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SOUTH AUSTRALIA

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NUNDROO 1, 2 & 3
WELL COMPLETION REPORT

ABSTRACT

Nundroo 1, 2&3 intersected metabasalts or gabbros, meta andesites or diorites and interlayered sediments possibly with associated acid igneous extensives or intrusives. These rocks were subjected to granulite facies metamorphism and later by retrograde amphibolite facies metamorphism c.1570Ma. This age is not directly correlative with any other known South Australian orogenic event. the age of the earlier granulite facies metamorphism is unknown. The metabasics are anomalous in Ti and V and are slightly anomalous in Cu, Cr and Ni. There are no similar metabasics in South Australia, however the Nundroo gneisses have a similar strikelength, metamorphic history, protoliths and anomalous trace element content to that of the Frazer Range in Western Australia.

INTRODUCTION

The Nundroo drilling project was proposed in February 1987 as the first phase of investigation of the little known southwestern Gawler Craton. The drilling proposal is directly related to the systematic mapping program planned for this region in 1989-90.

Previous drilling local to Nundroo is restricted to percussion water bores, with one hole near Pintumba intersecting gneissic granite at 27 m and Eyre Highway Bore 12, 10 km west of Colona, intersecting mica schist at 77 m. Eyre Highway Bore 10, 209 km northwest of Nundroo, failed to intersect basement at 81 m (Williams, 1972, 73).

In 1975 Roberts divided the region into five magnetic zones (Fig. 2). Zone A where magnetic basement was estimated at approximately 2 km, Zone B & C at 2000-1000 m, Zone D at 100-200 m, and Zone E at 100-200 m. Roberts considered BC & D as possible high grade metamorphics with interlayered banded iron formations and possible linear magnetic basic bodies. Zone E was considered granitoid with possible relic metasediments. this last interpretation is partly supported by outcrop of pale grey granodioritic with banded block plagioclase biotite hornblende

xenoliths 2.5 km southeast of Coorabie and a similar rock type 18 km due east of Coorabie. the granodiorite has been tentatively correlated with other late syn Kimban granites in the region e.g. Pt. Sinclair on NUYTS 1:250 000 map sheet.

Zone D was selected for investigation because of relatively shallow cover and very well defined linear anomalies with a continuous strike length of 40 km and a possible discontinuous length of 150 km (including 50 km offshore). It was considered possible that Zone D might extend into the Tarcoola Region and therefore may contain Archaean - Early Proterozoic metasediments and possible interlayered banded iron formation . the Archaean to Early Proterozoic Mulgathing Complex was known to contain metabasics which were prospective for nickel, chromium and plotinoids and calcsilicates prospective for Cu, Pb and Zn (Daly et al. 1978; Warner, 1971).

The project began with two ground magnetic and gravity traverses (Fig. 3) totalling 77.7 line kilometres across Zone D. Ten rotary drillholes, nominally 100 m deep, with bottom hole coring were planned to investigate different magnetic and gravity anomalies. Over angled 400 m diamond hole was to be sited following completion of the rotary drilling program.

Subsequently 16 rotary holes were completed and a SIROTEM survey carried out. Lithological descriptions of the rotary drillholes, detailed cover sequence geology, petrology of the crystalline basement, geochemistry, magnetic and gravity data, detailed geophysical modelling, SIROTEM data and interpretation may be found in Martin, Daly and Benbow, 1988.

Nundroo 1 was spudded on 25 km May 1987 at 16,800 mW on anomaly Z and was angled 60^{o}E towards 115^{o} to intersect magnetic basement with a modelled steep westerly dip. Nundroo 1 was abandoned at 59.6 m due to drilling problems and relocated, as Nundroo 2, 100 m east, and completed to 375.6 m.

Nundroo 3 was spudded on 10th August 1987 at 19,800 mW in a magnetically quick zone without any strong linear magnetic anomalies and was completed to 234.94 m (also declined 70^{o} towards 115^{o}).

GEOLOGY

Drilling results

Nundroo 1 intersected 6 m (5.20 m true thickness) of calcreted Bridgewater Formation, 4 m (3.46 m) of Nullarbor Limestone, 16.3 m (14.12 m) of Wilson Bluff Limestone, 15.7 m of

weathered gneiss and 5.6 m of foliated pink, migmatitic, porphyroblastic, quartz, feldspar, biotite, garnet gneiss interlayered with green, feldspar, amphibole, garnet, magnetite, gneiss. Drilling ceased at 59.6 m (Enclosure 1 & 2) due to loss of circulation. One HQ core barrel and 13.5 m of HQ drilling rods remain stuck in the hole (Appendix 1).

Nundroo 2 intersected 3 m (2.82 m) of calcreted Bridgewater Formation, 6 m (5.64 m) of Nullarbor Limestone, 10 m (9.40 m) of Wilson Bluff Limestone, 17.65 m of weathered gneiss and 275.12 m of green to black plagioclase, amphibole, pyroxene, magnetite gneiss interlayered with grey, plagioclase, pyroxene, amphibole, garnet, magnetite gneiss. Below the basic gneiss 36.65 m of pink, quartz, feldspar, biotite, garnet gneiss with thin green, plagioclase, hornblende, pyroxene gneiss interbands was intersected. Drilling ceased at 375.6 m (Enclosures 2 & 3) and the hole was geophysically logged (Enclosures 7, 8 & 9).

Nundroo 3 intersected 4 m (3.76 m) of Bridgewater Formation, 10 m (9.4 m) of Nullarbor Limestone, 12 m (11.28 m) of Wilson Bluff Limestone, 16 m (15.0-3 m) of Hampton Sandstone, 18 m (16.91 m) of Pidinga Formation, gm of weathered gneiss, 49.95 m of distinctively garnet rich, pinkish-grey, quartz, feldspar, garnet, biotitic, magnetite gneiss intruded by now deformed fine grained basic dykes or sills. the garnet rich gneiss overlies 116 m of green, foliated, plagioclase, amphibole, magnetite gneiss with subordinate biotite interlayered with green to black, plagioclase, biotite, garnet gneiss with subordinate amphibole. Drilling ceased at 234.94 m (Enclosures 5 & 6) and the hole was geophysically logged (Enclosures 10, 11 & 12).

The Bridgewater Formation, Nullarbor Limestone and Wilson Bluff Limestone were intersected in all three drillholes; detailed descriptions of each unit intersected in each hole is summarized. No core was recovered, all descriptions are based on drill cuttings collected every three metres for Nundroo 1 & 2 and every two metres for Nundroo 3.

The Bridgewater Formation is characteristically partially to wholly carbonate cemented and is cream to pink to reddish-brown in colour. The original lithology is a fine to medium grained aeolian grainstone (nomenclature after Dunham, 1972) where individual grains may be fragments of shell, red coralline algae, echinoids, formanifera, bryozoa and fine grained limestone (Martin et al., 1988) which have subsequently been partially to wholly recrystallized by secondary carbonate during calcrete development.

Cutting samples from intervals thoroughly cemented by secondary carbonate can only be described as calcareous mudstone i.e. no trace of the fossils remain. Laminated secondary carbonate and reddish-brown and black pisoliths developed in the calcrete profile are common cutting fragments. The Bridgewater Formation also characteristically contains at least 20% of silty to very fine grained, subangular, translucent quartz.

The Nullarbor Limestone is a cream to orange-brown poorly consolidated to consolidated, sandy, calcareous, mudstone with thin interbeds of white very fine grained recrystallized limestone. The quartz sand content varies from 10-40% and is very fine grained to fine grained subangular to subrounded translucent quartz. The mudstone may contain a low percentage of green to black glauconite.

The Wilson Bluff Limestone is characteristically multicoloured in all three holes, from pale pinkish-brown to reddish-orange-brown to green and is a poorly consolidated calcareous mudstone containing up to 20% of green to black, medium grained, subrounded grains of glauconitic commonly agglutinated to form soft to moderately hard pellets. Thin interbeds of finer grained recrystallized limestone, which contain glauconite are also inferred to occur. (White recrystallized limestone from the Nullarbor Limestone which may have been a contaminant does not usually contain in these holes, glauconite). The mudstone contains between 10-50% of very fine grained subrounded translucent quartz and less commonly a low percentage of coarse grained subrounded milky quartz.

The Hampton Sandstone was intersected in Nundroo 3 only and is strikingly orange-brown in colour. The quartz sand is poorly consolidated, very fine grained to very coarse grained, poorly sorted, subrounded and predominantly translucent, less commonly milky. The clay content varies from 20-50% and may be slightly calcareous and contain a low percentage of glauconite. Near the base the Hampton Sandstone becomes more clayey. Chips of reddish-brown, ferruginous, clayey sand suggest that the characteristic orange-brown. Colour is due to irregular development of ferruginization within the sand sequence.

The Pidinga Formation was also intersected in Nundroo 3 only. The lithology is predominantly a black carbonaceous mud with 10-30% fine grained to very coarse grained, translucent to milky quartz overlying a medium to coarser grained, subrounded to subangular, quartz sand with 10-20% pale grey clay or mud matrix

and a few fragments of gneiss.

Nundroo 1, 2 & 3 all intersected weathered gneiss. Reddish-brown ferruginous clay was intersected in both Nundroo 1 & 2 however in Nundroo 3 the ferruginization was developed in the Hampton Sandstone and the underlying basement although kaolinized was iron free. The basement in Nundroo 1 & 2 was therefore last exposed after deposition of the Hampton Sandstone, i.e. post latest Eocene (Lowry, 1970; Benbow, in press), prior to the deposition of the Wilson Bluff Limestone intersected in all three holes.

Nundroo 1 intersected 5.6 m of unweathered gneiss before the hole was abundant due to drilling problems. The gneiss intersected is distinctively grey-pink, coarse grained to very coarse grained, migmatitic and porphyroblastic, feldspar rich, quartz, plagioclase, biotite, garnet, magnetite gneiss crudely compositionally banded on a 1/2-2 cm scale and with garnet porphyroblasts up to 1.5 cms. The abundant plagioclase may be partially altered to sericite or locally scapolite. the felsic gneiss contains green finer grained interbands richer in amphibole. One interband contains an ovoid pod of clinopyroxene possibly once a basic intrusive). Another mafic rich interband contains a tight S fold with an amplitude of 7 cms and a wavelength of approximately 3 cms.

Nundroo 2 intersected 275.12 m of basic gneiss. The basic gneiss may be described as a composite of two end members. One a black to dark green, medium grained to locally coarse grained, poorly compositionally banded to massive, plagioclase, hornblende, clinopyroxene gneiss with subordinate magnetite and with thin (< 5 mm) concordant plagioclase rich pegmatites to thicker (< 5 cms) partially discordant plagioclase rich pegmatite. The other a pale grey-green, distinctively banded, on 0 mm to 5 cm scale, fine to medium grained plagioclase, clinopyroxene, orthopyroxene, garnet, magnetite gneiss interlayered with hornblende, plagioclase, clinopyroxene gneiss with subordinate orthopyroxene and magnetite. Locally the light green clinopyroxene and pale brown orthopyroxene is sufficiently coarse grained to be recognized in the last specimen. Overall the finer grained compositionally banded mafic gneiss contains less concordant and discordant plagioclase rich pegmatite than the amphibole rich end member. Both end members and the discordant feldsic pegmatites have been cross cut by irregular very coarse grained pink pegmatites (< 2 m thick) containing minor very coarse grained biotite, hornblende or

garnet. Amphibole rich gneisses adjacent to the pink pegmatites may be very coarse grained and contain abundant acicular pale brown mica. Pyroxene rich gneisses may contain coarse grained clinopyroxene, orthopyroxene and garnet adjacent to the intrusive potash feldspar rich pink pegmatites.

The basic gneiss is cross cut by a number of thin (< 0.5 m) pervasive shear zones which remain compositionally banded. Paler layers are predominantly plagioclase and biotite plus magnetite, darker layers are predominantly hornblende and plagioclase plus magnetite; both layers contain varying amounts of secondary quartz.

Below the basic gneiss Nundroo 2 intersected 36.65 m of pink to white to grey, strongly foliated, finely compositionally banded, fine to coarse grained, quartz, feldspar, garnet, biotite, sillimanite gneiss with feldspar porphyroblasts < 1 cm and a moderate to abundant garnet content. The gneiss is characterized by pink and white porphyroblastic feldsic segregations (5 mm - 2 cms) and wispy biotite, garnet and sillimanite aligned parallel to foliations. Small tight folds with sharp hinges are common. the feldsic gneiss is interlayered with thin green, finely banded, fine grained, plagioclase, amphibole, pyroxene, magnetite gneiss i.e. is interlayered with the basic gneiss. Thin essentially conformable feldsic pegmatites occur, some of which contain mafic xenoliths.

Nundroo 3 intersected 49.95 m of foliated pinkish-grey garnet rich, fine to medium grained, well banded to poorly banded, feldspar, quartz, garnet, biotite, magnetite gneiss. The gneiss is characterized by thin concordant to slightly discordant feldspar segregations (5 mm - 4 cms) locally porphyritic, and strongly aligned biotite with associated garnet. The felsic segregations may be greenish in colour due to sericitic alteration of plagioclase (cream potash feldspar is less altered). Concordant to partially discordant coarse-grained pegmatites (< 2 m) also occur containing green plagioclase, cream potash feldspar, quartz ribbons, biotite and garnet. the garnet rich gneiss is intruded by thin (.2 - 3.3 m), black, now foliated, fine grained, homogeneous plagioclase, amphibole, biotite, pyroxene gneiss which may contain host gneissic xenoliths.

Below the garnet rich gneiss Nundroo 3 intersected 116 m of black to dark green and white fine to medium grained, foliated effectively homogeneous, plagioclase, biotite, garnet, quartz gneiss, with subordinate hornblende and magnetite, interlayered

with fine to coarse grained, green and white, homogenous, amphibole, plagioclase gneiss with subordinate biotite. The biotite rich gneiss contains persistent to abundant garnet, whereas the amphibole rich gneisses contain rare or no garnet. both lithologies contain thin concordant to slightly discordant feldsic layers and poddy discordant feldsic zones. The amphibole rich gneiss also contains locally abundant coarse grained amphibole. Thin (< 0.5 m) now foliated, homogeneous, fine grained, basic sills or dykes intrude the amphibole rich gneiss.

Mineralogy and Metamorphism

Sixty seven thin sections were cut from diamond core from Nundroo 1, 2&3. Detailed descriptions may be found in APPENDIX 2.

The basic gneisses intersected in Nundroo 2 indicate that these rocks, now plagioclase, clinopyroxene, orthopyroxene, + hornblende garnet, magnetite gneisses, have been subjected to granolitic facies metamorphism followed by later retrogressive amphibolite facies metamorphism. The later event is associated with moderate to strong fabric development and local pervasive shear zones. The amphibolite facies is a regional metamorphic event not a localized shearing event, i.e. it is regional at least to the southern end of Zone D (Fig. 2). Clinopyroxene is partially to wholly replaced by amphibole, orthopyroxene by biotite and garnet and magnetite become metastable. Interstitial and vein quartz was introduced at this time. The more acid to intermediate lithologies show mineralogies associated with the later phase of metamorphism and a well defined to locally mylonitic foliation. thin interlayered felsic segregations and porphyroblast development also occurs. In some zones discordant felsic segregations are dominant.

A brief description of the mineralogy and texture of each rock unit is summarized here. More detailed descriptions may be found in Appendix 2. the depths at which all petrological and analytical samples were taken are plotted on the detailed geological logs for Nundroo 1, 2&3 i.e. Enclosures 1, 3 5. Sample data is also listed in Table 1.

(1) Felsic porphyroblastic gneisses Nundroo 1 (54.0-59.42 m)

Coarse grained porphyroblastic, quartz, plagioclase, biotite, garnet, magnetite, gneiss with interlayers rich in amphibole.

Quartz: The most abundant mineral with a granoblastic elongate

texture with curved to embayed to scalloped boundaries. Larger grains exhibit moderately strong strain features, including undulose extinction, deformation band boundaries and subgrain development. Quartz ribbons also occur.

Plagioclase: has a granoblastic elongate texture with curved to embayed to scalloped boundaries. Large crystals are typically antiperthitic. Albite, carlsbad and pericline twins all occur. Lamellae may be kinked. Plagioclase is locally wholly replaced by sericite. Scapolitic is also moderately abundant in some plagioclase rich layers.

Biotite: Subhedral biotite shows chocolate brown to yellow pleochroism and is aligned parallel to foliation.

Garnet: Coarse grained, porphyroblastic, subhedral to anhedral, poikiolitic, enclosing opaques, biotite, quartz and feldspar. Euhedral, equant garnet is less common. Biotite has grown through and around garnet porphyroblasts indicating garnet grew late in the fabric forming event.

Amphibole: Locally very abundant. Amphibole rich layers contain abundant quartz and plagioclase. Typically, anhedral, elongate, composite crystals with deep green to yellow pleochroism. Amphibole has an elongate granoblastic texture with curved to embayed to scalloped margins.

Opaques: Opaque minerals are most abundant in the amphibole rich layers. Some are skeletal whereas in the biotite, garnet rich zones opaques are coarse grained and have grown around grain margins.

(2) Mafic gneisses Nundroo 2 (36.65-511.77 m)

These rocks may be very finely compositionally banded (on a mm scale) or broadly banded to massive. Prograded mineral assemblages indicate granulite facies metamorphism followed by later retrogressive amphibolite facies metamorphism.

Plagioclase: Typically the most abundant mineral with an equant to elongate granoblastic texture with straight or curved grain boundaries. Approximately half of the plagioclase is untwinned the remainder showing albite, carlsband and pericline twinning.

The albite twins are commonly current and bent. The anorthite content derived from limited suitable albite twins is 40-42% i.e. within the Andesine range.

Plagioclase may form symplectic intergrowths with garnet in those basic gneisses which are least retrograded. Adjacent to later felsic pegmatites, very coarse grained porphyroblasts of plagioclase (and clinopyroxene) occurs indicating mesasomatic growth. Scapolite is common, derived from plagioclase, in retrogressed zones.

Clinopyroxene: Characteristically forms composite masses with a granoblastic elongate texture, with straight to current boundaries. The clinopyroxene in plain transmitted light is pale green in colour, with poor pleochroism, and has a moderately high birefringence. The pyroxene is commonly twinned and is very coarse porphyroblasts grown near intrusive pegmatites shows exsolution lamellae. Replaced in part by hornblende.

Orthopyroxene: Strongly pleochroic, from pink-brown to pale green, with only moderate birefringence and parallel extinction. Characteristically intergrown with composite masses of clinopyroxene, with a granoblastic texture. Replaced in part by biotite and less commonly hornblende.

Garnet: Both euhedral and porphyroblastic forms occur. May be very coarse grained and form part of a compositional band. Less commonly it is symplectic i.e. intergrown, with plagioclase. Garnet occurs only in compositional bands containing plagioclase, clinopyroxene, orthopyroxene and magnetite. Garnet is most abundant where orthopyroxene is abundant. Layers which contain more than a few percent of hornblende do not contain garnet, i.e. garnet is not stable in the amphibolite facies.

Opaques: Vary in abundance from 1-7% from very fine grained to coarse grained. The fine-grained opaques are enclosed within pyroxines whereas coarse grained opaques appear to have grown during amphibolite facies metamorphism. Skeletal opaques occur in metastable orthopyroxene.

Hornblende: Pleochroism varies from straw yellow to khaki green and in strongly deformed zones pale blue-green to yellow-green suggesting a different chemical composition.

Hornblende replaces clinopyroxene and less frequently orthopyroxene. It is granoblastic to elongated, subhedral, and has grown at the expense of clinopyroxene and opaques during a later metamorphic event. Hornblende rich zones contain virtually no opaques. Magnetic susceptibility geophysical logs for Nundroo 2 (Enclosure 7) also indicate that the most amphibole rich zones in the most regressed, are lease magnetic.

Biotite: Has characteristic known to straw-yellow pleochroism and anhedral to subhedral crystal shape. May be intergrown in lamellae with hornblende indicating biotite has grown at the same time as hornblende. Biotite has grown at the expense of opaques and orthopyroxene. Generally low in abundance except in shear zones with well developed anastomosing texture.

Apatite: The most common accessory. Usually round, occasionally euhedral, translucent, colourless with a high birefringence. Apatite may occur in compositional bands and is ... to 2% in abundance. Apatite is locally very coarse-grained due to metasomatic growth near pegmatites.

Quartz: Less than 5% in abundance, interstitial in character.

Sphene: Characteristically brown in colour, unevenly textured with high relief and birefringence. Generally less than 1% in abundance.

Zircon: Very low abundance, very fine grained, round in shape and dark in colour in plane polarized light.

(3) Acidic gneisses Nundroo 2 (311.77-375.60 m)

Pink to grey and white, strongly foliated finely compositionally bounded, quartz, feldspar, biotite, garnet sillimanite gneiss, porphyroblastic in part with thin basic gneiss interlayers previously described on pages 13-16.

Quartz: The most abundant component (approximately 40-60%), fine to medium grained with a granoblastic elongate texture with current to embayed grain boundaries. Quartz exhibits moderately strong strain features including deformation band boundaries, subgrain development and new grain growth. Quartz ribbon development is also common.

Potash feldspar: Has a granoblastic elongate texture with current to embayed boundaries. Characteristically perthitic with small elongate blebs, less commonly crosshatch twinning is developed. In plain polarized light is faintly iron oxide dusted.

Plagioclase: May be twinned, albite, carlsbad and penclined twins are present. No suitable crystals were found for composition determination. Locally highly altered to sericite.

Garnet: Pink-brown in colour and euhedral to subhedral and equant in shape. Most abundant in layer parallel bands with biotite, sillimanite and opaques.

Sillimanite: Occur as trains of small euhedral, polygonal shaped, crystals parallel to fabric. Characteristic moderately high relief and birefringence.

Biotite: Has brown to straw yellow pleochroism, is aligned parallel to fabric and is subhedral to euhedral in shape. Locally altered to chlorite.

(4) Garnet rich gneisses, Nundroo 3 (69.0-122.88 m)

Strongly foliated, quartz, feldspar, biotite, garnet gneisses with abundant garnet and thin felsic segregations.

Garnet: Pink-brown in colour, coarse grained, equant, subhedral and highly fractured with current crystal boundaries.

Biotite: Shows distinctive deep red-brown to straw-yellow pleochroism (i.e. is iron-rich biotite). Biotite is strongly aligned parallel to foliation and partly anastomoses around the garnet. Biotite has partially intergrown with and has also intergrown garnet. The red-brown biotite also contains characteristically radiation haloes adjacent to small round zircon crystals within the biotite. Both biotite and garnet have grown during the fabric forming event.

Quartz: May either occur as large elongate, anhedral crystals, with curved to embayed boundaries, which exhibit undulose extinction and domain band boundaries or as small polygonal, strain free crystals with a poorly developed granoblastic texture i.e. the quartz has begun to re-equilibrate to amphibolite facies

conditions.

Potash feldspar: Equant to elongate grains with curved to embayed boundaries. Exhibits crosshatch twinning which is deformed and kinked in places.

Plagioclase: Has curved to embayed boundaries, is anhedral, elongate and is generally very sericitized but may still show remnant twinning.

Opaques: Have been extensively remobilized during the fabric forming event. Opaques are intergrown with biotite and have also grown around grain boundaries. Abundant opaque minerals have also infilled later brittle fractures most noticeable in fractured garnet porphyroblasts and in biotite and larger quartz crystals.

(5) Intermediate-basic, biotite garnet gneiss, Nundroo 3 (118.95-234.94 m depth interval includes interlayered amphibole-rich intermediate basic gneiss described on pages 25 to 26).

Effectively homogeneous, black and white plagioclase, biotite, garnet gneiss with subordinate hornblende and opaques.

