but sand coarser and less lignitic component.

Very LIGNITIC & CARBONACEOUS GRAVELLY coarse SAND, light brown to brown with common lignite fragments (one whole leaf seen).

Sludge sample: as above but less gravel.

As above - very lignitic with common lignite fragments.

Sludge sample: as above but sand medium-very coarse, less lignite.

One piece of very hard well cemented poorly sorted PEBBLY medium-very coarse SANDSTONE, very PYRITIC (10%). Subrounded sand grains but pebbles up to 7 mm are commonly fractured.

One piece of very light black lignite with rare sand grains.

Very LIGNITIC and CARBONACEOUS fine-medium SAND, several pebbles up to 32 mm. Bound with very sticky clay (drilling mud?) Some laminations of carbonaceous material and very fine clean sand.

Clean buff CLAYEY SILTSTONE, surface manganese coatings common with ?very fine grained pyrite. Observed laminations are very weak. Very sticky when wet (?drilling mud).

Similar to above but quite sandy (fine-medium grained). Lighter colour.

Blue-green LAMINATED slightly weathered CLAY SILTSTONE. Laminations less than 1 mm approx.normal to core axis. Non calcareous with manganese coatings common. Well fractured and mod. fissile & hard.

Blue very clayey soft SILTSTONE with some medium sand grains. Common large pods of lignite fragments. Core ground away.

Blue-green LAMINATED SILTSTONE. Laminations less than 1 mm thick of varying lighter (?quartz rich) and darker (?biotite rich) layers. In part finely sandy and pyritic with common manganese surface coatings. Quite fissile and well cleaved, occasional sub horizontal quartz veins nearly parallel to the laminations. Becomes harder and more blue-grey toward the base with decreased weathering.

END OF HOLE 187.00 metres.

WELL: BARABBA No.2
DEPTH: 0-50 m.
LOGGED BY: C.D. COCKSHELL

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CORE DESCRIPTION

CORE No. CONTINUOUS
RECOVERY (ave. %) 84.6 % 79.5 %
DATE: 30/3/77

CORE	DEPTH	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	0	Humic, Fe	Red-brown slightly sandy CLAY SOIL, very sticky red clay and some cream clay. Abundant limonite gravel fragments. Sand is medium-coarse grained.
	10	Fe	Red-brown slightly SANDY CLAY with up to 40% compact cream clay. Bands rich in limonite fragments are common but limonite content is much less than above. Sand is mainly fine grained. Cream clay component increases in amount towards the base.
		Fe	Red-brown slightly sandy SILTY CLAY, easily broken. Minor cream clay component. Sand is very fine grained.
	20		Slightly clayey SILTY fine-medium SAND, red-brown to orange rare opaque and very coarse grains. Very soft.
		Fe	Very CLAYEY orange-brown GRAVELLY SAND. Clay is brown, orange component is limonitic. Granules up to 4mm towards the base grain size increases and amount of clay decreases.
			Very CLAYEY SILTY finely SANDY GRAVEL with abundant pebbles up to 48mm of quartz and limonitic quartz. Extremely broken. Mainly orange.
			Orange SILTY very fine SAND with some coarse sand grains and pebbles, possibly contamination from above. Trace mica and opaques.
			Grades gradually into red and grey mottled SANDY CLAY. Trace mica and opaques. Sand is very fine.
	30		Grey very CLAYEY SILTY fine SAND. Clays are orange and brown.
			SILTY GRAVELLY very coarse SAND, generally clean and orange and grey. Granules up to 3mm.
			Grey very finely SANDY coarse SILT, generally clayey and mottled with orange silty very fine sand.
	40		Mottled orange and grey SILTY very fine SAND. Bands of cleaner orange fine-medium sand and rare bands of siltier clayey very fine orange sands. Common opaques.
			As above but sands becoming coarser.
			Orange and grey GRAVELLY SILTY medium-coarse SAND. Common pebbles up to 40mm. Opaques common.
			Mottled grey-white and orange very SILTY very fine SANDS with some ?clay matrix. Coarser zones are orange.
			White-grey very CLAYEY SILTY very fine SAND with bands of sandy silts.
	50	Mn	Grey SANDY SILTY CLAY, moderately compact, manganese coatings and?slicken- sides

WELL: BARABBA No.2

DEPTH: 50-88.8 m.

LOGGED BY: C.D. COCKSHELL

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CORE DESCRIPTION

CORE No. CONTINUOUS

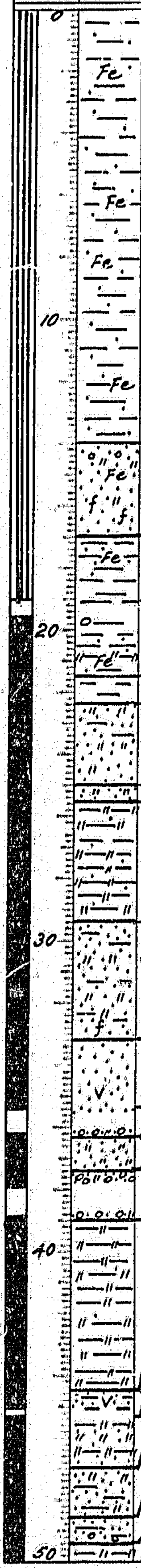
RECOVERY (ave. %) 88.7%

DATE: 30/3/77

CORE	DEPTH	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	50		As above, varicoloured grey and orange finely SANDY, SILTY CLAY, quite compact and hard, manganese coatings common, rare clean fine sand lenses.
			Grey and orange CLAYEY SILTY medium SAND, quickly grading to SANDY GRAVEL at the base with pebbles up to 15mm. Manganese coatings less common.
			Grey, CLAYEY SILTY very fine-fine SAND, moderately compact as above, trace opaques, manganese coatings, and rare granules to 4mm.
			Mottled green and limonitic orange SANDY CLAY, compact with slicken-sides.
			Orange CLAYEY SILTY very fine-fine SAND, ?carbonaceous.
			Orange very coarse SANDY GRAVEL, very soft, well rounded grains.
			Very sticky mustard CLAYEY SILTY medium FELDSPATHIC SAND, very CALCAREOUS
			Very hard very CALCAREOUS SILTY very fine SAND, ?Carbonaceous, orange.
	60		Much softer and less calcareous sand than above.
			Interbanded soft and very hard very CALCAREOUS orange find SAND. Generally clean with common opaques. Very hard band 55.7 - 56.0 metres.
			Grades quickly into well rounded orange coarse SANDY GRAVEL. Highly calcareous with granules up to 4mm.
			Grades back to interbedded hard and soft orange SILTY fine SAND, then to finely SANDY SILT with common opaques and occasional granules.
			Extremely hard very CALCAREOUS grey fine-medium SAND STONE FOSSILIFEROUS.
			Highly CALCAREOUS orange FOSSILIFEROUS SILTY fine SAND with some glauconite and opaques, zones of coarser sands with granules to 3mm.
			Brown-dark brown coarse SANDS non-calcareous some glauconite and gravel. Dark brown pigment ?clays.
			Non calcareous orange clean very fine SAND, trace fossils, mica and opaques.
	70		Orange GRAVELLY fine-coarse SAND, common glauconite and opaques, trace mica. Becomes SANDY GRAVEL (to 8mm) rounded grains toward base.
			Orange-green slightly gravelly very fine-fine SAND with pink garnets, and glauconite, trace mica, very slightly calcareous granules to 4mm.
			Orange-green SILTY GRAVELLY very coarse SAND, slightly glauconitic, faintly calcareous, trace mica and opaques becoming fine-medium grained.
			Thin band of similar material but much more gravel, with pebbles up to 5mm.
			Clean orange slightly gravelly very fine-fine SAND, very soft, similar to sands above.
			Orange-green slightly gravelly fine-very coarse SAND with limonitic grains, very common, trace mica and opaques, non calcareous.
	80	Fe, Mn	Weathered blue-green LAMINATED SILTSTONE, laminations less than 1mm, very compact and well developed cleavage, quite broken in parts, limonite and manganese coatings common, rare quartz veins up to 8 cm thick subparallel to laminations. Laminations are about 60°-70° to the core axis. Several bands of finer grained material which are very broken.
			As above but very hard and unweathered.
	90		End of hole 88.80 metres.

WELL: BARABBA No.3 DEPTH: 0-50 m. LOGGED BY: C.D. COCKSHELL	DEPARTMENT OF MINES — SOUTH AUSTRALIA **CORE DESCRIPTION**	CORE No. CONTINUOUS RECOVERY (ave. %) 85.0%91.0% DATE: 19/4/77

CORE | DEPTH m | GRAPHIC LOG | GEOLOGICAL DESCRIPTION OF CORE



Red-brown slightly SANDY CLAY with some limonite fragments and minor zones of white-cream clay. Very sticky.

Light brown slightly feldspathic GRAVELLY very coarse SAND, abundant opaque grains some siltstone fragments.

Mottled red and cream CLAY, in part contaminated by sands from above, very sticky when wet.

Grey CLAY in part mottled by red iron staining at top are several pebbles up to 30mm with orange very fine sand. Minor bands of orange silt.

Red-orange CLAYEY SILT with interveined cream clay. Rare sand grains.

Orange SILTY very fine SAND with interveined cream clay. Coarsening grain size toward base.

Pale orange SILTY medium SAND, rare very coarse grains, opaques common, very soft.

Mottled grey CLAY and orange SILT with rare sand grains. Frequently varies from pure clay to pure silt. Grain size increases toward base.

Orange CLAYEY SILTY very fine SAND with rare medium grains. Coarsens toward base to medium sand with minor feldspar.

Clean orange very fine SAND with common opaques and minor mica.

Orange-grey coarsely SANDY GRAVEL with rounded quartz grains up to 5mm some grey silty very fine sand.

Grey SILTY very fine SAND trace opaques.

Grey SANDY GRAVEL with abundant silty very fine sand, and angular pebbles up to 22mm. Very loose and soft.

Mottled grey CLAY and red-orange SILT with rare very coarse sand grains.

Orange CLAYEY medium SAND trace opaques and mica.

Mottled orange and grey CLAYEY SANDY SILT, sand is medium grained. Common bands of silty very fine sand.

Grey CLAYEY SILTY fine SAND, frequently iron stained.

Grey CLAYEY medium SAND, frequently ironstained, with some granules up to 3mm.

Mottled grey CLAY and orange-red SILTY CLAY.

WELL: BARABBA NO. 3
DEPTH: 50-100m.
LOGGED BY: C.D. COCKSHELL

DEPARTMENT OF MINES — SOUTH AUSTRALIA

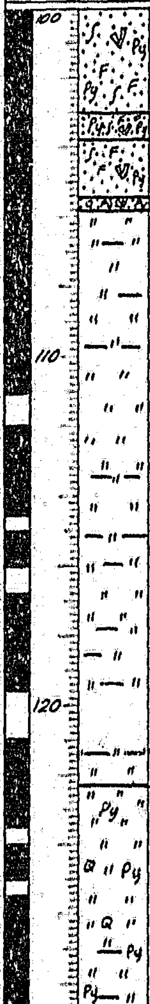
CORE DESCRIPTION

CORE No. CONTINUOUS
RECOVERY (ave. 82.0 %
DATE: 19.4.77

CORE	DEPTH	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	50		Mottled grey CLAY and orange-red SILTY CLAY as above. Slicken-sided.
			Gradually coarsens to grey CLAYEY SILT with some orange silt
			Gradually coarsens to mottled grey and orange SILTY very fine SAND with rare medium grained bands
			Very clean white medium SAND with common opaques and mica
			Mottled grey and orange SILTY very fine SAND
			Very clean white medium SAND
			Mottled grey and orange SILTY CLAYEY very fine SAND softer than above. Becoming cleaner and coarser toward base.
	60		Clean orange coarse SAND
			Grey CLAYEY SANDY SILT partially iron stained
			Grey-green CLAYEY fine SAND with common slicken-sides and manganese coatings. Common opaques and trace feldspar and garnet.
			Orange SILTY SANDY GRAVEL with pebbles up to 30 mm.
			Highly CALCAREOUS orange SILTY very fine SAND
			Highly CALCAREOUS cemented very hard fine SANDSTONE with thin zones of clayey green softer sand with slicken-sides and manganese coatings.
			Buff-yellow highly CALCAREOUS SILTY fine SAND with manganese coatings.
			Highly calcareous cemented very hard buff fine SANDSTONE rare fossils.
	70		Interbedded very CALCAREOUS mustard-orange fine SANDS and finely SANDY GRAVEL with granules up to 4 mm. Very soft and slightly glauconitic
			Very CALCAREOUS orange-mustard SILTY very fine SAND, fossiliferous in part, very oxidized with minor glauconite. Some thin interbeds of highly calcareously cemented very hard buff sandstone as above.
			As above but with interbeds of silty very coarse sand.
			As above but no coarse sand. Fine sand is now brown and less oxidized. Glauconite and fossils common.
	80		Very CALCAREOUS brown-green SILTY very fine SAND similar to above, common glauconite and fossils. Rare bands of fine-medium sand. Becoming very fossiliferous and green toward the base.
			Non calcareous mustard-yellow clean fine SAND with no observable fossils. Abundant limonitic granules and trace mica, opaques and glauconite.
			CALCAREOUS GLAUCONITIC carbonaceous dark grey clean fine SAND, some orange fine sand and rare granules. Less fossiliferous and very soft. Possibly bioturbated.
	90		As above but only slightly to faintly calcareous
			As above but non-calcareous
			Slightly calcareous highly GLAUCONITIC mustard medium SAND
	100		CARBONACEOUS GLAUCONITIC fine SAND as above, frequently very fossiliferous. Pyrite very common and strong H_2S odour. Fossils frequently pyritized.

WELL: BARABBA NO. 3	DEPARTMENT OF MINES — SOUTH AUSTRALIA	CORE No. CONTINUOUS
DEPTH: 100-128m.8	**CORE DESCRIPTION**	RECOVERY (ave. %) 83.7%
LOGGED BY: C.D. COCKSHELL		DATE: 19.4.77

CORE	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE



CARBONACEOUS GLAUCONITIC fine SAND as above, quite pyritic many pyritized fossils observed. Very strong H_2S aroma.

As above but gravelly and less pyritic. Pebbles up to 20 mm.

As above but very little gravel.

As above but sand is medium grained and gravelly with pebbles up to 10 mm. Pyrite very common. Some pyritized fossils.

Buff LAMINATED CLAYEY SILTSTONE. Laminations very weak due to weathering, and vary from 35° to 60° to core axis. Non calcareous, moderately hard but very broken. Clay rich zones are very friable and crumbly, some thin quartz veins subparallel to laminations Rare irregular veins of darker material near base colour changes slowly to pale grey-buff toward base.

As above but now dark grey and less weathered. Clay much less common. Pyrite very common and concentrated along cleavage planes. Laminations are extremely variable in orientation - 10-60° to core axis.

END OF HOLE 128.8 metres

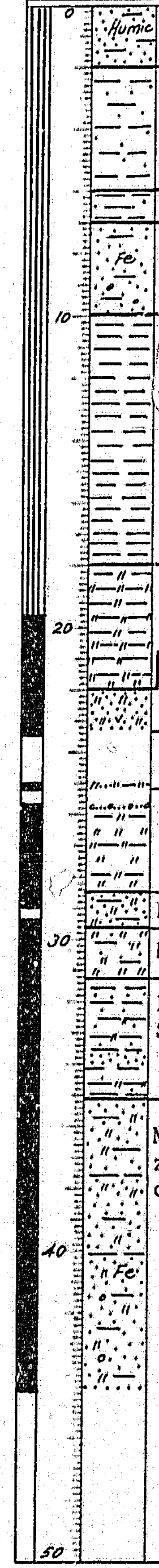
WELL: BARABBA NO. 4
DEPTH: 0-50 m.
LOGGED BY: C.D. COCKSHELL

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CORE DESCRIPTION

CORE No: CONTINUOUS
RECOVERY (ave%): 70.1% 73.9%
DATE: 2.5.77

CORE	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE



Orange CLAYEY medium SAND, humic in part

Very sticky orange-brown slightly sandy CLAY

As above but with a cream clay component up to 20%

Orange-brown very CLAYEY coarse SAND with limonite fragments very common.

Mottled red and cream CLAY.

Mottled red SILTY CLAY and buff-grey CLAYEY SILTS

Mottled orange and buff-grey SILTY fine-medium SAND, clayey in part with trace mica and opaques. Quite soft and friable.

Mottled orange and light grey finely SANDY SILTS and CLAYEY SILTS.

At top a small section of silty sandy gravel with pebbles up to 8 mm. Mottled orange and light grey SILTY CLAY.

Mottled orange and grey CLAYEY SILTY fine SAND

Mottled orange and grey CLAYEY SANDY SILT

Light grey SANDY CLAY frequently mottled by orange sandy clayey silt. Some orange sand rich zones.

Mottled orange and light grey CLAYEY SILTY very fine-fine SAND with zones with granules common. Some zones of cleaner medium sand and rare clay rich zones (less than 0.2 metres thick).

WELL: BARABBA NO. 4
DEPTH: 50-95.2m.
LOGGED BY: C.D. COCKSHELL

DEPARTMENT OF MINES -- SOUTH AUSTRALIA

CORE DESCRIPTION

CORE No: CONTINUOUS
RECOVERY (ave %): 67.5%
DATE: 2.5.77

CORE	DEPTH	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	50		Orange SILTY fine SAND with rare granules upto 5 mm. Some finer clayeyer bands, redder in colour forming weak laminations at 90° to core axis.
			Similar to above but sand is medium-coarse and with much limonite cement.
			As above but sand now coarse-very coarse
			Highly CALCAREOUS orange fine-very coarse SAND with trace opaques.
			Green highly CALCAREOUS very FOSSILIFEROUS SILTY very fine-fine SAND, glauconite, very common Fossils mainly Mollusca and Echinoids.
			Green GLAUCONITIC FOSSILIFEROUS highly CALCAREOUS coarse SAND opaques very common. Large macrofossils prolific.
	60		Green very fine-fine SAND as above but common coarse grains.
			Grey-green GLAUCONITIC very fine SAND, SILTY and ?clayey in part, less calcareous and fossiliferous than above, fossils mainly large turretellia, trace pyrite and ?carbonaceous material.
			Grey non-calcareous CLAYEY fine-medium SAND, GLAUCONITIC and CARBONACEOUS, pyrite associated with calcareous turretellia fossils.
			Orange highly CALCAREOUS slightly clayey medium SAND. Some lignite fragments.
			Grey moderately CALCAREOUS PYRITIC, GLAUCONITIC SILTY very fine SAND some medium grains and large turretellia.
			Grey faintly calcareous PYRITIC GLAUCONITIC CARBONACEOUS SILTY very fine SAND with some clay and lignite fragments.
	70		Brown-black PYRITIC CLAYEY LIGNITE. Very light and soft.
			Light grey slightly calcareous clean medium SAND. Extremely soft
			Mottled clean white fine SAND, black CLAYEY LIGNITE and dominant brown SILTY very CARBONACEOUS very fine SAND. Soft with few fossils.
			Black very CARBONACEOUS SILTY very fine SAND, very soft with few fossils. Sludge sample contains more lignite fragments.
			Off-white very CLAYEY GRITTY very coarse SAND with thin bands of very carbonaceous material subparallel to core axis. These bands are up to 5 mm thick and comprise up to 5% of rock.
			Similar to above but no carbonaceous veins. Many granules and pebbles, mainly subrounded. Pyrite and pink orthoclase common.
	80		Similar to above but finer grained and common thin irregular veins of lignite (? tree roots) and pyrite.
			Off-white very CLAYEY coarse SAND similar to above, gravelly in zones and toward base, common orthoclase and pyrite. Zones of pale green colour.
			Similar to above but very hard CLAY CEMENTED medium SANDSTONE, No glauconite, little pyrite, siderite-limonite weathering of pyrite common, rare orthoclase grains. Quartz grains are mainly subrounded.
			Similar to above but softer and greener due to ? chlorite opaques common, some granules and quartz veins at about 45° to core axis.
	90		Deep green-pale green poorly sorted slightly GRAVELLY SILTY very FINE SANDSTONE, common opaques delineate a weak cross bedding, frequent subrounded pebbles up to 10 mm. Pink orthoclase pebbles common, some pyrite often associated with quartz pebbles. Minor clay in matrix of sand grains. Green colour due to ?chlorite. Common quartz grains at 60°-50° to core axis. Upper and lower contacts at about 70° to axis. At base are a very large number of orthoclase and quartz granules.
			Very hard light coloured clay cemented ARKOSE. Quartz and pink orthoclase predominant, white plagioclase variable with amount of weathering to clay. Some green ?chlorite grains. Equigranular subrounded very coarse sand to granule grain size, some elongate pebbles up to 6mm indicate a weak bedding plane at 60° to core axis.

END OF HOLE 95.2 metres

WELL: BARABBA No.5	DEPARTMENT OF MINES -- SOUTH AUSTRALIA	CORE No. CONTINUOUS
DEPTH: 0-50 m.	**CORE DESCRIPTION**	RECOVERY (ave. 75. %) 62.%
LOGGED BY: C.D.COCKSHELL		DATE: 4/5/77

CORE	DEPTH m	GEOLOGICAL DESCRIPTION OF CORE
	0	Red-orange slightly sandy CLAY humic in part, limonite fragments common.
		Mottled red and cream sticky CLAY.
		Red-orange very CLAYEY medium SAND (clay probably contaninant from above) Coarsening toward base to very clayey sandy gravel with pebbles up to 8 mm limonite fragments common.
	10	Mottled orange and off-white CLAY rare sand grains, limonite fragments and quartz granules (probably from above).
		Orange-brown very CLAYEY SILTY medium SAND gravelly towards base. Fine grained opaques very common.
		Grey CLAYEY SILT with some mottling by orange clean silt. Becomming very finely sandy toward base.
	20	Mottled grey and orange SILT very fine SAND slightly clayey. Becomming medium grained and cleaner towards base.
		Orange GRAVELLY medium-very coarse SAND with pebbles up to 40 mm. Opaques very common. One small piece at base is white and clay cemented.
		At top several quartz pebbles up to 44 mm. Mottled orange and grey SILTY fine-medium SAND with opaques less common than above. Basal gravelly band at 28.5 - 28.6m with rounded pebbles up to 8 mm.
	30	White SANDY CLAYEY SILT frequently mottled with orange limonitic sandy silt thin zones of orange gravelly sandy silt with rounded pebbles up to 5 mm.
		Orange to white SILT medium-coarse SAND clean in white sections. Trace opaques and granules. One pebble, 18 mm at 30.6 metres. Several zones moderately hard and cemented by limonite. Slightly carbonaceous. Basal gravelly band 33.3- 33.4 metres.
		Similar to above but silty very fine sand, much cleaner than above.
		As above but clayey and buff-yellow.
		Similar to above but moderately hard in part due to limonite cement, sand is medium-coarse and gravelly with granules up to 4 mm.
	40	Orange-yellow SILTY very fine SAND with thin laminae of red ferruginous silt producing a weak sub horizontal lamination. Effect increases with clay content towards base.
		Orange-yellow SILTY fine-very coarse SAND in part gravelly with granules up to 4 mm. Some very weak red silty laminations.
		White slightly SILTY CLAY.
		Light grey-mustard yellow SILTY fine SAND with some very weak red silty laminations. Generally very soft with trace mica and carbonaceous material. Some bands of medium sand. Harder limonitic cemented band 49.3-49.4 metres.
	50	

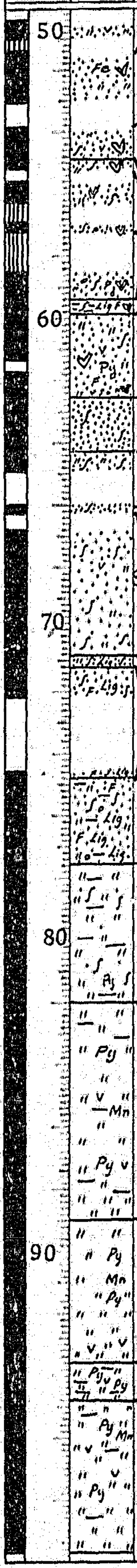
WELL: BARABBA No.5
DEPTH: 50-99.7m
LOGGED BY: C.D. COCKSHELL

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CORE DESCRIPTION

CORE No. CONTINUOUS
RECOVERY (ave %) 82.7%
DATE: 5/5/77

CORE | DEPTH | GRAPHIC LOG | GEOLOGICAL DESCRIPTION OF CORE



Light grey-mustard yellow SILTY fine SAND as above.

Mottled mustard and maroon GLAUCONITIC LIMONITIC SILTY fine-medium SAND. Top part is glauconitic and cemented while lower part is cleaner and lighter in colour.

Dark green-black very GLAUCONITIC SILTY fine-medium SAND very carbonaceous with trace mica grains, non-calcareous.

As above but sand coarse and soft.

As above but sand very soft, fine-medium grained and less glauconitic.

As above but sand medium grained with trace granules and pyrite.

Dark green-black GLAUCONITIC LIGNITIC carbonaceous SILTY CLAY, pyritic with very common lignitic plant remains.

Green-grey SILTY medium SAND with rare granules. less glauconite than above, few plant remains, mica common and trace pyrite, bioturbated appearance. Becomes coarser to base with some pebbles up to 10 mm.

Very hard SILICEOUS grey and dark grey-black fine-medium SANDSTONE. Carbonaceous darker bands 1 mm to 100 mm thick, in grey host rock (?) at 70° - 80° to core axis. Grains subangular.

Dark browny grey very CARBONACEOUS SILTY fine SAND Very soft.

Hard SILICEOUS brown-grey fine SANDSTONE similar to above.

Softer but compact brownish black very CARBONACEOUS SILTY very fine-fine SAND. Rare mica grains and harder bands. Sand grains are coated with black carbonaceous material.

Similar to above but more carbonaceous (40%) and fine-medium grained. Very common lignitic plant remains, rare granules and mica grains, sand grains coated black.

Brown LIGNITIC fine SAND with black carbonaceous material. Zones of brownish black sands as above. Frequent plant remains.

Mottled white CLAYEY SILTY very fine SAND, brown LIGNITIC GRAVELLY fine SAND and black lignitic plant remains. Very hard silicified bands 75.6-75.7 metres and 75.9-76.0 metres. Some zones extremely lignitic with massive wood fragments up to 200 mm in length.

Buff-pale brown slightly sandy CLAYEY SILTSTONE with abundant black carbonaceous material in the form of plant (?root) remains, thin veins, and small pods. Veins often show a preferred orientation at 30° to core axis. The silt has contorted bands of white and pale maroon harder clayier silt of variable thickness up to 5 mm. Bands are dominantly at 90° to core axis. Lenses of same material and lenses and small pods of grey clayey silt are common. Rare mica grains and pods of pyrite, carbonaceous content gradually decreases and rock grades to below.

As above but light grey coloured and less weathered carbonaceous content becoming nil. Laminations as above but often broken and at 80° to axis. Pods and thick lenses of pyrite common, some manganese coatings, mica common. Often well broken and cleaved.

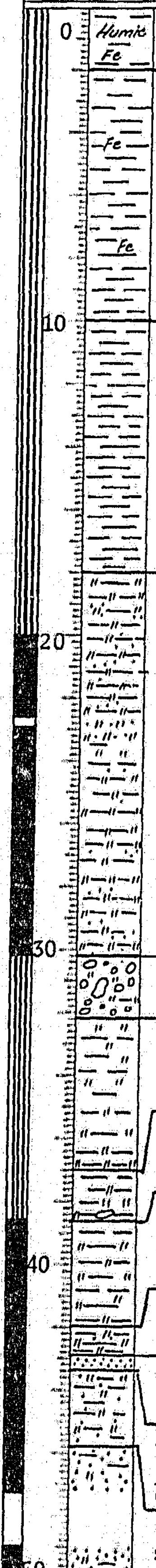
As above but greenish light grey, maroon component now darker and more abundant in both short lenses and long thin lenses subparallel to 80° to axis. Rare bands of more random oriented lenses mica very common. Some multicoloured zones near major ?cleavage zones.

Similar to above but mottled red, light grey and maroon sandy clayey, siltstone, pyrite and mica very common, green zones at cleavages, red, mottling in bands at 20° to core axis.

Light greenish light grey-white CLAYEY SILTSTONE similar to above with thick frequently stringey, maroon lenses often delineating a plane at 80° to core axis. These lenses are often deformed and cresent shaped. Becoming harder and less clayey to base

END OF HOLE 99.7 metres

WELL: BARABBA No.6 DEPTH: 0-50 m. LOGGED BY: ?.D.COCKSHELL	DEPARTMENT OF MINES — SOUTH AUSTRALIA **CORE DESCRIPTION**	CORE No. CONTINUOUS RECOVERY (ave.74.1%) 64.7% DATE: 1/6/77



DEPTH m	GEOLOGICAL DESCRIPTION OF CORE
0	Sticky brown CLAY ferruginous and humic in part.
	Sticky brown CLAY with a minor light grey clay component. Ferruginous
10	Mottled orange and light grey CLAY.
20	Mottled orange-dark red SANDY SILT and light greenish grey SILTY CLAY. Clay is mainly in veins of variable size, orientation and intensity. Silt component quite porous, ferruginous and unconsolidated. Some zones of both coarser and finer material. Becomes sandier towards base.
30	Sludge samples: BOULDER GRAVEL generally clean but some mottled clayey silt, boulders up to 69 mm mainly quartz, jasper and siliceous quartzite.
	Mottled orange CLAYEY SILT and pods of light greenish grey clay. Some pebbles at top.
	Mottled light greenish grey CLAY and dark red-brown CLAYEY SILT. One 50 mm pebble at base.
40	As above but red-brown material is slightly silty clay in fine veins and surface coatings of light greenish grey very slightly silty clay. Abundant slicken-sides.
	As above but grey CLAY now SANDY and more red slightly sandy SILT. Some manganese veins and coatings.
	Mottled red-orange slightly silty fine-medium SAND and yellow-orange very finely SANDY SILT.
	Mottled orange SANDY SILT and light grey SANDY CLAY with rare manganese coatings. Amount of silt decreasing and clay becoming very sandy to base. Light grey becoming predominant colour.
50	Light grey very CLAYEY fine SAND with minor orange sandy-silt. Very soft. Clay and silt amount quickly decreasing.

WELL: BARABBA No.6

DEPTH: 50-100 m.

LOGGED BY C.D.COCKSHELL

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CORE DESCRIPTION

CORE No. CONTINUOUS

RECOVERY (ave. %) 64.4%

DATE: 1/6/77

CORE	DEPTH	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	50		Light grey slightly clayey fine SAND with rare orange silty sand pods, as above. Rare clean zones.
			Light grey CLAYEY medium SAND with common granules and opaques. Trace mica.
			Grey SILTY CLAY, quite compact.
			Light grey very CLAYEY medium SANDY GRAVEL with pebbles to 12 mm.
			Light grey very CLAYEY very finely SANDY SILT. Trace of mica and opaques.
			Grades quickly into mottled pale mustard-yellow and pale green slightly silty CLAY, with bands of iron stone grit and concretions.
	60		Mottled light greenish grey and yellow-orange very limonitic slightly sandy CLAYEY SILT. Trace of mica and opaques.
			Grades quickly into yellow-green very LIMONITIC SILTY fine SAND with common mica and opaques.
			Very hard and broken yellow highly CALCAREOUS cemented fine-medium SANDSTONE.rare fossil traces.
			Softer yellow LIMONITIC very CALCAREOUS SILTY fine SAND.
			Very hard yellow highly CALCAREOUS cemented fine SANDSTONE as above.
			Softer yellow limonitic CALCAREOUS SILTY fine SAND. As above.
			Very hard yellow CALCAREOUS cemented SANDSTONE as above. Fossiliferous in part.
	70		Softer brown-orange CALCAREOUS LIMONITIC fine SAND. Rare fossils. One piece hard calcareous sandstone at base.
			Brown-orange slightly calcareous LIMONITIC SILTY medium SAND. Rare fossils. Bands of siliceous cemented material common. Minor, black material ?carbonaceous or ?manganese-rich. Becomming less calcareous and possibly clayey to base.
			Similar to above but brown-yellow-green colour, frequently more siliceous and more black material - ?glauconite.
	80		Slightly greenish dark brown CLAYEY SILTY very fine SAND with abundant black ?glauconitic grains, and rare green glauconitic grains. Fossiliferous in part, limonitic and possibly lignitic.
			Possibly clean medium buff - yellow SAND.
			Dark greenish brown CLAYEY SILTY very fine SAND as above. Fossils more common.
			Very hard grey slightly glauconitic medium SANDY SPARITIC LIMESTONE with common fossils.
			Green very CALCAREOUS GLAUCONITIC coarse SAND. Very fossiliferous with mainly bivalves, gastropods and bryozoa.
	90		Very hard grey highly CALCAREOUS cemented GLAUCONITIC medium SAND. with common fossils.
			Green very CALCAREOUS GLAUCONITIC coarse SAND similar to above, very fossiliferous with some ?clay.
			Yellow-green very CALCAREOUS clean fine SAND less glauconite and fossil content and softer.
			Light green very GLAUCONITIC very CALCAREOUS clean fine SAND. fossils very common. Glauconite 20%. Rare deep green "clayey" ?glauconite pods, very soft in part.
	100		Green-grey GLAUCONITIC SILTY very fine SAND similar to above but less fossiliferous, calcareous and glauconitic. Becoming darker with clay content. Many very hard siliceous cemented bands. at 97.6-97.7, 98.2-98.3, 98.7-98.9, 99.1-99.3, 99.8-100.2 metres.

WELL: BARABBA NO. 6

DEPTH: 100-150

LOGGED BY: C.D. COCKSHELL

DEPARTMENT OF MINES — SOUTH AUSTRALIA

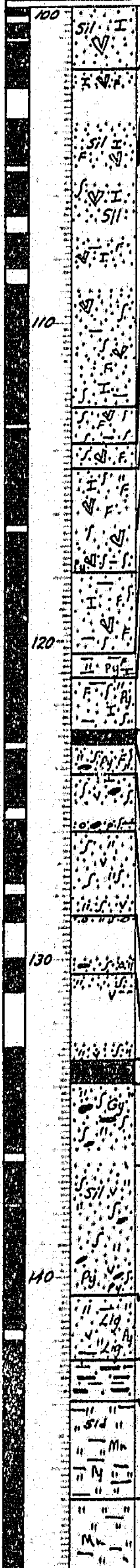
CORE DESCRIPTION

CORE No. CONTINUOUS

RECOVERY (ave. %) 82.8

DATE: 1/6/77

CORE | DEPTH | GRAPHIC LOG | GEOLOGICAL DESCRIPTION OF CORE



Green-grey GLAUCONITIC SILTY very fine SAND as above. Hard siliceous bands at 99.8-100.2, 101.3-101.4, 101.6-102.0 metres

As above but more glauconitic and common large turretella and other fossils. Hard siliceous bands at 103.6-103.9, 104.5-104.8 m

Similar to above but more glauconitic, carbonaceous and clayey much less siliceous, more compacted harder bands at 105.8-105.9, 106.1-106.3, 107.3-107.7, 108.0-108.2, 108.8-108.9, 111.3-111.4 metres.

As above but very carbonaceous and less calcareous

As above but less carbonaceous

Mottled light grey clean SAND and darkgrey CLAYEY CARBONACEOUS SILTY fine SAND, faintly calcareous but still quite glauconitic. Calcareous fossils - mainly bivalves, gastropods, and large turretella - still common. Rock has bioturbated appearance giving rise to mottling.

As above but frequently very micaceous and rare zones rich in pyrite needles.

As above but siltier and clayier and more calcareous.

Darkgrey CARBONACEOUS SANDY SILTY CLAY mica and pyrite common and rare calcareous fossils in non-calcareous rock mass.

Brown-grey CLAYEY SILTY fine SAND with abundant calcareous fossils. Common mica, pyrite and glauconite. Carbonaceous in part. Bioturbated appearance similar to above but with some zones of clean white medium sand. Frequently quite calcareous but becoming faintly calcareous, coarser grained and gravelly to base.

Browny-black SANDY CLAYEY LIGNITE. non-calcareous and pyritic.

Brown-black very CARBONACEOUS SILTY fine SAND with abundant pods and fragments of black clayey lignite and plant remains pyritic.

Brown-grey CARBONACEOUS slightly clayey coarse SAND with rare lignite fragments and common mica and garnet very soft and becoming coarser and gravelly to base. Frequently mottled with light brown silty fine sand.

Grey-brown slightly carbonaceous SILTY very fine SAND with some darker more carbonaceous bands. Mica common. Very soft.

Greenish brown slightly silty GRAVELLY coarse SAND with abundant carbonaceous pods and rare lignitic fragments. Pebbles to 6 mm.

Grey-brown slightly carbonaceous SILTY fine SAND similar to above.

Black CLAYEY LIGNITE with pods of brown very fine sand. Pyritic.

Brown SILTY very fine SAND with abundant LIGNITE FRAGMENTS and clear, very fine and small gypsum crystals which often predominate over sand. Rare mottling of white, brown and dark brown due tovariable carbonaceous content.

Similar to above but mottled white, brown and black carbonaceous very fine sands interbedded with hard fissile well compacted sands of similar nature. These sands are often very silty and well cleaved (at 90° to axis). Abundant large lignitic plant remains gives a mottled appearance. Micaceous in part and pyritic to base.

Dark brown LIGNITIC SILTY very fine SAND, similar to above, frequently micaceous, pyritic and clayey.

Dark brown-black very finely SANDY LIGNITIC CLAY with common pods and bands of brown clayey fine sand. Quite micaceous and pyritic.

Light grey-buff CLAYEY SILTSTONE, generally quite pyritic, with well developed cleavage at 70° to core axis. Weathered ?sulphide or manganese coating grains common on cleavage surfaces.

As above but colour is creamy-orange due to limonite content. Weak fine laminations less than 2 mm thick at 80° to axis.

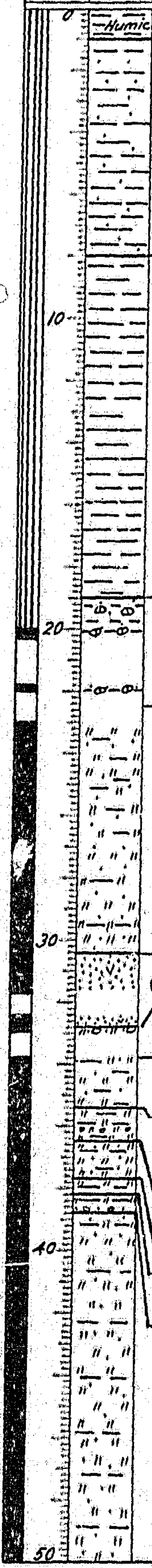
WELL: BARABBA NO. 6	DEPARTMENT OF MINES — SOUTH AUSTRALIA	CORE No. CONTINUOUS
DEPTH: 150-163.1 m	**CORE DESCRIPTION**	RECOVERY (ave. 100 %
LOGGED BY: C.D. COCKSHELL		DATE: 1.6.77

CORE	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	150 – 160	Gy, Sid, Mn, Py	Light greenish grey and pale orange finely LAMINATED CLAYEY SILTSTONE often very pyritic on well developed cleavage (at 60°-80° to axis) surface are common thin round grains of weathered ? sulphide or ?manganese coating as well as coarse sand size rounded equant grains of dark pink-orange, hard material, possibly concretions of iron or siderite rare pods of fine clear needle crystals of ?gypsum. Laminations generally less than 2 mm and at 60°-80° to the core axis. Colour varies to brown-orange-red and greenish yellow. Predominantly compact but rare zones of more cleaved rock mass.

END OF HOLE 163-1 metres

WELL: BARABBA NO. 7 DEPTH: 0-50 m. LOGGED BY: C.D.COCKSHELL	DEPARTMENT OF MINES — SOUTH AUSTRALIA **CORE DESCRIPTION**	CORE No. CONTINUOUS RECOVERY (ave. %) 78.6 % 85.7 % DATE: 5/7/77

CORE | DEPTH m | GRAPHIC LOG | GEOLOGICAL DESCRIPTION OF CORE



Mottled cream and orange SANDY CLAY, very humic in part.

As above but no humic component. Sand fine to coarse cream clay becoming light greenish grey and sandamount decreasing with depth.

Mottled light greenish grey and orange-dark red SILTY CLAY.

Greenish grey slightly SANDY hard CALCRETE NODULES with mottled light greenish grey and orange CLAY MATRIX.

Orange-brown finely SANDY CLAYEY coarse SILT with common pods of light greenish grey silt which are frequently hard and calcareous. Composition varies from silty very fine sand to very clayey medium silt. Manganese coatings and mica common.

Orange-brown medium SAND non-calcareous with trace of mica and opaques.

Brown SANDY GRAVELLY SAND with quartz pebbles up to 30 mm.

Mottled red-orange SANDY CLAYEY SILT and light grey clayey silt with rare pods of yellow-orange fine sand.

Similar to above but mottled dark red SILTY CLAY, light grey inter-veining CLAY and yellow CLAYEY SILT. Thin gravel band at 36.1 metres with pebbles up to 10 mm

Similar to above but red-orange SANDY CLAYEY SILT, light grey CLAYEY SILT and yellow fine SAND.

As above but grey CLAYEY SILT predominant.

As above but very clayey and crumbly. Becoming sandy and gravelly at base with pebbles up to 15 mm.

Mottled orange-brown CLAYEY very finely SANDY SILT and red and light grey SILTY CLAY. Slicken-sides and manganese coatings common. Clay is frequently sandy and shows a diamictitic appearence. Composition is variable in amount of each component.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CORE DESCRIPTION

WELL: BARABBA NO. 7
DEPTH: 50-100 m
LOGGED BY: C.D. COCKSHELL

CORE No. CONTINUOUS
RECOVERY (ave. %) 65.2%
DATE: 5.7.77

CORE	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	50		As above, mottled brown-orange very finely SANDY CLAYEY SILT and light grey and red SILTY CLAY with rare yellow pods of silty clay. Slicken-sides common. Composition quite variable from light grey very finely sandy clay to brown very finely sandy silt.
			Similar to above but predominatly light grey finely SANDY CLAY with minor red CLAYEY SILT. Amount of sand increasing with depth.
			Mottled orange-yellow and light grey CLAYEY SILTY fine SAND
	60		Pale greenish white clean fine SAND with minor clay in some zones. Trace opaques and granules. Some zones pale yellow and very soft.
			As above but clayier and greenish
			As above but cleaner and with limonitic veins.
			Pale green fossiliferous CALCAREOUS CLAYEY medium SAND. Very soft in part. Sand grains are well rounded.
	70		Hard broken very CALCAREOUS richly fossiliferous medium SANDSTONE. Fossils predominantly molluscs.
			Light green very soft clean SAND, CALCAREOUS but with few fossils.
			Dark greenish grey very CALCAREOUS and GLAUCONITIC, fine SAND richly fossiliferous with mainly small calcareous molluscs.
			Hard grey SILICEOUS and CALCAREOUS fine SANDSTONE. Fossils are of small to medium size, mainly molluscs of various types. Glauconite very common
			As above but no silica cementing, very soft and crumbly, calcareous and glauconitic.
	80		Hard grey SILICEOUS SANDSTONE as above
			Softer crumbly very GLAUCONITIC and CALCAREOUS SAND as above. Fossils more varied but mainly ?sponge spicules and mollusca. Hard siliceous band 79.6-79.7 metres.
			Hard SILICEOUS band as above, fossils very common.
			Softer non-siliceous SAND as above, less calcareous and fossiliferous, and darker grey colour. Fossils mainly small.
			Hard SILICEOUS band as above but only slightly calcareous
	90		Softer non to faintly calcareous non-siliceous fine SAND. Dark greenish grey with little glauconite and fossil content slightly clayey and more compact than above. Interbedded hard and softer bands with common slightly calcareous bands. Trace mica. Becomes brownish with pods of limonite with depth.
	100		As above but greenish-brown, calcareous, glauconite, clay and limonitic pods more common. Grades to whitish-green near base and very calcareous with fossils common.