Plagioclase: The most abundant mineral is anhedral, equant with a poorly developed granoblastic texture with curved to embayed boundaries. Albite, carlsbad and pericline twinning occurs however twin planes may be bent and very diffused. Some untwinned plagioclase also occurs. Locally replaced by sericite.

Biotite: Typically shows brown to straw-yellow pleochroism, is subhedral to euhedral and elongate parallel to a moderate foliation. Biotite anastomoses around large garnet porphyroblasts, and contains small round zircons with radiation haloes.

Quartz: Has a poorly developed elongate granoblastic texture with current to embayed margins. Predominantly occur as elongate grains, layer grains exhibit undulose extinction and deformation band boundaries. Anhedral interstitial quartz also occurs.

Garnet: Coarse grained anhedral to euhedral porphyroblasts occur. May form large poikioblastic grains containing, biotite, plagioclase quartz and opaques. Partially replaced by opaque mineral.

Hornblende: Shows green to straw yellow pleochroism, is subhedral and aligned parallel to a moderate foliation. Hornblende is partially replaced by biotite.

Opaques: Have grown around grain boundaries, most commonly biotite, garnet and hornblende. The opaques also infill fractures and appear to replace in part, along crystal margins, both biotite and garnet. Skeletal grains also occur.

(6) Intermediate-basic amphibolite rich gneiss, Nundroo 3 (118.95-234.94 m)

Effectively homogenous, green and white, plagioclase, amphibole gneiss with subordinate biotite.

Plagioclase: Most abundant mineral, occurs predominantly as small equant, anhedral, grains with a granoblastic elongate texture with curved boundaries. Larger grains have scalloped to lobate boundaries, some are antiperthitic. Many grains contain ill-defined twins. Lamellae may be bent. Locally plagioclase may be sericitic.

Quartz: Elongate anhedral grains with a granoblastic texture with current to lobate boundaries. May also occur as quartz ribbons and as interstitial quartz.

Hornblende: Anhedral with deep green to yellow-green pleochroism, elongate parallel to foliation. May in part being replaced by biotite. Locally very coarse grained.

Biotite: Much less abundant than hornblende, exhibits brown to yellow pleochroism is anhedral and elongate parallel to foliation. May be replaced in part by chlorite.

Apatite: Elongate, subhedral, colourless grains with high relief. Most abundant in amphibole rich zones.

Opaques: Overall low in abundance. Large grains have grown with

the biotite. Much lower abundance than in garnet rich and amphibole poor lithologies.

Geochemistry and possible protoliths

Whole rock, silicate and 25 trace element analysis of one metre of quarter core, was done for 24 samples from Nundroo 1, 2 & 3. Core was taken to select the most homogenous core for analysis. In addition 29 samples were collected by filleting 2 m of core and submitted for spectrographic analysis of 23 elements. Table 1 summarizes the type of geochemistry for each sample and related depth and drillhole. Table 2 lists all major element and trace element data. Table 3 shows the relationship between rock unit, lithological unit, geochemistry and possible protolith. Figs. 5-10 summarized geochemical data. (Tables 1, 2 & 3 may be found in APPENDIX 3).

From lithological, petrological and geochemical data the felsic porphyroblastic gneisses from Nundroo 1 between 54.0-59.42 m, have been interpretated as sediments with thin metabasic intrusives or extrusives. Mafic gneisses from Nundroo 2 (36.65-311.77 m) have been assigned an intensive origin either intrusive or extrusive. Acid gneisses in Nundroo 2 (311.77-375.60 m) are considered metasedimentary with thin basic extrusives or intrusives. Garnet rich gneisses from Nundroo 3 (69.0-122.85 m) are considered iron-rich meta-igneous intermediate basics.

The mean composition of 14 basic meta-igneous gneisses is listed in Column A. The mean chemical composition of the basalt clan (N=1996) after Mawson, 1967 is listed in Column B.

	A	(S.D.)	B	(S.D.)
SiO_2	48.78	3.89	49.2	3.23
TiO_2	1.64	1.55	1.9	1.03
Al_2O_3	15.14	1.62	15.8	2.13
Fe_2O_3	7.07	2.06	3.0	1.35
FeO	5.95	1.56	8.0	1.90
MnO	0.19	0.04	0.17	0.10
MgO	6.54	2.70	6.6	2.11
CaO	10.01	1.54	10.0	1.46
Na_2O	3.08	0.78	2.7	0.75
K_2O	0.96	0.95	1.0	0.65
P_2O_5	0.34	0.28	0.33	0.25
H_2O^+			0.9	0.73
H_2O				
CO_2				
LOI	0.77	0.41		

It can be seen from the data that despite granulite facies metamorphism and later amphibolite facies metamorphism the two sets of data are essentially identical except for total iron. Similarly the mean composition of 7 samples of intermediate-basic meta-igneous gneisses is listed in Column A. The mean chemical composition of andesites (N=2,600) is listed in Column B and for diorite (N=872) is listed in Column C (after Le Maitre, 1976) for comparison.

	A	(S.D.)	B	C
SiO_2	56.51	3.67	57.9	57.48
TiO_2	0.77	0.09	0.87	0.95
Al_2O_3	15.52	1.21	17.0	16.67
Fe_2O_3	7.00	4.44	3.3	2.50
FeO	5.42	1.58	4.0	4.92
MnO	0.47	0.32	0.14	0.12
MgO	3.51	0.50	3.3	3.71
CaO	3.82	1.66	6.8	6.58
Na_2O	2.36	1.21	3.5	3.54
K_2O	2.87	0.83	1.6	1.76
P_2O_5	0.22	0.10	0.21	0.29
H_2O^+			1.2	1.15
H_2O				
CO_2				
LOI	0.75	0.11		

The data sets are similar except for total FeO which is anomalous.

Major element geochemistry for both the metabasics and intermediate basics have been plotted on an AFM diagram (after Wager and Deer, 1939) in Fig. 5. The data follows approximately a tholeiitic trend. Similarly a plot of total of FeO/MgO vs SiO_2 after Miyashiro, 1975 outlines of tholeiitic trend. Data plotted on the Jensen (1976) triangular diagram (FeO + Fe_2O_3 + TiO_2, Al_2O_3 and MgO) also falls within the tholeiitic field. The metabasics and intermediate basics. Therefore might be oceanic tholeiites, island arc tholeiites or continental tholeiites. It should be noted that data for the sediments fall on the tail end of the tholeiitic curve. This may indicate that the sediments may include acid volcanics or acid intrusives. The variation in Al_2O_3 content from only four whole rock analyses of the sediments is low. More whole rock analyses are needed. If the Al_2O_3 variation remained low the presence of acid igneous rocks is likely. However if the Al_2O_3 values were more erratic, the acid rocks are more likely wholly sediments.

Trace element data plotted on Pearce and Cann (1973) triangular diagrams Ti/100, Zr and Yx3 and Ti/100, Zr and Sr/z and Zr vs Ti result in severe scatter (Fig. 6). Similarly data plotted on Meschentes (1986) triangular diagram ZXNb, Zr/4 and Y results in a sever scatter (Fig. 6). No discrimination can be made using these elements. Clearly granulite facies metamorphism and later amphibolite facies metamorphism has 'mobilized' these normally immobile elements.

The geochemistry of all samples is summarized in Figs. 7, 8 and 9. From these simple variation diagrams the subdivision between metabasics (numbers 1-3), intermediate-basics (4 & 5), sediments (6) (with a possible dacitic or granodioritic component) and pegmatites (7) is real and persistent. Please refer Table 3 (Appendix 3) for the relation between rock units in the text and numbers on the diagrams.

Chondritic plots for the metabasics, intermediate basics and sediments may be seen in Fig. 10. Note the last diagram which is a composite plot of the mean of each group. Thorium and uranium values for the metabasics and intermediate basics on considered not useful because many values were below detection limit. Of interest the plot for the sediments is similar to that for the metabasics. All three plots have some similarities. The value of the chondritic plots is uncertain as NL, Zr, Y, Ti and Sr from Fig. 6 are not "immobile". Both metamorphic events have affected each rock type however and the chondritic diagrams may be valid to compare different rock types within the drillholes, but are most likely to be invalid for comparison with any other rock unit.

The metabasics and meta-intermediate basics contain slightly anomalous metal values (APPENDIX 3, Table 2) for Cu, Ti, V, Ni, Cr and possibly Pd and Pt. One 10 cm sample of metabasic from Nundroo 2 contained > 1% Cu, a 2 m filleted repeat sample averaged 300 ppm. Copper values for the metabasics fall between 15 and 700 ppm with a mean of 200 ppm, anomalous for basalt. The maximum titanium value is 6.8% however the average value is less than 2%. The anomalously high titanium value is currently being checked. A thin section from the analysed interval does not show a higher than average percentage of opaques. Vanadium values in the metabasics which vary between 124-620 ppm, for whole rock data, and up to 1 000 ppm for spectrographic data are also anomalous for basalts and are likely associated with the titanium. Niobium values of 30-50 ppm are also greater than an average of 20 ppm for mafic rocks (Hawkes and Webb, ...). Niobium is commonly

associated with Ta and Ti. Maximum values from whole rock sampling for Cr were 500 ppm (spectrographic 800 ppm) and for Ni 300 ppm (spectrographic 600 ppm) again anomalous when compared to an average basalt (Hawkes and Webb, op.cit.). One sample of metabasalt contains detectable Pt and Pd (sppb).

Geochronology and Regional Correlation

Whole rock Rb/Sr geochronology of the Nundroo drill core was not attempted because it was considered that the probable result would reflect the latest metamorphic event rather than the earlier granulite facies metamorphism. Uranium/lead geochronology was attempted on metamorphic zircons separated from whole core from metabasics in Nundroo DDH2. The data obtained (APPENDIX 4) does not differentiate between Archaean to Early Proterozoic Mulgathing Complex, Early Proterozoic time equivalents of the Hutchison Group, syn-Kimban intrusives or extrusives or an unknown Precambrian igneous and metasedimentary sequence. The last metamorphic effect on the meta-igneous and metasedimentary gneisses approximately 1570 Ma, cannot be equated with any known orogene event in South Australia. The style of deformation that is similar to that of the Kimban Orogeny which occurred between 1840-1720 Ma Parker et. al. 1980. The age obtained (Appendix ...) assumes a confirmed Rb loss until the present which may be incorrect.

The age of the earlier phase of granulite facies metamorphism remains unknown.

Weakly foliated basics likely late synKimban (D_3) intrusives are known from Pt. James (NUYTS) and Pt. Brown (STREAKY BAY) (Flint, 1987; Watkins and Flint, 1983). Isoclinally folded basic gneisses identical to Nundroo 2, outcrop poorly, almost below wave base at Cape Adieu (NUYTS) and are considered older than the basics at Pt. James (Flint, 1987). Flint pers. comm., suggests an Early Proterozoic age for this outcrop, with the isoclinal folds likely related to a Kimban D_1/D_2 folding event. No other occurrence of metasediments or meta-igneous rocks with a D_1/D_2 fabric are known on FOWLER NUYTS or STREAKY BAY. Geochronology of local foliated igneous rocks all indicate Rb/Sr whole rock ages of 1507-1535 Ma (Flint, 1987).

Metabasics within isoclinally foliated granulite facies metasediments are known from the Mulgathing Complex in the Tarcoola region. These often very weathered rocks contain anomalous Ni, Cr values (Warner, ...) and are yet to be explored

for Pt. The largest body known, Hopeful Hill, has a magnetic signature of 15 km in length. Plagioclase, orthopyroxene, clinopyroxene granulites also occur as thin discontinuous layers and boudins within Archaean-Early Proterozoic quartz feldspar biotite and hypersthene-bearing felsic gneisses (Fanning et al., 1981) at Cape Carnot on southern Eyre Peninsula.

Metabasics, both conformable bodies and dykes also occur within the Early Proterozoic Hutchison Group on southern Eyre Peninsula. Parker (pers. comm., 1988) considers that some of these basics may have been extrusive basalts contemporaneous with sedimentation. Amphibolites on the Mangalo 1:50 000 map sheet (Parker, 1983) have strike lengths of up to 25 km. Anomalous Ni, Cr values have been reported by Mortimer et. al., 1988 in basic dykes (several hundred metres long) which intruded the Donington Granitoid Suite (1843 + 2 Ma) near Pt. Lincoln during the Kimban D_2D_3 event (Parker et. al., 1986).

In summary the Nundroo metabasics and intermediate-basics are not directly correlative with any known South Australian basic volcanics. The magnetic zone nominally 150 km long (Fig. ...) is much larger than for either currently known South Australian Archaean or Proterozoic metabasic occurrences. The Nundroo metavolcanics have some similarity to the Frazer Range Orogenic Belt which consists of granulite facies, later retrograded to amphibolite facies plagioclase hypothene gneisses, considered metabasics, with interlayered metasediments and possibly meta-acid volcanics. The metabasics and magnetitic with anomalous vanadium and titanium and locally copper, chromium and nickel. The metavolcanics have a strike length of 160 km and a width of 15-30 km (Tyrwhitt and Orridge, 1975).

Exploration Potential

The Nundroo drillholes have intersected a previously unknown zone of meta-igneous and metasedimentary rocks with a continuous strike length of 40 km (and discontinuous length of 150 km) and possible width of .... kms. Only a small portion of this zone was intersected by the Nundroo drilling program. Geochronology has not been able to establish a probable age for these rocks which have no apparent direct correlative in South Australia. Geochemistry does not distinguish between oceanic tholeiites, island are tholeiites or continental tholeiites. Slightly anomalous values of Ti, V and Nb may indicate more basic rocks exist undetected within this zone. Much more data is required to

evaluate the exploration potential of this region.

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APPENDIX 1

WELL DATA

Drilling of 3 stratigraphic cored holes in the Nundroo Area have been completed for the Regional Geology Section.

Drillers F. Costello and H. Klingberg operated the Mindrill 10L DM No. 6 diamond drill coring with HQ, NQ and BQ wireline core barrels, delays were again encountered during the project with the failure of input shaft and bearings in the auxiliary gearbox; appeared the housing was worn and fractured causing movements of the bearing and input shaft, this resulted in damage to the drive cogs and gearbox.

Construction details of each bore are as under:

Bore No. 1 Bore Serial No. 155/87 Driller: F. Costello.

Depth 62.60 m, drilled 62.60 m, core recovered 5.60 m.
Angle 60°
Drilled 187 mm roller bit from surface to 27 m and installed 12 m of 127 mm PVC.
Drilled 127 mm roller bit 27 m to 30 m and installed 30 m of 4" steel pipe and pressure cemented.
Drilled HQ coring from 30 m to 62.60 m, recovered 5.60 m core.
HQ barrel and rods stuck at 62.60 m unable to get out, abandon hole, backscrew rods recovered 45 m.
Left in hole HQ core barrel complete with bit and reamer,
HQ compact overshot assembly,
+ 13.50 m of HQ wireline rods.

Bore No. 2 Bore Serial No. 156/87 Driller: F. Costello.

Depth 375.60 m, drilled 375.60 m, core recovered 339.60 m.
Angle 70°
Drilled 187 mm roller bit from surface to 24.60 m and installed 24 m of 127 mm PVC.
Drilled 127 mm roller bit from 24.60 m to 36.00 m and installed 36 m of 200 mm 4" steel pipe and pressure cemented.
HQ3 coring from 36.00 m to 164.50 m, drilled 128.50 m, core recovered 128.50 m.
Installed HQ rods as casing to 164.50 m.
NQ coring from 164.50 m to 375.60 m, drilled 211.10 m, core recovered 211.10 m.

On completion of drilling pulled out the 164.50 m HQ rods leaving the 36.00 m of 200 mm steel pipe in hole.

BORE NO. 3 Bore Serial No. 22/88 Drillers: F. Costello & H. Klingberg

Depth 235.60 m, drilled 235.60 m, core recovered 171.94 m.
Angle 60°
Drilled 216 mm roller bit from surface to 1.70 m and installed 1.70 m 203 mm PVC.
Drilled 187 mm roller bit from 1.70 m to 9.50 m and installed 9.50 m of 152 mm PVC.
Drilled 120 mm roller bit from 9.50 m to 63.00 m and installed 63 m of HQ rods as casing.
NQ coring from 63 m to 201.70 m, drilled 138.70 m, core recovered 138.70 m, installed 202.06 m of NQ rods as casing reduced to BQ.
BQ coring from 201.70 m to 235.06 m, drilled 33.36 m, core recovered 33.24 m.

Broke several male wireline rod joints both NQ & BQ, when reduced to BQ drilled some 33 metres when a male rod pin broke at

158 m, fished for line of rods and barrel, connected tap but could not pull out but could pull back some 25 to 30 metres when would jam tight, then could free and rods and barrel would move to bottom, but not up, tried to work back without success, so pulled NQ rods as casing and reamed over BQ rods and barrel from 201.70 m to 222.40 m when B Q barrel became free, pulled out to surface and inspected. It appeared that a section of broken rod thread was jamming behind the shoulder of barrel and drill rod.

On the recovery of the other BQ core barrel and rods, the hole was stopped and all 3 holes were geophysically logged. No. 3 hole on completion attempts were made to pull the HQ rod that was used as casing, could not pull out as suspected were cemented at base. Attempted to cut off at several depths, this also was unsuccessful as the casing cutter was out of order, the sealing O ring U/S, backscrewed same but only recovered 0.60 m and placed cement plug in bore from 40 metres to surface, the remaining bores NOs. 1 and 2 cemented top section to ground level to 2 metres.

Project commenced on 20-5-87 and was completed on 9-10-87, drilled 3 holes total metreage 673.26 m, core recovered 517.14 m.

Debit No. 138-G34 refers.
Approval $130,000.00
Approximate cost total $136,000.00

APPENDIX 2

PETROLOGY

5334 RS 142

Drillhole and Depth: Nundroo 1 55.11-55.16 m

Hand Specimen Description:
Dark grey to green medium grained moderately well foliated amphibolite gneiss in contact with a lt green-grey leucocratic layer or vein.

Thin Section Description:

Rock	Xenolith		
Hornblende	40%	Clinopyroxene	90%
Plagioclase	30%	Sericite	10%
Quartz	23%	Quartz	minor
Opaques	10%	Opaque	minor
Garnet	5%	Hornblende	minor
Biotite	minor		
Clinopyroxene	minor		
Apatite	minor		
Scapolite	2%		
Sericite	minor		

A fine to medium-grained in equigranular (0.2-1 mm) granoblastic elongate texture where the play-play & hbl-play boundaries are curved to straight. Sillimanite appears as equant anhedral grains with curved boundaries. Quartz occurs as veins, parallel to the main fabric, ranging from 3-8 mm on width where quartz shows minor undulose extinction and DBB's. The garnet occurs as one large poikioblastic crystal (10 mm in diameter) which contains inclusions of hornblende, opaques, plagioclase biotite, sillimanite and quartz. There is an increase in grain size near the pyroxenite vein (0.5-1.5 mm).

The vein is made almost entirely of granular clinopyroxene which has been highly fractured and sericitized. It is equigranular (approx. 1 mm) with equant grains which are subhedral to euhedral. Minor small anhedral quartz and subhedral hornblende.

5334 RS 143

Drillhole and Depth: Nundroo 1 58.64-58.68 m

Hand Specimen Description:
Interbanded grey quartz feldspar garnet gneiss and greenish quartz, scapolite (ex plagioclase) chlorite gneiss.

Paler layer:

Plagioclase/scapolite	30%
Quartz	45%
Hornblende/chlorite/sericite	20%
Opaques	5%

Plagioclase is partially to wholly altered to scapolite (which has a characteristic high birefringence and is uniaxial). Chlorite/sericite are also alteration products. Hornblende is very skeletal. Opaques are coarse and have grown during the alteration process. Ribbon quartz occurs parallel to elongation.

Biotite rich layer:

Quartz	30%
Biotite	30%
Plagioclase	30%
Hornblende	10%
Garnet	<2%
Opaques	2%
Biotite	trace

Subhedral to euhedral biotite is abundant with a granoblastic texture with straight to current boundaries.

Plagioclase is also abundant and is both twinned and untwinned.

Hornblende is ..... and forms alongside composite masses. Quartz ribbons occur parallel to fabric.

5334 RS 145

Drillhole and Depth: Nundroo 1 59.36-59.41 m

Hand Specimen Description:
A grey moderately well foliated, medium grained, quartz feldspar biotite garnet gneiss.

Thin Section Description:

Quartz	45%
Plagioclase	30%
Biotite	20%
Garnet	3%
Sericite/muscovite	5%
Opaques	5%
Zircon	minor
Sphene	minor
Scapolite	minor

The rock is scapolite inequigranular fine to medium-grained 0.2 mm - 1.5 mm) with a granoblastic elongate texture with some quartz ribbon development.

The fabric is moderately strong defined by the alignment of elongate biotite grains (AR5-10:1) elongate quartz and quartz ribbons. Grain boundaries of the quartz are embayed to scalloped, the grains exhibit moderately strong strain features undulose extinction deformation band boundary (DBB) development and subgrain development.

The garnets are generally equigranular (grains 1 mm) subhedral to euhedral equant grains, they developed late syntectonic to post tectonic with evidence of the fabric wrapping around them in only two of grains. The rock appears to be a metamorphosed pelitic sediment.

5334 RS 150

Drillhole and Depth: Nundroo 2 52.00-52.08 m

Hand Specimen Description:
A grey fine to medium-grained, moderately foliated, homogeneous quartz, feldspar amphibole biotite gneiss.

Thin Section Description:

Plagioclase	50%
Hornblende	10-15%
Biotite	10%
Orthopyroxene	7%
Clinopyroxene	10%
Scapolite	2-3%
Quartz	1-2%
Zircon	minor
Opaques	5-10%
Sericite/Muscovite	minor

Medium-grained inequigranular (0.2-1.0 mm) granoblastic to granoblastic elongate texture with grain boundaries dominantly curved. A weak gneissic foliation is defined by the alignment of elongate biotite, hornblende and opaques and to a lesser degree by clinopyroxene and pigeonite. The feldspars exhibit low strain features curved twinning (plag.) and undulose extinction and have curved grain boundaries.

The OPX grains can be quite coarse up to 3 mm are quite ragged and commonly show replacement by hornblende, biotite and magnetite and later sericite/muscovite. The CPX forms in coarse (2-3 mm) aggregates of subhedral medium (0.5 mm) grains and is occasionally replaced by sericite/muscovite. Scapolite exists as small (2 mm) discrete anhedral grains most commonly in the more hornblende rich zones. Biotite and hornblende are intimately associated within zone which approximate compositional layering with interstitial OPX plagioclase layers. Most of the opaques are associated with the biotite and hornblende although some with the pyroxenes.

The rock is a basic granulite probably of igneous origin.

5334 RS 152

Drillhole and Depth: Nundroo 2 54.92-55.00 m

Hand Specimen:
Massive fine grained plagioclase pyroxene amphibole grains.

Thin Section Description:

Plagioclase	50%
Hornblende	30%
Clinopyroxene	10%
Biotite	5%
Opaques	5%
Apatite	<1%
Scapolite	<1%

Texture granoblastic with straight to curved boundaries. Plagioclase is most abundant with both twinned and untwinned crystals, locally altered to sericite. Hornblende has an elongate granoblastic texture forms large composite crystals and is intergrown with opaques and subhedral biotite. Clinopyroxene is anhedral, contains skeletal opaques and is partially replaced by hornblende. Opaques have grown during biotite hornblende development. Earlier opaques are skeletal within clinopyroxene.

5334 RS 153

Drillhole and Depth: Nundroo 2 64.18-24 m

Hand Specimen:
Grey-green fine grained banded basic gneiss with a moderate to strong fabric.

Thin Section:

Paler layer:

Plagioclase	60%
Clinopyroxene	25%
Hornblende	5%
Orthopyroxene	3%
Opaques	5%
Biotite	1%
Apatite	1%
Quartz	?1%

Textured granoblastic equigranular to elongate with straight to curved grain boundaries. A greater part of this layer is plagioclase both twinned and untwinned. The twins are commonly current indicating moderate deformation. Both albite and pericline twinning occur pericline twinning predominates. Clinopyroxene in anhedral and composite grains are oriented parallel to foliation. The clinopyroxene is partially replaced by hornblende and sericite and occasionally shows relict twinning. Hornblende is anhedral to subhedral with grains parallel to foliation. Hornblende is anhedral to subhedral with grains parallel to foliation. Hornblende occurs commonly with opaques and biotite. Hornblende occasionally encloses opaqued grains. The orthopyroxene is anhedral and is usually intergrown with clinopyroxene. It is partially replaced by hornblende and sericite. The opaques and biotite (anhedral to subhedral), are characteristically associated. Small anhedral to subhedral apatite crystals occur.

Dark layer:

Hornblende	35%
Clinopyroxene	30%
Plagioclase	30%
Orthopyroxene	1%
Opaques	3%
Apatite	<1%
Biotite	<1%

Textured granoblastic equigranular to elongate with straight to curved grain boundaries. the layer is almost wholly hornblende which subhedral elongate and parallel to foliation intergrown with anhedral composite clinopyroxene up to 4 mm in length and twinned plagioclase. The clinopyroxene occasionally contains relic twins and is partially replaced by amphibole and sericite. Orthopyroxene is anhedral intergrown with clinopyroxene and hornblende and is partially replaced by sericite. Biotite is anhedral and usually associated with opaques. apatite crystals are small and anhedral.

5334 RS 154

Drillhole and Depth: Nundroo 2 65.14 - 21 m

Hand Specimen:
Grey-green fine-grained compositionally banded moderately foliated basic gneiss with a pinkish garnet rich interband.

Thin section:

Darker bands:

Amphibole(khaki green)	30%
Clinopyroxene	30%
Plagioclase	30%
Orthopyroxene	3%
Opaques	5%
Biotite	<1%
Sphene	<1%
Apatite	<1%

Texture granoblastic equigranular to elongate with straight to curved boundaries. Amphibole, subhedral to anhedral is orientated parallel to foliation, and is intergrown with and partly replaces clinopyroxene. The clinopyroxene is anhedral and forms large composite crystals up to 4 mm. The clinopyroxene contains remnant twins and is partly sericitized. Orthopyroxene is intergrown with clinopyroxene and is partially replaced by amphibole and sericite. The ..... is both twinned & untwinned, perictine twinning predominates.

Paler layer:

Clinopyroxene	60%
Plagioclase	35%
Opaques	5%
Amphibole	<1%
Biotite	<1%
Quartz	<1%
Apatite	<1%

Large composite clinopyroxene crystals form this distinctive layer partially replaced by sericite and amphibole. Plagioclase twinned & untwinned is interlayered with the abundant clinopyroxene. Biotite is associated with opaques is anhedral and partially replaces clinopyroxene.

Garnet layer:

Garnet	35%
Amphibole	30%
Scapolite	33%
Opaques	2%
Quartz	<1%
Sphene(in scapolite-rich layer)	1%

Distinctive garnet rich layer poikioblastic containing mymekatic quartz and scapolite (colourless with characteristic high birefringence). the associated anhedral amphibole is a pale blue-green colour in natural light rather than the more common khaki green. The sphene is anhedral, pale brown in colour with a strong relief and high birefringence.

5334 RS 155

Drillhole and Depth: Nundroo 2 82.93-94 m

Hand Specimen:
Medium to coarse grained black compositionally banded basic gneiss with a moderate foliation.

Thin Section:

Hornblende	60%
Plagioclase	35%
Sphene	1-2%
Opaques	2-5%
Chlorite(alteration of plagioclase)	1-2%
Biotite	<1%
Apatite	Trace

Texture granoblastic, equigranular to elongate, with straight to curved boundaries. Hornblende is the most abundant mineral showing blue-green, khaki green and pale yellow-green pleochroism. The subhedral to anhedral, composite grains are interbanded with plagioclase. The hornblende is crudely aligned parallel to foliation. the plagioclase, twinned & untwinned, may be altered to chlorite, locally alteration is extensive. Sphene is more abundant than in previous thin section, commonly rims opaque minerals and may partially replace amphibole. Biotite is subhedral and may be intergrown with amphibole overall grainsize is larger single grains are often 1 mm, composite grains may form a continuous layer.

5334 RS 156

Drillhole and Depth: Nundroo 2 84.12-18 m

Hand Specimen:
Dark green medium to coarse-grained amphibole rich gneiss, veined by quartz and carbonate, containing moderately abundant acicular silvery-brown biotite ..... bands.

Thin Section:

Hornblende	90%
Biotite(locally wholly biotite)	5%
Quartz(interstitial)	2-5%
Calcite(veining)	<1%

Texture of the blue-green to yellow-green hornblende is granoblastic equigranular to elongate, locally poikioblastic with interstitial quartz. Biotite is euhedral and forms a mass of overlapping elongate crystals crudely aligned to foliation. The biotite probably crystallized later than the hornblende. Some biotite intergrown with hornblende is poikioblastic. The thin section is veined by thin calcite veins and apparently contains no plagioclase.

5334 RS 157

Drillhole and Depth: Nundroo 2 88.58-66 m

Hand Specimen:
Banded fine to medium grained dark green-grey basic gneiss with a moderate foliation.

Thin Section:

Hornblende	50%
Clinopyroxene	15%
Plagioclase	30%
Orthopyroxene	2-5%
Opaques	1-2%
Biotite	trace
Apatite	trace

Texture granoblastic equigranular to elongate with straight to curved boundaries. Hornblende is abundant and is interlayered on a 2-5 mm scale with plagioclase. Hornblende crystals are anhedral composite and orientated parallel to foliation. Clinopyroxene is less abundant, anhedral, forms composite crystals, may contain relic twinning, and is partially replaced by hornblende & sericite. Anhedral orthopyroxene is much less abundant and occurs in the mafic rich layers. Plagioclase, both twinned & untwinned, occurs as discrete layers and within the mafic rich bands. Bent pericline twinning indicates moderate deformation.

5334 RS 159

Drillhole and Depth: Nundroo 2 122.50-56 m

Hand Specimen:
Poorly banded fine to medium grained grey-green basic gneiss with a moderate foliation.

Thin Section:

Hornblende	30%
Clinopyroxene	30%
Plagioclase	30%
Orthopyroxene	5-8%
Opaques	1-3%
Biotite	trace
Apatite	trace

Texture granoblastic equigranular to elongate with straight to curved boundaries. The gneiss is crudely compositionally layered with alternating hornblende, clinopyroxene and plagioclase rich layers. Hornblende is khaki-green to yellow-green, anhedral to subhedral. Compositic crystals are common, clinopyroxene crystals are anhedral, commonly composite and may show relic twinning. Orthopyroxene is anhedral and is associated with the clinopyroxene & amphibole rich layers. Plagioclase is both twinned and untwinned, some twin lamellae are bent indicating moderate deformation. Biotite is minor and anhedral. Opaques are more abundant in the clinopyroxene rich layers than in the hornblende rich layers. In the centre of the thin section is a coarser grained hornblende crystal = 4 mm and a coarse grained composite clinopyroxene = 4 mm (average grainsize is usually less than 1 mm). The large hornblende contains small polygonal shaped opaques.

5334 RS 160

Drillhole and Depth: Nundroo 2 116.42-.49 m

Hand Specimen:
Poorly banded medium to coarse grained - green, basic gneiss with a weak foliation.

Thin Section:

Hornblende	60%
Orthopyroxene	10%
Clinopyroxene	10%
Plagioclase	20%
Biotite	trace

Texture granoblastic to poikiolitic equigranular with straight to curved boundaries. Hornblende is abundant anhedral to subhedral also commonly poikiolitic and forms composite masses. The hornblende (2-3 mm) encloses the generally smaller = 0.5 mm anhedral orthopyroxene crystals. Orthopyroxene is partially sericitized & clinopyroxene. Plagioclase is both twinned & untwinned, some twin lamellae and bent, indicating moderate deformation opaques are absent.

5334 RS 162

Drillhole and Depth: Nundroo 2 126.09-.13 m

Hand Specimen:
Medium grained interbanded pale feldsic gneiss and green basic gneiss with a moderate foliation.

Thin Section:

Dark Layer:

Hornblende	60%
Plagioclase	20%
Clinopyroxene	13%
Orthopyroxene	5%
Opaques	2%
Biotite, apatite	trace

Texture granoblastic equigranular to elongate with straight to curved boundaries. Hornblende is most abundant and forms composite masses. The hornblende rich layers are also crudely layered. Associated ..... are clinopyroxene and orthopyroxene which may be moderately to severely altered to sericite. Plagioclase is both twinned and untwinned. Average grainsize .2-.5 mm.

Pale layer:

Plagioclase	57%
Opaques	5%
Orthopyroxene	5%
Clinopyroxene	1%
Hornblende	1%
Biotite	trace
Apatite	1%
Zircon	<1%

Texture granoblastic equigranular to elongate with straight to curved boundaries. Plagioclase which is most abundant is both twinned and untwinned. (Average grain size .4-.7 mm). Pericline twinning is most abundant. Anhedral orthopyroxene is partially sericitized and commonly rimmed by clinopyroxene. biotite is associated with opaques, small clear apatite crystals are more abundant than in previous thin sections. Zircon is less abundant, round, dark in plan polarized with characteristic high birefingence. Hornblende is anhedral to subhedral and is associated with opaques. The bluish mineral noted in hand specimen is likely to be calcic rich plagioclase.

5334 RS 163

Drillhole and Depth: Nundroo 2 130.15-.15 m

Hand Specimen:
Fine grained, compositionally banded, feldsic to basic gneiss with a well developed foliation veined by a sheared and recrystallized porphyroblastic pegmatite.

Thin Section:

Banded gneiss, pale layer:

Plagioclase	60%
Biotite	35%
Opaques	5%
Secondary quartz	1%
Apatite	<1%
Sphene	trace
Zircon	trace

Plagioclase texture is granoblastic elongate with embayed boundaries (.05-1 mm) is most abundant, generally untwinned and locally sericitized. Biotite is elongate to wispy and forms an anastomosing texture (< 0.5 mm). Subordinate wispy opaques, colourless apatite, brown sphene and very small round dark zircon also occur.

Banded gneiss, dark layer:

Hornblende	55%
Plagioclase	30%
Opaques	2-5%
Secondary quartz	1-2%
Biotite	trace

Texture granoblastic elongate parallel to foliation with embayed boundaries. Hornblende is most abundant .... a grain size from 0.1 mm to 1 mm. Plagioclase is predominantly untwinned, 0.05 mm to 0.3 mm in size.

Pegmatite:

Plagioclase	60%
Quartz	30%
Biotite	10%

Vein consists of porphyroblastic 5-10 mm x 10 mm partially sericitized twinned plagioclase and quartz (< 0.5 mm) with embayed crystal boundaries. Both quartz and the margins of the plagioclase crystals have been recrystallized. The pegmatitic zone also contains subhedral biotite (< 1 mm) surrounding the margins of the coarse plagioclase from an anastomosing texture.

The basic gneiss has been sheared. The pale layers appear most deformed with the development of an anastomosing texture.

5334 RS 164

Drillhole and Depth: Nundroo 2 130.22-.26 m.

Hand specimen:
Fine grained, compositionally banded, basic gneiss with a well developed foliation.

Thin section:

Darker layers:

Plagioclase	55%
Hornblende	40%
Opaques	2-5%
Secondary quartz	2-5%
Biotite	trace
Apatite	trace

Plagioclase is most abundant both twinned & untwinned (albite, carslbad and pericline twinning) and is anhedral with a granoblastic texture and embayed margins (.05-.7 mm). Hornblende is anhedral with straw yellow to khaki-green pleochroism and is elongate parallel to foliation (.02-.6 mm).

Paler layers:

Plagioclase(more highly stressed zones)	80%
Hornblende)	5-10%
Biotite)	
Secondary quartz	5-6%
Scapolite	1-2%
Apatite	trace
Sphene	trace

Plagioclase is most abundant, granoblastic elongate with embayed margins, and may be twinned or untwinned. Rarely appears to be ..... with scapolite (very high birefringence). Hornblende & biotite is less abundant c anhedral wispy character curved around plagioclase (0.5-0.8 mm) forming an anastomosing texture. Plagioclase & quartz are finely recrystallized in narrow more strongly sheared zones.

Sheared basic gneiss with narrow feldsic more deformed zones.

5334 RS 165

Drillhole and depth Nundroo 2 146.45-.49 m

Hand Specimen:
Medium-grained compositionally banded basic gneiss with a moderate foliation and ..... low percentage of fine grained sulphide. Predominantly pyrite plus some chalcopyrite.

Thin Section:

Mafic rich layer:

Hornblende	70%
Plagioclase	18%
Secondary quartz	10%
Opaques	2-3%
Apatite	trace

Abundant hornblende with straw-yellow to blue-green pleochroism.

Texture granoblastic elongate with straight ..... Hornblende (.2-1.0 mm) is subhedral tp poikioblastic enclosing secondary quartz. Twinned plagioclase is subordinate (0.4-.8 mm). Basic layer is banded by a coarse grained secondary quartz rich layer < 4 mm, with granoblastic texture and straight to current crystal ..... Opaques (0.1-.6 mm) are .....

Feldspar rich layer:

Plagioclase	70%
Biotite	5%
Hornblende	20%
Secondary quartz	3-5%
Opaques	2-3%
Apatite	trace

Abundant plagioclase predominantly untwinned with granoblastic texture, with straight to current ..... (0.2-2 mm). Hornblende (.1-1 mm) is granoblastic elongate subhedral to poikioblastic and ..... parallel to foliation direction. Quartz is enclosed by the poikioblastic hornblende. Biotite (0.5-1 mm) subhedral, elongate parallel to foliation are appears to have grown after hornblende.

5334 RS 166

Drill hole and depth: Nundroo 2 160.0-.05 m

Hand Specimen:
Crudely banded grey-green mafic gneiss containing moderately abundant garnet.

Thin Section:

Pyroxene rich layer:

Clinopyroxene	25%
Orthopyroxene	10%
Plagioclase	30-50%
Opaques	5-7%
Apatite	trace
Garnet	10-30%
Secondary quartz	

Abundant pyroxene and garnet intergrown with plagioclase. Plagioclase both twinned & untwinned, is granoblastic with straight to current boundaries and essentially equigranular (.5-.9 mm) clinopyroxene forms larger composite crystals with granoblastic ..... margins and is intergrown with the less abundant orthopyroxene. Garnet (1-4 mm) forms large crystals, with granoblastic margins, which are intergrown with clinopyroxene and appear symplectic with plagioclase and possibly quartz. Amphibole has crystallized later than clinopyroxene. Opaque commonly occur within clinopyroxene & garnet crystals.

Amphibole rich layer:

Amphibole	40%
Clinopyroxene	20%
Plagioclase	30%
Orthopyroxene	5%
Opaques	5-7%
Apatite	trace

Abundant hornblende (0.1-2.00 mm) granoblastic elongate with straight to curved boundaries intergrown with clinopyroxene and orthopyroxene. The amphibole appears to be replacing the clinopyroxene & orthopyroxene. Amphibole is yellow-green to khaki-green in colour i.e. different composition to that developed in shear zones (which is blue-green). Orthopyroxene is typically strongly pleochroic pink-brown to pale-green. Clinopyroxene is typically pale green and poorly pleochroic. Plagioclase (0.5-.8 mm) is partly twinned and ..... equigranular granoblastic with straight to curved boundaries.
Note: amphibole rich layer is predominantly garnet free.

Rock name:
Basic granulite (partially retrogressed under amphibole facies conditions).

5334 RS 168

Drillhole and depth: Nundroo 2 183.70-.75 m.

Hand specimen:
Foliated feldsic gneiss, compositionally layered, with a moderate percentage of mafic minerals.

Thin section:

Feldsic layer:

Plagioclase	70%
Clinopyroxene	15%
Orthopyroxene	10%
Opaques	3%
Hornblende	1-2%
Biotite	1%
Secondary quartz	10%
Apatite	trace
Zircon	trace

Plagioclase is host abundant and has a granoblastic elongate texture with current boundaries and is partially sericitized. Clinopyroxene (0.1-1 mm) may form large composite crystals with granoblastic internal margins and is intergrown with orthopyroxene (.1-.6) which is generally smaller in grain size. Some clinopyroxene crystals are formed. Hornblende replaces both ortho & clinopyroxene and still has a granoblastic elongate texture. Biotite replaces orthopyroxene and in part ?magnetite i.e. commonly rims opaques. The feldsic gneiss is banded with clinopyroxene or orthopyroxene rich layers on 5+10 mm scale. Secondary quartz (<1 mm) occurs elongate parallel to foliation.

Hornblende rich layer:

Abundant medium-coarse hornblende (0.2-2.5 mm) forms a distinct compositional band 5 mm and is elongate parallel to banding. It is intergrown with plagioclase and has a granoblastic texture with current margins. the amphibole rich layer also contains pristine and partially replaced clino and orthopyroxene. Secondary quartz (<1 mm) occurs on either side of the amphibole rich layer.

5334 RS 170

Drillhole and depth 230.12-.20 m

Hand Specimen:
Fine-grained foliated poorly compositionally banded mafic-rich basic gneiss.

Thin section:

Hornblende rich layer:

Hornblende	50%
Plagioclase	35%
Clinopyroxene	5%
Orthopyroxene	5%
Opaques	<1%
Secondary quartz	5%
Apatite	trace
Zircon	trace

Abundant hornblende (0.1-0.3 mm) forms interlocking masses with a granoblastic elongate texture with straight to curved boundaries. Hornblende has partially & presumably wholly replaced now subordinate ortho and clinopyroxene. Plagioclase (An 40-42) is both twinned and untwinned (0.1-.9 mm) with a granoblastic elongate fabric with curved boundaries.

Clinopyroxene rich layer:

Plagioclase	50%
Clinopyroxene	30%
Hornblende	25%
Orthopyroxene	5%
Opaques	1-2%
Apatite	trace
Secondary quartz	1-2%

Clinopyroxene (.1-.9 mm) forms large interlocking masses with a granoblastic equant texture with straight to curved boundaries. The clinopyroxene may be twinned. Hornblende is partially replacing the clinopyroxene and orthopyroxene and is granoblastic elongate in texture. Plagioclase (.2-.7 mm) is granoblastic elongate with curved boundaries (An 40).

5334 RS 172

Drillhole and depth: Nundroo 243.23-.28 m

Hand Specimen:
Green & white fine grained finely layered basic gneiss with subordinate garnet.

Thin Section:

Clinopyroxene	30%
Plagioclase	30%
Garnet	20%
Hornblende	10%
Opaques	7-10%
Orthopyroxene	2%
Biotite	trace
Apatite	trace
Zircon	trace
Quartz in feldsic vein	introduced

Clinopyroxene (0.2-0.6 mm) is abundant and forms composite masses with a granoblastic elongate texture with straight to curved boundaries. The clinopyroxene is intergrown with plagioclase (.2-.7 mm) & garnet. The garnet (0.6-5 mm) is symplectic with both plagioclase (An 40-42) & clinopyroxene. Hornblende with a granoblastic elongate texture replaces with clino & orthopyroxene & commonly rims opaques. Biotite replaces orthopyroxene & rims opaques. Opaques (0.1-1 mm) are coarser and more abundant than in previous thin sections.

5334 RS 173

Drillhole and depth: Nundroo 2 246.50-.55 m

Hand Specimen:
Medium to coarse grained greyish-green & white banded foliated basic gneiss.

Thin Section:

Hornblende	70%
Plagioclase	30%
Opaques	1-2%
Sphene	<1%
Apatite	trace
Biotite	trace

locally 10% & secondary qtz. in coarse grained feldsic veins

Abundant hornblende (.2-1.3 mm) with distinctive bluish-green to straw-yellow pleochroism. Hornblende forms an interlocking masses with a granoblastic texture with straight to curved boundaries. Hornblende is also partially poikioblastic enclosing plagioclase and secondary quartz. Plagioclase (.1-1.0 mm) is both twinned and untwinned and has a granoblastic texture with curved boundaries. Sphene may rim opaques.

5334 RS 174

Drillhole and depth: Nundroo 2 250.56-.63 m

Hand Specimen:
Grey, medium to coarse, poorly banded basic gneiss with feldsic leucosones.

Thin Section:

Plagioclase	50%
Clinopyroxene	20%
Hornblende	20%
Orthopyroxene	5%
Garnet	<1%
Opaques	2-5%
Apatite	trace
Biotite	trace

Abundant (An 42) plagioclase (.2-.6 mm) with a granoblastic elongate texture and curved boundaries. the gneiss contains crude layers richer in clino and orthopyroxene, and layers richer in hornblende. The gneiss contains coarse grained quartz & plagioclase feldspar leucosomes parallel to the crude compositional banding but which cut across individual clinopyroxene & orthopyroxene crystals i.e. post data granulite facies development. The leucosomes also cross cut hornblende which indicates emplacement later than most hornblende. Hornblende (.2-1.3 mm) replaces both clino & orthopyroxene and has a granoblastic elongate texture. Clinopyroxene (.2-3.5 mm) may be very coarse grained and twinned. Orthopyroxene (.2-2.5 mm) is less abundant with typical pale green to pink-brown pleochroism. Both have a granoblastic texture. Rare garnet is intergrown with clinopyroxene.

5334 RS 175

Drillhole and depth: Nundroo 2 252.82-.90 m

Hand Specimen:
Fine grained basic gneiss with a very coarse grained feldsic segregation or pegmatite containing coarse grained pyroxene, plagioclase and subordinate pyrite and chalcopyrite.

Thin Section:

Basic gneiss:

Plagioclase	50%
Hornblende	45%
Opaques	5%
Apatite	1-2%
Clinopyroxene	<1%
Biotite	trace

Abundant plagioclase (0.1-0.6 mm) and hornblende (0.2-0.8 mm). With a granoblastic elongate texture with curved boundaries. Plagioclase is generally untwinned ..... apatite which is round is more abundant and coarser than usual (.05-.2 mm). Hornblende has almost completely replaced clinopyroxene. Biotite appears to replace hornblende and is usually adjacent to opaques.

Coarser zone:

Clinopyroxene	40%
Plagioclase	50%
Hornblende	10%
Apatite	1-2%
Opaques	<1%

Very coarse porphyroblastic (2-10 mm) clinopyroxene, which may be twinned or contain exsolution lamellae. Other clinopyroxene crystals are large composite masses with a granoblastic texture. the lamellae have a fabric parallel to the elongate axes of hornblende which replaces in part the clinopyroxene. Coarse grained plagioclase has a granoblastic elongate texture with straight to curved margins. Apatite is coarse grained round to subhedral (.05-.7 mm) and moderately abundant. Plagioclase An 40 is generally untwinned although allsite carlsbad & perictine twinning occurs.

The coarser grained zone may have been produced by metasomatic growth when the nearby pegmatite was introduced.

Rock Name:
Retrogressed basic gneiss with a metasomatic zone.

5334 RS 177

Drillhole & depth: Nundroo 2 263.62-.69 m

Hand Specimen:
Grey fine grained compositionally banded mafic gneiss.

Thin Section:

Clinopyroxene rich zone:

Plagioclase	50%
Clinopyroxene	30%
Hornblende	15%
Orthopyroxene	2-5%
Opaques	2-5%
Biotite	trace
Secondary quartz	
Apatite	trace
Zircon	trace

Abundant plagioclase An 42 with a granoblastic elongate texture .... straight to curved boundaries. Clinopyroxene forms composite elongate masses with a granoblastic elongate texture with straight to curved boundaries. Orthopyroxene is subordinate and is partially & likely wholly replaced by hornblende. Clinopyroxene has been less effected by hornblende replacement. Biotite replaces orthopyroxene & rims opaques. Late introduction of interstitial quartz and thin quartz rich veins parallel to layering has occurred.