WELL: BARABBA NO. 7

DEPTH: 100-150 m

LOGGED BY: C.D. COCKSHELL

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CORE DESCRIPTION

CORE NO. CONTINUOUS

RECOVERY (ave %) 86.2%

DATE: 5.7.77

CORE	DEPTH	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	100		Similar to both units above - calcareous in some zones, faintly calcareous in others, calcareous zones fossiliferous and frequently mottled with orange limonitic pods.
			Light grey very CALCAREOUS CLAYEY fine SAND, very GLAUCONITIC with few fossils.
			Green-grey glauconitic faintly calcareous fine sand as above.
			As above but calcareous and fossil rich
			As above but very calcareous and fossiliferous and greenish-orange
			As above but very coarse grained
			As above but medium-fine grained
			As above but hard well compacted sandstone
	110		As above but much softer and with a green colour
			As above but much less clay, carbonate and fossil content, becoming faintly calcareous and darker in colour.
			As above but very calcareous
			As above but faintly to slightly calcareous
			As above but very calcareous and fine grained
			As above but faintly calcareous
			As above but very hard and calcareous in part with fossils often common
			As above but slightly calcareous with minor fossils and hard bands, clayey and very fine grained and grey in colour.
	120		As above but hard and SILICEOUS
			As above but softer and less siliceous, slightly to moderately calcareous with common fossils. Becoming coarsely silty with some harder more siliceous bands
			As above but silty very fine sand with bioturbated appearance
			As above but very calcareous and common fossils
			As above but harder and SILICEOUS
			As above but less siliceous and softer
			As above but harder and SILICEOUS
			As above but softer and less siliceous
			As above but hard and SILICEOUS and common medium sized gastropods and other molluscs.
	130		As above but softer, less siliceous, darker and more pronounced bioturbation, more fossils, glauconite and clay trace pyrite.
			As above but SILICEOUS and common large turretellas. A thin bed of extremely glauconitic (30%) softer sand 129. 8-130.0 metres.
			Grey softer very finely SANDY SILT, slightly to moderately calcareous, slightly carbonaceous, very GLAUCONITIC with minor pyrite and some calcareous and trace fossils. Quite bioturbated. Large turretellas common. Becoming more pyritic, clayier and heavily bioturbated toward base.
			Grey faintly calcareous LIGNITIC very CLAYEY SILT, slightly sandy in part with pyrite and small calcareous fossils common.
	140		Dark greenish grey CLAYEY very finely SANDY SILT, slightly to moderately calcareous, carbonaceous and, in part very clayey. Common pyrite and fossils- calcareous, trace and turretellas.
			Dark grey SILTY LIGNITIC CLAY, faintly calcareous, with small fossils, pyrite and slicken-sides common.
			Grey GLAUCONITIC CALCAREOUS slightly SANDY CLAYEY SILT as above. Carbonaceous and commonly pyritic.
			Dark grey SILTY LIGNITIC CLAY as above. Faintly calcareous.
			Grey GLAUCONITIC CLAYEY SILTY fine SAND as above. Lignitic and very pyritic and faintly calcareous.
	150		Light grey extremely SILICEOUS SANDSTONE vughy in part.

WELL: BARABBA No.7	DEPARTMENT OF MINES — SOUTH AUSTRALIA	CORE No. CONTINUOUS
DEPTH: 150-151.2 m.	**CORE DESCRIPTION**	RECOVERY (ave %) 91.7%
LOGGED BY: C.D.COCKSHELL		DATE: 5.7.77

CORE	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	150		Light to dark brown LIGNITIC SILTY very fine SAND, non-calcareous, zones of very dark very lignitic sand near top.
	151.2		Light grey very SILICEOUS QUARTZITIC SANDSTONE as above. Common vughs up to 15 mm in diameter. Thin veins of darker material frequently show banding at 70^{o} to core axis.

END OF HOLE 151.20 metres.

APPENDIX V

PALAEONTOLOGICAL REPORT ON

SELECTED BARABBA BOREHOLES

PALAEONTOLOGICAL REPORT ON SELECTED BARABBA BOREHOLES

1. BARABBA No. 1

A palaeontological sample collected from 66.31-66.37 m contains the foraminifera *Planorbulinella inaequilateralis* and *P. plana*, which indicate an Early Miocene age. A further washed sample from 82.41-82.46 m had abundant *Amphistegina lessoni* and *Pararotalia verriculata*. It probably correlates with the lower "*Amphistegina*" peak of Lindsay and Bonnett (1973) which is Late Oligocene/Early Miocene. Palynological sampling at 100.71-100.81 m, 103.53-103.63 m and 104.45-104.54 m were correlated by W.K. Harris (pers. comm., 1977) with the Late Eocene *Sparganiaceaepollenites barungensis* Zone.

2. BARABBA No. 2

A sample from 53.40-53.43 m is probably Early Miocene. Foraminifera include abundant *Pararotalia verriculata*. Samples from 61.75-61.82 m and 65.13-65.24 m contain *Amphistegina lessoni*, *Pararotalia verriculata* and *Notorotalia* sp. 1, hence dating near the Oligocene/Miocene boundary. No *Bolivinopsis* or *Guembelitria* were noted in these latter two samples.

3. BARABBA No. 5

A palynology sample collected from the interval 59.74-59.84 m was correlated tentatively with the Late Eocene *Sparganiaceae-pollenites barungensis* Zone (Harris, W.K., pers. comm., 1977).

4. BARABBA No. 6

Six palynological samples yielded diagnostic floras in this bore. Sample intervals yielding assemblages were:- 112.07-112.12 m, 120.66-120.72 m, 123.64-123.69 m, 133.33-133.38 m, 140.39-140.44 m and 143.21-143.23 m.

All floras were characteristic of the Late Eocene *Sparganiaceaepollenites barungensis* Zone. Microplankton comprise up to 20% of the assemblage in samples from the Rogue Formation but constitute less than 1% of the floras in samples from the Clinton Formation. Organic microplankton, where present, belong to the *Spiniferites* biofacies (Harris, W.K., pers. comm., 1977).

5. BARABBA No. 7

Foraminifera recognised in a sample from 108.48-108.53 m include *Amphistegina lessoni*, *Bolivinopsis cubensis* and *Notorotalia* sp. 1, which indicate a Late Oligocene age. In a sample collected from the interval 117.55-117.60 m the planktonic foraminifera *Guembelitria stavensis*, *Chiloguembelina cubensis* and *Globigerina* sp. aff. *angulosuturalis* were found suggesting a middle Oligocene age. A good latest Eocene-early Oligocene fauna containing *Chiloguembelina cubensis*, *Guembelitria stavensis*, *Cassigerinella eocaenica*, *C. chipolensis*, *Sphaeroidina bulloides*, *S. variabilis*, *Turborotalia gemma* and *Subbotina* sp. was found in the sample collected from 129.32-129.40 m in the bore (Lindsay, J.M., pers. comm., 1977).

APPENDIX VI

PETROGRAPHIC REPORTS

SAMPLE INFORMATION

SAMPLE NO.	BARABBA HOLE	STRATIGRAPHIC UNIT TAKEN FROM
P645/77	No. 1	Hindmarsh Clay
P646/77	No. 1	Port Willunga Formation, Upper Hard Band
P647/77	No. 1	Port Willunga Formation
P648/77	No. 1	Port Willunga Formation, Ruwarung Member
P649/77	No. 1	Bedrock, Weathered Siltstone
P650/77	No. 1	Bedrock, Fresh Siltstone
P651/77	No. 4	Rogue Formation
P652/77	No. 4	Bedrock, Diamictitic Unit
P653/77	No. 4	Bedrock, Arkosic Unit
P654/77	No. 5	Rogue Formation, Gull Rock Member
P655/77	No. 5	Clinton Formation

EXAMINATION OF SAMPLES FROM BARABBA GRAVITY LOW

1. PETROGRAPHY

Sample: 645/77; TS38635

Location:
Barabba No. 1, 33.43 - 33.52 m

Rock Name:
Silty mudstone

Thin Section:
The sample contains approximately 15% of quartz and less than 1% of feldspar and these two constituents form detrital grains embedded in an abundant iron-stained clay matrix.

The detrital grains of quartz and feldspar range in size up to 0.5 mm but the average grain size is probably less than 0.05 mm and hence the sample has been described as "silty". As well as a wide grain size range there are marked variations in the degree of roundness of the grains and hence it appears that these are derived from several different sources. One of the most characteristic features of these detrital grains is the presence of notably well rounded quartz grains ranging in size from 0.2 to 0.3 mm. These are not abundant but are distinct from most of the other grains which are more or less angular in shape. In addition, many of the grains have re-entrant angles and it is possible that some have been partly replaced by the matrix; it is difficult to understand why some should have been altered in this way but on the one hand there are markedly rounded grains and on the other grains with notably lobate and irregular shape and no other interpretation seems possible. The rock contains a few widely distributed grains of feldspar and these are generally not more than 0.1 mm in size. Both plagioclase and microcline were identified and both form fairly clear and fresh grains in which twinning can still be seen. The grains of feldspar are angular in shape and these, too, appear to have been partly replaced by the matrix.

The detailed mineralogy of the matrix cannot be determined optically since the material is extremely fine-grained and partly obscured by a pervasive brown ferruginous stain. It is likely that the matrix is an argillaceous material and in some places the material appears to show a moderate birefringence and may therefore be illitic. In general the matrix forms a random granular aggregate with no evidence of, for example, bulk extinction. In one or two places there are aggregates of clay up to about 0.15 mm in size and these do show weak preferred orientation and it is possible that they represent some kind of lithic fragment which has been replaced by clay.

There are such slight variations in the degree of iron-staining and this is responsible for the slight variations in the red to brown colour of the rock.

The sample is a silty mudstone characterised by a wide range of detrital grain types even though the great majority of these grains consist of single quartz crystals.

Sample: P646/77; TS38636

Location:

Barabba No. 1, 66.53 - 66.60 m

Rock Name:

Limestone

Thin Section:

The rock contains approximately 20% of quartz, 1% of feldspar and traces of tourmaline and the remainder of the sample is calcite. The latter forms a sparitic cement around the silicate mineral and remnants of fossil fragments of calcite.

Approximately 20% of the volume of the rock consists of generally dark fine-grained calcite which appears to be remnants of fossil fragments. Some of these fragments are curved crossed sections of shells up to about 1 mm in size but many are somewhat elongate to equant dark fragments generally 0.1 to 0.2 mm in size. The origin of the latter cannot be determined since they have no distinctive shape but it is likely that they are fragments of fossil material of some kind. Less common fossil fragments are apparent cross sections of ?gastropods and a few small coiled objects no more than about 0.2 mm in size. There are also several somewhat more irregular and less well defined chambered objects. Calcite cement probably forms about 50% of the rock and is present as a granular aggregate of equant anhedral crystals 0.1 to 0.3 mm in size. This material is fairly homogeneous throughout the rock and forms an efficient cement.

Quartz and feldspar are present as subround to angular grains which have an average size of 0.1 mm. These are randomly distributed throughout the rock and appear to be of detrital origin. Feldspars are fresh and plagioclase appears to be at least as abundant as potassium feldspar. It is likely that many of the fragments of silicate have been partly replaced by the sparitic calcite but some still retain subrounded outlines. Tourmaline and ?muscovite occur as rare detrital grains.

The sample is a relatively quartz rich and fossiliferous limestone cemented by sparitic calcite.

Sample: P647/77; TS38637

Location:
Barabba No. 1, 80.94 - 81.00 m

Rock Name:
Porous fossiliferous limestone

Thin Section:
An optical estimate of the constituents gives the following:

	%
Calcite	55
Pores	25
Quartz	15
?Chamosite	5
Feldspar	1

Most of the sample consists of fossiliferous debris with which is associated a little quartz and pellets of a green mineral tentatively identified as chamosite. The thin section contains numerous pores which appear to be an integral part of the rock.

Fossil fragments have a wide size range from several centimetres to less than 0.1 mm. Some of the larger fragments are curved shell cross sections and there are elongate and rhomb shaped chambered bodies also. Many of the smaller fragments are aggregates of fine-grained calcite and show a little or no texture. Many of these fragments are oval or subrectangular in shape and there is a considerable population of these less than 0.2 mm in size. Some of the smaller fragments have been stained by ferruginous material and now have a submicroscopic grain size. There is probably no calcite cement in the rock and all of the material is in fact detritus of some kind.

Quartz grains are generally subangular to subround in shape and they have an average size of approximately 0.2 mm. The grains are essentially randomly distributed throughout the rock although there are slight irregular concentrations in some places. Feldspar is fresh but the few grains of plagioclase and microcline seen in the thin section are probably not sufficient to indicate the relative proportion of these two feldspar types.

The sample contains about 5% of a fine-grained green mineral which occurs in some places in chambers in small fossil fragments (?foraminifera) and also appears to form sub-circular pellets generally 0.1 to 0.2 mm in size. It is not possible from optical examination alone to indicate whether this mineral is chamosite or glauconite but the former appears more likely.

The sample is a limestone which consists very largely of fossil fragments which appear to have been barely cemented at all. Other constituents of the rock are detrital grains of quartz and feldspar and a little ?authigenic chamosite or glauconite. The sample appears to have a large natural porosity.

Sample: P648/77; TS38638

Location:
Barabba No. 1, 89.60 - 89.62 m

Rock Name:
Silica-cemented sand

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	40
Cement	35-40
Calcite	15
Chamosite	5-10
Tourmaline	trace

The sample consists of sand grade detrital fragments of quartz, calcite (fossils), chamosite and tourmaline and these components have been cemented initially by a carbonate mineral and then subsequently, and largely, by secondary chalcedonic silica.

The detrital fragments have an average size of about 0.2 mm and most of the quartz fragments are single crystals with plane extinction. They range in shape from angular to subrounded and most appear to retain their detrital shapes. In many places grains form an apparent framework but elsewhere the matrix is so abundant that this is not the case. The detrital fragments of calcite are generally fossiliferous fragments which have a wide range of shape but in general are similar in size to the quartz grains. Some of the fragments are multi-chambered fossils (possibly foraminifera), others are shell cross sections and yet others, generally smaller, are fine-grained granular aggregates of calcite with a sub-rectangular shape.

The sample contains a little green material similar to that described in the sample above. This is tentatively identified as chamosite and it forms both within chambers in fossils and it also appears to form small subrounded pellets.

These detrital fragments carry a discontinuous fine-grained granular rim of a carbonate mineral and this separates them from the abundant cement which is fine-grained chalcedonic material. This cement comprises probably more than one third of the volume of the rock and appears to be an efficient, impervious matrix firmly cementing all of the diverse detrital fragments. In some places the secondary silica forms crystals as much as about 0.03 mm in size but for the most part it forms a homogeneous extremely fine-grained aggregate in which individual crystals can barely be identified.

The sample is a fairly well sorted but rather heterogeneous sandstone containing quartz, fossil fragments and possibly pellets of chamositic material which has been cemented first by a sparse carbonate and mainly by an abundant aggregate of chalcedonic material.

Sample: P649/77; TS38639

Location:
Barabba No. 1, 169.60 - 169.68 m

Rock Name:
Silty mudstone

Thin Section:
The sample consists of approximately 25 to 30% of detrital grains in an abundant argillaceous matrix. Apart from slight variations in the colour of the stained-clay matrix, the sample is perfectly homogeneous.

The detrital grains are commonly less than 0.03 mm in size and generally fall in the fine to medium grained silt grade. Quartz is the most abundant detrital phase and forms equant anhedral grains/crystals most of which have a distinctly irregular shape due to reaction with the clay. No feldspar was specifically identified in the sample but it is possible that if feldspar had been present amongst the detrital material it may well have been complete replaced by the clay. The sample contains trace amounts of tourmaline and zircon and there are small flakes of muscovite most of which are less than 0.04 mm in length. These detrital components are randomly distributed through the thin section and there is no bedding or layering defined by the distributi or orientation of these grains.

The matrix material which comprises the bulk of the rock, is pale brown in plane polarized light and dark between crossed-nicols. The material clearly consists of a iron-stained clay and there are, in fact, numerous minute specks of opaque and semi-opaque material throughout the matrix. The proportion of the ferruginous material varies a little from place to place in the section and this defines patches which have a different colour. As far as can be determined these patches are probably in parallel lines with the bedding in the rock but macroscopic examination of the thin section indicates that, if bedding is present, then it is contorted and there is evidence of some kind of micro-faulting or slumping which renders the bedding rather indistinct.

The sample is a faintly bedded mudstone which contains a moderate proportion of silt grade silicate grains.

Sample: P650/77; TS38640

Location:
Barabba No. 1, 185.68 - 185.79 m

Rock Name
Dolomitic and ferruginous siltstone

Thin Section:
The sample is rather fine-grained and it is difficult to give proportions of the minerals present; however, the rock contains large amounts of quartz, dolomite and ferruginous material and smaller amounts of detrital tourmaline and muscovite.

Quartz is present as grains and crystals commonly as little as 0.02 mm in size. These crystals occur in a contiguous aggregate of fine-grained dolomitic material and it is thought that the carbonate probably comprises more than 60% of the volume of the rock. Many of the quartz grains are irregular in shape and few have any direct evidence of having been detrital grains. The rock does, however, contain a little muscovite which forms extremely thin flakes up to about 0.06 mm in length. These flakes do not show any preferred orientation and they are widely distributed throughout the rock but probably form less than 2% of the sample. Intergrown with these components is an oriented network of opaque and semi-opaque ferruginous material. The overall amount of this material defines beds in the sample but the network of ferruginous material is oriented at an angle of about 45% to the overall bedding direction. Certain structures in the bedding are defined by variations in the amount of fine-grained ferruginous material and hence it appears that the rock has undergone probably only a very small amount of deformation and this probably occurred while the rock was still in a plastic condition. It is not possible to understand why the network of opaque is oriented at such a consistent angle to the bedding. There are a few veinlets of dolomitic material which are aligned parallel to the orientation of the network of opaques and the presence of these may suggest that there has been some post-depositional stress which resulted in fracturing of the sample at a relatively high angle to the bedding. The presence of dolomite in fractures indicates the mobility of this mineral and it is probable that the sample has been dolomitized but whether the dolomite has replaced pre-existing carbonate or phyllosilicate material is not possible to determine from examination of the thin section.

The sample is a bedded, dolomitic siltstone in which a fine-grained aggregate of dolomite is the principal component. The sample contained a considerable amount of dark ferruginous material forming a network aligned at a high angle to the overall bedding direction.

Sample: P651/77; TS38641

Location:
Barabba No. 4, 61.70 - 61.76 m

Rock Name:
Calcareous and ?chamositic siltstone

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	35
Opaques and semi-opaques	30
?Chamosite	15
Clay/pores	15
Calcite	5
?Gypsum	2- 3

Essentially, the sample is homogeneous and consists of silt grade quartz grains, larger green pellets of ?chamosite resting in a matrix of fine-grained material largely obscured by goethite/limonite. The thin section also contains a few large calcareous fossil fragments and there are spherules of ?gypsum.

Quartz is present as angular equant grains generally less than 0.04 mm in size. The grains have irregular outlines and may well have been partly corroded by adjacent fine-grained ferruginous material. Included with the quartz in the classification above are a few grains of clear feldspar (which together comprise probably less than 1% of the rock); the feldspar is unusually clear and fresh but most of the grains have exceptionally irregular shapes and have been partly replaced by the matrix. About 15% of the rock consists of round or oval fine-grained green grains which are probably chamositic but may also be glauconitic. These are generally structureless grains with apparently an extremely fine-grained granular texture. The average size of these grains is about 0.2 mm and hence they are notably larger than the grains of quartz. Dark material in part forms an intergranular matrix but there are somewhat more compact and dense dark aggregates which may represent grains of some kind. Such aggregates range from equant patches about 0.1 mm in size to distinctly rectangular patches as much as 0.5 mm in length. To some extent these dark patches resemble extremely densely iron-stained calcite in some of the rocks from Barabba No. 1 but no calcite can be identified unambiguously in the grains in this rock. Fragments of calcite are clearly fossil fragments of some kind and most are extremely large (more than 1 cm).

The intergranular material in the rock is rather difficult to define since it consists partly of iron-stained material, partly of pores and probably also of clear clay material. The proportion of dark material varies considerably from place to place in the section and there is generally a little relatively clear clay material around many of the quartz grains. X-ray diffraction analysis would be required to characterise this material with confidence. The rock also contains small spherules of a mineral faintly stained by alizarin red-S. This material may well be gypsum which shows this rather characteristic staining and the mineral does form elongate crystals with a low birefringence. The spherular structures invariably have a well defined radial texture and most are about 0.05 mm in size. These spherules may well represent a little authigenic gypsum which has developed in the rock after deposition.

The sample is a rather immature siltstone which contains relatively large grains/pellets of ?chamosite and a few large fossil fragments. The sample is cemented by iron-stained clay and possibly also by a little authigenic gypsum.

Sample: P652/77; TS38642

Location:
Barabba No. 4, 90.08 - 90.1 m

Rock Name:
Argillaceous fine-grained sandstone

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	50
Matrix clay	30
Feldspar	7-10
Green clay	5
Carbonate	5
Opaques	3
Tourmaline	trace

The sample is a fine-grained sandstone with a fairly abundant argillaceous matrix which is green in colour. There is also a little authigenic carbonate which forms small patches. The sample contains a sparse population of grains more than about 0.3 mm in size.

Less than 10% of the sample consists of exceptionally large grains most of which are 0.2 to about 1 mm in size. Both quartz and feldspar are present amongst these grains and there is one large aggregate of a fine-grained sedimentary lithology which also forms a single grain. Most of these larger grains are subangular in shape but one or two are notably well rounded.

In the bulk of the sandstone quartz and feldspar form well sorted grains which have an average size of about 0.1 mm. There appears to have been some distortion of the grains during compaction and there are numerous long and concavo-convex grain boundaries. Feldspar grains are fresh and both plagioclase and microcline were specifically identified in the thin section. Despite the angularity of the grains there is considerable evidence that they have been well sorted during transport and deposition.

Matrix material consists of extremely fine-grained clay most of which appears to be genuine argillaceous matrix although some may have been derived from the degradation of a small amount of lithic material. Some of the clay shows a distinct green colour and this material may be either glauconite or chamosite. Such material is definitely a part of the clay matrix and is not detrital.

Carbonate is present as relatively large patches (commonly 0.1 to 0.6 mm in size) which are coarse-grained and irregular in shape. The carbonate appears to have developed in the rock after deposition and hence is an authigenic mineral possibly indicating relatively reducing conditions during some period in the post-depositional history of the rock.

Apart from a few unusually large grains this is a fairly well sorted fine-grained sandstone which contains detrital quartz and feldspar. There is fairly abundant matrix some of which is probably either chamositic or glauconitic. The rock also contains a little authigenic carbonate.