The hornblende rich zone has a 40% hornblende and 5-10% clino & orthopyroxene.

Rock name:
Partially retrogressed basic granite.

5334 RS 179

Drillhole and depth: Nundroo 2 273.18-.26 m

Hand Specimen:
Strongly foliated feldsic pegmatite with a mafic xenolith.

Thin Section:

Pegmatite:

Plagioclase	50%
Quartz	50%
Sericite(altered plagioclase)	5%

Coarse plagioclase (argoclase) (0.2-1.3 mm) has an elongate granoblastic texture with straight to curved boundaries and is partially altered to sericite. Less than half the plagioclase is twinned. Quartz (0.1-5 mm) ribbons with a granoblastic elongate texture surround elongate zones of composite plagioclase crystals. Within the coarse grained quartz are polygonal subgrains indicating moderate deformation.

Mafic xenolith:
Contains plagioclase garnet clinopyroxene amphibole & opaques i.e. partially retrogressed basic granulite.

5334 RS 180

Drillhole and depth: Nundroo 2 278.30-.34 m

Hand Specimen:
Broadly compositionally banded fine grained basic gneiss. The paler gneissic layer is composed of feldspar pyroxene opaques and minor garnet. The darker gneissic layer contains feldspar abundant amphibole, opaques and rare garnet.

Thin Section:

Paler layer:

Plagioclase	55%
Clinopyroxene	30%
Garnet	2-5%
Orthopyroxene	5%
Opaques	5%
Hornblende	<1%
Biotite	trace
Apatite	trace

Plagioclase (An 40-42) (0.1-0.8 mm) is abundant with a granoblastic elongate texture with straight to curved boundaries. Less than half is twinned, pericline carlsbad and ..... are present. Pale green very poorly pleochroic clinopyroxene which also has a characteristic moderately high birefringence forms elongate masses with granoblastic texture (0.2-0.9 mm) with straight to curved boundaries. May be twinned. Garnet (0.3-2 mm) is euhedral to subhedral and granoblastic symplectic with plagioclase and occasionally twinned. Orthopyroxene (0.1-0.5 mm) is subordinate with a granoblastic texture and is generally a portion of the larger clinopyroxene masses. Orthopyroxene is partially replaced by biotite and clinopyroxene by hornblende. Opaques (.05-.9 m) are partially degraded to biotite. Apatite is subhedral to euhedral.

Dark layer:

Hornblende	25%
Clinopyroxene	10%
Orthopyroxene	5%
Opaques	2-5%
Apatite	trace
Biotite	trace

Textures as for the clinopyroxene layer except that hornblende is overall coarser than the clino and orthopyroxene i.e. (0.1-1.5 mm). The hornblende has extensively replaced clinopyroxene. Note garnet is absent. Plagioclase comparison is similar composition An 42.

Rock Name:
Partially retrogressed banded basic granulite.

5334 RS 181

Drillhole & depth: Nundroo 2 68.36-.40 m

Hand Specimen:
Finely banded amphibole rich (black) and alternatively pyroxene rich (greenish-grey) basic gneiss (mm to cm banding).

Thin Section:

Pyroxene rich layer:

Plagioclase	50%
Clinopyroxene	35%
Orthopyroxene	5%
Amphibole	1-2%
Opaques	5-7%
Biotite	1%
Apatite	<1%

Plagioclase (An 42) is abundant, granoblastic elongate, with straight to curved boundaries, approximately half is twinned. Pericline carlsbad & albite twins are present (0.1-1 mm). Clinopyroxene (01.-1 mm) forms composite elongate masses producing compositional bands with a granoblastic elongate texture and with curved boundaries. Orthopyroxene is subordinate and generally intergrown with clinopyroxene. Hornblende partially replaces clinopyroxene and biotite, orthopyroxene and opaques (.05-.7 mm). Apatite is translucent, anhedral to subhedral (.05-0.2 mm).

Amphibole rich layer:

Plagioclase	45%
Hornblende	35%
Clinopyroxene	10%
Orthopyroxene	5%
Opaques	5%

Textures are as for the pyroxene rich layer except that hornblende (0.1-1.7 mm) is overall coarse than the clino & orthopyroxene and appear to replace clino & orthopyroxene more completely.

5334 RS 182

Drillhole and depth: Nundroo 2 132.76-.80 m

Hand Specimen:
Banded fine-medium grained basic gneiss. Bands are amphibole rich (black) or pyroxene rich (pale grey-green).

Pyroxene rich layer:

Plagioclase	60%
Clinopyroxene	25%
Orthopyroxene	5%
Opaques	5%
Hornblende	5%
Sphene	trace
Apatite	trace
Biotite	trace

Abundant plagioclase (An 40) with a granoblastic elongate texture with straight to curved boundaries (0.2-1.5 mm), clinopyroxene (.2-1.0 mm) form large composite masses which defines layering and has an elongate granoblastic texture with straight to curved boundaries. Orthopyroxene is generally intergrown with clinopyroxene. Amphibole (.2-1.0 mm) replaces both clino & orthopyroxene. Biotite replaces both orthopyroxene and opaques. Gneiss contains a concordant coarser zone of plagioclase and quartz.

Amphibole rich layer:

Plagioclase	60%
Hornblende	30%
Clinopyroxene	5%
Orthopyroxene	2%
Opaques	3%
Apatite	trace
Biotite	trace

Texture as for pyroxene rich layer, amphibole (0.1-1.7 mm) is overall coarser than for clino & orthopyroxene and more completely replaces clino or orthopyroxene.

5334 RS 183

Drillhole and depth: Nundroo 2 160.62-.67 m

Hand Specimen:
Medium to coarse grained compositionally banded basic gneiss. Bands and richer either in amphibole (block) or pyroxene (grey-green). Coarse grained garnet is moderately abundant. Gneiss also contains coarse grained clots of brown ortho-pyroxene.

Thin Section:
Pyroxene-rich zone:

Plagioclase	45%
Clinopyroxene	30%
Garnet	10-15%
Amphibole	5%
Orthopyroxene	3%
Opaques	2%
Secondary quartz?	<5%
Apatite	trace
Biotite	trace

Abundant pale-green clinopyroxene forms elongate composite masses producing crude compositional layering. Texture is granoblastic elongate with straight to curved boundaries. Grain size (0.1-1.0 mm) is overall coarser than for previously described gneisses. Pyroxene may be twinned and rarely shows exsolution lamellae. Orthopyroxene with characteristic strong pleochroism (pale green to pale-brown) is usually intergrown with the clinopyroxene. Some very coarse grained (< 1.5 mm). Orthopyroxene also occurs as clusters 3-5 mm in diameter. Garnet is much more abundant than in previous slides, may be euhedral and is characteristically symplectic with predominantly plagioclase and quartz. Garnet may also be twinned. The garnet may also be intergrown with clinopyroxene and contains abundant opaques. Grain size varies between (1-4 mm). Plagioclase (An 40) is granoblastic elongate with straight to curved boundaries. More than half is untwinned. Carlsbad pericline and albite twinning occur. Amphibole (0.1-.6) replaces clinopyroxene, biotite orthopyroxene.

Amphibole rich zones are slightly coarser grained overall (0.2-=1.8 mm) and contain no garnet.

5334 RS 184

Drillhole and depth: Nundroo 2 198.64-.69

Hand Specimen:
Fine grained compositionally banded basic gneiss, compositional banding is produced by variation in black amphibole and grey-green pyroxene. A few clots of coarser brown orthopyroxene occur in your clinopyroxene rich layers.

Thin Section:
Pyroxene rich zone:

Plagioclase	50%
Clinopyroxene	30%
Orthopyroxene	10%
Hornblende	5%
Opaques	2-5%
Apatite	trace

The thin section contains more abundant orthopyroxene than usual. The orthopyroxene (0.1-1.7 mm) forms crude bands and composite masses and is intergrown with the more abundant clinopyroxene (0.1-1 mm). Texture is granoblastic elongate with curved boundaries. Plagioclase (0.2-1.1 mm) is twinned by carlsbad. Albite and pericline twins however no twinning is visible for approximately half the plagioclase (An 40). Hornblende (0.1-1.1 mm) has an elongate granoblastic texture and partially replaces clino and orthopyroxene. Composite masses of hornblende define mm scale bounding. Opaques are commonly enclosed by clinopyroxene & orthopyroxene. Most opaques are external to the later hornblende crystals some opaques have regrown within the hornblende elongate parallel to latest foliation development. (Usually elongation is parallel to compositional bounding except in shear zones).

5334 RS 185

Drillhole and depth: Nundroo 2 209.35-.39 m

Hand Specimen:
Fine to medium grained feldsic compositionally banded basic gneiss with layers richer in grey-green pyroxene and dark green-black amphibole with locally abundant garnet clots up to 7 mm. Feldsic zones appear slightly discordant to mafic compositional layering.

Thin Section:
Pyroxene rich zone:

Plagioclase	40%
Clinopyroxene	25%
Garnet	15%
Orthopyroxene	5-10%
Hornblende (30% in amphibole rich zones)	5-10%
Opaques	10%
Secondary quartz	
Apatite	trace
Zircon	trace

This thin section is characterized by coarse garnets which have euhedral crystal shape. The garnets are intergrown with plagioclase producing distinctive symplectic intergrowths. The garnet also contains abundant opaques and may be twinned. Clinopyroxene (.2-1.0 mm) is abundant and form composite masses which produce crude ..... Texture is elongate granoblastic with current boundaries. Orthopyroxene is commonly intergrown with the clinopyroxene (.1-1.2 mm). Amphibole also with an elongate granodiorite texture replaces both clino & orthopyroxene.

Opaques (.05-1./5 mm) are abundant overall and are also abundant within garnet and are coarser than for many other thin sections.

Plagioclase (An 42,43) has a granoblastic elongate texture with curved boundaries. Albite carlsbad & pericline twins are present.

A coarser grained feldsic zone is approximately parallel to compositional frequency.

5334 RS 186

Drillhole and depth: Nundroo 2 245.25-.30 m

Hand Specimen:
Medium to coarse grained basic gneiss. Broad compositional banding (< 2 cms) is produced by abundant amphibole (dark green-black) or abundant pale green-grey clinopyroxene.

Thin Section Description: 5334 RS 186

Hornblende	30%
Plagioclase	35%
Garnet	5%
Clinopyroxene	20%
Orthopyroxene	2%
Opaques	3%
Sericite	5%

The rock is a retrograde basic granulite with a granoblastic elongate texture with crude compositional layering a 5-10 mm scale with large garnet porphyroblasts up to 10 mm in diameter. The clinopyroxene and orthopyroxene is commonly being replaced by hornblende i.e. has hornblende coronas and fibrous hornblende along cleavage planes. In some bands the hornblende has completely replaced the pyroxene producing a equigranular granoblastic, hornblende, plagioclase & minor opaque gneiss. Other bands are inequigranular where coarser clinopyroxene is partially replaced by hornblende and ?magnetite, these layers also contain garnet which is being replaced by hornblende opaques. The garnet appears to be an early mineral and probably coexisted with the CPX. The orthopyroxene layers are also highly sericitized compared with the hornblende rich layers. There is a much higher opaque content in the clinopyroxene rich layers.

5334 RS 187

Drillhole and depth: Nundroo 2 261.77-.81 m

Hand Specimen:
Banded medium-grained grey pyroxene rich basic gneiss with block medium-grained amphibole rich layers with minor garnet and accessory sulphide.

Thin Section Description: 5334 RS 187

Clinopyroxene	20%
Orthopyroxene	7%
Hornblende	20%
Plagioclase	35%
Garnet	2%
Quartz	2%
Opaques	10%
Biotite	<1%
Sericite/chlorite	2%
Zircon	access

The rock has a medium to fine grained in equigranular granoblastic elongate texture with some compositional layering into felsic plagioclase rich & mafic rich layers. The feldspars are generally equigranular 0.4-1.0 mm with curved straight boundaries and occasional triple point junction. The pyroxene varies in size from 2 mm to 0.2 mm as do the hornblende. The pyroxene boundaries are generally curved to embayed, where two pyroxenes are in contact the boundaries are curved to straight. Hornblende rims the pyroxenes and commonly replaces pyroxene along fractures and cleavage planes.

There is one hornblende rich band made up of dominantly large 1-2 mm elongate embayed hornblende with a fine grained aggregate of plagioclase and minor relict chloritized pyroxene.

The rock is a two pyroxene granulite which has undergone retrograde amphibolite facies metamorphism.

5334 RS 189

Drillhole and depth, Nundroo 2 265.62-.67 m

Hand Specimen:
Well banded medium to coarse grained plagioclase rich, amphibole, pyroxene gneiss with subordinate garnet.

Thin Section Description:

Plagioclase	30%
Hornblende	30%
Clinopyroxene	25%
Garnet	10%^
Opaques	5%
Orthopyroxene	<5%
Secondary quartz, quartz vein	

Texture granoblastic with straight to curved boundaries. Plagioclase is both twinned and untwinned. Hornblende forms elongate subhedral composite masses. Clinopyroxene which forms large composite masses contains skeletal opaques and is partially replaced by hornblende. Clinopyroxene is poikioblastic and contains anhedral plagioclase. Garnet is very coarse grained fractured anhedral and locally poikioblastic. Orthopyroxene is fractured and replaced in part by hornblende. Opaques have grown predominantly during amphibole growth. Skeletal grains occur within low corroded clinopyroxene.

5334 RS 207

Drillhole and Depth: Nundroo 2 293.94-293.98 m

Hand Specimen Description:
A weakly layered weakly foliated dark green-grey medium grained amphibolite.

Thin Section Description:

Hornblende	50%
Plagioclase	40%
Sphene	2%
Quartz	76%
Opaques	2%

The rock has a medium-grained (0.5-1.0 mm) equigranular granoblastic texture, the grains are commonly subhedral and equant with curved and occasionally embayed grain boundaries. Within one layer (10 mm wide) the hornblende is poikioblastic containing small <.5 mm anhedral grains of quartz. Anhedral grains of sphene form coronas around the opaques while being in contact with the hornblende sphene probably a product of a magnetite & hornblende reaction.

The rock is a basic igneous rock which has been metamorphosed to amphibolite facies grade and has undergone a later silica enrichment from SiO_2 rich fluids of unknown origin.

5334 RS 209

Drillhole and Depth: Nundroo 2 295.19-295.23 m

Hand Specimen Description:
A grey medium grained moderately foliated basic gneiss.

Thin Section Description:

Plagioclase	60%
Clinopyroxene	30%
Hornblende	5%
Magnetite	5%
Garnet	access
Sphene	access
Quartz	minor
Sericite	"

The rock has a weakly elongate granoblastic texture and is medium grained (0.5-1.0 mm). The grain boundaries are most commonly curved or straight in the plagioclase while the CPX boundaries are curved or embayed. The hornblende forms reaction rims around the CPX and has developed along the cleavage planes within the CPX it also forms reaction rims around the magnetite. Garnet occurs as small (<0.5 mm) equant euhedral grains randomly dispersed through the slide. Quartz occurs as small anhedral grains and appears to be the result of a late stage SiO_2 enrichment. Minor sphene as coronas around the magnetite.

5334 RS 210

Drillhole and depth: Nundroo 2 295.27-295.31 m

Hand Specimen Description:
Banded to finely bounded grey-green (clinopyroxene rich) and green-black (amphibole rich) basic gneiss with a low garnet content.

Thin Section Description:

Unit 1		Unit 2	
Clinopyroxene	50%	Hornblende (dk. olive-green to pale khaki)	35%
Plagioclase	54%	Plagioclase	40%
Hornblende (blue-green to lt. green)	10%	Garnet	20%
Garnet	1%	Opaques	2%
Opaque	5%	Clinopyroxene	5%

Unit 1

Medium-grained granoblastic texture weak fabric defined by alignment of CPX crystal aggregates. Hornblende replaces CPX firming corona textures and growing along cleavage planes. Some garnet is rimmed by hornblende as is some of the magnetite. Plag. has curved to straight boundaries and shows some weak strain features e.g. undulose extinction. CPX have curved to embayed boundaries. This is same basic rock as 5334 RS 209.

Unit 2

Has a medium-grained slightly elongate granoblastic texture, a weak fabric defined by the alignment of elongate hornblende (AR1.5-2:1). Subhedral hornblende and plagioclase with curved and occasional embayed boundaries. Garnet is subhedral with grains up to 5 mm in diameter and has been overgrown to a minor extent by hornblende.

5334 RS 211

Slide cut in wrong position.

5334 RS 212

Drillhole and Depth: Nundroo 2 300.90-300.98 m

Hand Specimen Description:
Dark grey-green compositionally banded medium grained weakly foliated basic gneiss.

Thin Section Description:

Unit 1		Unit 2	
Clinopyroxene	40%	Hornblende	50%
Plagioclase	50%	Plagioclase	40%
Garnet	7%	Clinopyroxene	5%
Hornblende	1%	Opaque	3%
Opaques	2%	Garnet	2%
		Sphene	minor

The rock is an interlayered (10-20 mm scale) medium grained (0.5-1.0 mm) clinopyroxene rich gneiss and medium to coarse grained (0.7-1.2 mm) hornblende rich gneiss. Both have an equigranular granoblastic elongate texture. The grain boundaries in Unit 2 are dominantly curved to straight and in Unit 1 are curved and embayed. A weak-moderate foliation is defined by the alignment of elongate grains of CPX and hornblende. This is a rock composed of two interlayered basic units of differing bulk composition possibly two basalt types.

Darker layer is Unit 2 and lighter Unit 1.

5334 RS 214

Drillhole and Depth: Nundroo 2 307.71-307.76 m

Hand Specimen Description:
Dark grey-green weakly foliated finely compositionally banded basic gneiss.

Thin Section Description:

Clinopyroxene	20%
Orthopyroxene	10%
Hornblende	20%
Plagioclase	40%
Garnet	3%
Opaques	10%
White Mica	minor

A medium grained (0.5-1.0 mm) granoblastic elongate texture with a moderate foliation. Compositional layering on the mm scale is evident and quite variable in composition with end members compositions CPX & OPX & Plag. & Opaques and Hbl & Plag & minor CPX + opaques. Garnet and CPX are closely associated with most of the garnet appearing in the CPX rich layers. Almost all of the opaques appear in the CPX+OPX + plag. + garnet layer may be as high as 20% opaques. The magnetite is replacing the CPX and garnet while hornblende replaces the CPX. Another CPX + OPX + Plag. layer contains no garnet and very little opaque matrix (< 12%) hence it appears that the garnet is Fe rich.

There are several crosscutting veinlets which are infilled with opaques and mica, there is common sericitization of the rock along these veins.

5334 RS 216

Drillhole and Depth: Nundroo 2 317.87-317.94 m

Hand Specimen Description:
Layered medium to coarse grained, moderately well foliated, grey, quartz feldspar garnet biotite gneiss and fine to medium grain dark grey to green basic gneiss.

Thin Section Description:

Unit 1		Unit 2	
Hornblende	35%	Plagioclase	30%
Plagioclase/sericite	35%	Quartz	50%
Quartz	25%	Biotite	7%
Opaques	5%	Garnet	15%
		Opaques	minor
		Hornblende	minor
		Chlorite	minor
		Sphene	minor

Unit 1

A fine-grained (0.2-0.5 mm) granoblastic elongate texture defining a weak layer parallel fabric. The grain boundaries of the hornblende and plagioclase are generally curved and occasionally embayed especially where in contact with quartz. The quartz generally develops as subhedral to anhedral quite elongate grains which display moderately strong undulose extinction. The plagioclase is completely sericitized.

Unit 2

An inequigranular granoblastic elongate texture with a moderately strong tectonic fabric defined by the alignment of elongate biotite grains, quartz ribbons and slightly elongate quartz and feldpsar grains.

The feldspars are generally subhedral to euhedral with curved to straight grain boundaries, the quartz is generally more anhedral with curved and embayed boundaries. The quartz exhibits moderately high strain features including strongly undulose extinction and DBB development while the plagioclase exhibits slightly deformed twinning. The garnet developed as equant euhedral grains ranging in size from 0.5-1.0 mm. Very elongate poikioblastic garnet has developed along the boundary between the two units containing inclusions of sericitized plagioclase, quartz hornblende and opaques. This garnet development occurs all the way along the boundary except where the boundary is obscured by quartz ribbon development. Quartz ribbon development is common throughout unit 2 developing up to 2 cm in length and 1-3 mm in width.

The rock is an interlayered pelitic sediment and basic rock possibly a basaltic tuff where the basic layer is 1 cm thick.

5334 RS 218

Drillhole and Depth: Nundroo 2 320.88-320.92 m

Hand Specimen Description:
A medium-grained well foliated well layered (2-5 mm) grey and pink quartz feldspar biotite garnet gneiss.

Thin Section Description:

Quartz	45%	
Plagioclase	13%	
K-feldspar	30%	microcline
Biotite	3%	
Garnet	5%	
Sillimanite	4%	
Chlorite	minor	
Sericite	minor	
Opaques	2%	
Zircon	minor	(3 grains 0.1 mm)

The rock has a fine to medium-grained (0.1-4 mm) granoblastic elongate texture. Quartz is subhedral to anhedral with curved to embayed grain boundaries (rarely scalloped), it exhibits moderately strong strain features including DBB's, sub-grain development and new grain growth. Quartz ribbon development is also common with the ribbons up to 7 mm and 1-2 mm in width. The feldspar grains are mostly anhedral to subhedral with curved and rarely embayed grain boundaries. The garnets are euhedral to subhedral and ..... ranging from 0.3 to 1.0 mm in size, they tend to concentrate in well defined layer parallel bands along with sillimanite biotite and the opaques. Sillimanite occurs as trains of generally small (< 0.2 mm) euhedral diamond-polygonal shaped crystals parallel to the fabric.

All the minerals appear to be part of the prograde mineralogy during the main fabric forming event with the garnet and sillimanite having formed late during the event than the felsic portion. Most of the K-spar concentrates in layers up to 3 mm in width.

The rock is a compositionally banded metamorphosed metasediment probably arkosic in original composition.

5334 RS 219

Drillhole and Depth: Nundroo 2 331.26-332.32 m

Hand Specimen Description:
Contact of a dark grey-green fine-grained mafic rock and a compositionally banded quartz feldspar garnet biotite gneiss.

Thin Section Description:

Unit 1		Unit 2	
Hornblende	40%	Quartz	50%
Plagioclase	25%	Plagioclase	25%
Quartz	20%	K-spar	10%
Opaques	10%	Garnet	10%
Clinopyroxene	5%	Biotite	5%
Sericite	minor	Sericite/mica	minor
		Opaques	<1%

Unit 1

Is composed of equigranular, fine-grained, (0.2-0.7 m) subhedral grains with curved to embayed boundaries with a granoblastic elongate texture defining a moderate layer parallel fabric. Quartz develops as elongate subhedral to euhedral grains and as quartz ribbons within this basic. It appears that the CPX is .....

Unit 2

Has an inequigranular fine to medium-grained granoblastic elongate texture. The quartz grains are commonly quite elongate (AR2-4:1), anhedral with curved and embayed boundaries, quartz ribbon development is also quite common. the feldspars are generally more equant but some are still elongate parallel to the tectonic fabric they mostly have straight to curved boundaries but can occasionally be embayed. The garnets are generally equant, euhedral to subhedral although near the boundary with Unit 1 they are poikioblastic containing grains of quartz, biotite and opaques. Some compositional banding is evident with lighter feldspar rich layers 3-5 mm in width these layers are depleted in garnet and biotite cf. the rest of the fabric material. The white feldspar rich layer along the contact appears to be due to metamorphic compositional layering and not associated with veining.

5334 RS 220

Drillhole and Depth: Nundroo 2 339.13-339.18 m

Hand Specimen Description:
Well layered well-foliated pink and grey quartz feldspar garnet biotite gneiss.