Sample: P653/77; TS38643

Location:
Barabba No. 4, 93.00 - 93.06 m

Rock Name:
Grus

Thin Section:
The sample consists of subequal amounts of potassium feldspar and quartz and minor amounts of tourmaline and what are interpreted as lithic fragments. In many respects the sample resembles a granitic rock and its interpretation as a very young sediment derived from a granite is put forward tentatively. This interpretation is based on the presence of a few tourmaline crystals (up to 0.4 mm in size) and one or two lithic fragments which are not granitic (the largest of these is some kind of micaceous schist).

Quartz and feldspar have a granular texture and many crystals are more than 1 mm in size. The crystals are irregular as in a granitic rock and there is no evidence of any significant rounding of many of the larger crystals of both quartz and microcline. In some place, however, smaller crystals may show some evidence of rounding and even of authigenic optically continuous overgrowths. Most of the feldspar in the rock is microcline perthite and this mineral forms crystals ranging in size from about 2 mm to about 0.2 mm.

The thin section contains two patches of finer grained lithology one of which is definitely metamorphic. The smaller has a granular to granoblastic texture and consists largely of quartz with small amounts of microcline and mica. The larger fragment, however, is about 2 to 3 mm in length and 1 mm broad and is a foliated mica schist. This clast has an average crystal size of about 0.05 mm. In one place in the thin section there is a subround tourmaline crystal 0.4 mm in size and this appears to be distinctly of sedimentary origin rather than being plutonic or metamorphic.

The sample is a rather chaotic rock consisting largely of quartz and microcline perthite. Although the sample has what is essentially an interlock and granitic texture and granular texture, there are some features which indicate that the sample is in fact of sedimentary origin. There are traces of optically continuous overgrowths on some quartz crystals but apart from these there is no way to distinguish detrital material from any secondary "authigenic" material. In summary, therefore, the sample is interpreted as a very young sediment derived from the weathering of essentially a granitic rock with, however, some metamorphic components. The sample has probably been barely transported and there is little evidence of sorting or modification of the original broken granite fragments.

Sample: P654/77; TS38644

Location:
Barabba No. 5, 63.93 - 64.00 m

Rock Name:
Quartzite

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	95
Opaques	2- 5
Feldspar	2
Tourmaline	trace-1
Zircon	trace

The range of proportions of opaques and semi-opaques varies from place to place in the thin section within the range quoted above. The sample is a compressed pure quartz sandstone which now has almost a granular (rather than a clastic) texture.

Quartz and feldspar grains show evidence of excellent sorting and have an average size of about 0.15 mm. In general the quartz grains as now preserved are mainly subround but most show some evidence of having been deformed during compaction and, probably, partial recrystallisation of of the rock. Original grain shapes are preserved in those crystals which show an annular ring of dark material which presumably defines the limits of the original grain. As far as can be determined from this evidence the original detrital grains of quartz were well rounded. Optically continuous quartz overgrowths can only be detected on about 3 to 5% of the grains. As indicated above, grain-to-grain contacts are generally concavo-convex or long and straight.

Detrital feldspar is not abundant and is present as a few untwinned grains which can be generally be identified by the small amount of alteration they show in contrast to the clear quartz. The rock contains a moderate amount of tourmaline which is present as detrital grains generally not more than about 0.1 mm in size. The tourmaline grains are commonly subround to round in shape.

In one part of the thin section there are intercrystalline seams and patches of semi-opaque goethitic material. These seams comprise probably about 2% of the rock. In other parts of the thin section, however, intercrystalline semi-opaque material is abundant and forms a virtually contiguous aggregate. The proportion of this material is estimated as about 5%, locally rising to about 10%. Even in those parts of the rock where the semi-opaque material is relatively abundant the quartzitic nature of the sample is evident and it is clear that the rock has essentially the same texture in those parts of the sample which are virtually monomineralic and those in which there is relatively abundant intercrystalline ferruginous material.

The sample is a pure siliceous sandstone which has been compacted and which has developed a granular texture. The rock contains traces of detrital feldspar and tourmaline and some parts of the sample have a little inter-granular goethite which forms films and small cuspate intergranular patches.

Sample: P655/77; TS38645

Location:
Barabba No. 5, 76.38 - 76.44 m

Rock Name:
Ferruginous sandstone

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	50
Opaques and semi-opaques	30
Matrix	20
Tourmaline	trace
Zircon	trace

The sample consists essentially of an ill-sorted quartz sand but opaques and semi-opaques occur both as relatively large compact patches and also obscure a considerable amount of intergranular material. Much of the latter is probably iron-stained clay but elsewhere the intergranular material may well consist almost entirely of the ferruginous oxide/hydroxide.

The detrital grains of quartz commonly range in size up to about 0.1 mm and there are rare grains up to about 0.4 mm in size. As far as can be determined the average grain size of the sample is probably less than 0.06 mm but this varies a little from place to place depending on the proportion of relatively large grains. It is also possible that the apparent grain size has been reduced by a partial replacement of quartz by goethitic material. Most of the quartz grains are angular to subangular in shape with a few showing sub-round outlines. Most of the smaller (and more abundant) grains tend to be distinctly angular and this is almost certainly due to partial loss of detrital shape due to reaction with, or replacement by, goethite/limonite. Most of the grains consist of single quartz crystals showing a little undulose extinction and the quartz therefore appears to be of the common or plutonic variety. Tourmaline and zircon are relatively fine-grained and neither is abundant.

The intergranular material in the sandstone is obscured by dark red semi-opaque and opaque material which is clearly ferruginous. The density of the colour of this material varies considerably from place to place in the thin section but nowhere can the exact nature of much of the matrix be identified; it is likely from the fine-grained texture of some of the material that it is argillaceous but elsewhere there is some evidence of secondary quartz having been partly replaced by goethite/limonite. From textures such as these there is a gradation to those areas of the thin section in which intergranular material has been completely replaced by opaques and quartz grains now rest in a contiguous aggregate of this material.

Some places in the thin section simply consist of homogeneous compact aggregates of dark material but because of the friability of the sample, these are associated with considerable pores in the section and it is not possible to see whether or not the compact opaque material formed lenses or veins or whether it formed discrete patches.

The sample is an ill-sorted quartz sand with probably a fairly sparse clay matrix and possibly a little secondary silica. These materials have been partly replaced (and in some places completely replaced) by goethite/limonite.

REMARKS

The difficulty in distinguishing the very fine grained components in thin section is indicated by the discrepancy between core logging and the petrographic report on samples P650/77 and P655/77. In order to remove this discrepancy, higher resolution examination would be necessary. However, this is outside the scope of this report.

The report on samples P646/77 and P647/77 clearly shows the relative percentages of carbonate and quartz, which was often difficult to determine during the logging of the core. However, before major sections of the Port Willunga Formation are reclassified as limestones, examination of a more extensive selection of samples is required.

The distinction between chamosite and glauconite is difficult in thin sections. However, the stratigraphy of the area and its correlation to the north and south indicates that the green mineral reported in samples P647/77, P648/77, P651/77 and P652/77, is more likely to be glauconite.

APPENDIX VII

PHYSICAL AND CHEMICAL ANALYSES

Includes 1. Porosity and Permeability Measurements

2. Geochemical Metal Scan

3. Proximate Coal Analyses

4. Water Analyses

1. POROSITY AND PERMEABILITY MEASUREMENTS

The porosity was measured by the Kobé method and the permeability is that to nitrogen.

The results are as follows:

SAMPLE	STRATIGRAPHIC UNIT TAKEN FROM	POROSITY (%)	PERMEABILITY (md)
P645/77	Hindmarsh Clay	29.9	>7 000
P646/77	Port Willunga Form. Upper Hard Band	1.3	< 0.2
P647/77	Port Willunga Formation	50.2	4 730
P648/77	Port Willunga Form. Ruwarung Member	17.6	*
P649/77	Bedrock, weathered siltstone.	39.6	1 280
P650/77	Bedrock, fresh siltstone.	4.5	< 0.2
P651/77	Rogue Formation	45.6	500
P652/77	Bedrock, diamictitic unit.	17.2	43
P653/77	Bedrock, arkosic unit.	3.3	< 0.2
P654/77	Rogue Form. Gull Rock Member.	3.0	< 0.2
P655/77	Clinton Formation.	*	1 370
P656/77	Clinton Form. Lignite seam.	*	*

Note:- * means that the sample was too friable for the particular measurement to be made.

2. GEOCHEMICAL METAL SCAN

SAMPLE	BARABBA HOLE	DEPTH FROM (m)	TO (m)	STRATIGRAPHIC UNIT TAKEN FROM
A398/77	No. 1	115.25	115.28	Clinton Form. Lignite Seam
A399/77	No. 6	133.50	133.54	Clinton Form. Lignite Seam
A400/77	No. 3	128.30	128.40	Bedrock, fresh siltstone

All values are in ppm. Lignite analysis based on dry sample. The results are as follows:

SAMPLE	Ba	Co	Cr	Mn	Mo	Ni	V	W	Ag
A398/77	X	X	30	10	25	X	30	X	X
A399/77	X	X	20	20	15	X	25	X	X
A400/77	500	60	100	30	X	120	150	X	0.1

Note: X means that concentration is below detection limits.

SAMPLE	As	Bi	Cu	Pb	Sb	Sn	Zn	Au	P
A398/77	X	X	15	50	X	X	X	X	X
A399/77	X	X	10	2	X	X	10	X	X
A400/77	X	X	70	50	X	1	50	X	1 000

3. PROXIMATE COAL ANALYSIS

The samples A398/77 and A399/77 are the same as those described in the Geochemical Metal Scan section. The results are as follows, with all values except calorific value in %.

ANALYSIS	A398/77	A399/77
AS RECEIVED		
MOISTURE	48.88	56.67
VOLATILE MATTER	21.64	18.84
FIXED CARBON	20.73	17.09
ASH	8.75	7.40
TOTAL	100.00	100.00
MOISTURE FREE		
VOLATILE MATTER	42.34	43.48
FIXED CARBON	40.55	39.44
ASH	17.11	17.08
TOTAL	100.00	100.00
SODIUM	0.82	0.54
SULPHUR	4.30	3.45
CALORIFIC VALUE (J/g)	21130	22040

4. WATER ANALYSIS

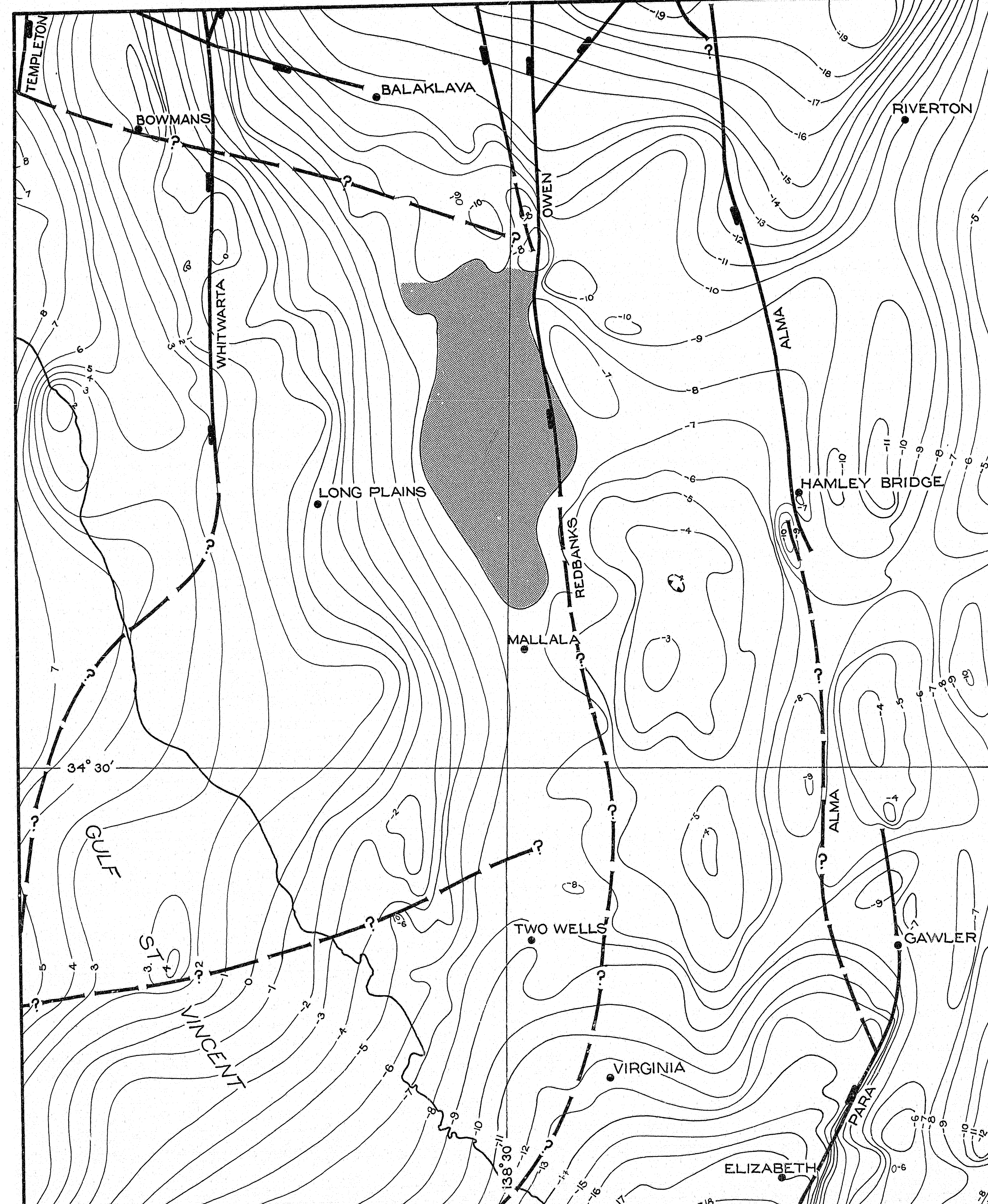
SAMPLE	BARABBA HOLE	DEPTH OF SCREEN FROM(m)	TO(m)	TEST	DURATION OF TEST
W6328/77	No. 1	118.53	119.53	PUMP	10 HOURS
W6343/77	No. 2	75.60	76.60	PUMP	10 HOURS
W6356/77	No. 5	65.00	66.00	BAILER	35 BAILS

Samples were collected at the completion of the tests with chemical analysis producing the following results. All values are in milligrams/litre except where indicated.

ANALYSIS	SAMPLE W6328/77	W6343/77	W6356/77
CATIONS			
CALCIUM	455	69	86
MAGNESIUM	470	89	80
SODIUM	3 600	745	535
POTASSIUM	73	18	20
ANIONS			
CARBONATE			25
BICARBONATE	466	295	191
SULPHATE	1 922	279	358
CHLORIDE	5 379	1 127	784
NITRATE	< 1	< 1	1
TOTAL DISSOLVED SOLIDS	12 618	2 472	1 983
TOTAL HARDNESS AS $CaCO_3$	3 070	539	544
CARBONATE HARDNESS AS $CaCO_3$	365	242	157
NON-CARBONATE HARDNESS AS $CaCO_3$	2 705	297	387
TOTAL ALKALINITY AS $CaCO_3$	365	242	198
REACTION - pH	7.0	7.5	8.8
CONDUCTIVITY AT 25°C (micro-s/cm)	19 196	4 377	3 401

FIG. I

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE 1:1,000,000
COMPILED C.D.Cockshell	NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY LOCALITY PLAN	DATE 3-10-77
DRN J.W. / CKD C.D.C.		PLAN NUMBER
GEOPHYSICS DIVISION		S13054



LEGEND

- Bouguer gravity contour (1 milligal interval).
- Bouguer gravity low.
- Fault (with direction of dip).
- Inferred fault or monocline.
- Outline of Barabba gravity low.

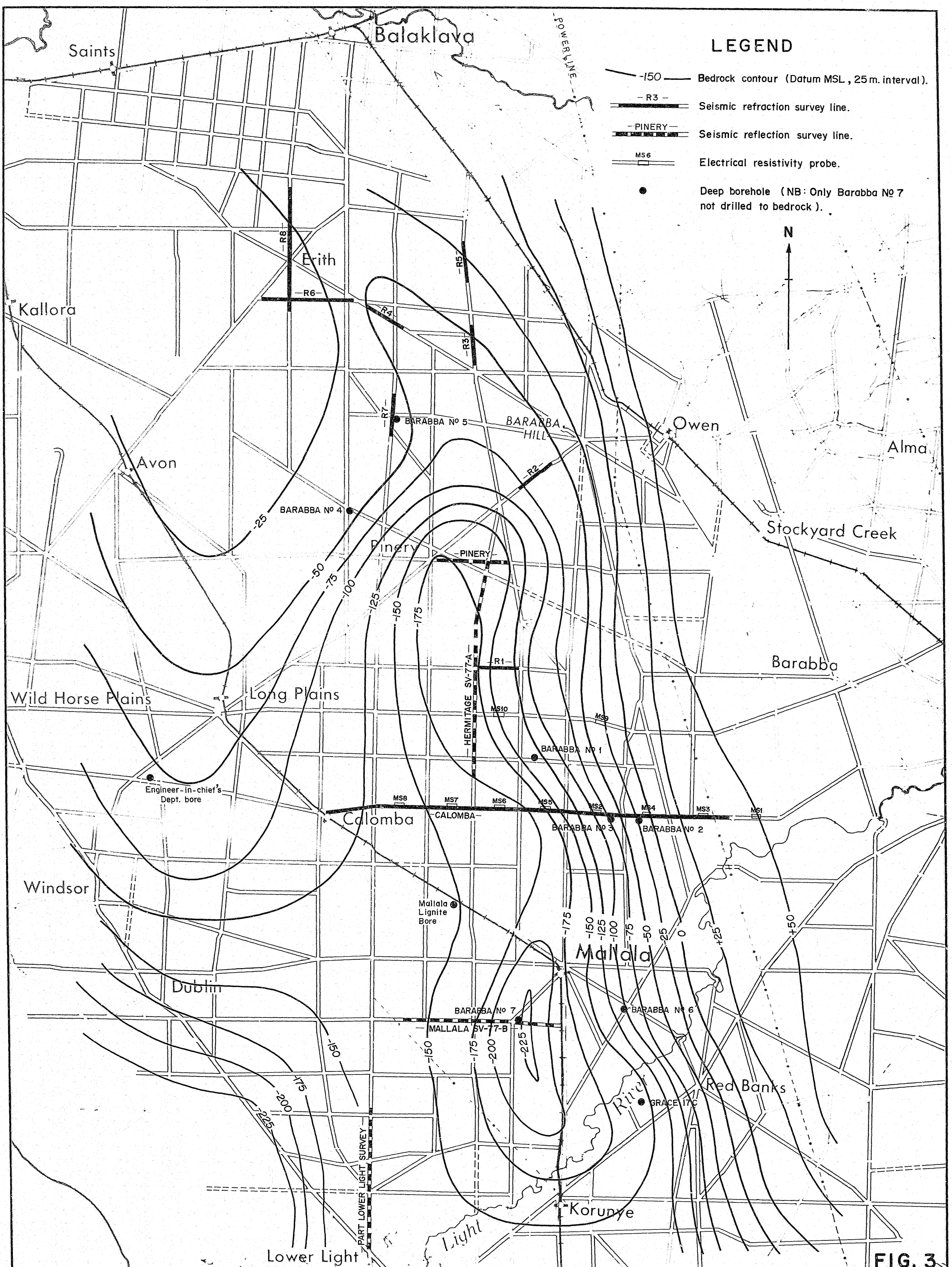
1:250,000

KILOMETRES 0 5 10 15 20 25 30 KILOMETRES

FIG. 2

DEPARTMENT OF MINES – SOUTH AUSTRALIA		SCALE. 1:250,000
COMPILED: C.D.Cockshell	NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY	DATE: 3-10-77
DRN: J.W. CKD. C.D.C.	BOUGUER GRAVITY CONTOURS AND MAIN TECTONIC FEATURES	PLAN NUMBER: 77-887
GEOPHYSICS DIVISION		

1348

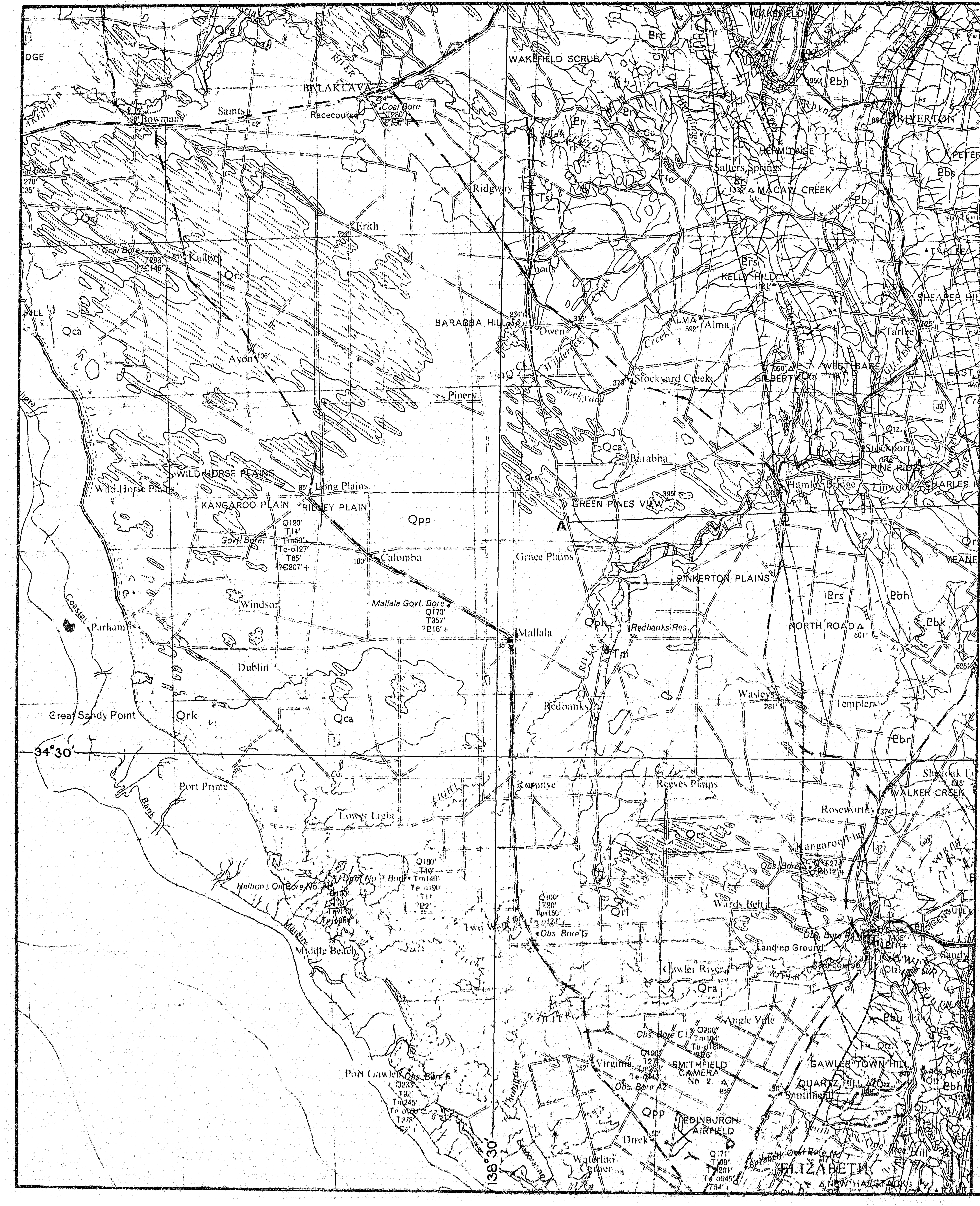


KILOMETRES

2 0 2 4 6 8 10

GEOPHYSICS DIVISION	DEPARTMENT OF MINES—SOUTH AUSTRALIA	SCALE 1:100 000
COMPILED: C.D. Cockshell	NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY	DATE: 19-1-78
DRN: N.S. CKD C.D.C.	BEDROCK CONTOUR MAP	PLAN NUMBER: 78-68