Thin Section Description:

Quartz	50%
Plagioclase	10%
K-feldspar	30%
Garnet	5%
Biotite	<1%
Sillimanite	3%
Opaques	1%
Zircon	minor
Sericite	minor

The rock is medium to fine-grained with a granoblastic elongate texture as for slide 5334 RS 218.

5334 RS 223

Drillhole and Depth: Nundroo 2 348.44-348.49 m

Hand Specimen Description:
Grey-green fine to medium-grained moderately-banded moderately-foliated basic gneiss.

Thin Section Description:

Plagioclase	23%
Quartz	20%
Hornblende	5%
Clinopyroxene	15%
Orthopyroxene	10%
Scapolite	5%
Sericite	minor
Opaques	7%
Biotite	minor

The rock has a fine to medium-grained granoblastic weakly elongate texture. The two pyroxenes coexist as anhedral skeletal grains with curved and embayed boundaries. The plagioclase has curved and occasional embayed boundaries and exhibit some bent twinning. The hornblende appear to be replacing the pyroxenes and has straight to embayed boundaries there also appears to be an alignment of slightly elongate larger hornblende grains. The scapolite forms as equant subhedral to euhedral grains commonly replacing OPX and CPX, coexists with hornblende or partly replaces it. The opaques form anhedral grains along boundaries of the mafic minerals and is in particular associated with the hornblende. Quartz occurs commonly as quartz ribbons and as elongate anhedral grains.

5334 RS 224

Drillhole and Depth: Nundroo 2 353.90-353.95 m

Hand Specimen Description:
Contact between band of grey-green fine to medium-grained compositionally banded moderately well-foliated basic gneiss and a grey foliated weakly banded quartz feldspar biotite garnet gneiss.

Thin Section Description:

Basic Gneiss		Felsic Gneiss	
Hornblende	25%	Plagioclase	20%
Clinopyroxene	15%	K-feldspar	10%
Plagioclase	30%	Quartz	35%
Quartz	15%	Biotite	15%
Opaque	7%	Garnet	20%
Orthopyroxene	10%	Opaque	1-2%
		Sericite	minor

Basic gneiss

This is an equigranular fine-grained rock (0.1-0.5 mm) with a granoblastic elongate texture where grains have straight to curved boundaries. Quartz developed as anhedral to subhedral elongate grains or commonly as quartz ribbons.

Felsic Gneiss

This is an inequigranular fine to medium-grained granoblastic texture. Euhedral equant garnet grains grow up to 1.5 mm in diameter and some of the biotite grains anastomose around the garnets.

Between the two units is a metamorphic reaction zone about 8 mm in width. Its mineralogy is a combination of the two units but it is characterized in particular by a high content of poikioblastic garnet (25-30%) and skeletal opaque grains (15%). A moderate foliation is developed defined by elongate grains.

5334 RS 225

Drillhole and Depth: Nundroo 2 359.32-359.37 m

Hand Specimen Description:
Moderately well foliated grey quartz feldspar biotite garnet gneiss with interlayered green-grey basic gneiss.

Thin Section Description:

Felsic Gneiss		Basic Gneiss	
Quartz	40%	Hornblende	40%
Plagioclase	25%	Plagioclase/sericite	40%
K-spar?	?	Clinopyroxene	5%
Garnet	15%	Orthopyroxene	5%
Biotite	10%	Amphibole	minor
Opaques	<1%	(? Riebeckite)	
Sericite	5%	Cordierite	minor
Chlorite	2%		

Basic Gneiss

- Granoblastic elongate texture.
- Grain boundaries curved to embayed.
- Orthopyroxene has been euralitized i.e. replaced by hornblende.
- Biotite and hornblende are closely intergrown.
- Alteration along a vein with development of Riebeckite and scapolite as alteration products.
- Also along the fracture is CPX rimming cordierite with some riebeckite developed along the interface. Quartz is also common along the fracture.
- Feldspars completely sericitized.
- Hornblende quite coarse 1-2 mm anhedral slightly poikioblastic grains containing sericitized plagioclase and minor anhedral quartz blebs.

Felsic Gneiss

- Medium grained granoblastic elongate texture where grain size varies from 0.1-1.0 mm.
- Anhedral to subhedral grains with curved to embayed boundaries.
- Quartz ribbon development.
- Garnet equant euhedral grains 1-2 mm.
- Sericitization of ?K-spar and plagioclase.
- Very few opaques.

Boundary:

- Zone 10 to 15 mm.
- Development of poikioblastic garnet.
- Chlorite replaces biotite in the felsic gneiss.
- Sericitization of feldspars decreases from basic to felsic gneiss.

5334 RS 227

Drillhole and Depth: Nundroo 2 367.13-367.17 m

Hand Specimen Description:
Grey and pink, well layered (3-5 mm), well foliated quartz feldspar biotite garnet gneiss.

Thin Section Description:

Quartz	40%
Plagioclase	30%
K-spar	10%
Biotite	7%
Garnet	10%
Sillimanite	7%
Opaques	<1%
Chlorite	<1%

- Fine to medium grained granoblastic elongate texture.
- Well foliated with the foliation defined by the alignment of elongate biotite qtz. and to a lesser degree by feldspar.
- Irregular compositional banding into felsic bands composed of quartz and feldspar and mafic bands composed of garnet sillimanite biotite and minor chlorite.
- Most opaque concentrated in the mafic bands.
- Very similar to 5334 RS 218.

5334 RS 228

Drillhole and Depth: Nundroo 2 374.42-374.46 m

Hand Specimen Description:
Contact of a dark green-grey medium grained banded and moderately well foliated basic gneiss, and light grey coarse grained quartz feldspar biotite gneiss.

Thin Section Description:

Felsic Unit		Basic Unit	
Quartz	40%	Hornblende	30%
Plagioclase	20%	Orthopyroxene	5%
Biotite	10%	Scapolite	2%
Garnet	5%	Biotite	2%
Sericite	15%	Quartz	20%
Chlorite	2%	Plagioclase	30%
Opaques	<1%	Opaques	7%
Epidote	minor		

Felsic Unit

- Inequigranular coarse grained (up to 7 mm) granoblastic elongate texture.
- Most grains are anhedral with curved embayed or scalloped boundaries.
- Some minor quartz ribbon development.
- Quartz exhibits sub-grain DBB development.
- The feldspars are commonly sericitized.
- The biotite grains exhibit a strong red-brown to straw yellow pleochroism.
- Biotite partly anastomose around the larger feldspar grains.
- Chlorite closely intergrown and replacing the biotite.
- Garnet developed as large subhedral to euhedral grains.

Basic Gneiss

- Medium-grained (0.5-1.0 mm) granoblastic elongate texture.
- Moderately good foliation defined by elongate hornblende quartz and biotite.
- Most grains are anhedral with curved to embayed boundaries.
- OPX is being replaced by hornblende and opaques.
- Quartz occurs as anhedral blebs embayed into and replacing all other minerals.
- Scapolite is partly being replaced by ?reibeckite.
- Plagioclase is less sericitized than in the felsic portion.
- Most opaques occur in the basic unit.

5334 RS 230

Drillhole and Depth: Nundroo 3 72.08-72.13 m

Hand Specimen Description:
Grey-pink foliated and banded garnet quartz feldspar biotite gneiss.

Thin section Description:

Garnet	35%
Biotite	20%
Quartz	25%

K-feldspar	10%
Plagioclase	5%
Opaques	5%

- Coarse-grained granoblastic elongate texture with some anastomosing of biotite around the garnet.
- Garnets are coarse-grained (up to 2.0 mm) equant and subhedral and are generally highly fractured with curved boundaries.
- The biotite grains, which show deep red-brown to straw yellow pleochroism are aligned parallel to the foliation and partly anastomose around the garnet, they are also intergrown with and overgrowing the garnet.
- Quartz develops as elongate anhedral grains with some quartz ribbon development.
- Quartz exhibits strong undulose extinction and DBB's, grain boundaries are curved to embayed.
- K-feldspars are equant anhedral and exhibit deformed cross hatch twinning and have curved grain boundaries.
- Plagioclase grains are equant subhedral with straight grain boundaries and concentrate in thin (5 mm) felsic layers.
- Opaques closely associated with biotite commonly developing along the cleavages.

5334 RS 232

Drillhole and Depth: Nundroo 3 78.25-78.30 m

Hand Specimen Description:
Grey moderately well foliated banded medium grained quartz feldspar biotite garnet gneiss cross cut by a thin 7 mm dark grey pseudotachalite at a small angle to the foliation.

Thin Section Description:

Garnet	20%
Quartz	35%
Biotite	15%
K-feldspar	15%
Plagioclase	10%
Opaques	3%
Zircon	trace

- An inequigranular granoblastic elongate texture to partly anastomosing texture.
- Moderately well developed foliation defined by alignment of biotite lath elongate grains and to a lesser extent by elongate K-feldspar grains. Opaques are elongate parallel to foliation and may be intergrown with biotite.
- Garnets are generally equant subhedral to euhedral grains (0.5-3.0 mm) with biotite anastomosing around and intergrown with them. Garnets are also ..... parallel to foliation direction.
- K-feldspar exhibits microperthite twinning which is deformed and kinked in places. Equant to slightly elongate grains with curved to straight grain boundaries.
- Plagioclase grains are almost wholly sericitized and show remnant twinning.
- Quartz appear as anhedral elongate grains with curved to embayed grain boundaries. It exhibits strongly undulose extinction and DBB's.

Pseudotachalyte:

- A very fine groundmass of red mica (probably biotite) and opaques (< .01 mm) containing occasional small grains of feldspar and quartz (< .1 mm).
- One side of the vein is an extremely sharp contact with the pelitic gneiss on the other is a zone of cataclastics, 3 mm wide, of the pelitic sediment.
- The high mica content of the vein indicates that this was not a dry system at the time of cataclastics.

5334 RS 234

Drillhole and Depth: Nundroo 3 93.40-93.44 m

Hand Specimen Description:
Light grey-green well banded well-foliated quartz feldspar + garnet gneissic pegmatite.

Thin Section Description:

Quartz	45%
Plagioclase	30%
Garnet	10%
Chlorite	<1%
Sericite	10%
Biotite	minor
K-feldspar	5%

- A coarse-grained anastomosing texture where quartz ribbons (greater than several cms in length) anastomose around elongate mosaics of feldspar.
- The feldspars are generally equant (0.5-1.5 mm) subhedral with straight to curved boundaries.
- Deformed twinning is evident in both the K-feldspar and plagioclase.
- The garnets are equant subhedral; grains up to 5 mm across, they are commonly highly fractured with chlorite developed along the fractures.
- The feldspars predominantly plagioclase are patchily sericitized with some associated chlorite development.
- This may represent a deformed pegmatitic zone.

5334 RS 235

Drillhole and Depth: Nundroo 3 93.46-93.50 m

Hand Specimen Description:
Grey-green banded and foliated quartz feldspar pegmatite with subordinate garnet and biotite.

Thin Section Description:

Quartz	20%
K-feldspar	45% (microcline)
Plagioclase	30%
Biotite	<1%
Sericite	10%
Chlorite	minor
Opaques	minor
Apatite	minor
Sphene	minor
Zircon	minor

- Coarse-grained inequigranular granoblastic texture. Grainsize (1-6 mm).
- Apparent compositional layering into plagioclase rich layers and microcline rich layers.
- Large anhedral microcline surrounded by mosaic of polygonal microcline grains with occasional triple part junctions evident.
- Some texture seen in the plagioclase rich portion but this is highly sericitized.
- Quartz apparent as quartz veins or ribbons up to 3 mm in width and as anhedral elongate grains.
- Biotite grains along quartz veins and in regions of highly altered plagioclase.
- ..... is also associated with the altered plagioclase.
- Chlorite associated with both biotite and sericite.
- Only a few opaque grains all associated with quartz veining/ribbons.

5334 RS 236

Drillhole and Depth: Nundroo 3 94.77-94.81 m

Hand Specimen Description:
Off-white to pink foliated coarse pegmatitic rock with thinshclieren of biotite and garnet in the biotite garnet gneiss that envelopes the pegmatite.

Thin Section Description:

Plagioclase	20%
K-feldspar	35% (microcline)
Quartz	20%
Biotite	10%
Garnet	10%
Apatite	minor
Opaques	minor
Sericite	5%

- Granoblastic to granoblastic elongate texture.
- Dominantly large anhedral skeletal microcline grains surrounded by mosaics of polygonal equant microcline grains.
- Plagioclase appears in distinct zones or layers as sericitize equant polygonal grains.
- Quartz mostly large ribbons 3-4 m wide made up of single grains.
- Schlieren composed of oriented biotite which anastomose and are intergrown with equant subhedral garnets (up to 4 mm) with minor associated quartz and opaques.
- The foliation defined by oriented schieren, quartz ribbons and the compositional layering within the pegmatite and elongate quartz grains.

5334 RS 237

Drillhole and Depth: Nundroo 3 98.31-98.35 m

Hand Specimen Description:
Grey and pink compositionally banded moderately well foliated quartz feldspar biotite garnet gneiss. Banding is on a mm scale.

Thin Section Description:

Quartz	40%
Plagioclase	20%
Biotite	15%
Garnet	15%
Sericite	5-10%
Opaques	1%
Apatite	minor
Carbonate	minor
Sphene	minor

- An inequigranular medium-grained granoblastic elongate to anastomosing texture grainsize up to 3 mm.
- Well developed foliation defined by biotite laths, which are intergrown with and anastomose around subhedral to anhedral equant garnets, and alignment of elongate quartz grains and minor quartz ribboned development.
- Compositional banding is irregular and moderately defined by felsic rich and biotite + garnet + opaque layer on scale of 2-5 mm.
- Opaques closely associated with biotite i.e. growing along cleavage planes and grain boundaries and with late brittle fractures.
- Quartz is either large elongate anhedral grains up to 3 mm which exhibit undulose extinction and DBB's or as small <0.5 m polygonal strain free grains.
- Plagioclase appears as grains of varying size <1 mm up to 3 mm which are generally anhedral with curved to embayed boundaries. They are generally strongly sericitized.
- Apatite is closely associated with the garnet and opaques.
- Small grain of carbonate rimmed by opaques, carbonate of unknown origin.

5334 RS 238

Drillhole and Depth: Nundroo 3 104.94-104.98 m

Hand Specimen Description:
Grey-pink moderately foliated garnet-rich quartz feldspar garnet biotite gneiss, with minor compositional banding.

Thin Section Description:

Garnet	30%
Biotite	20%
Quartz	30%
Plagioclase	10%
Sericite	5%
Opaque	5%
Apatite	trace

- Medium grained inequigranular (up to 4 mm) granoblastic elongate to weakly anastomosing texture as seen previously.
- Compositional banding - garnet + biotite + quartz + opaque gneisses with a single 7 mm band of plagioclase + quartz + minor biotite.
- Some quartz ribbon development most commonly in the plagioclase quartz band.
- Minor plagioclase seen in more felsic portions of the garnet rich gneiss.
- Plagioclase quite sericitized.

5334 RS 240

Drillhole and Depth: Nundroo 3 115.96-116.00 m

Hand Specimen Description:
Grey-green moderately well foliated medium-grained basic gneiss.

Hornblende	20%
Biotite	15%
Plagioclase	45%
Carbonate	1%
Apatite	minor
Epidote	3%
K-feldspar	15%
Opaques	1%
Clinopyroxene	3%
Sphene	minor

- Equigranular medium-grained (0.5-1.5 mm) granoblastic elongate texture.
- Moderately well developed fabric defined by the alignment of anhedral elongate hornblende and biotite laths.
- Hornblendes have curved to embayed boundaries.
- Feldspars are mostly euhedral with curved & embayed boundaries.
- Epidote are elongate euhedral grains with curved grain boundaries.
- Clinopyroxenes are relict highly fractured euhedral grains that appear to be replaced by hornblende, biotite and to a lesser degree by epidote.
- Feldspars are highly sericitized.
- The rock is cross cut by two late stage carbonate veins.
- The opaques are scattered but majority are associated with the biotite and hornblende.

5334 RS 242

Drillhole and Depth: Nundroo 3 119.96-120.00 m

Hand Specimen Description:
Coarse-grained grey moderately well foliated amphibole feldspar gneiss.

Thin Section Description:

Hornblende	25%
Plagioclase	60%
Biotite	7%
Chlorite	minor
Sericite	5%
Opaques	minor
Apatite	minor
Sphene	minor
Zircon	minor

- Inequigranular coarse-grained (0.5-3.0 mm) granoblastic elongate texture.
- Moderately well foliated defined by elongate anhedral hornblende, with curved to embayed boundaries, and biotite laths.
- Feldspars are generally equant and polygonal with straight to curved boundaries but there are same zones where they are anhedral and where new grain development is visible along the grain boundaries. There is minor patchy sericitization of the feldspar.
- Apatite appears as accessory in hornblende grains.
- Opaques mostly associated with biotite and hornblende.
- Hornblendes commonly contain small round blebs of feldspar (although may be quartz).

5334 RS 243

Drillhole and Depth: Nundroo 3 122.59-122.64 m

Hand Specimen Description:
Grey-green medium-grained moderately well foliated gneiss with thin white felsic bands parallel to the foliation.

Thin Section Description:

Hornblende	30%
Biotite	15%
Plagioclase	25%
Quartz	10%
K-feldspar	20%
Sericite	5%
Apatite	1-2%
Opaques	5%
Sphene	<1%

- Medium grained (0.1-1 mm) granoblastic elongate texture.
- Moderately well developed foliation defined by alignment of elongate anhedral hornblende, biotite lathes and occasional slightly elongate k-feldspar grains.
- A 5 mm band parallel to the foliation in the centre of the slide is composed almost wholly of ribbon quartz and feldspar, but with minor biotite and opaques.
- All the quartz is confined to this band or the area immediately surrounding it.
- The basic rock is a finer grained version of 5334 RS 242.

5334 RS 244

Drillhole and Depth: Nundroo 3 125.17-125.21 m

Hand Specimen Description:
Light grey-green coarse grained spotted hornblende feldspar gneiss.

Thin Section Description:

Hornblende	20%
Biotite	10%
Plagioclase	50%
Opaques	<1%
Quartz	20%
Apatite	1-2%
Sericite	minor

- Medium-grained granoblastic elongate texture with moderately well developed fabric.
- Anhedral elongate hornblende.
- Small biotite laths.
- Most plagioclase is equant anhedral with curved boundaries but some larger relict grains with scalloped to lobate boundaries deformed twinning and they can be antiperthitic.
- Quartz is irregular blebs or elongate anhedral grains with curved to lobate boundaries and more rarely as quartz ribbons.
- Only minor sericitization of the feldspar.
- Some compositional banding on 1-5 mm scale with most quartz in the zones devoid of hornblende.

5334 RS 246

Drillhole and Depth: Nundroo 3 129.24-129.28 m

Hand Specimen Description:
Grey moderately well foliated quartz feldspar biotite garnet gneiss.

Thin Section Description:

Quartz	20%
Plagioclase	40%
Biotite	20%
Garnet	10-15%
Hornblende	5-10%
Opaques	5-7%
Sericite	minor
Apatite	<1%
Zircon	trace

- Inequigranular medium-grained (0.5-4.0 mm) granoblastic elongate to partly anastomosing texture.
- Biotite laths and anhedral elongate hornblende grains define a moderately good fabric which is intergrown with, i.e. inclusion of biotite within garnet, and anastomoses around equant subhedral garnets.
- Anhedral blebs and elongate grains of quartz embay into the biotite hornblende and garnet.
- Dendritic opaques grow along grain boundaries of biotite hornblende and garnet.
- Feldspars are commonly equant vary in grainsize from (0.1-2 mm) and have curved grain boundaries. Some exhibit bent and deformed twinning.

5334 RS 250

Drillhole and Depth: Nundroo 3 164.95-165.00 m

Hand Specimen Description:
A grey moderately well foliated feldspar biotite hornblende garnet gneiss with irregular white blebs (1-3 mm across) of quartz.

Thin Section Description:

Hornblende	10%
Biotite	20%
Plagioclase	50%
Quartz	5-10%
Garnet	5%
Opaques	5%
Sericite	minor
Apatite	accessory
Beryl	minor
Zircon	trace

- Medium grained inequigranular (0.2-4 mm) granoblastic elongate is partly anastomosing texture.
- some of the opaques are elongate and mimic the shape of biotite laths suggesting possible total replacement.
- Beryl appears as a late stage mineral anhedral equant grains that overprint hornblende and biotite.
- Some compositional banding but quite diffuse into mafic rich and felsic rich band.
- Quartz occurs in the felsic rich bands and generally elongate anhedral grains. Most quartz occurs together in small 5 mm zones.

5334 RS 252

Drillhole and Depth: Nundroo 3 187.96-188.00

Hand Specimen Description:
Light grey-green well-foliated well-banded (on mm scale) hornblende plagioclase gneiss.

Thin Section Description:

Plagioclase	55%
Quartz	20%
Hornblende	25%
Biotite	10%
Apatite	accessory
Chlorite	minor
Opaques	<1%
Sericite	minor

- Medium-grained inequigranular (0.1-4.0 mm) granoblastic elongate texture.
- Anhedral hornblende commonly contain inclusions of biotite and occasionally plagioclase.
- Biotite laths much smaller than in previous slides.
- Plag. exhibits rare deformed twinning and occasionally antiperthitic textures.
- Larger plagioclase grains are deformed and have totally embayed boundaries while smaller crystals are equant with curved boundaries.
- Quartz mostly as anhedral elongate grains often in mosaic of predominantly quartz up to 5 mm in length.
- Bounding is evident but very discontinuous better described as elongate clots up to 8 mm in length generally less than 4 mm in width.
- Chlorite associated with biotite.

5334 RS 255

Drillhole and Depth: Nundroo 3 208.75-208.79 m

Hand Specimen Description:
Light grey-green well-foliated moderately banded hornblende plagioclase biotite gneiss.

Thin Section Description:

Plagioclase	40%
Hornblende	35%
Biotite	5%
Quartz	20%
Opaques	<1%

- Same as 5334 RS 252 except slightly coarser in grainsize.

5334 RS 257

Drillhole and Depth: Nundroo 3 218.86-218.90 m

Hand Specimen Description:
Dark grey-green fine-grained foliated basic gneiss cross cut by lt. grey-pink vein which is also foliated.

Thin Section Description:

Basic Gneiss		Vein	
Hornblende	35%	Sericite	29%
Plagioclase)	64%	Calcite	1%
Sericite)		Plagioclase	70%
Opaque	<1%		

- Fine-grained equigranular (0.1-0.5 mm) granoblastic slightly elongate texture.
- Fabric defined by alignment of elongate hornblende.
- Grain boundaries mostly straight to curved with triple point junctions evident, feldspar grains are commonly polygonal.
- Opaques are associated with hornblende and appear as blebs on the grain boundaries.
- In the vein the feldspars are somewhat larger up to 3 mm and embayed & scalloped boundaries are larger grains are somewhat elongate parallel to the foliation.
- Small calcite grains appear in the vein.
- Feldspars throughout the slide are highly sericitized.

5334 RS 258

Drillhole and Depth: Nundroo 3 229.84-229.88 m

Hand Specimen Description:
Dark green coarse grained weakly foliated amphibolite.

Thin Section Description:

Hornblende	75%
Biotite	7%
Plagioclase)	14%
Sericite)	
Chlorite	2%
Opaques	1%
Quartz	1%
Vesuvianite	minor
?Beryl	minor

- Inequigranular coarse-grained granoblastic weakly elongate texture.
- Large equant to slightly elongate hornblende grains with interstitial plagioclase grains (0.1-0.5 mm), these grain boundaries between hornblende and plagioclase are mostly embayed.
- Hornblende-hornblende grain boundaries are mostly straight occasionally curved.