10 CENTIMETRES



REFERENCE

CAINOZOIC	QUATERNARY	RECENT	Qrl	Undifferentiated lake deposits
			Qra	Grey fluviatile silts, sands and gravels of the modern drainage channels
			Qrs	Red-brown aeolian FULHAM SAND and pale-yellow MOLINEAUX SAND of the dunefields, underlain in places by Pleistocene aeolian calcareous sand of the WOORINEN FORMATION.
			Qrk	ST KILDA FORMATION: Light-grey shelly stranded beach ridge deposits and shelly silts and sands overlain in places by modern intertidal and swamp deposits
			Qy	YAMBA FORMATION EQUIVALENT Grey and brown crystalline gypsum deposits.
		PLEISTOCENE	Qpp	POORAKA FORMATION: Pale red-brown sandy clay containing carbonate of the LOVEDAY SOIL. Gravel lenses near ranges. (Small outcrops of older calcrete and veneers of younger sand and soils are not differentiated)
			Qca	Calcrete in BAKARA SOIL with RIPON CALCRETE at base, nodular and platy carbonate
			Qph	HINDMARSH CLAY of St. Vincent Basin and BLANCHETOWN CLAY of Murray Basin: Grey and red-brown mottled sandy clay containing, near the ranges, gravel and boulder beds with red clay matrix (Underlying Plio-Pleistocene beds not differentiated)
	TERTIARY		Tfe	Laterite: ferruginous residual of old weathering profile, includes reworked laterites probably largely Pliocene in age
			Tsi	Silcrete: residual of Tertiary weathering profile
			Tm	Miocene marine yellow-brown MORGAN LIMESTONE, green brown FINNISS CLAY, yellow-brown calcareous sandstone of MANNUM FORMATION of Murray Basin and yellow-buff MELTON LIMESTONE of Yorke Peninsula. Miocene upper PORT WILLUNGA BEDS (section only, except in Redbanks area).
			Te-o	Sandy limestone and cherty siltstone of Oligocene lower PORT WILLUNGA BEDS and Eocene BLANCHE POINT MARLS and equivalents north-west of Clinton (subsurface only).
			T	Undifferentiated white quartz sand and pebbly conglomerate, sandy clays, in places with ferruginous matrix. Probable ages range from Eocene to Pliocene. Includes (section only) lignitic NORTH and SOUTH MASLIN SAND, MULOOWURTIE CLAY and CLINTON COAL MEASURES of Eocene age
PROTEROZOIC	ADELAIDE SYSTEM	TORRENSIAN / BURRA GROUP	Ꮛbu	Flaggy feldspathic UNDALYA QUARTZITE (STONY FELL QUARTZITE), includes unnamed siltstone members.
			Ꮛbh	WOOLSHED FLAT SHALE: Grey laminated siltstone, minor quartzite member.
			Ꮛbx	Black carbonaceous slatey BALHANNAH SHALE MEMBER
			Ꮛbk	White and grey SKILLOGALEE DOLOMITE (including CASTAMBUL and MONTACUTE DOLOMITE MEMBERS and unnamed quartzite and siltstone members).
			Ꮛbr	RHYNIE SANDSTONE (ALDGATE SANDSTONE) Feldspathic fine- to coarse-grained sandstone and arkose, local cross-bedding and heavy-mineral banding, minor conglomerate and dolomite members.
		WILLOURAN / RIVER WAKEFIELD GROUP	Ꮛrs	STRADBROOKE FORMATION: Laminated grey-green phyllite and schist, minor quartzite and dolomite.
			Ꮛri	INGOMAR QUARTZITE: Pale-brown fine- to coarse grained feldspathic quartzite.
			Ꮛrc	BOCONNOC FORMATION: Grey sandy phyllite, quartzite and dolomite.
			Ꮛry	BLYTH DOLOMITE BEDS: Grey and black dolomite, some black chert, minor quartzite.
			Ꮛr	Unnamed sandstone, phyllite and dolomite.
			?Ꮛr	?Diapiric breccia, including dolomite

FIG 4

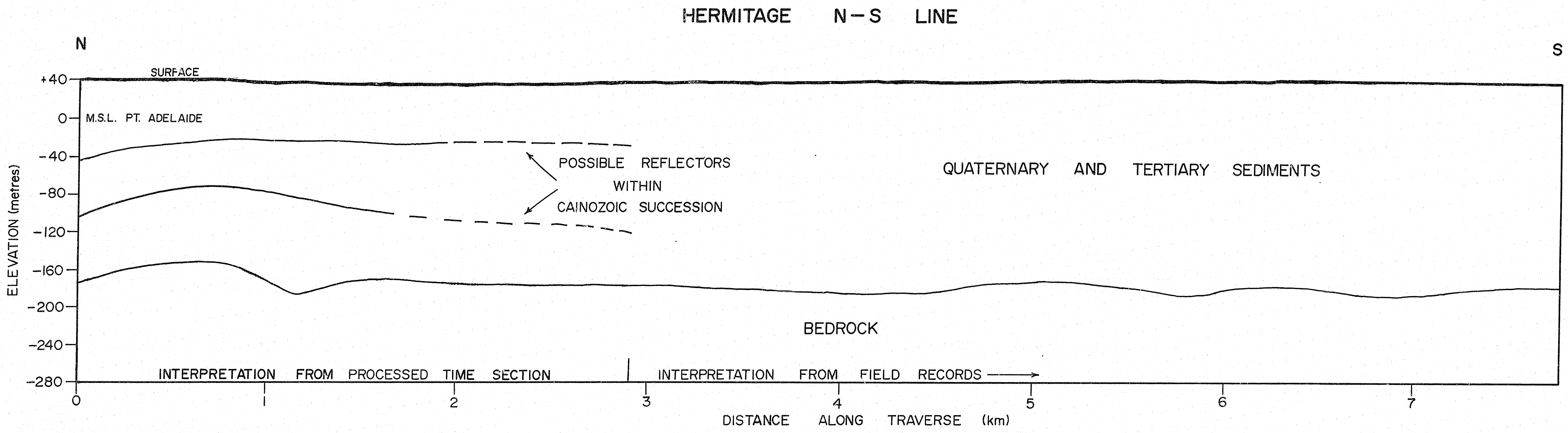
1:250,000

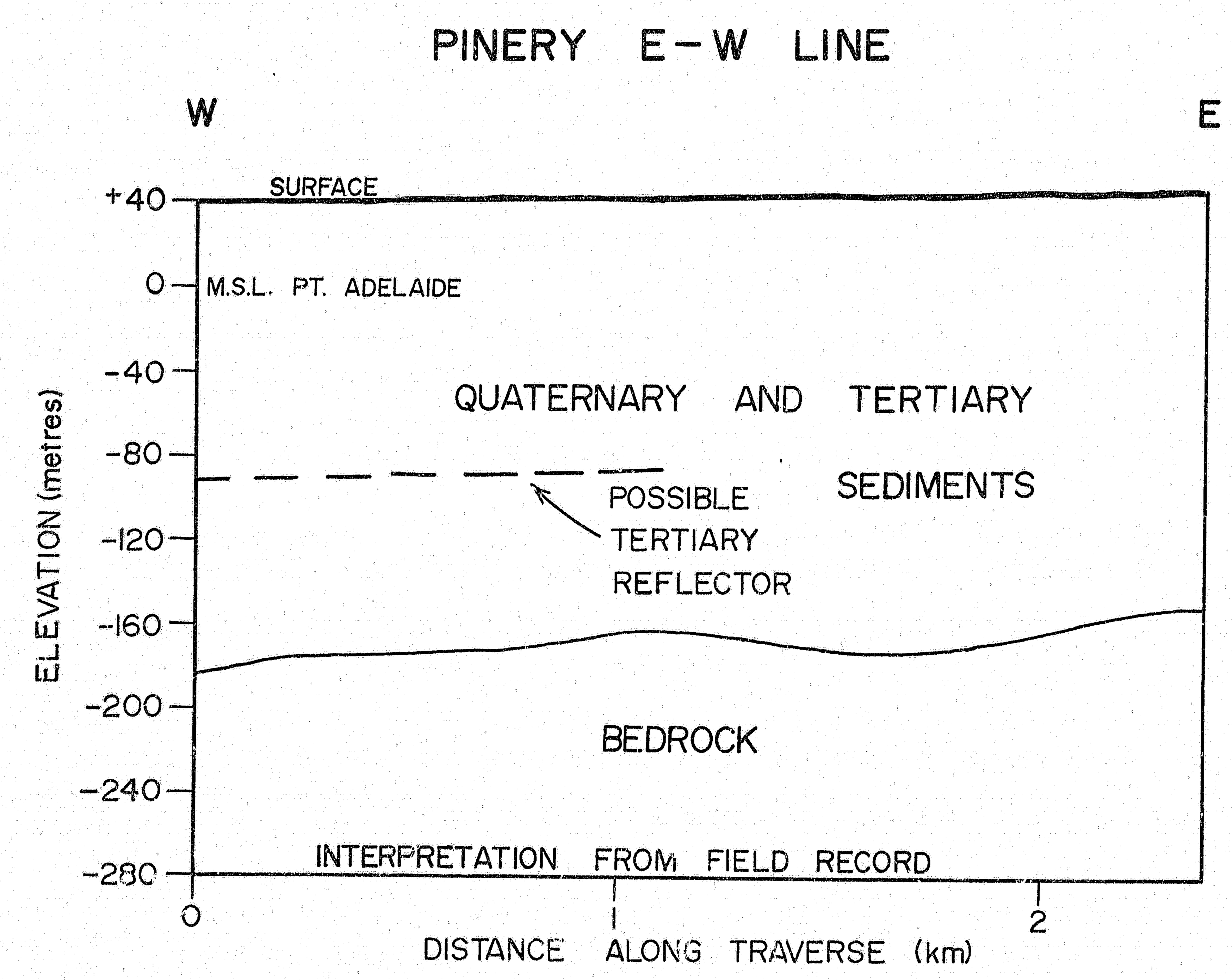
KILOMETRES 0 5 10 15 20 25 30 KILOMETRES

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE 1: 250,000
COMPILED C.D.Cockshell	NORTHERN ADELAIDE PLAINS	DATE 3-10-77
DRN. J.W. CKD.	GAS STORAGE STUDY	PLAN NUMBER
GEOPHYSICS DIVISION	**GEOLOGICAL PLAN**	77-885

Milligals.
BOUGUER GRAVITY PROFILE
ELEVATION (metres)
SURFACE
M.S.L. PT. ADELAIDE
UNSATURATED RECENT SEDIMENTS
500 TO 600 m/s
QUATERNARY AND TERTIARY SEDIMENTS 1700 TO 1900 m/s
WEATHERED BEDROCK
FRESH BEDROCK
PROBABLE WEATHERED BEDROCK 2770 m/s
BEDROCK 5240 m/s
BARABBA No.3
BARABBA No. 2
MS 1
MS 2
MS 3
MS 4
MS 5
MS 6
MS 7
MS 8
CALOMBA
DISTANCE ALONG TRAVERSE (Km)
N.B. BOUGUER DENSITY USED 2·00, COMPARED WITH 2·67 USED BY P. WILLIAMS, 1977 IN DEPARTMENTAL UNPUBLISHED REPORT.
LOCATION AND NUMBER OF SEISMIC SHOTPOINTS
LOCATION AND NUMBER OF RESISTIVITY SOUNDING CENTRES
TOP OF BEDROCK (?FRESH) FROM SEISMIC REFRACTION
TOP OF BEDROCK INTERPRETED FROM ALL DATA
TOP OF BEDROCK (?WEATHERED AND ?FRESH) FROM RESISTIVITY SOUNDINGS
V/H = 5
GEOPHYSICS DIVISION
DEPARTMENT OF MINES–SOUTH AUSTRALIA
SCALE 1:20000
COMPILED C.D. COCKSHELL
NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY
DATE 12-12-77
DRN. K.W.
CKD. C.D.C.
CALOMBA LINE INTERPRETED CROSS-SECTION
PLAN NUMBER
77-1088
10 CENTIMETRES ON ORIGINAL DRAWING

Figure 5

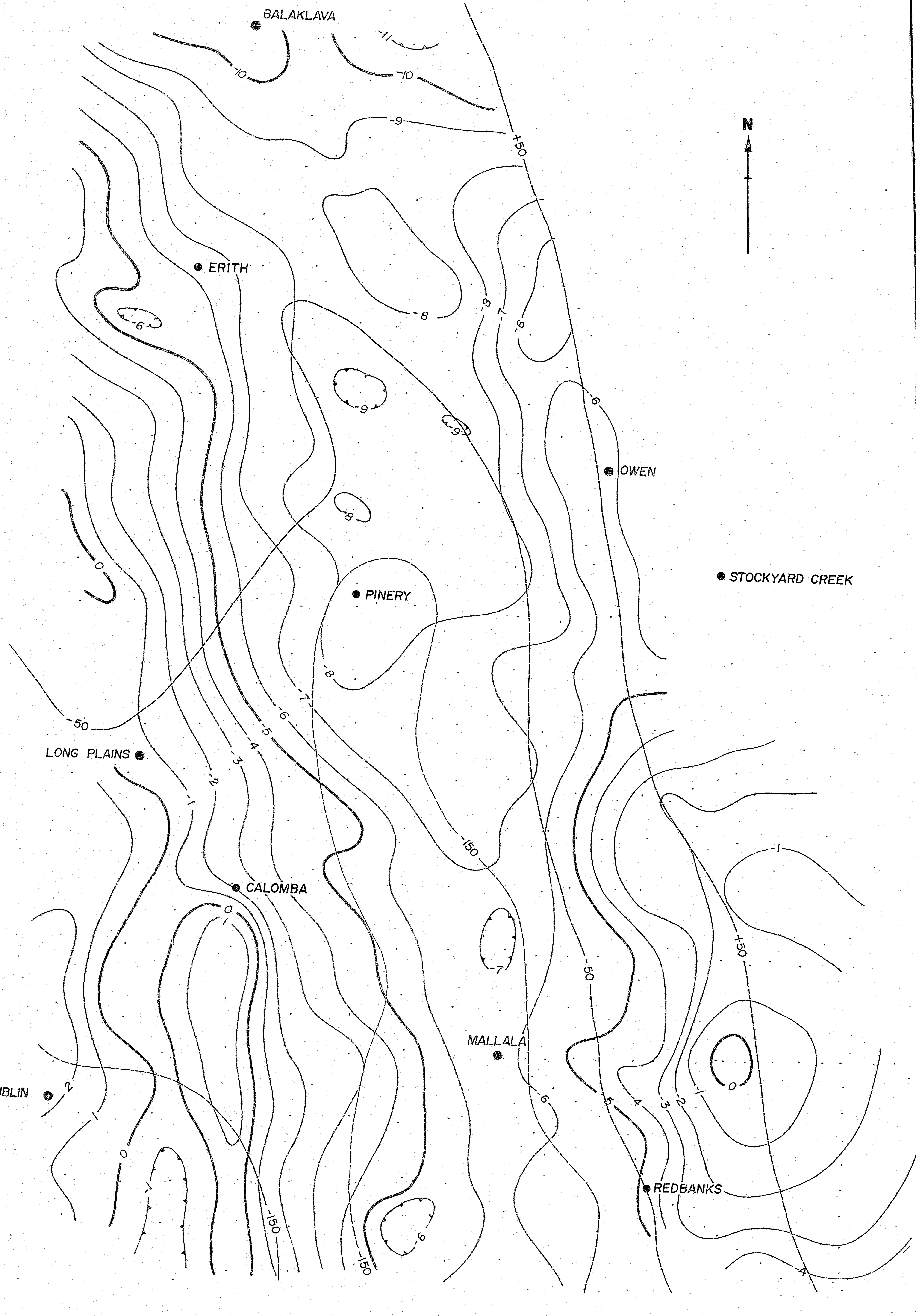




$\frac{V}{H} = 5$

Figure 6

GEOPHYSICS DIVISION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE: 1:20000
COMPILED: C.D. COCKSHELL	NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY	DATE: 12-12-77
DRN: K.W. CKD: C.D.C.	INTERPRETED CROSS-SECTIONS, PINERY AND HERMITAGE SEISMIC REFLECTION LINES	PLAN NUMBER: 77-1087



—3— Bouger gravity contour (1 milligal interval).

—150— Bedrock depth contour (Datum MSL, 100m. interval).

· Gravity station.

BASED ON WILLIAMS (1977) SURVEY BUT RECALCULATED USING BOUGER DENSITY OF 2·0 GRAMS/CC. LOOPS OF DUBIOUS ACCURACY HAVE BEEN OMITTED.

FIG. 7

GEOPHYSICS DIVISION	DEPARTMENT OF MINES—SOUTH AUSTRALIA	SCALE: 1:100 000
COMPILED: C.D. Cockshell	NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY	DATE: 19-1-78
DRN: N.S. CKD. C.D.C.	DETAILED GRAVITY CONTOUR MAP	PLAN NUMBER: 78-67

1348

10 CENTIMETRES

Figure 8

N.B. POSSIBLE BEDROCK ANISOTROPISM NEAR CROSS-OVER POINT DISCUSSED IN TEXT.

$\frac{V}{H} = 5$

GEOPHYSICS DIVISION	DEPARTMENT OF MINES—SOUTH AUSTRALIA	SCALE 1:10 000
COMPILED C.D. COCKSHELL	NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY	DATE 12-12-77
DRN. K.W. CKD. C.D.C.	INTERPRETED CROSS-SECTIONS OF REFRACTION LINES R6, R7 AND R8	PLAN NUMBER 77-1086