- Hornblendes commonly contain round blebs of plagioclase in them.
- The plagioclase is highly sericitized.
- Biotite occurs as lath oriented parallel to the foliation and commonly in clots and to a lesser extent along the grain boundaries of hornblende.
- Chlorite is commonly replacing biotite.
- Opaques generally appear along grain boundaries of hornblende and biotite.

5334 RS 260

Drillhole and Depth: Nundroo 3 230.40-.44 m

Hand Specimen Description:
Grey-pink medium-grained moderately foliated quartz feldspar biotite gneiss in contact with a green-grey medium-grained hornblende feldspar gneiss. there is a 5 mm contact zone of light grey feldspar biotite hornblende gneiss.

Thin Section Description:

Felsic Gneiss		Basic Gneiss	
Plagioclase	10%	Plagioclase	60%
K-feldspar (microcline)	25%	Hornblende	15%
Biotite	7%	Biotite	10%
Quartz	35%	Quartz	5%
Chlorite	2%	Sericite	10%
Opaques	3%	Vesuvianite	minor
Sericite	20%		

Felsic Gneiss

- Medium-grained equigranular (0.2-1.0 mm) granoblastic elongate texture.
- Moderately well-foliated with foliation defined by elongate grains of quartz and k-feldspar and to a lesser degree by alignment of biotite.
- The grain boundaries are generally curved and occasionally embayed.
- Quartz exhibits undulose extinction.
- K-feldspar exhibits perthitic twinning which is commonly deformed.
- Plagioclase is commonly highly sericitized.

Basic Gneiss

- Medium-grained inequigranular (0.2-4.0 mm) granoblastic elongate texture.
- Large anhedral elongate hornblende grains, biotite laths and elongate quartz grains define a good foliation.
- Large plagioclase with embayed boundaries exhibit deformed twinning and are antiperthitic. These are surrounded by smaller polygonal plagioclase grains.
- The biotite anastomoses around the large plagioclase grains.
- The quartz content decreases rapidly away from the contact with the felsic gneiss.
- The contact zone is of felsic composition dominantly quartz ribbons (1 mm in width) with interstitial plagioclase and k-feldspar polygonal grains.

APPENDIX 3

TABLE 1

Thin section and geochemical sample RS numbers and depths

Drillhole	Thin Section Depth(m) RS No.	Depth(m)	Whole Rock Silicate Analysis RS No.	Depth(m)	Spectrographic Analysis RS No.	Depth(m)
1	5334 RS 142	55.15-.16	5334 RS 144	58.80-59.40	5334 RS 146	54-56
	RS 143	58.64-.69				
	RS 145	59.36-.41				
2	RS 150	52.00-.08	RS 151	52-53	RS 190	38-40
	RS 152	54.92-55.00		RS 158	88-89	RS 191 64-66
	RS 153	64.18-.24	RS 161	116-117	RS 192	73-75
	RS 154	65.14-.21	RS 167	160-161	RS 193	82-84
	RS 181	68.36-.40	RS 169	183-184	RS 194	96-98
	RS 155	82.93-.94	Rs 171	230-231	RS 195	107-109
	RS 156	84.12-.18	RS 176	252-253	RS 196	119-121
					RS 89	120.4
					RS 90	126.8
	RS 157	88.58-.66	RS 178	263-264	RS 197	138-140
	RS 160	116.42-.49	RS 208	293-294	RS 198	149-151
					RS 93	153.0
	RS 159	122.50-.56	RS 213	307-308	RS 199	176-178
	RS 162	126.09-.13	RS 217	320-321	RS 200	194-196
	RS 163	130.15-.18	RS 221	339-340	RS 201	205-207
	RS 164	130.22-.26	RS 222	348.10-349	RS 202	221-223
	RS 182	132.76-.80	RS 226	359-360	RS 203	242-244
	RS 165	146.45-.49			RS 204	250-252
					RS 205	272-274
	RS 166	160.00-.05			RS 206	282-284
	RS 183	160.62-.67			RS 215	312-14
	RS 168	183.70-.75			RS 229	373-75

RS 184 198.64-.69
RS 185 209.35-.39
RS 170 230.12-.20
RS 172 243.23-.28
RS 186 245.25-.30
RS 173 246.50-.55
RS 174 250.56-.63
RS 175 252.82-.90
RS 187 261.77-.81
RS 177 263.62-.69
RS 189 265.62-.67
RS 179 273.18-.25
RS 180 278.30-.34
RS 207 293.94-.98
RS 209 295.19-.23
RS 210 295.27-.31
RS 211 298.26-.31
RS 212 300.90-.98
RS 214 307.71-.76
RS 216 317.87-.94
RS 218 320.88-.92
RS 219 331.26-.32
RS 220 339.13-.18
RS 223 348.44-.49
RS 224 353.90-.95
RS 225 359.32-.37
Rs 227 367.13-.17
RS 228 374.42-.46

3 RS 230 72.08-.13 RS 231 72-73 RS 233 80-82
RS 232 78.25-.30 RS 239 104-105 RS 248 143-145
RS 234 93.40-.44 RS 241 115-116 RS 249 155-157
RS 235 93.46-.50 RS 245 124-126 RS 254 197-199
RS 236 94.77-.81 RS 247 129-130
RS 237 98.31-.35 RS 251 164-165
RS 238 104.94-.95
RS 240 115.96-116.0 RS 253 187-188
RS 242 119.96-120.0 RS 256 207.77-208.79
RS 243 122.59-.64 RS 259 228.87-229.88
RS 244 125.17-.21
RS 246 129.24-.28
RS 250 164.95-168.0
RS 252 187.96-188.0
RS 255 208.78-208.79
RS 257 218.86-.90
RS 258 229.84-.88
RS 260 230.40-.44

TABLE 3

Relationship between rock unit, lithological group, geochemistry and possible protolith

Drillhole	Depth(m)	RS No.	SiO_2	CaO + MgO%	Na_2O + K_2O%	Ni + Cr(ppm)	Rock Unit	Lithological Group (text)	Lithological Group	Possible Protolith (diagrams)
1	54-56	5334 RS146	-	-	-	156	q+p+b+g+h gneiss		(1)	6 Sediment & basic igneous
	58.80-59.40	RS144		65.30		6.53		5.34	66	layer q+p+b+g gneiss
	(1)	6	sediment							
2	38-40	RS190	-	-	-	60	p+h+b+py gneiss		(2)	2 basic igneous
	52-53	RS151	46.2	12.87	4.55	83	p+h+b+py gneiss		"	2 "
	64-66	RS191	-	-	-	156	p+ph+h+g gneiss		"	2 "
	73-75	RS192	-	-	-	206	p+py+h gneiss	"	2	"
	82-84	RS193	-	-	-	165	h+p gneiss	"	2	"
	88-89	RS158	48.4	18.95	3.74	341	h+py+p gneiss	"	1	"
	96-98	RS194	-	-	-	615	p+ph+h gneiss	"	2	"
	107-109	RS195	-	-	-	115	h+p+py gneiss	"	1	"
	116-117	RS161	49.50		24.70		2.32	807	h+p+py gneiss	" 1 "
	119-121	RS196	-	-	-	420	h+p+py gneiss	"	1	"
	120.4	RS89	-	-	-	1400	h+p+py gneiss	"	1	"
	126.8	RS90	-	-	-	800	p+h+py+g gneiss		"	2 "
	138-140	RS197	-	-	-	155	p+py+h+g gneiss		"	2 "
	138.8	RS91	-	-	-	250	p+py+h+g gneiss		"	2 "
	147.9	RS92	-	-	-	250	q+kf+p		7	pegmatite
	149-151	RS198	-	-	-	156	p+py+h+g gneiss		"	2 basic igneous
	153.0	RS93	-	-	-	250	p+py+h+g gneiss		"	2 "
	160-161	RS167	48.70		17.20		3.03	208	p+py+h+g gneiss	" 2 "
	176-178	RS199	-	-	-	155	p+py+h+g gneiss		"	3 "
	183-184	RS169	59.30		9.69	4.73	125	p+py+j gneiss		"

3	"										
	194-196	RS200	-	-	-	105	p+py+h gneiss	"	2	"	
	205-207	RS201	-	-	-	210	p+py+h+g gneiss	"	2	"	
	221-223	RS202	-	-	-	210	p+h+py gneiss	"	1	"	
	230-231	RS171	47.90	20.70		3.45	507	p+py+h gneiss	"	2	"
	242-244	RS203	-	-	-	100	p+py+g+h gneiss	"	1	"	
	250-252	RS204	-	-	-	106	p+py+h+g	"	2	"	
	252-253	RS176	48.50	16.0	4.45	183	p+py+h gneiss	(2)	2	basic igneous	
										(pegmatitic)	
	263-264	RS178	50.00	15.30		4.05	107	p+py+h gneiss	"	2	basic igneous
	272-274	RS205	-	-	-	155	q+p		7	pegmatite	
	282-284	RS206	-	-	-	100	p+py+h+g gneiss	"	2	basic igneous	
	293-294	RS208	47.80	16.95		3.28	91	h+p+q gneiss	"	2	"
	307-308	RS213	48.70	20.20		2.87	526	p+py+h+g gneiss	"	2	"
	312-314	RS215	-	-	-	150	q+kf+p+g+b gneiss	(3)	6	sediment	
	320-321	RS217	67.00	3.36	7.26	111	q+kf+p+g+b gneiss	"	6	"	
	339-340	RS221	69.10	2.74	8.19	119	q+kf+p+g+s gneiss	"	6	"	
	348.10-349	RS222	50.60	15.35	2.82	288	p+py+q+h gneiss	(2)	2	basic igneous	
	359-360	RS226	64.30	5.30	5.84	234	q+p+b+g+h gneiss	(3)	6	sediment	
	373-375	RS229	-	-	-	160	q+p+b+g+h gneiss	"	6	sediment + basic igneous layer	
3	72-73	RS231	55.29	4.85	5.13	95	g+q+b+kf+p gneiss	(4)	5	intermediate igneous	
	80-82	RS233	-	-	-	200	q+g+kf+p+b gneiss	"	5	"	
	104-105	RS239	52.45	7.39	1.73	110	g+q+b+p gneiss	"	5	"	
	115-116	RS241	46.62	12.73		6.93	85	p+h+b+py gneiss	2	basic dyke	
	125-126	RS245	56.10	8.99	6.22	55	p+h+b+q gneiss	(5)	4	intermediate igneous	
	129-130	RS247	56.00	7.89	5.78	80	p+b+h+g+q gneiss	"	4	"	
	143-145	RS248	-	-	-	100	p+h+b+q gneiss	"	4	"	

	155-157	RS249	-	-	-	160	p+b+h+g+q gneiss	"	4	"				
	164-165	RS251	55.26	7.43	5.70	95	p+b+h+g+q gneiss	"	4	"				
	187-188	RS253	56.16	9.49	6.24	85	p+h+b+q gneiss	"	4	"				
	197-199	RS254	-	-	-	80	p+h+b gneiss	"	4	"				
	207.77-208.79	RS256	50.09	12.82	5.90	65	p+h+q+b gneiss	"	2	basic igneous				
	228.87-229.88	RS259	40.68	18.33	4.39	105	h+p+b gneiss	"	1	basic igneous				
							(hornblende segregation)							

KEY:

p	plagioclase	q	quartz
py	pyroxene	g	garnet
h	hornblende	kf	potassium feldspar
b	biotite	s	sillimanite

Lithological Grouping (diagrams)

Symbol	Rock Unit	Modifer
1	Basic	melanocratic (contains 0-30% plagioclase)
2	Basic	mesocratic (contains 35-65% plagioclase)
3	Basic	leucocratic (contains 65-70% plagioclase)
4	Basic	intermediate (contains plagioclase + quartz)
5	Basic	intermediate (contains plagioclase + quartz + abundant garnet)
6	Acid	(quartz, potassium feldspar, plagioclase, biotite, garnet gneiss)
7	Pegmatites	

Lithological Grouping (text)

see pages 13-26.

APPENDIX 4

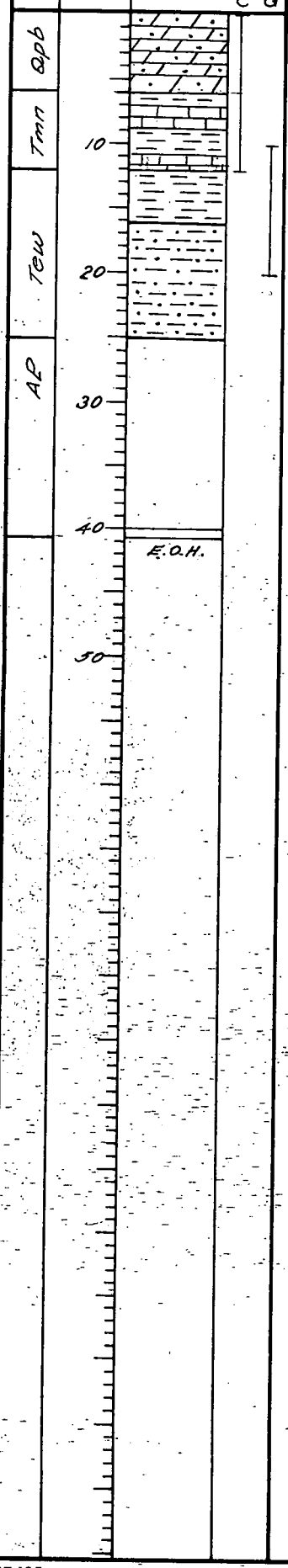
GEOCHRONOLOGY

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 1

DEPTH: 41.1 m | INCLINATION: 90°

LOGGED BY: A.R.M. | DATE: 1987 | DRN:



DESCRIPTION

BRIDGEWATER FORMATION — hard pink calcreted aeolianite with scattered quartz grains.

NULLARBOR LIMESTONE - white to yellow fine to very fine-grained packstone inter-bedded with white carbonaceous mud, becomes glauconitic at base.

WILSON BLUFF LIMESTONE - khaki green clay with approx. 20% very fine grained to fine grained quartz grains.
- khaki green to orange sandy clay.

WEATHERED BASEMENT - dark red brown clay with scattered angular quartz grains and matic grains of varying sizes.

? MULGATHING COMPLEX - interlayered dark grey quartz + plag + hbl + opx + gnt + sill gneiss and qtz + plag + biot + gnt gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan No: S 20129

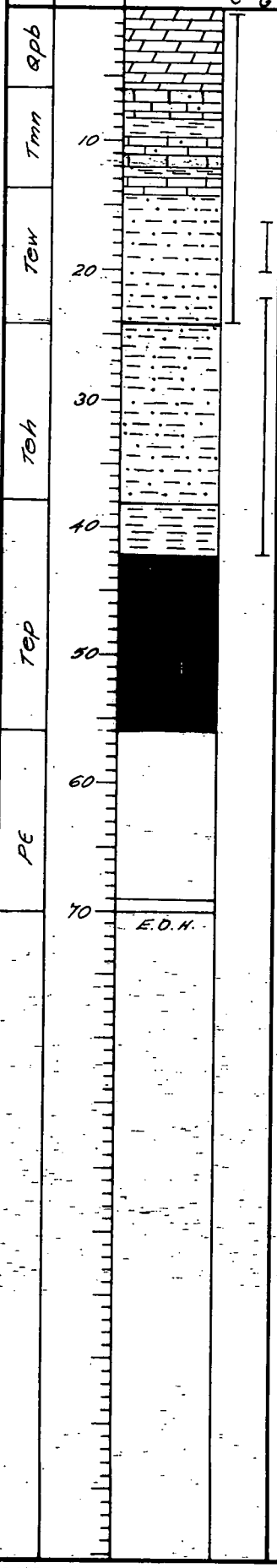
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 2

DEPTH : 70.0m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - hard brown-pink pisolithic calcreted aeolian grainstone, with scattered quartz grains.

NULLARBOR LIMESTONE - white and yellow fine-grained recrystallized packstone with scattered quartz grains, interbedded with light grey to white carbonaceous mud.

WILSON BLUFF LIMESTONE - light grey to greenish carbonaceous mud with common quartz grains also glauconitic.

HAMPTON SANDSTONE - khaki green and brick red sandy clay and silt. Contains 30% fine grained quartz which increases to about 60% near the base. Glauconitic.

Light grey-green glauconitic clay with 20% very fine to silt size quartz grains.

PIDINGA FORMATION - dark brown to black lignitic clay.

WEATHERED BASEMENT.

?MULGATHING COMPLEX - grey medium-grained plag + hbl + opx gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S20130

461/4

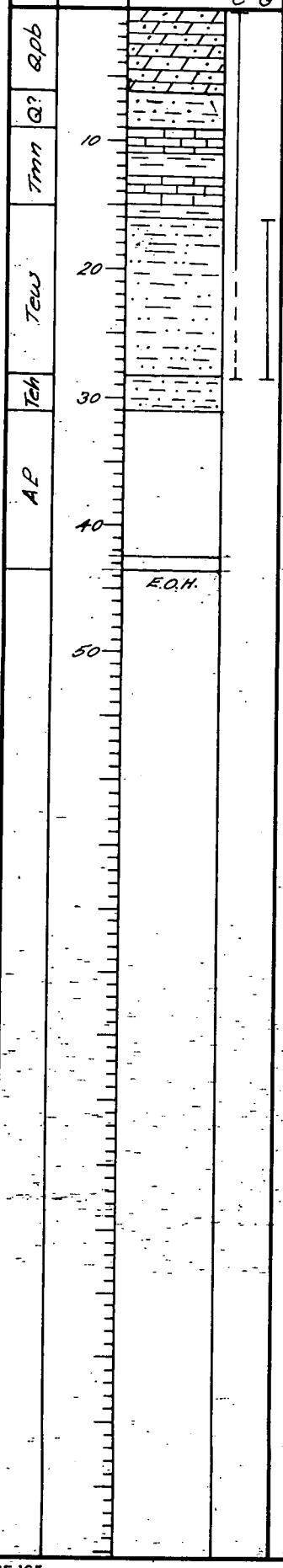
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 3

DEPTH: 43.32m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - light pink brown, hard calcreted aeolian fine-grained grainstone with common scattered quartz grains.

- white to light-orange carbonaceous mud with aburdant fine to silfsize grains.

NULLARBOR LIMESTONE - white hard recrystallized fine-grained packstone to wackestone interbedded with white sandy carbonaceous clay.

WILSON BLUFF LIMESTONE - khaki green and orange sandy clay to clayey sand, glauconitic. Contains minor carbonate.

Brick red - orange clayey sand and sandy clay

WEATHERED BASEMENT

? MULGATHING COMPLEX - Grey fine to medium-grained quartz + plag + biot. + hbl + sill gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20131

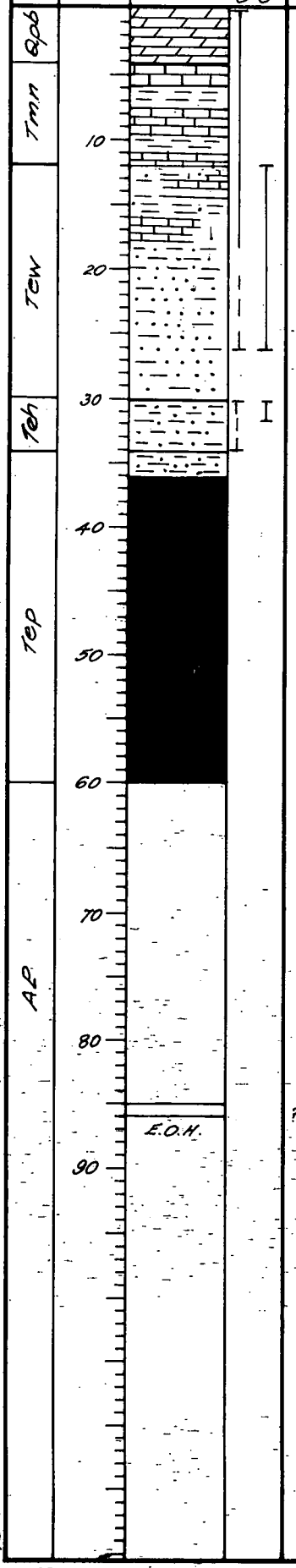
4614

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 4

DEPTH: 86.0m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - pink hard calcreted aeolianite.

NULLARBOR LIMESTONE - white to light orange recrystallized fine grained packstone with scattered quartz grains. Interbedded with white carbonaceous mud.

WILSON BLUFF LIMESTONE - light greenish grey carbonaceous mud with some interbedded fine-grained white packstone. Glauconitic, carbonaceous.

- light khaki to orange fine to medium-grained clayey sandstone with minor white limestone fragments.

HAMPTON SANDSTONE - light brown and red sandy clay.

- light grey sandy clay.

PIDINGA FORMATION - dark brown to black lignitic clay with minor clean white sand lenses.

WEATHERED BASEMENT - grey clay containing subangular fragments of basement

?MULGATHING COMPLEX - dark green mylonitic quartz + plag + hbl + opx + sill + opaque + chlorite gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20132

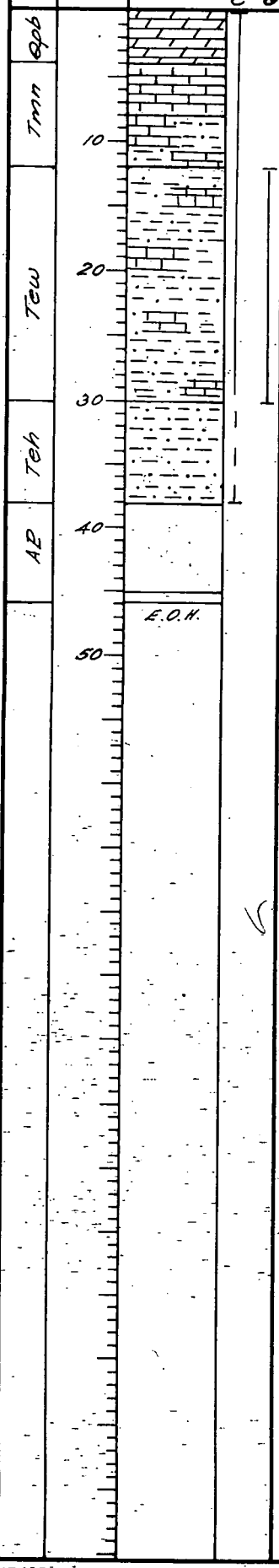
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO - NRD 5

DEPTH: 45.8m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - pink, hard calcreted aeolianite.

NULLARBOR LIMESTONE - orange recrystallized fine grained grainstone to packstone with common scattered quartz grains.

- light grey carbonaceous clay and hard recrystallized white fine grained packstone.

WILSON BUFF LIMESTONE light green and grey carbonaceous sandy clay and totally recrystallized limestone, glauconitic.

- bryozoal fragments.

- bryozoal fragments.

Red brown sandy clay.

WEATHERED BASEMENT - red brown and mauve sandy clay with angular basement fragments.

? MULGATHING COMPLEX - pink and grey coarse to very coarse-grained migmatite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20133

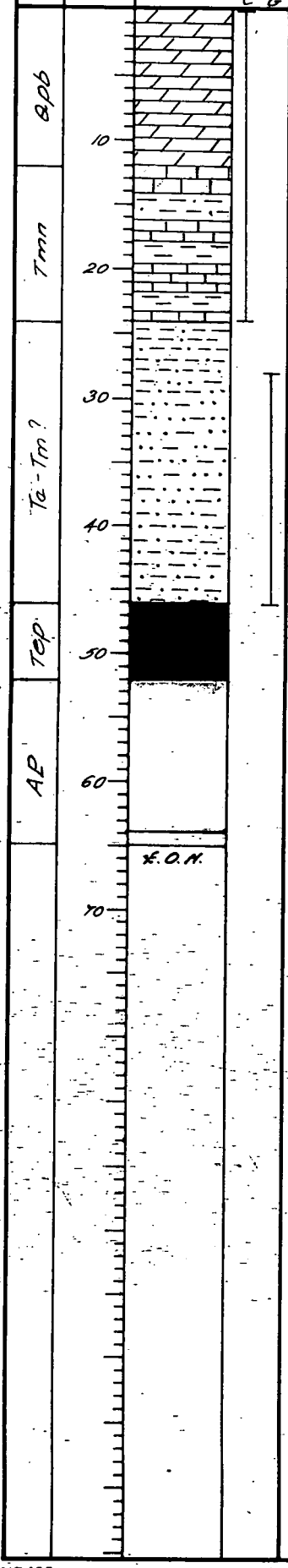
4614

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 6

DEPTH: 64.9m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - light pink-brown hard, pisolithic, calcreted aeolian grainstone.