10 CENTIMETRES ON ORIGINAL DRAWING

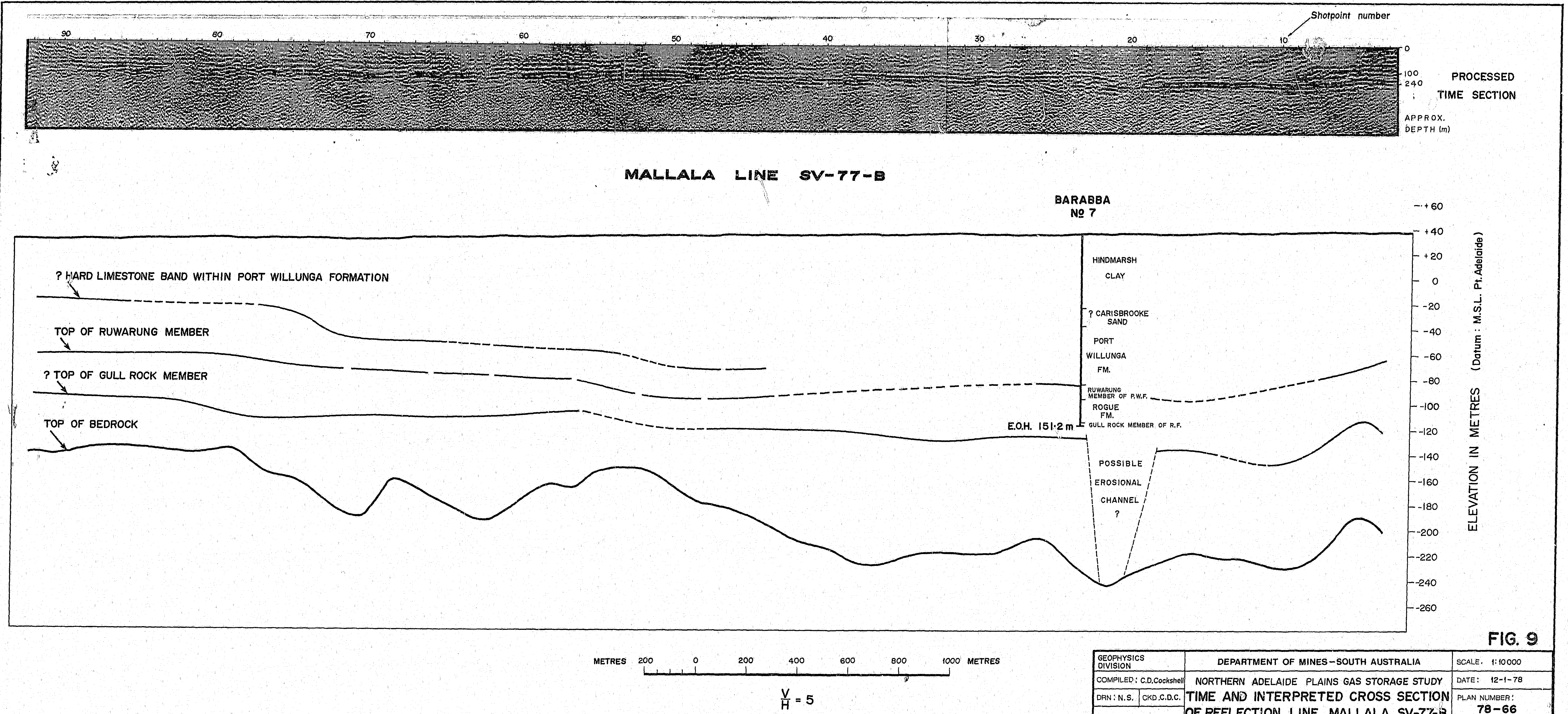
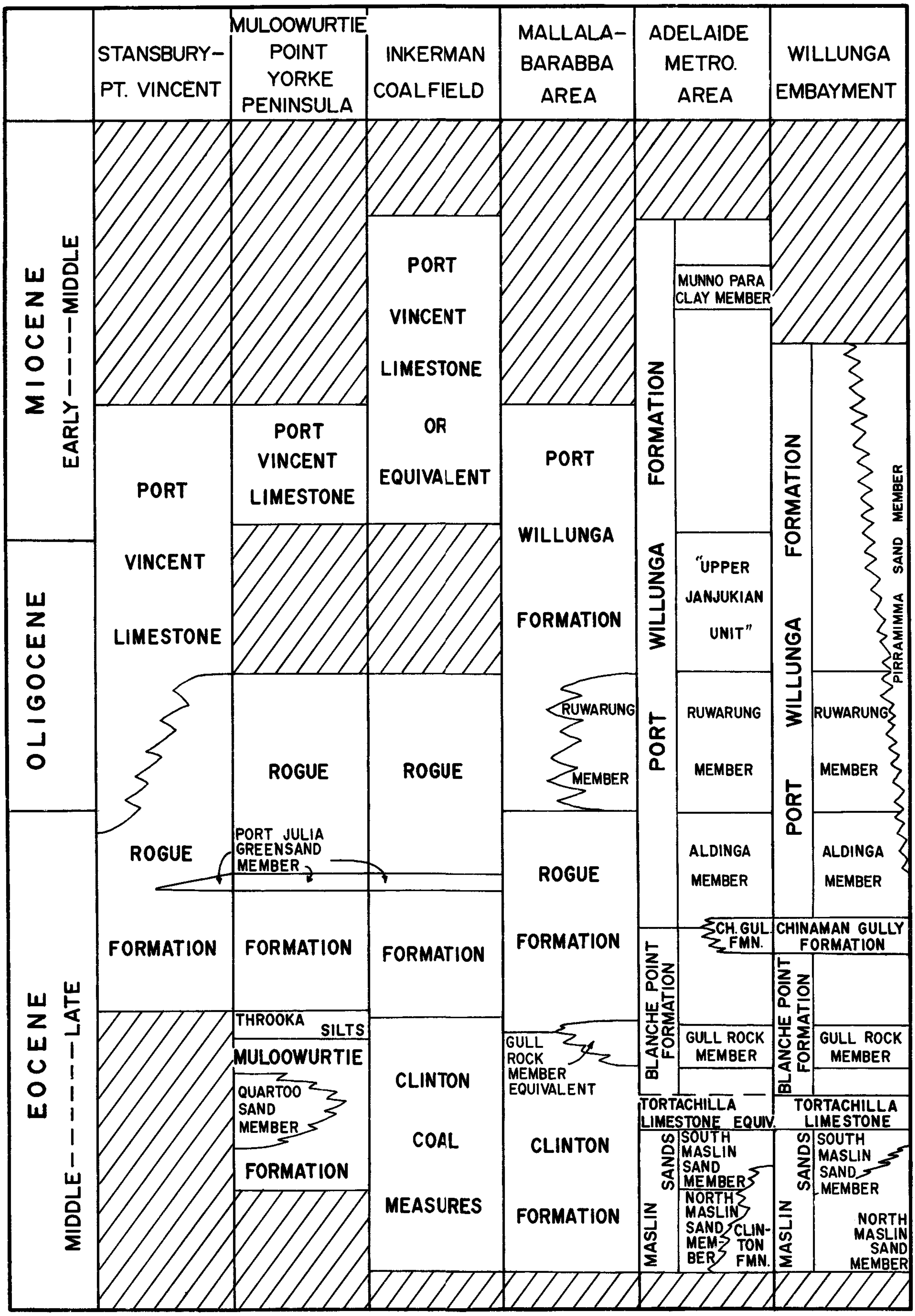


FIG. 9

GEOPHYSICS DIVISION		DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE. 1:10000
COMPILED : C.D.Cockshell		NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY	DATE: 12-1-78
DRN : N.S.	CKD. C.D.C.	TIME AND INTERPRETED CROSS SECTION OF REFLECTION LINE MALLALA SV-77-B	PLAN NUMBER: 78-66

133

10 CEN IM TR S

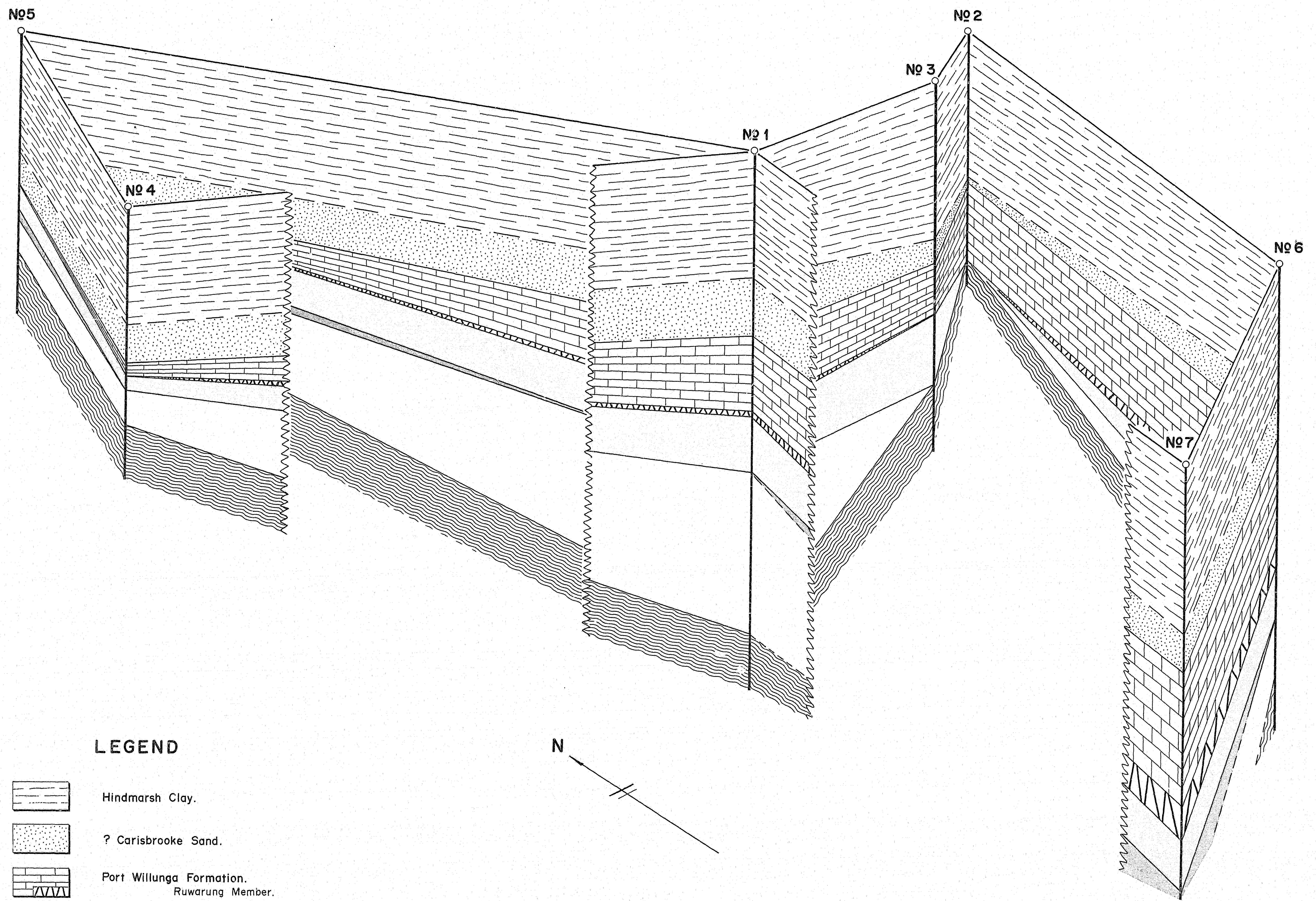


AFTER COOPER, 1977a, 1977b; LINDSAY, 1968, 1969, STUART, 1970

Figure 10

GEOPHYSICS DIVISION	DEPARTMENT OF MINES—SOUTH AUSTRALIA	SCALE –
COMPILED C.D. COCKSHELL	NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY **TERTIARY CORRELATION CHART**	DATE: 12-12-77
DRN: K.W. — CKD C.D.C.		PLAN NUMBER: S13152

JOB 137G



LEGEND

- Hindmarsh Clay.
- ? Carisbrooke Sand.
- Port Willunga Formation.
  - Ruwarung Member.
- Rogue Formation.
  - ? Gull Rock Member.
- Clinton Formation.
- Bedrock.

METRES 1000 0 1 2 3 4 5 KILOMETRES

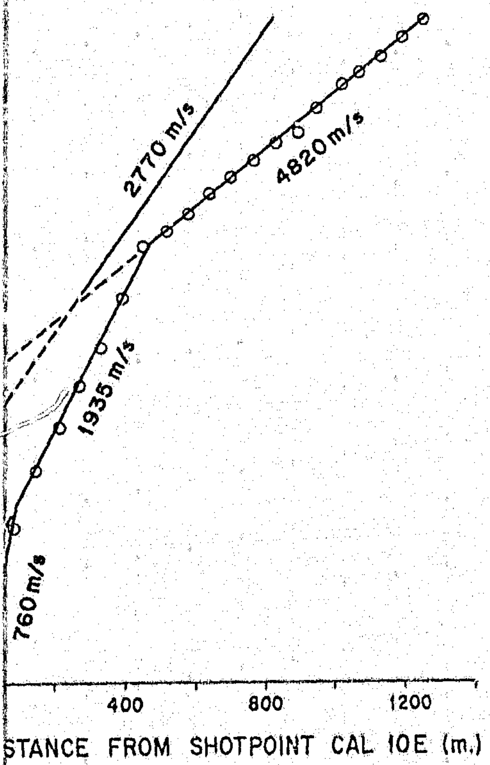
$\frac{V}{H} = 50$

FIG. 11

DEPARTMENT OF MINES–SOUTH AUSTRALIA				
NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY				
FENCE DIAGRAM OF BARABBA BOREHOLES				
GEOPHYSICS DIVISION	COMPILED: C. D. C.	DRN: N. S.	SCALE: 1: 50 000	PLAN NUMBER 78-105
DIRECTOR OF MINES		CKD: C. D. C.	DATE: 27-1-78	

10 CENTIMETRES

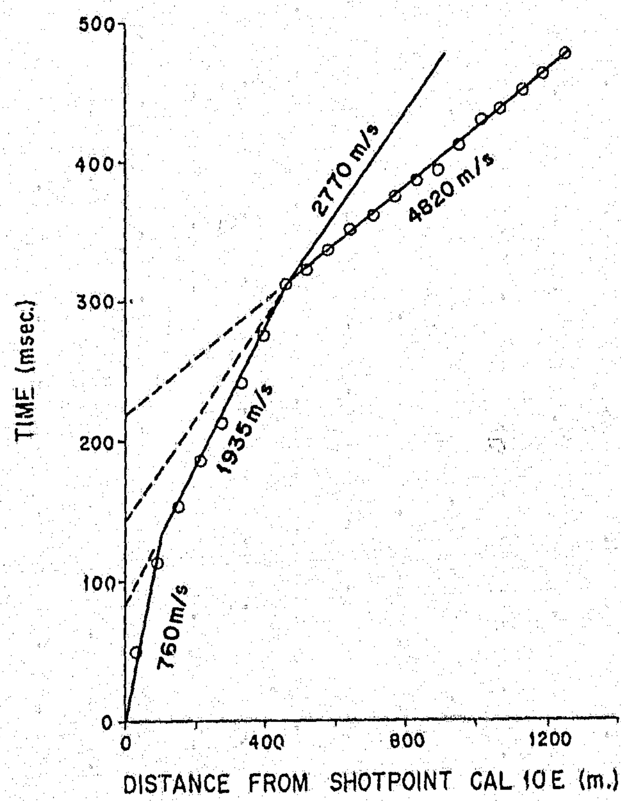
B. Case 2



ered layer is 20 metres thick with
ty 2770 m/s.

R	VELOCITY (m/s)	THICKNESS (m)	DEPTH (m)
	760	32·2	0
	1935	126·6	32·2
	2770	20·0	158·8
	4820	?	178·8

C. Case 3



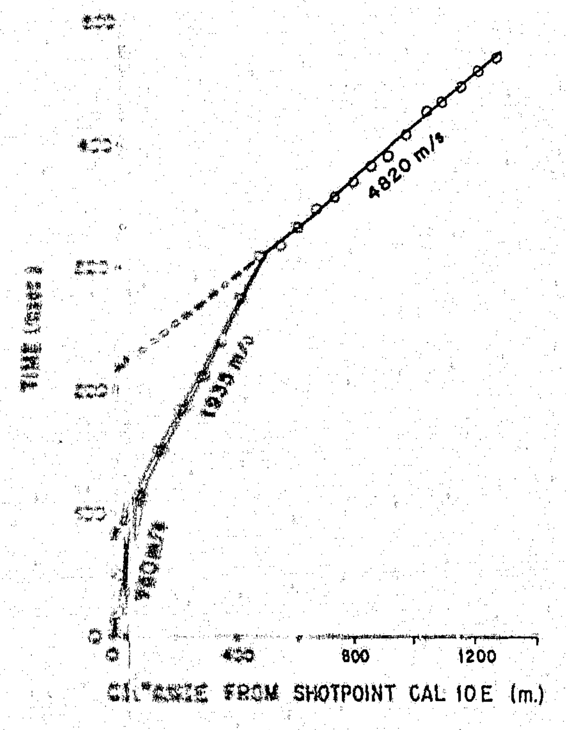
Weathered layer is 96·6 metres thick (maximum thickness for 'hidden layer' with velocity 2770 m/s).

LAYER	VELOCITY (m/s)	THICKNESS (m)	DEPTH (m)
1	760	32·2	0
2	1935	78·8	32·2
3	2770	96·6	111·0
4	4820	?	207·6

FIG. 12

GEOPHYSICS DIVISION	DEPARTMENT OF MINES—SOUTH AUSTRALIA	SCALE as shown
COMPILED . C.D.Cockshell	NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY	DATE 27-1-78
DRN . N.S. / CKD C.D.C.	TIME—DISTANCE GRAPHS OF REFRACTION SPREAD CAL 10E	PLAN NUMBER 78-106

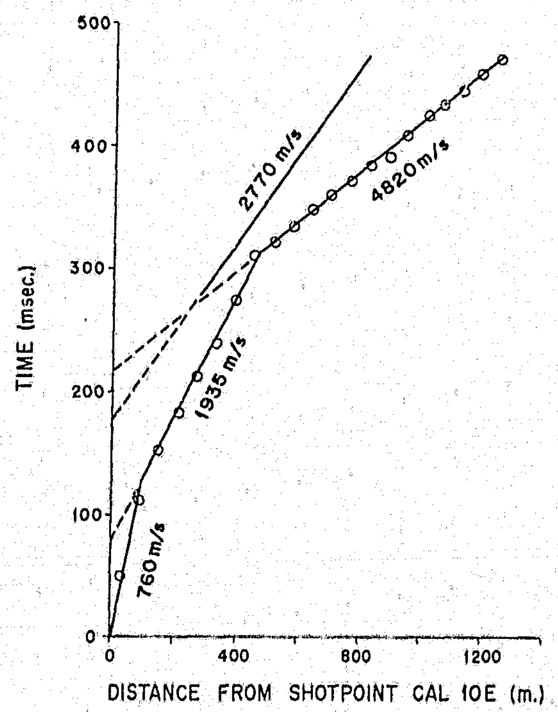
A. Case 1



No weathered layer present.

LAYER	VELOCITY (m/s)	THICKNESS (m)	DEPTH (m)
1	760	32·2	0
2	1935	138·9	32·2
3	4820	?	171·1

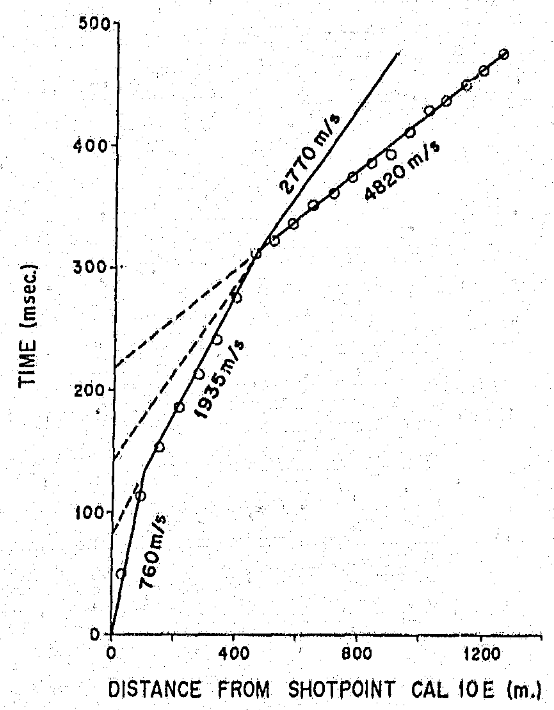
B. Case 2



Weathered layer is 20 metres thick with velocity 2770 m/s.

LAYER	VELOCITY (m/s)	THICKNESS (m)	DEPTH (m)
1	760	32·2	0
2	1935	126·6	32·2
3	2770	20·0	158·8
4	4820	?	178·8

C. Case 3



Weathered layer is 96·6 metres thick (maximum thickness for 'hidden layer' with velocity 2770 m/s).

LAYER	VELOCITY (m/s)	THICKNESS (m)	DEPTH (m)
1	760	32·2	0
2	1935	78·8	32·2
3	2770	96·6	111·0
4	4820	?	207·6

FIG. 12

GEOPHYSICS DIVISION	DEPARTMENT OF MINES—SOUTH AUSTRALIA	SCALE as shown
COMPILED C.D.Cockshell	NORTHERN ADELAIDE PLAINS GAS STORAGE STUDY	DATE 27–1–78
DRN. N.S. / CKD C.D.C.	TIME—DISTANCE GRAPHS OF REFRACTION SPREAD CAL 10E	PLAN NUMBER 78–106

FIG. 1

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 1

STATE: SOUTH AUSTRALIA 1:250000 MAP SHEET: ADELAIDE 1:100000 MAP SHEET: WAKEFIELD

BASIN: ST. VINCENT WELL STATUS: OBSERVATION BORE

LOCATION Lat. 34° 22' 29" S
Long. 138° 29' 59" E
HUNDRED: GRACE
SECTION: ADJ. 490

ELEVATION 45 m. above MSL

DATE SPUDDED 4 th. MARCH 1977
DATE DRILLING STOPPED 14 th. MARCH 1977
DATE RIG RELEASED 21 st. MARCH 1977
TOTAL DEPTH 187·0

HOLE SIZE

MILLIMETRES	FROM (m)	TO (m)
194	0	45·0
120	45·0	131·0
105	131·0	187·0

CASING

MILLIMETRES	FROM (m)	TO (m)
125	0	45·0
80	45·0	118·53

SCREEN SET FROM 118·53 TO 119·53 m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	0·4	185·4	1:200
NEUTRON NEUTRON	0·7	185·6	1:200
GAMMA GAMMA (DENSITY)	0·6	185·6	1:200
SELF POTENTIAL	45·0	186·0	1:200
POINT RESISTANCE	45·0	186·0	1:200
16" NORMAL RESISTIVITY	41·2	186·0	1:200
64" NORMAL RESISTIVITY	44·0	136·0	1:200
6' LATERAL RESISTIVITY	40·0	134·4	1:200
CALIPER	40·0	63·0	1:200
CALIPER	101·4	132·8	1:200

MUD RESISTIVITY 11·5 Ohm-metres at 20°C

OTHER Velocity survey at 25 m. interval from 134 m. upwards

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

- Clay, shale
- Silt, siltstone
- Sand, sandstone
- Calcite, limestone
- Coal, lignite
- Granules, pebbles
- Lignite pods
- Lignitic clay
- Q Quartz
- Py Pyrite
- V Micaceous
- ∫ Carbonaceous
- Fe Ferruginous
- V̄ Glauconitic
- Si Siliceous
- I Calcareous
- Ca Carbonate fragments
- F Fossiliferous
- f Feldspathic
- Gy Gypsiferous
- Mn Manganese
- Hum Humic
- Lig Lignitic

LITHOLOGY C.D. Cockshell
COMPILED C.D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1008

LITHOLOGICAL DESCRIPTION

SURFACE - 20·8 m. CLAY. Mottled red-brown and cream with minor silt and fine sand becoming common near the base. Trace of carbonaceous material and muscovite mainly near the top.

20·8 - 44·0 m. Interbedded SILTY CLAY & CLAYEY SAND. Clay is mottled orange-red and pale green-grey and frequently finely sandy. Sand is orange and fine grained and contains rare quartz granules. In part heavily ironstained. Frequent manganese coated surfaces.

44·0 - 64·0 m. SILTY SAND & SANDY CLAY. Sand frequently mottled orange and pale grey-green, commonly clayey and medium grained. Granules and carbonaceous material common near top. Trace of opaques and muscovite. Clay is light green and white, finely sandy and near top is silty. Thin band of white calcareous sandy clay near base.

64·0 - 90·2 m. CALCAREOUS SAND. Green, highly calcareous and fossiliferous, becoming glauconitic toward base. Fine grained, common thin interbeds of hard, calcareous cemented medium sandstone. Towards base becomes clayey, ? carbonaceous and frequently pyritic.

90·2 - 92·0 m. SILICEOUS CALCAREOUS SANDSTONE. Very hard and glauconitic. Grey, fine grained with common pyrite. Rare interbeds of less siliceous, softer material.

92·0 - 109·0 m. GLAUCONITIC SAND. Dark grey, fine grained and carbonaceous. Slightly calcareous in part with rare marine fossils. Trace of pyrite and mica.

109·0 - 111·5 m. LIGNITIC SILTY CLAY. Dark grey, slightly calcareous and finely sandy. Trace of glauconite and muscovite.

111·5 - 131·8 m. CARBONACEOUS SAND & CLAYEY LIGNITE. Sands are black and very fine grained with abundant pods of clayey lignite and plant remains. Lignites are thin, very clayey and slightly silty in part.

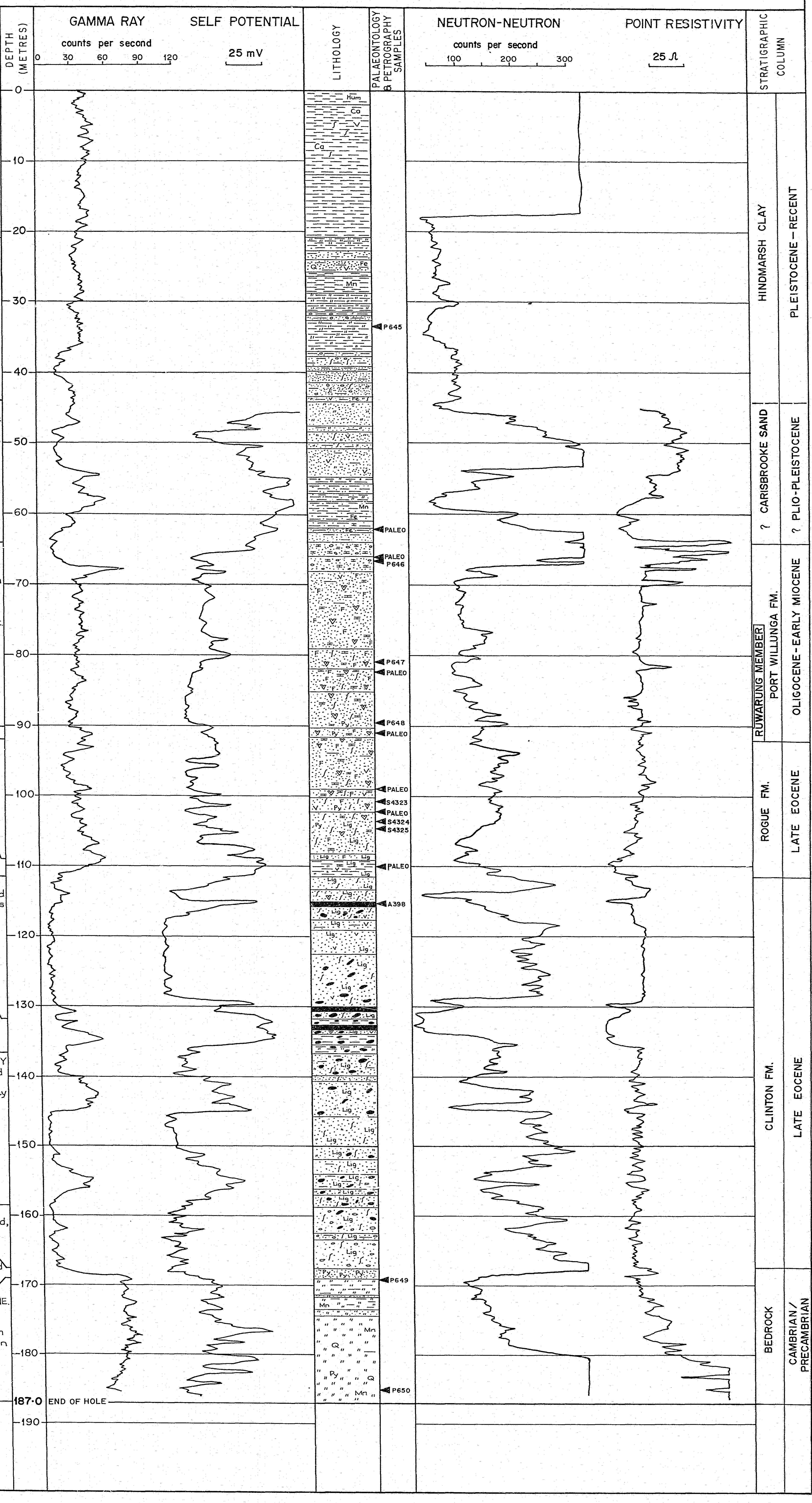
131·8 - 136·6 m. LIGNITIC CLAY & CLAYEY LIGNITE. Clay is black with abundant pods of clayey lignite and plant remains. Lignite is silty in part and black.

136·6 - 158·7 m. CARBONACEOUS SILTY SAND. Brown, very fine grained and rarely clayey. Common zones containing abundant pods of clayey lignite and plant remains including tree root veins. Becomes mottled brown and white near base.

158·7 - 167·6 m. CARBONACEOUS GRAVELLY SAND. Brown, coarse grained, slightly clayey in part. Rare clayey lignite pods near top.

167·6 - 169·1 m. PYRITIC PEBBLY SANDSTONE. Grey, coarse grained and very hard. Pyrite content up to 10%.

169·1 m. - T.D. LAMINATED SILTSTONE. Buff-grey weathered zone at top gradually becoming blue-green, hard and fresh. Clay very common in weathered zone. Well cleaved in part and rare irregular quartz veins up to 10 mm. thick. Laminations less than 1 mm. thick.



10 CENTIMETRES ON ORIGINAL DRAWING

FIG. 2

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 2

STATE: SOUTH AUSTRALIA

1:250000 MAP SHEET: ADELAIDE

1:100000 MAP SHEET: KAPUNDA

BASIN: ST. VINCENT

WELL STATUS: OBSERVATION BORE

LOCATION: Lat. 34°23'31" S
Long. 138°32'27" E
HUNDRED: GRACE
SECTION: ADJ. 216

ELEVATION: 69m. above MSL

DATE SPUDDED: 21 st. MARCH 1977
DATE DRILLING STOPPED: 25 th. MARCH 1977
DATE RIG RELEASED: 30 th. MARCH 1977
TOTAL DEPTH: 88·8 m.

HOLE SIZE

MILLIMETRES	FROM (m)	TO (m)
194	0	6·5
120	6·5	80·0
105	80·0	88·8

CASING

MILLIMETRES	FROM (m)	TO (m)
88	0	75·6

SCREEN SET: FROM 75·6 TO 76·6 m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	0	88·4	1:200
NEUTRON NEUTRON	0	88·4	1:200
GAMMA GAMMA (DENSITY)	-	-	-
SELF POTENTIAL	6·0	88·6	1:200
POINT RESISTANCE	6·0	88·8	1:200
16" NORMAL RESISTIVITY	10·0	87·7	1:200
64" NORMAL RESISTIVITY	8·0	85·8	1:200
6' LATERAL RESISTIVITY	6·0	88·0	1:200
TEMPERATURE	0	88·8	1:200
CALIPER	-	-	-

MUD RESISTIVITY: 6·0 Ohm-metres at 20·9°C

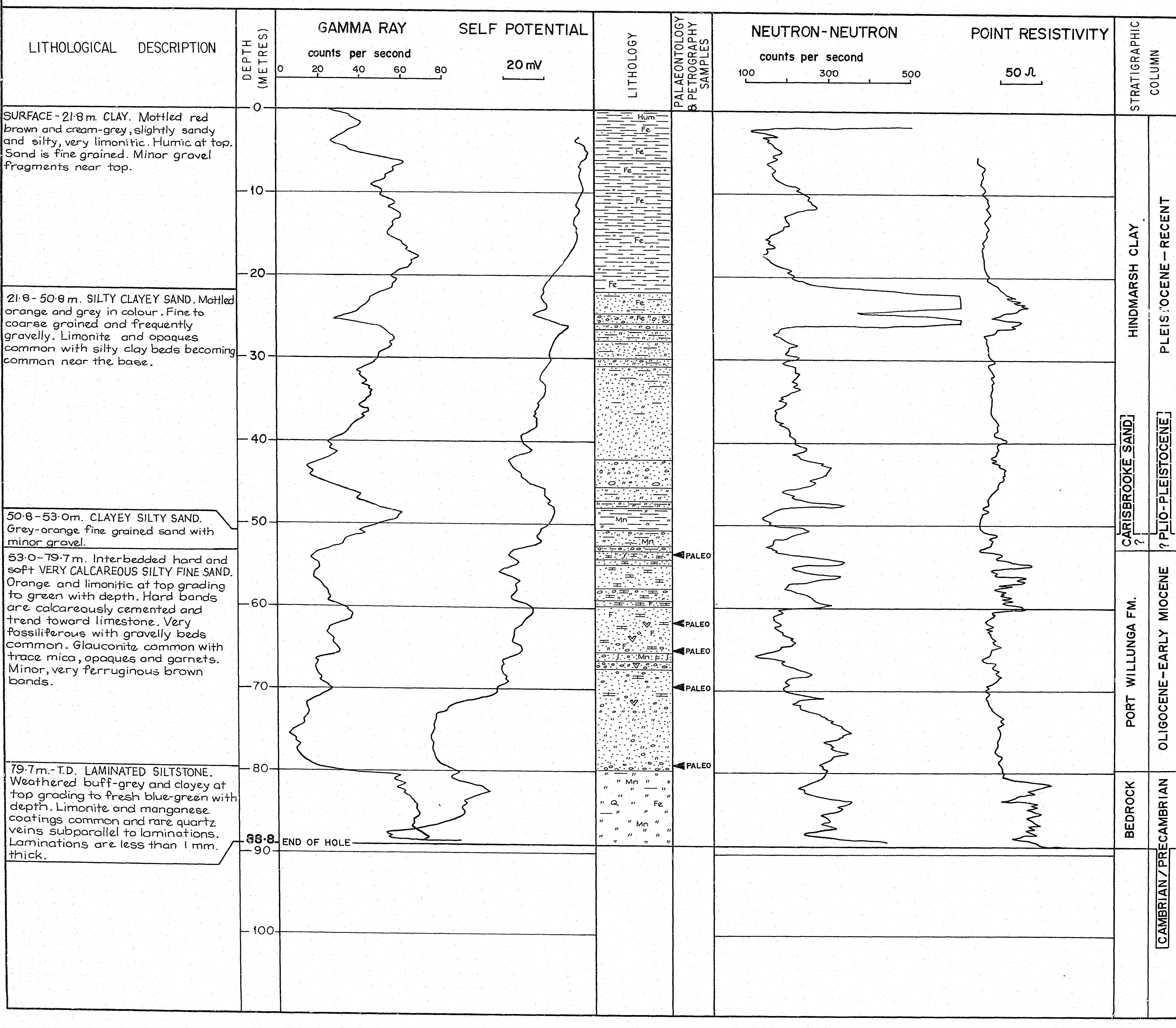
OTHER: -

DRILLED BY: S.A. DEPARTMENT OF MINES
DRILLING METHOD: ROTARY
LOGGED BY: S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Q Quartz	Ca Carbonate fragments
Silt, siltstone	Py Pyrite	F Fossiliferous
Sand, sandstone	V Micaceous	f Feldspathic
Calcite, limestone	∫ Carbonaceous	Gy Gypsiferous
Coal, lignite	Fe Ferruginous	Mn Manganese
Granules, pebbles	V Glauconitic	Hum Humic
Lignite pods	Si Siliceous	Lig Lignitic
Lignitic clay	I Calcareous	

LITHOLOGY: C.D. Cockshell
COMPILED: C.D. Cockshell
DRAFTED: N. Sandercock
DRAWING NUMBER: 77-1009



10 CENTIMETRES ON ORIGINAL DRAWING

FIG. 3

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 3

STATE: SOUTH AUSTRALIA   1:250 000 MAP SHEET: ADELAIDE   1:100 000 MAP SHEET: KAPUNDA

BASIN: ST. VINCENT   WELL STATUS: OBSERVATION BORE

LOCATION: Lat. 34°23'32" S
Long. 138°31'47" E
HUNDRED: GRACE
SECTION: ADJ. 215

ELEVATION: 65 m. above MSL

DATE SPUDDED: 31 st. MARCH 1977
DATE DRILLING STOPPED: 12 th. APRIL 1977
DATE RIG RELEASED: 16 th. APRIL 1977
TOTAL DEPTH: 128·8 m

HOLE SIZE

MILLIMETRES	FROM (m)	TO (m)
194	0	39·0
120	39·0	70·0
105	70·0	128·8

CASING

MILLIMETRES	FROM (m)	TO (m)
127	13·0	39·0
80	0	62·61

SCREEN SET: FROM 62·61 TO 63·61 m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	1·0	127·4	1:200
NEUTRON NEUTRON	1·0	128·1	1:200
GAMMA GAMMA (DENSITY)	-	-	-
SELF POTENTIAL	11·0	128·8	1:200
POINT RESISTANCE	11·0	128·8	1:200
16" NORMAL RESISTIVITY	11·0	128·0	1:200
64" NORMAL RESISTIVITY	10·0	127·0	1:200
6' LATERAL RESISTIVITY	10·0	127·4	1:200
TEMPERATURE	0	128·2	1:200
CALIPER	1·0	128·2	1:200

MUD RESISTIVITY: 10·5 Ohm-metres at 19°C

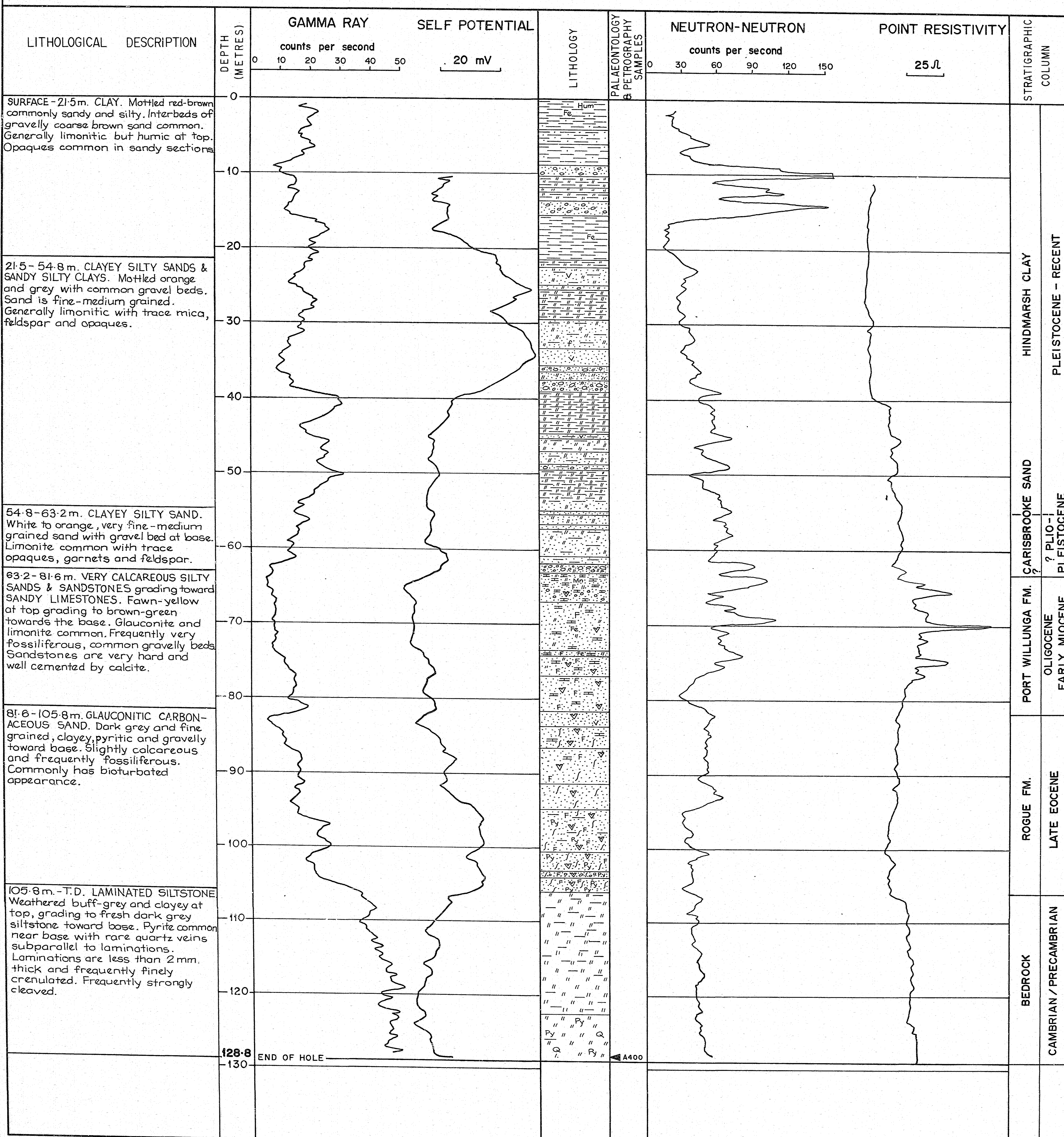
OTHER: -

DRILLED BY: S.A. DEPARTMENT OF MINES
DRILLING METHOD: ROTARY
LOGGED BY: S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Q Quartz	Ca Carbonate fragments
Silt, siltstone	Py Pyrite	F Fossiliferous
Sand, sandstone	V Micaceous	f Feldspathic
Calcite, limestone	ʃ Carbonaceous	Gy Gypsiferous
Coal, lignite	Fe Ferruginous	Mn Manganese
Granules, pebbles	∇ Glauconitic	Hum Humic
Lignite pods	Si Siliceous	Lig Lignitic
Lignitic clay	I Calcareous	

LITHOLOGY: C. D. Cockshell
COMPILED: C. D. Cockshell
DRAFTED: N. Sandercock
DRAWING NUMBER: 77-1010



10 CENTIMETRES ON ORIGINAL DRAWING

FIG. 4

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 4

STATE: SOUTH AUSTRALIA   1:250000 MAP SHEET: ADELAIDE   1:100000 MAP SHEET: WAKEFIELD

BASIN: ST. VINCENT   WELL STATUS: OBSERVATION BORE

LOCATION: Lat. 34°17' 51" S
Long. 138°25' 35" E
HUNDRED: DALKEY
SECTION: ADJ. 428

ELEVATION: 40 m. above MSL

DATE SPUDDED: 16 th. APRIL 1977
DATE DRILLING STOPPED: 23 rd. APRIL 1977
DATE RIG RELEASED: 28 th APRIL 1977
TOTAL DEPTH: 95·2 m.

HOLE SIZE:

MILLIMETRES	FROM (m)	TO (m)
194	0	19·5
120	19·5	80·0
105	80·0	95·2

CASING:

MILLIMETRES	FROM (m)	TO (m)
80	0	74·04

SCREEN SET: FROM 74·04 TO 75·04 m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	1·0	94·0	1:200
NEUTRON NEUTRON	1·0	94·0	1:200
GAMMA GAMMA (DENSITY)	-	-	-
SELF POTENTIAL	12·0	95·0	1:200
POINT RESISTANCE	12·0	95·0	1:200
16" NORMAL RESISTIVITY	12·0	95·0	1:200
64" NORMAL RESISTIVITY	12·0	95·0	1:200
6' LATERAL RESISTIVITY	12·0	93·0	1:200
CALIPER	-	-	-
CALIPER	-	-	-

MUD RESISTIVITY: 7·5 Ohm-metres at 20°C

OTHER: -

DRILLED BY: S.A. DEPARTMENT OF MINES
DRILLING METHOD: ROTARY
LOGGED BY: S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

- Clay, shale
- Silt, siltstone
- Sand, sandstone
- Calcite, limestone
- Coal, lignite
- Granules, pebbles
- Lignite pods
- Lignitic clay
- Q Quartz
- Py Pyrite
- V Micaceous
- J Carbonaceous
- Fe Ferruginous
- Gl Glauconitic
- Si Siliceous
- I Calcareous
- Ca Carbonate fragments
- F Fossiliferous
- f Feldspathic
- Gy Gypsiferous
- Mn Manganese
- Hum Humic
- Lig Lignitic

LITHOLOGY: C.D. Cockshell
COMPILED: C.D. Cockshell
DRAFTED: N. Sandercock
DRAWING NUMBER: 77-1011

LITHOLOGICAL DESCRIPTION

SURFACE - 19·0 m. CLAY with interbeds of CLAYEY SAND. Clays are mottled orange-red and cream-grey and sands are orange and medium-coarse grained. Humic at top. Frequently trace silt and sand in clays. Generally limonitic and commonly gravelly.

19·0 - 41·2 m. Interbedded CLAYEY SILTY SANDS & CLAYEY SILTS. Mottled orange and light grey with variable limonite content. Rare gravel and clay beds. Trace mica and opaques.

41·2 - 54·9 m. CLAYEY SILTY SANDS. Orange and fine grained, becoming coarse grained and gravelly toward base. Limonite very common, frequently forming weak cement.

54·9 - 59·4 m. CALCAREOUS SILTY SANDS. Orange at top grading to green at base. Fine-coarse grained, richly fossiliferous with common glauconite and opaques. Frequently grades toward SANDY LIMESTONE.