NULLARBOR LIMESTONE - white-light orange recrystallized fine-grained packstone with common scattered quartz grains and white sandy carbonaceous mud.

-light grey and orange sandy clay.

-light grey-green medium grained clayey sand.

-light grey-green sandy clay.

PIDINGA FORMATION - dark brown-black lignitic clay.

WEATHERED BASEMENT - green and grey with fragments of mafic material from basement.

? MULGATHING COMPLEX - well foliated quartz + feld. + biot. + hbl gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20134

4614

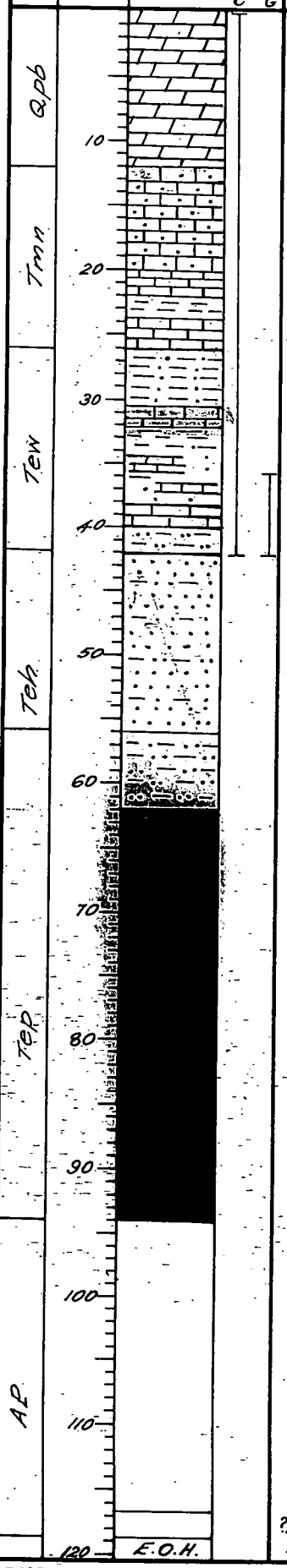
ME 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD-7

DEPTH: 118.7m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



* C - calcareous
G - glauconitic

DESCRIPTION

BRIDGEWATER FORMATION - Light pink-brown hard oolithic calcreted aeolian grainstone. Contains a possible wood fragment with calcite filled bore holes. (≈ 0.2mm diameter)

NULLARBOR LIMESTONE - indurated white - light yellow fine-grained sandy grainstone.

- white - light tan hard packstone with scattered quartz grains and minor carbonaceous clay.

WILSON BLUFF LIMESTONE - white malliable sandy carbonaceous clay.

- white clay fine-grained packstone in white sandy and silty carbonaceous clay.
- clays becoming greener, contain minor glauconite.

HAMPTON SANDSTONE - red brown moderately poorly sorted granule bearing fine to medium grained clayey sand.

- yellow-tan in colour.

- light grey-white fine-grained clayey sand.

PIDINGA FORMATION - dark brown-black lignitic clay.

WEATHERED BASEMENT - light grey sandy and silty clay, micaceous in part becoming greener towards the base with fragments of basement material.

?MULGATHING COMPLEX - dark green, coarse grained, massive amphibolite.

Sheet 1 of 1
Plan No. S.20135

4614

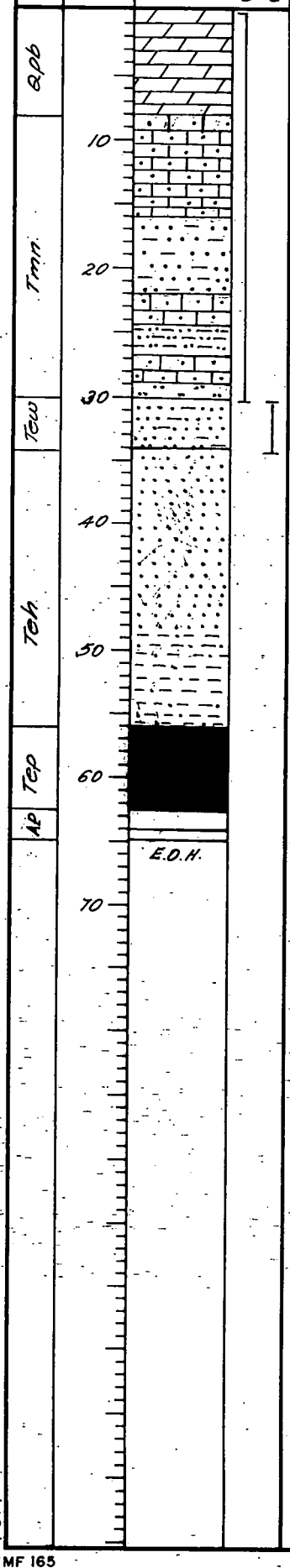
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 8

DEPTH: 64.7m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - pink-orange, pisolithic calcreted aeolian grainstone with scattered quartz grains.

NULLARBOR LIMESTONE - light yellow-orange fine-grained sandy grainstone.

- fine to very fine-grained quartz sand in an orange malleable clay matrix.

- white fine-grained sandy packstone and fine to very fine grain sand in white carbonaceous clay.

WILSON BLUFF LIMESTONE - khaki green fine to medium-grained quartz sand with minor green clay.

HAMPTON SANDSTONE - red brown, orange and grey medium-grained quartz sand with minor clay.

- red brown, orange and green clay with fine to very fine-grained quartz (20-40%).

PIDINGA FORMATION - dark brown lignitic clay with minor very fine-grained quartz more common towards the base.

WEATHERED BASEMENT - grey micaceous clay and sand.
? MULGATHING COMPLEX - grey phenocrystic qtz+feld+biotite+mylonite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan No. S 20136

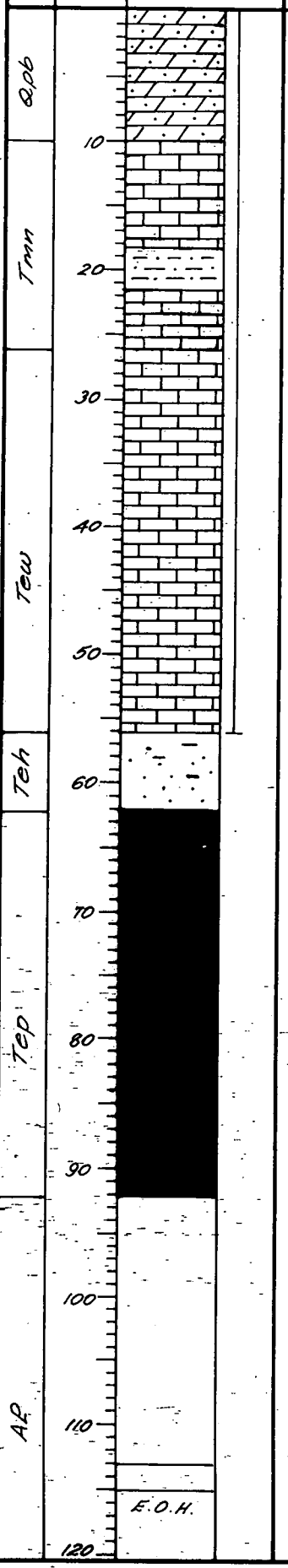
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 9

DEPTH: 115·0m INCLINATION: 90°

LOGGED BY: S.J.D. DATE: 1987 DRN:



DESCRIPTION

* C - calcareous

BRIDGEWATER FORMATION - pink-brown. pisolithic calcreted aeolian

NULLARBOR LIMESTONE - cream to pale pink, fine grained quartz sand with 20% carbonate mud.
- cream to pale brown recrystallized fine-grained packstone with carbonaceous mud.
- soft friable pale orange silty to fine-grained wackestone.

WILSON BLUFF LIMESTONE - recrystallized cream fine-grained packstone.

HAMPTON SANDSTONE - red brown to pink brown and yellow clay with 10-20% fine grained quartz sand.

PIDINGA FORMATION - dark-brown to black lignitic clay with minor silt size quartz sand.

WEATHERED BASEMENT - grey to brown clay with fine-grained to grit size, sub-rounded to angular quartz grains. Angular chips of basement near the base.

? MULGATHING COMPLEX - grey quartz+feldspar+biotite+mylonite.

Sheet 1 of 1
Plan N° S 20137

7614

MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 10

DEPTH: 18·7m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:

AGE / UNIT	DEPTH (m)	GRAPHIC LOG	DESCRIPTION
Qpb			BRIDGEWATER FORMATION - light pink grey pesolithic calcreted fine grained aeolianitic grainstone.
AZ	10		WEATHERED BASEMENT - grey-green micaceous clay with angular basement fragments.
	20	E.O.H. 18·7m.	? MULGATHING COMPLEX - medium to coarse-grained, dark green, massive amphibolite.

* C - calcareous

Sheet 1 of 1
Plan N° S 20138

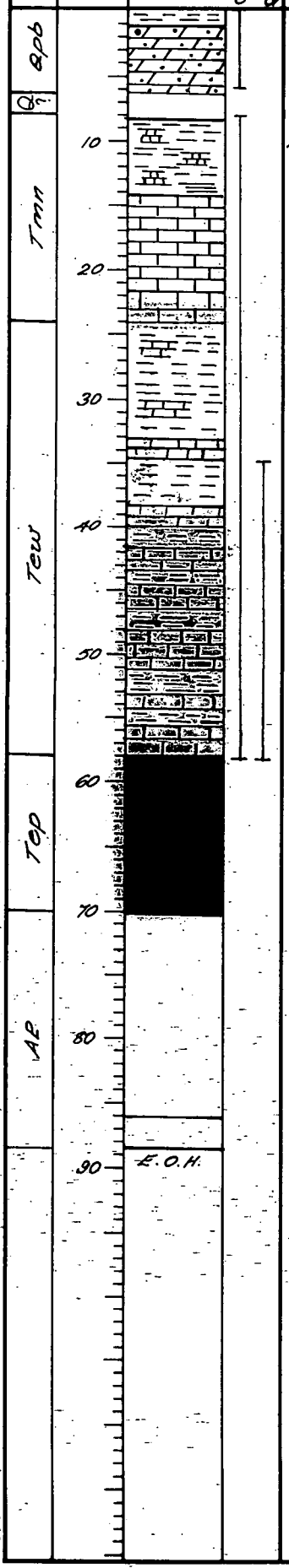
4614

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 11

DEPTH 88·6 m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

Red brown clay.

BRIDGEWATER FORMATION - hard, pink, pisolithic, calcreted, aeolian, grainstone.

- red brown clay.

NULLARBOR LIMESTONE - white carbonaceous clay with fragments of white recrystallized limestone containing scattered quartz grains.

- white recrystallized fine-grained packstone with scattered quartz grains.

WILSON BLUFF LIMESTONE.

- hard white partly recrystallized wackestone to packstone with scattered quartz grains, contains common sponge spicules and less common bryozoal and bivalve fragments. Interbedded with white carbonaceous clay.

- glauconitic in base.

PIDINGA FORMATION - dark brown to black lignitic clay with minor clean quartz interbeds.

WEATHERED BASEMENT - grey clay containing angular quartz feldspar and hornblende grains and minor pyrite and larger basement fragments at the base.

? MULGATHING COMPLEX - green-grey mylonitic quartz + K-spar + biot + chlor. gneiss.

* C - calcareous

G - glauconitic

Sheet 1 of 1

Plan N° S 20139

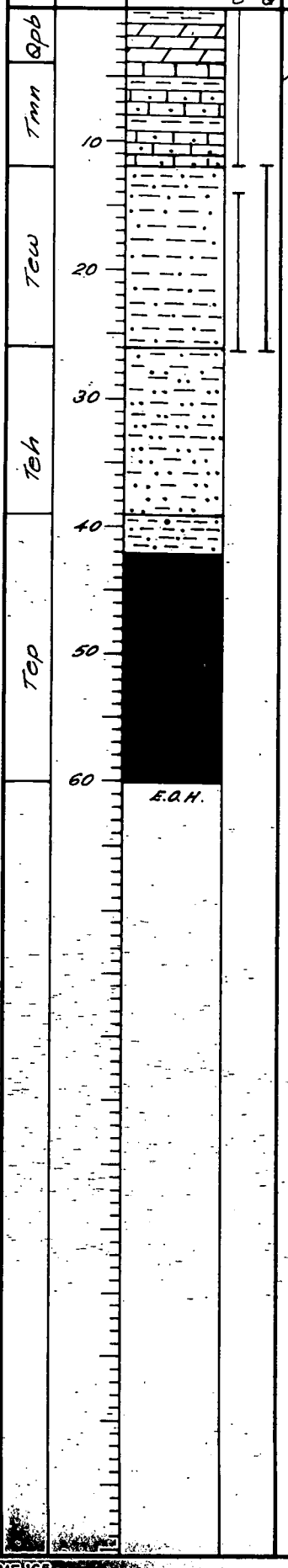
ME 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 12

DEPTH 60·0m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

Red brown clay.
BRIDGEWATER FORMATION - pink calcreted aeolianite.
NULLARBOR LIMESTONE - white to light orange recrystallized indurated fine to medium-grained grainstone/packstone composed of 20-40% quartz grains in a grey carbonaceous clay.

WILSON BLUFF LIMESTONE:-
L greenish grey and orange sandy clay.

HAMPTON SANDSTONE - red-brown and orange fine to med.-grained silty sandstone.

Light grey clay with 30% fine-grained quartz.
PIDINGA FORMATION - dark brown lignitic clay and silt.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan No: S 20140

MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 14

DEPTH 20.9m INCLINATION: 90°

LOGGED BY: S.J.D. DATE: 1987 DRN:

AGE / UNIT	DEPTH (m)	GRAPHIC LOG (C * G)	DESCRIPTION
Qpb			BRIDGEWATER FORMATION - light pink-brown hard pisolithic, calcreted, aeolian, grainstone.
Qph?	10		orange-brown clayey fine-grained sand with minor carbonate fragments.
Tew			cream silt to very fine-grained quartz sand with minor white fine-grained limestone fragments.
AP			WEATHERED BASEMENT - pinkish-brown clay with abundant basement fragments.
	20	E.O.H.	? MULGATHING COMPLEX - grey-pink, fine to medium-grained, porphyroblastic quartz + plag + biotite cataclasite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N°. S 20141

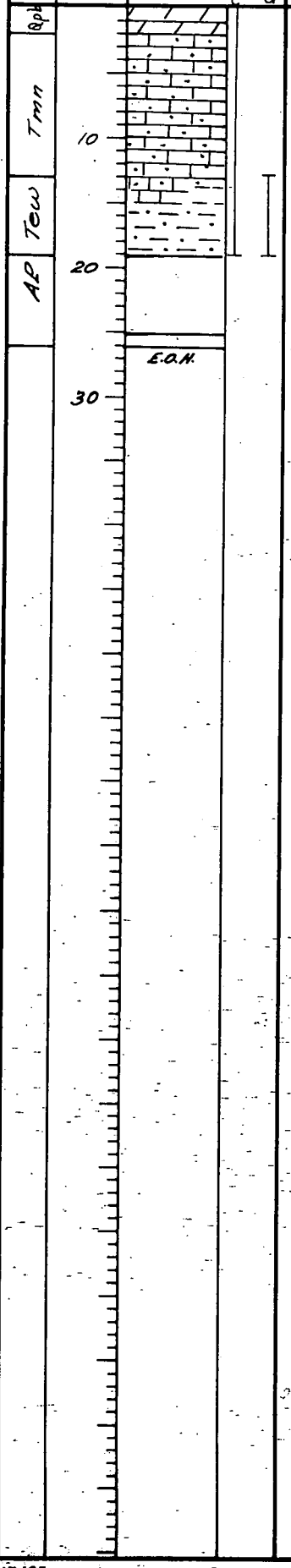
1614

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 15

DEPTH 26.06 m INCLINATION: 90°

LOGGED BY: S.J.D. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION.

NULLARBOR LIMESTONE - cream to pale-yellow hard grainstone with 20% of very fine grained quartz sand.

WILSON BLUFF LIMESTONE - cream to green sandy calcareous mudstone with minor fragments of recrystallized grainstone.

WEATHERED BASEMENT - cream to orange brown sandy clay with fragments of basement near the base.

?MULGATHING COMPLEX - green-black, medium grained, homogeneous amphibolite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20142

4614

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 16

DEPTH 5·9m INCLINATION: 90°

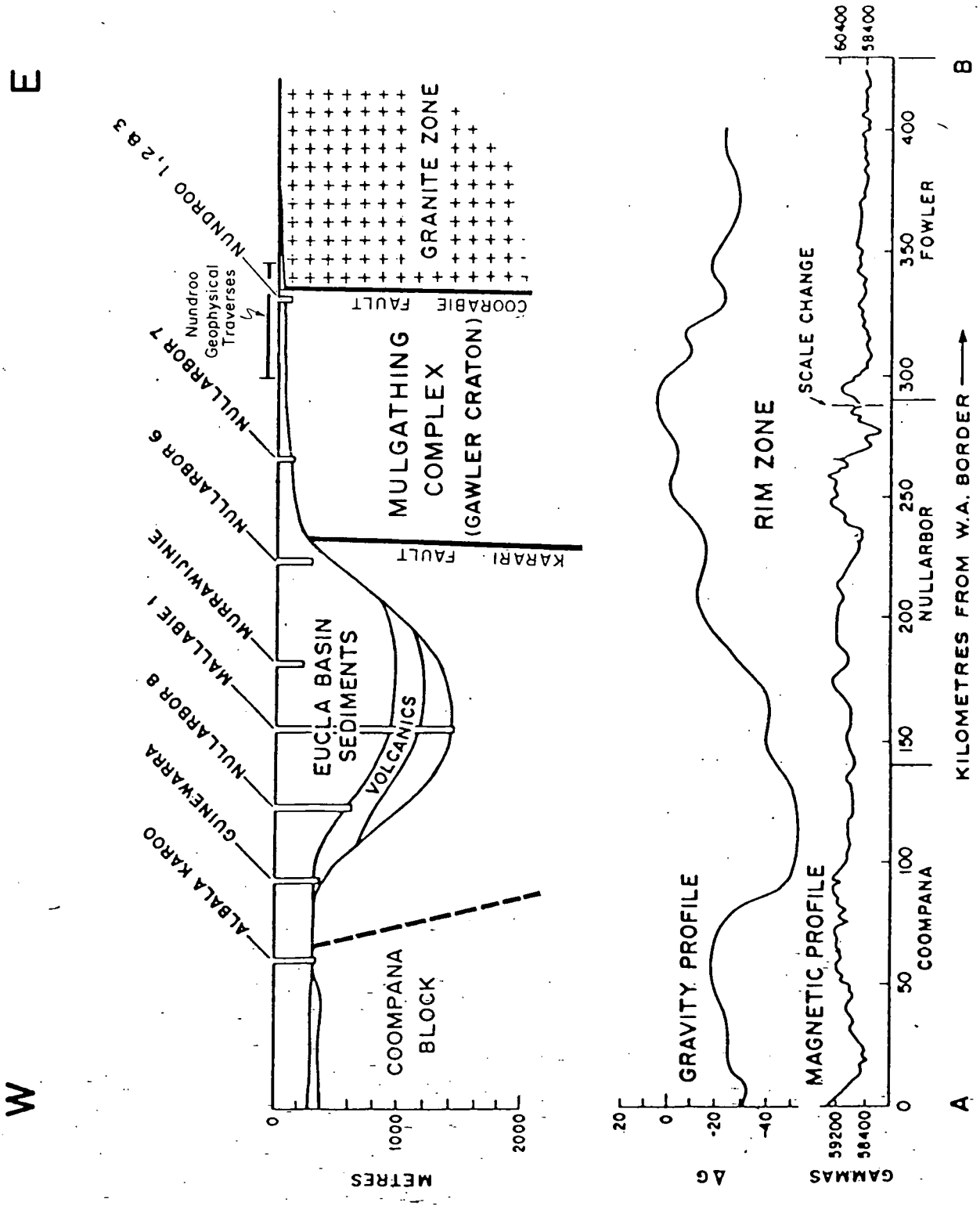
LOGGED BY: S.J.D. DATE: 1987

AGE / UNIT	DEPTH (m)	GRAPHIC LOG	DESCRIPTION
Qpb			BRIDGEWATER FORMATION - hard pale pink calcreted aeolian grainstone with scattered quartz grains. Occasional black pisoliths
Tew?	5		Wilson Bluff Limestone - cream recrystallised very fine-grained grainstone with 10-20% very fine-grained subangular quartz.
		E.O.H.	
	10		

Sheet 1 of 1
Plan No: S20166

4614

MF 165



Modified from Roberts, 1975

FIG. 4

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED: A.R. Martin | C.D.O | DATE