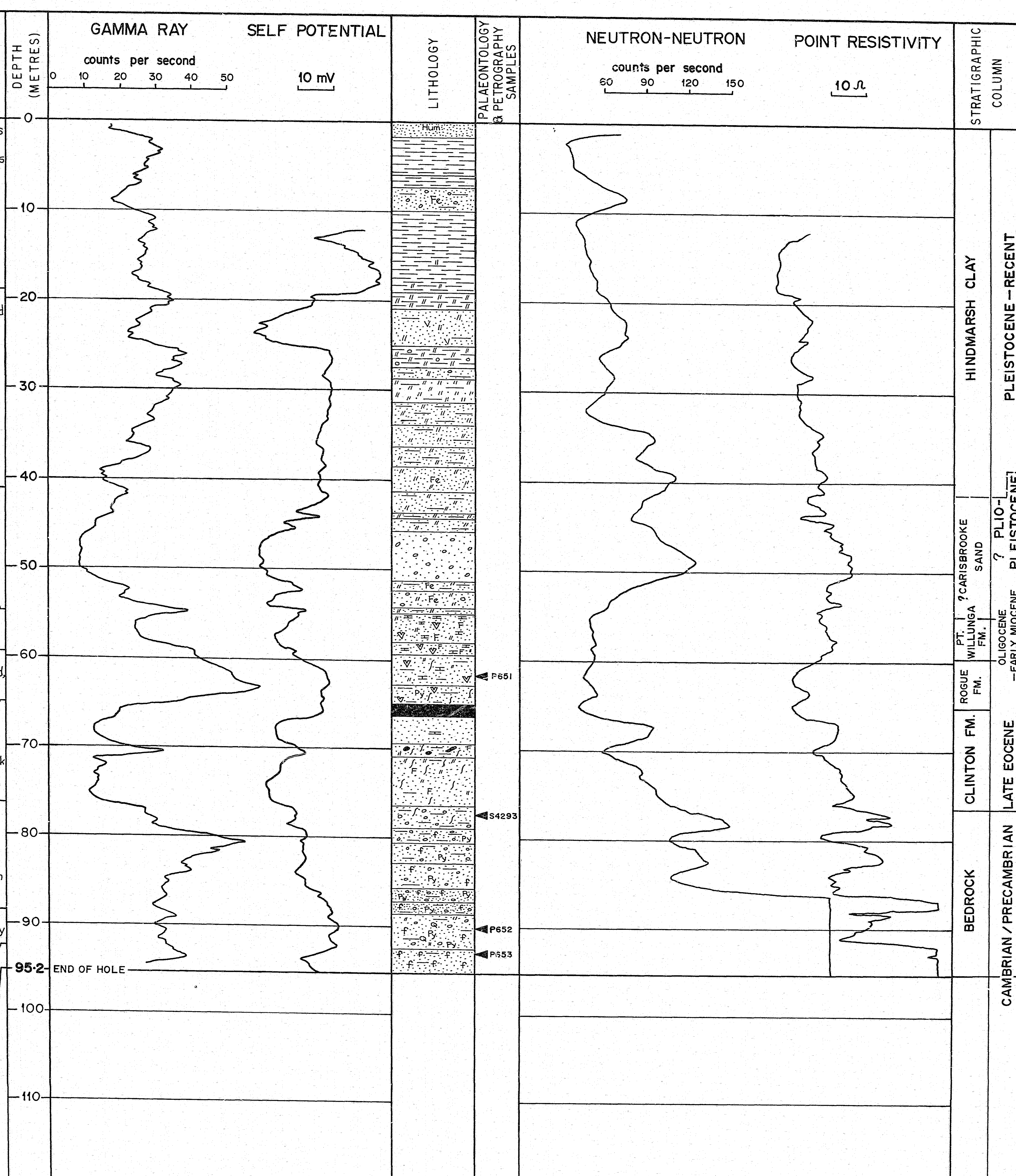
59·4 - 65·0 m. CLAYEY SILTY SANDS. Grey, glauconitic, and medium grained, pyrite and fossils common, slightly calcareous and trace carbonaceous material.

65·0 - 76·4 m. CARBONACEOUS SILTY SAND & LIGNITE. Brown-black, clayey medium sand, faintly calcareous. Black lignite in seams and pods, generally clayey. Trace pyrite.

76·4 - 88·5 m. CLAYEY GRAVELLY SANDS. Cream-buff, becoming less clayey toward base. Sand coarse grained. Lignitic plant root streaks near top but pyrite and feldspar common toward base. Common green ? chlorite grains, rare quartz veins.

88·5 - 92·5 m. PEBBLY SANDSTONE. Green, very fine grained sand, commonly silty with pink feldspar and quartz pebbles. Opaques, ? chlorite and pyrite common. Diamictitic appearance. Quickly grades into underlying unit.

92·5 m. - T.D. ARKOSE. Pinkish-grey and very hard. Quartz and pink feldspar predominant. White plagioclase commonly weathered to clay. Very coarse grained. Common green chlorite grains. Possible weak bedding plane indicated.



10 CENTIMETRES ON ORIGINAL DRAWING

FIG. 5

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 5

STATE: SOUTH AUSTRALIA   1:250000 MAP SHEET: ADELAIDE   1:100000 MAP SHEET: WAKEFIELD

BASIN: ST. VINCENT   WELL STATUS: OBSERVATION BORE

LOCATION: Lat. 34°16' 05" S
Long. 138°26'35"E
HUNDRED: DALKEY
SECTION: ADJ. 410

ELEVATION: 51 m. above MSL

DATE SPUDDED: 28 th. APRIL 1977
DATE DRILLING STOPPED: 6 th. MAY 1977
DATE RIG RELEASED: 11 th. MAY 1977
TOTAL DEPTH: 99.7 m.

HOLE SIZE:

MILLIMETRES	FROM (m)	TO (m)
194	0	25.0
120	25.0	70.0
105	70.0	99.7

CASING:

MILLIMETRES	FROM (m)	TO (m)
80	0	65.0

SCREEN SET: FROM 65.0m. TO 66.0m.

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	1.0	98.8	1:200
NEUTRON NEUTRON	2.0	98.8	1:200
GAMMA GAMMA (DENSITY)	6.0	98.8	1:200
SELF POTENTIAL	13.0	99.3	1:200
POINT RESISTANCE	13.0	99.3	1:200
16" NORMAL RESISTIVITY	22.0	99.7	1:200
64" NORMAL RESISTIVITY	22.0	99.7	1:200
6' LATERAL RESISTIVITY	13.0	99.7	1:200
CALIPER	2.0	99.4	1:200
CALIPER	-	-	-

MUD RESISTIVITY 10.8 Ohm-metres at 19°C

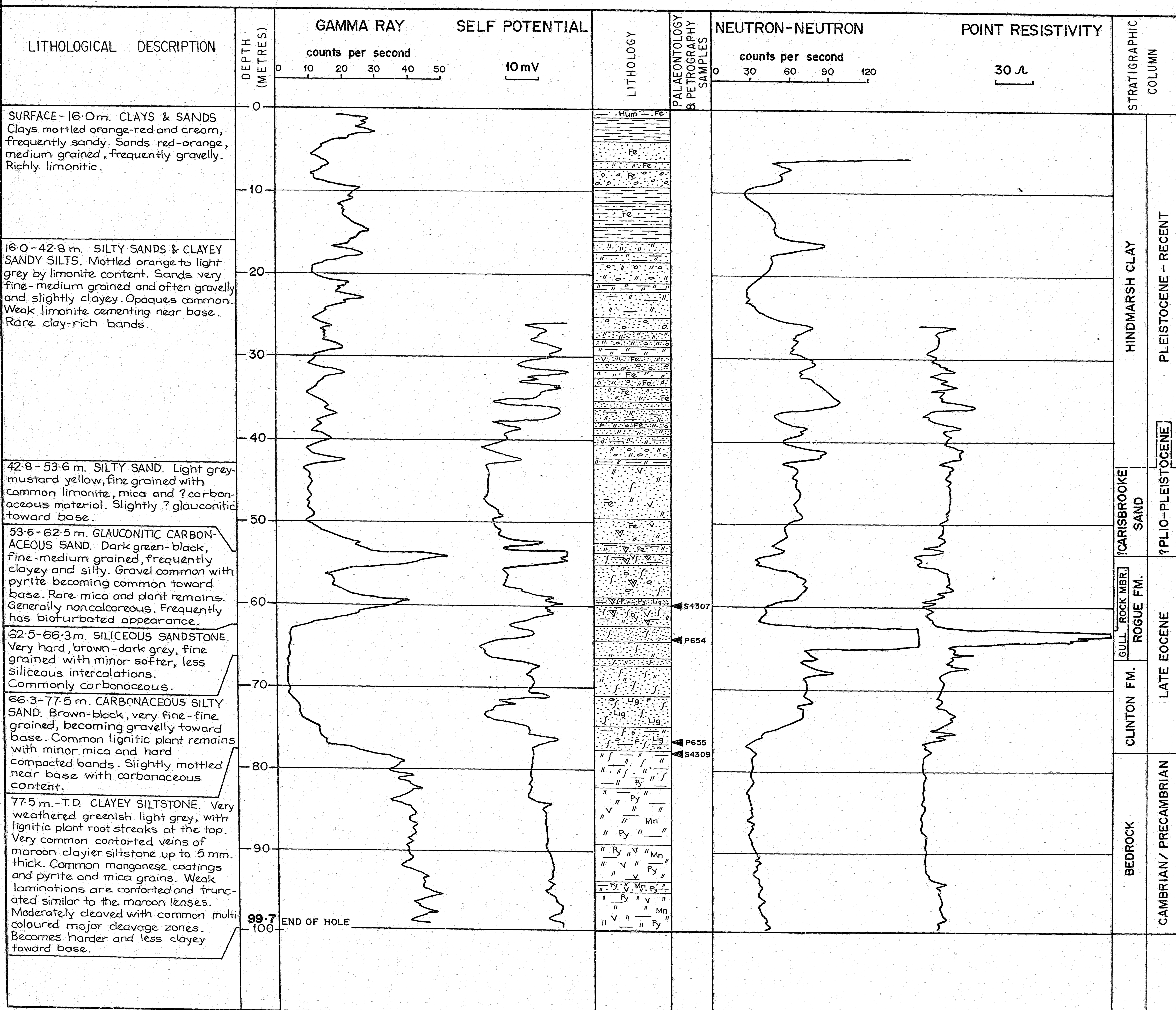
OTHER: -

DRILLED BY: S.A. DEPARTMENT OF MINES
DRILLING METHOD: ROTARY
LOGGED BY: S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Q Quartz	Ca Carbonate fragments
Silt, siltstone	Py Pyrite	F Fossiliferous
Sand, sandstone	V Micaceous	f Feldspathic
Calcite, limestone	ʃ Carbonaceous	Gy Gypsiferous
Coal, lignite	Fe Ferruginous	Mn Manganese
Granules, pebbles	V Glauconitic	Hum Humic
Lignite pods	Si Siliceous	Lig Lignitic
Lignitic clay	I Calcareous	

LITHOLOGY: C.D. Cockshell
COMPILED: C.D. Cockshell
DRAFTED: N. Sandercock.
DRAWING NUMBER: 77-1012



10 CENTIMETRES ON ORIGINAL DRAWING

FIG. 6

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 6

STATE: SOUTH AUSTRALIA | 1:250000 MAP SHEET: ADELAIDE | 1:100000 MAP SHEET: KAPUNDA

BASIN: ST. VINCENT | WELL STATUS: PLUGGED AND ABANDONED

LOCATION Lat 34° 27' 10" S
Long 138° 32' 05" E
HUNDRED GRACE
SECTION ADJ. 55

ELEVATION 43 m. above MSL

DATE SPUDDED 12 th. MAY 1977
DATE DRILLING STOPPED 21 st. MAY 1977
DATE RIG RELEASED 2 nd. JUNE 1977
TOTAL DEPTH 162·8 m.

HOLE SIZE

MILLIMETRES	FROM (m)	TO (m)
194	0	38·5
105	38·5	162·8

CASING

MILLIMETRES	FROM (m)	TO (m)
-	-	-

SCREEN SET FROM - TO -

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	0	158·8	1:200
NEUTRON NEUTRON	0	158·4	1:200
GAMMA GAMMA (DENSITY)	0	157·6	1:200
SELF POTENTIAL	-	-	-
POINT RESISTANCE	-	-	-
16" NORMAL RESISTIVITY	-	-	-
64" NORMAL RESISTIVITY	-	-	-
6' LATERAL RESISTIVITY	-	-	-
CALIPER	-	-	-
CALIPER	-	-	-

MUD RESISTIVITY -

OTHER -

DRILLED BY S. A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S. A. DEPARTMENT OF MINES

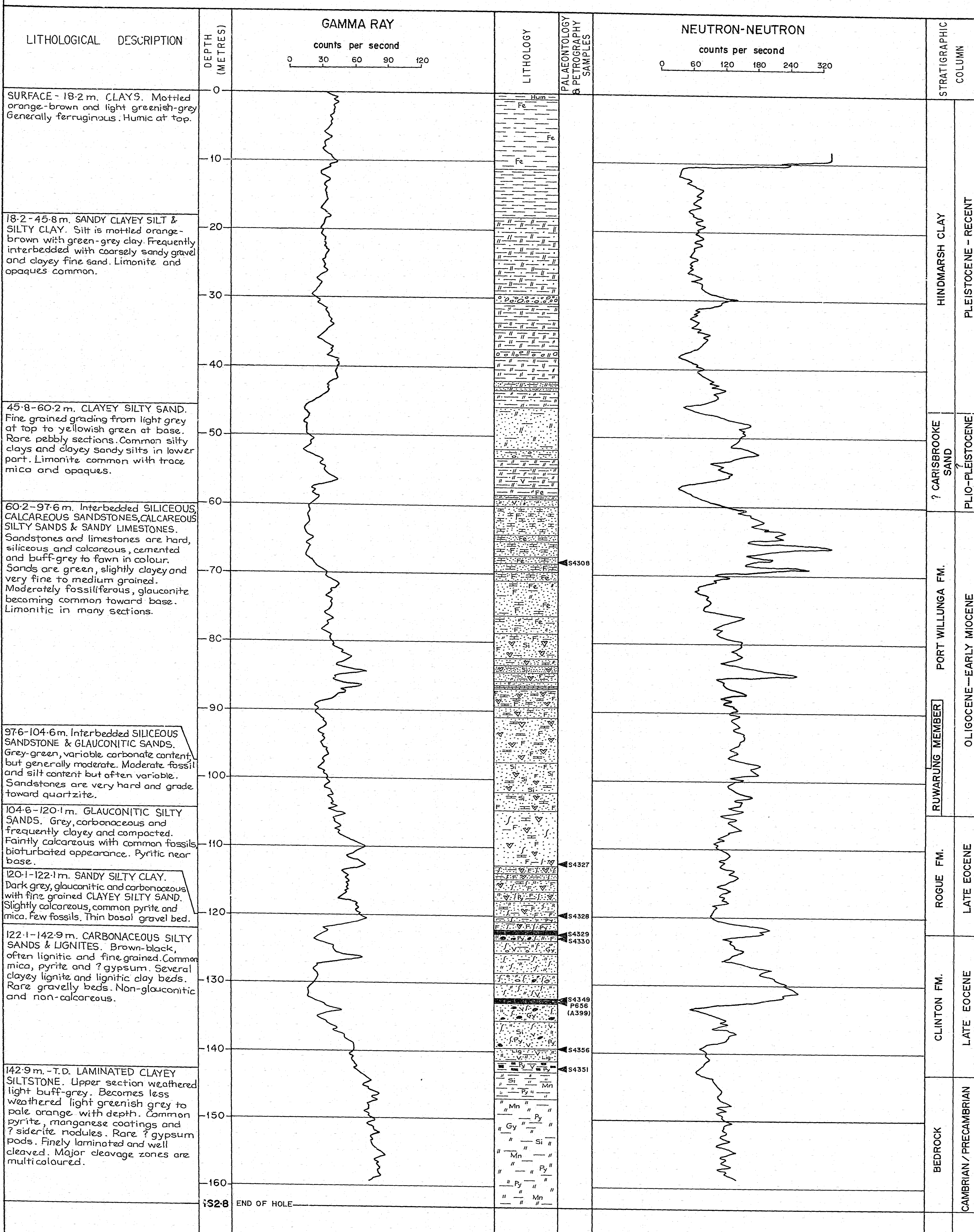
LITHOLOGICAL REFERENCE

Clay, shale; Silt, siltstone; Sand, sandstone; Calcite, limestone; Coal, lignite; Granules, pebbles; Lignite pods; Lignitic clay

Q Quartz; Py Pyrite; V Micaceous; ∫ Carbonaceous; Fe Ferruginous; V Glauconitic; Si Siliceous; I Calcareous

Ca Carbonate fragments; F Fossiliferous; f Feldspathic; Gy Gypsiferous; Mn Manganese; Hum Humic; Lig Lignitic

LITHOLOGY C. D. Cockshell
COMPILED C. D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1013



10 CENTIMETRES ON ORIGINAL DRAWING

FIG. 7

COMPOSITE WELL LOG

SOUTH AUSTRALIAN DEPARTMENT OF MINES

BARABBA NO. 7

STATE: SOUTH AUSTRALIA   1:250000 MAP SHEET: ADELAIDE   1:100000 MAP SHEET: WAKEFIELD

BASIN: ST. VINCENT   WELL STATUS: PLUGGED AND ABANDONED

LOCATION Lat 34°27'30" S
Long 138° 29'39" E
HUNDRED: GRACE
SECTION ADJ. 570

ELEVATION 35 m. above MSL

DATE SPUDDED 2nd. JUNE 1977
DATE DRILLING STOPPED 16th. JUNE 1977
DATE RIG RELEASED 16th. JUNE 1977
TOTAL DEPTH 151·2 m.

HOLE SIZE

MILLIMETRES	FROM (m)	TO (m)
120	0	20·0
105	20·0	151·2

CASING

MILLIMETRES	FROM (m)	TO (m)
-	-	-

SCREEN SET FROM - TO -

LOGGING

LOGS RUN	FROM (m)	TO (m)	DEPTH SCALE
GAMMA RAY	0	150·0	1:200
NEUTRON NEUTRON	0	150·2	1:200
GAMMA GAMMA (DENSITY)	0	151·0	1:200
SELF POTENTIAL	11·0	149·4	1:200
POINT RESISTANCE	11·0	149·4	1:200
16" NORMAL RESISTIVITY	20·3	150·0	1:200
64" NORMAL RESISTIVITY	19·1	148·9	1:200
6' LATERAL RESISTIVITY	11·1	150·6	1:200
CALIPER	0·2	66·4	1:200
CALIPER	-	-	-

MUD RESISTIVITY 0·45 Ohm-metres at 17·5°C

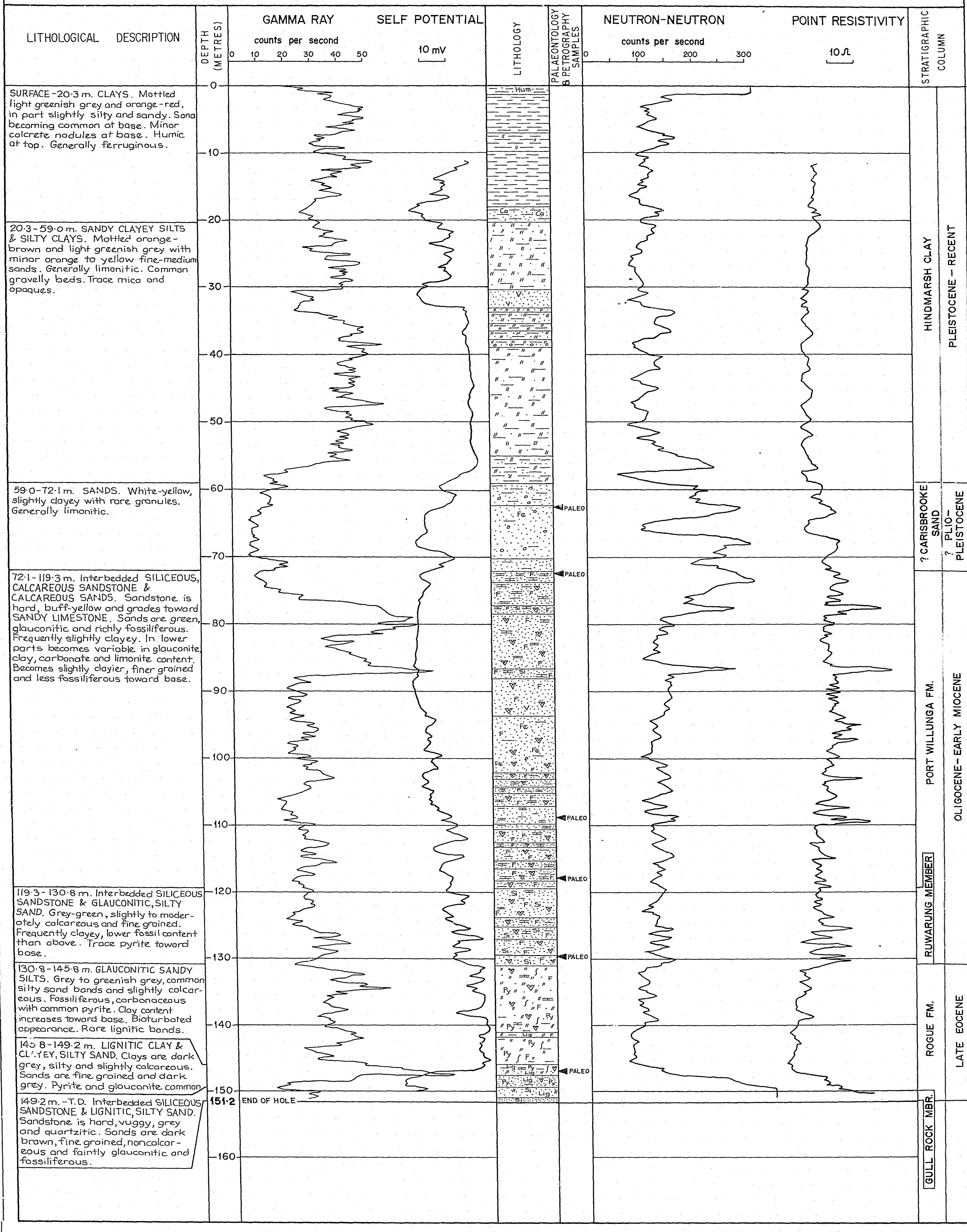
OTHER —

DRILLED BY S.A. DEPARTMENT OF MINES
DRILLING METHOD ROTARY
LOGGED BY S.A. DEPARTMENT OF MINES

LITHOLOGICAL REFERENCE

Clay, shale	Q Quartz	Ca Carbonate fragments
Silt, siltstone	Py Pyrite	F Fossiliferous
Sand, sandstone	V Micaceous	f Feldspathic
Calcite, limestone	∫ Carbonaceous	Gy Gypsiferous
Coal, lignite	Fe Ferruginous	Mn Manganese
Granules, pebbles	V Glauconitic	Hum Humic
Lignite pods	Si Siliceous	Lig Lignitic
Lignitic clay	I Calcareous	

LITHOLOGY C. D. Cockshell
COMPILED C. D. Cockshell
DRAFTED N. Sandercock
DRAWING NUMBER 77-1014



10 CENTIMETRES ON ORIGINAL DRAWING