DRAWN: E. Calabio | SCALE

DATE: 26/5/88 | CHECKED

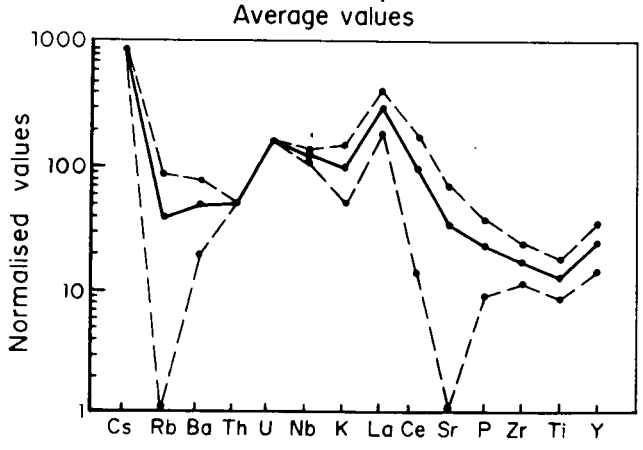
PLAN NUMBER: S20153

NUNDROO ROTARY DRILLHOLES
WESTERN GAWLER CRATON
REGIONAL GEOLOGICAL PROFILE

4614

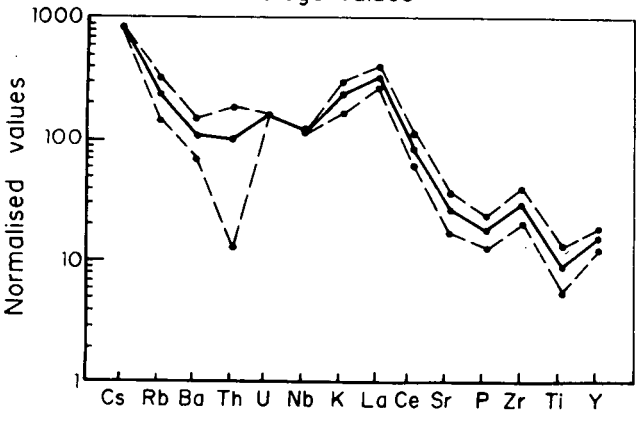
AMPHIBOLITES

Chondrite normalised plot (std dev.)
Average values



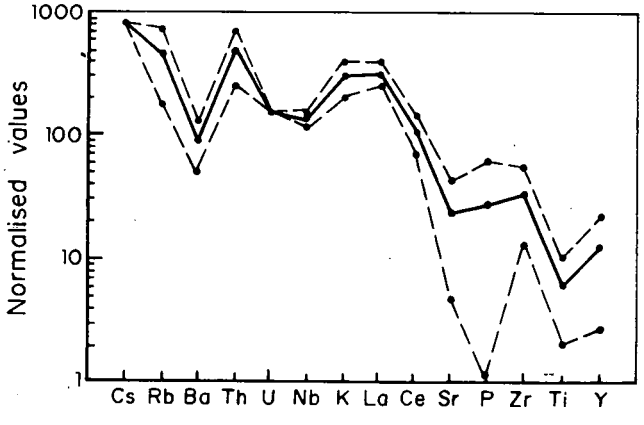
HBL PLAG GNEISS

Chondrite normalised plot (std dev.)
Average values



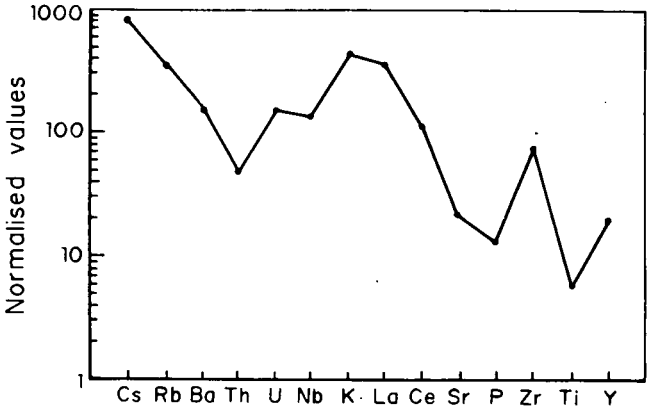
MYLONITES

Chondrite normalised plot (std dev.)
Average values



QTZ FELD BIOT GNEISS

Chondrite normalised plot 5334RS136



MIGMATITE

Chondrite normalised plot 5334RS107

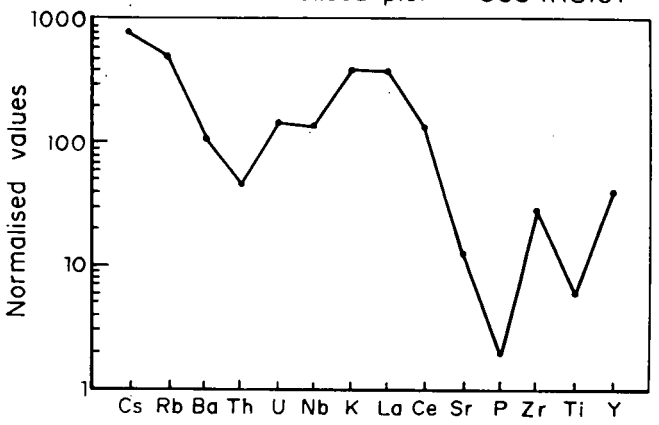


FIG. 13

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED A.R. Martin | C.D.O | DATE

DRAWN L.A.W. | SCALE

DATE 19·5·88 | PLAN NUMBER S.20157

CHECKED

NUNDROO ROTARY DRILLHOLES

CHONDRITE NORMALISED DIAGRAMS

4614

FIG. 3

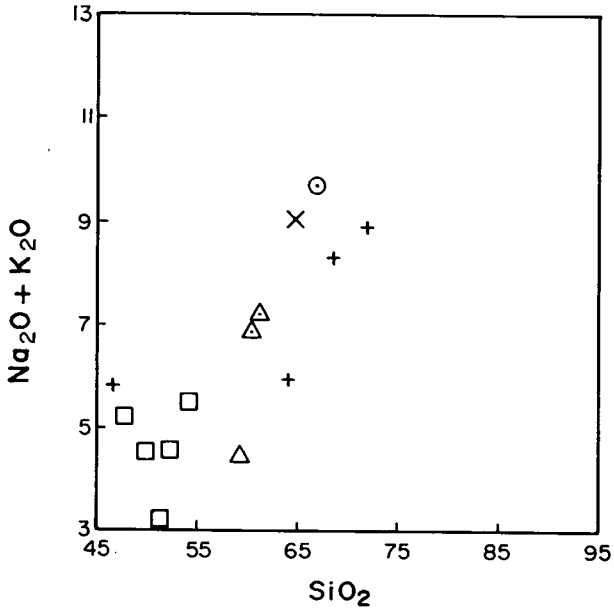
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

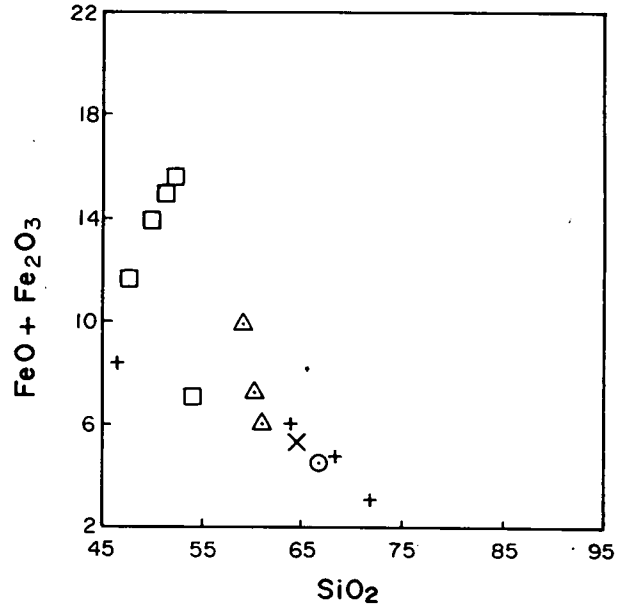
NUNDROO ROTARY DRILLHOLES

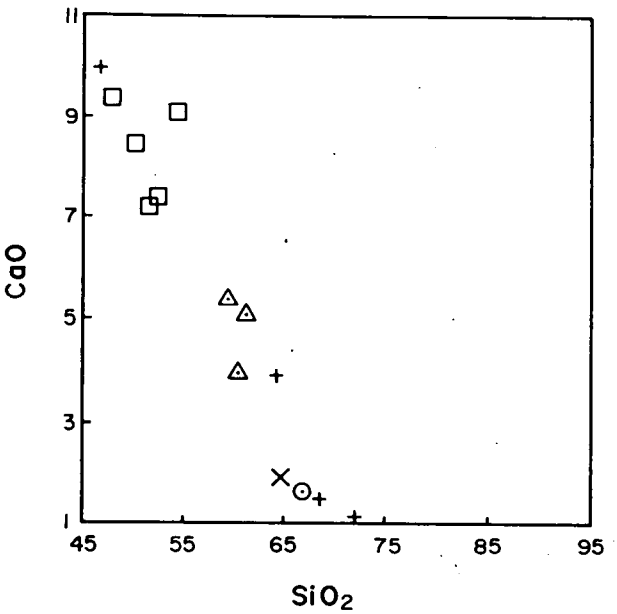
NUNDROO REGION

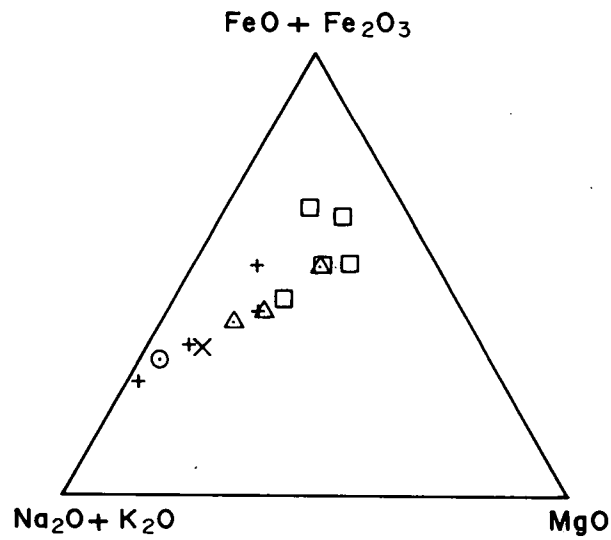
TOTAL MAGNETIC INTENSITY

COMPILED A.R. Martin	C.D.O. DATE
DRAWN E. Calabio	SCALE 1:250 000
DATE 5/5/88	PLAN NUMBER S20151
CHECKED	









⊙ Qtz field biot gneiss
□ Amphibolite
△ Hbl Plag gneiss
\+ Mylonite
× Migmatite

FIG. 12a

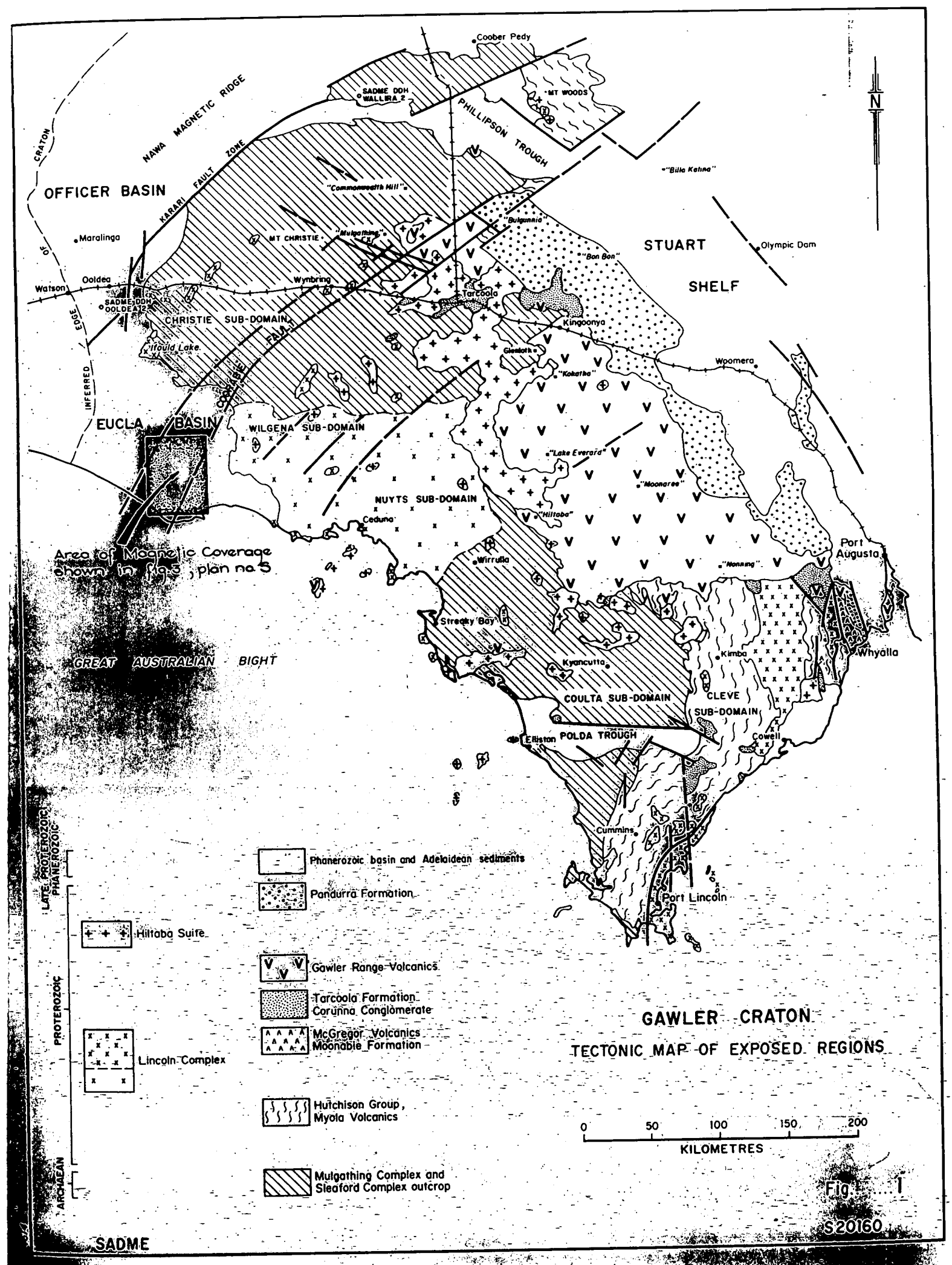
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

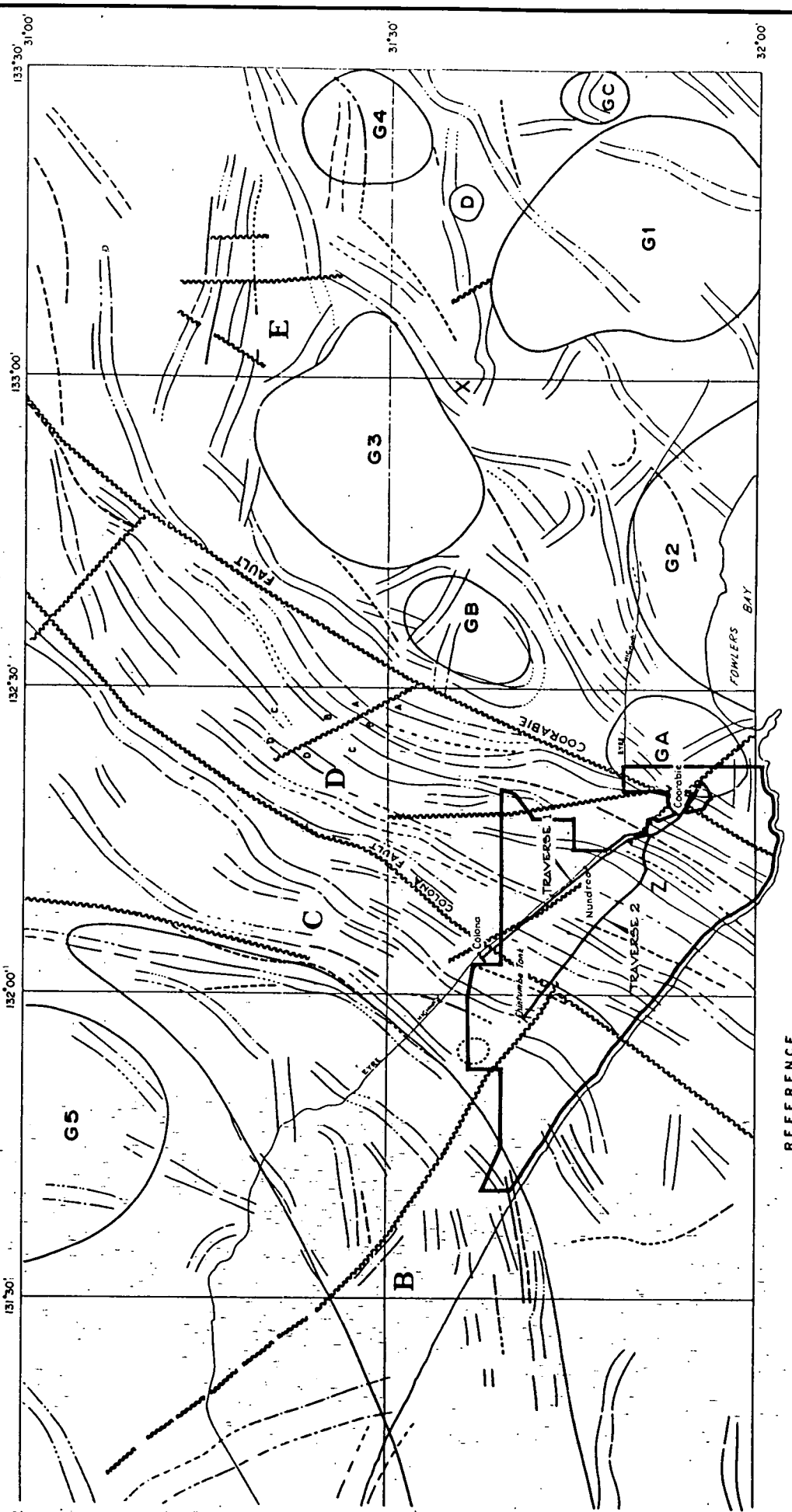
NUNDROO ROTARY DRILLHOLES

MAJOR ELEMENT GEOCHEMISTRY

COMPILED A.R. Martin	C D O DATE
DRAWN E. Calabio	SCALE graph
DATE 17/5/88	PLAN NUMBER S20155
CHECKED	

4614


Coober Pedy
SADME DDH WALLIRA 2
MT WOODS
PHILLIPSON TROUGH
NAWA MAGNETIC RIDGE
CRATON
KARARI FAULT ZONE
OFFICER BASIN
"Commonwealth Hill"
"Billa Kalina"
Maralinga
MT CHRISTIE
"Mulgathing"
"Bulgunnia"
STUART SHELF
Olympic Dam
"Bon Bon"
Watson
Ooldea
Wynbring
SADME DDH OOLDEA 12
Tarcoola
CHRISTIE SUB-DOMAIN
Kingoonya
Gladstone
Woomera
"Kokatha"
Mould Lake
EUCLA BASIN
WILGENA SUB-DOMAIN
"Lake Everard"
"Moonaree"
NUYTS SUB-DOMAIN
"Hiltaba"
Ceduna
Wirrulla
"Nonning"
Port Augusta
Area of Magnetic Coverage shown in fig 3, plan no 5
Streaky Bay
Whyalla
GREAT AUSTRALIAN BIGHT
Kyancutta
Kimba
COULTA SUB-DOMAIN
CLEVE SUB-DOMAIN
Elliston
POLDA TROUGH
Cowell
Cummins
Port Lincoln
LATE PROTEROZOIC PHANEROZOIC
PROTEROZOIC
ARCHAEAN
Phanerozoic basin and Adelaidean sediments
Pandurra Formation
Hiltaba Suite
Gawler Range Volcanics
Tarcoola Formation
Corunna Conglomerate
McGregor Volcanics
Moonable Formation
Lincoln Complex
Hutchison Group, Myola Volcanics
Mulgathing Complex and Sleaford Complex outcrop
GAWLER CRATON
TECTONIC MAP OF EXPOSED REGIONS
0 50 100 150 200
KILOMETRES
Fig 1
S20160
SADME



(After Roberts, 1975)

FIG. 3

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NUNDROO ROTARY DRILLHOLES
FOWLER AND NULLARBOR 1:250 000
MAGNETIC TREND

COMPILED A.R Martin	C.D.O. DATE
DRAWN E. Calabio	SCALE As shown
DATE 27/5/88	PLAN NUMBER S20152
CHECKED	

4614

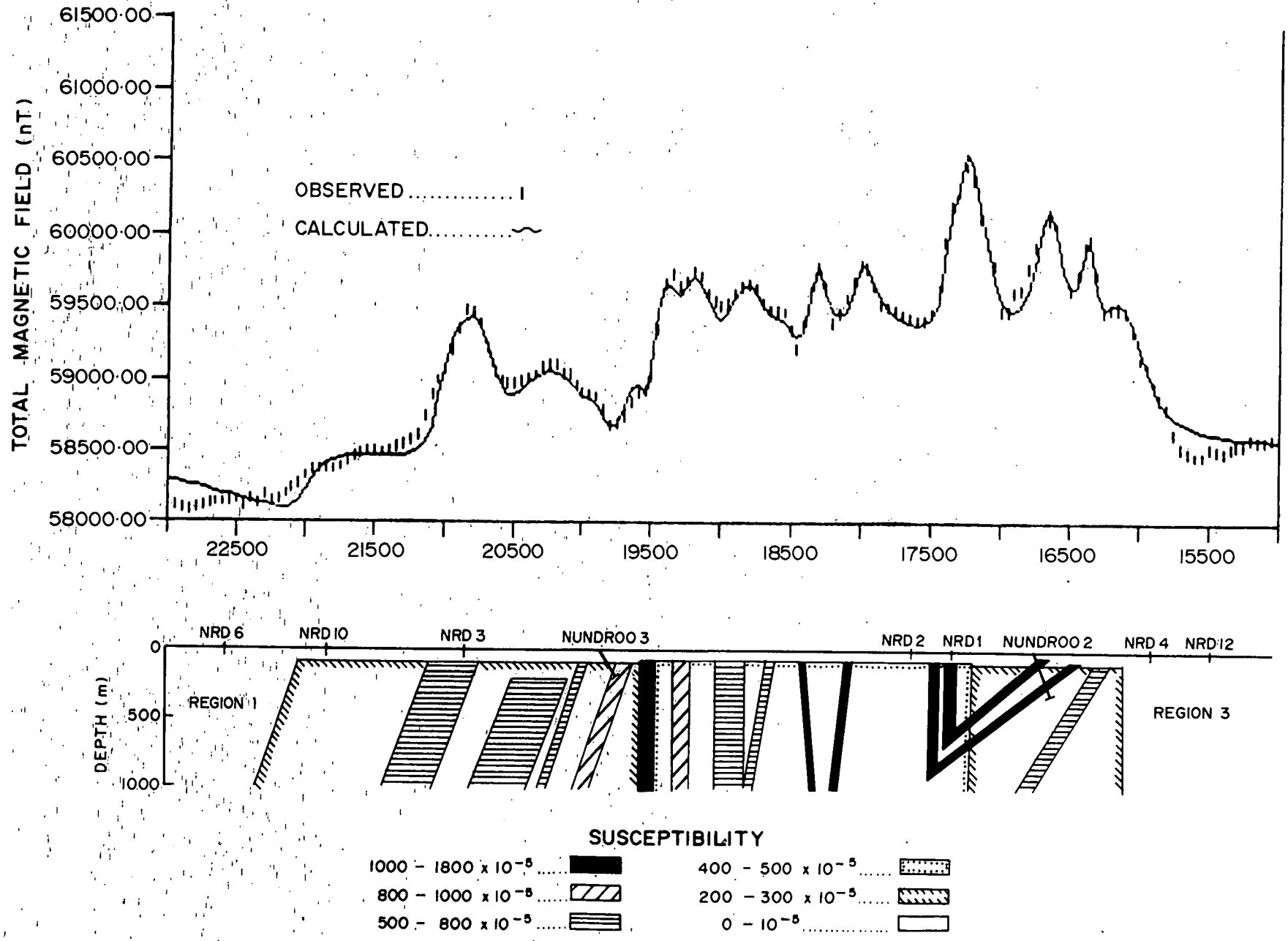


FIG. 8

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NUNDROO ROTARY DRILLHOLES

TRAVERSE 1

GROUND MAGNETIC PROFILE - (REGION 2)

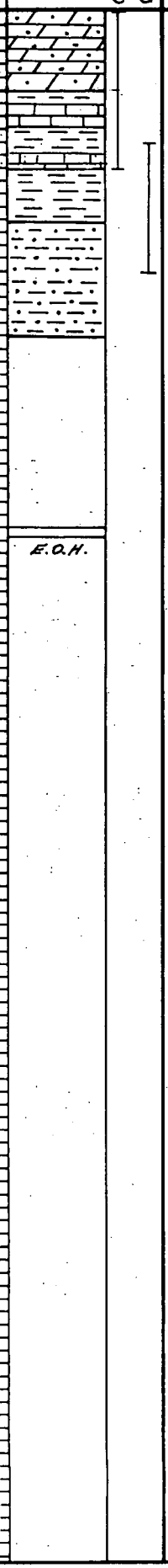
COMPILED *A. Martin*	DRAWN *E. Calabio*	DATE CHECKED *12/5/88*
C.D.O.	SCALE *graph*	PLAN NUMBER S 20154
DATE		

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 1

DEPTH: 41.1m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION — hard pink calcreted aedianite with scattered quartz grains.

NULLARBOR LIMESTONE - white to yellow fine to very fine-grained packstone inter-bedded with white carbonaceous mud, becomes glauconitic at base.

WILSON BLUFF LIMESTONE - khaki green clay with approx. 20% very fine grained to fine grained quartz grains.
- khaki green to orange sandy clay.

WEATHERED BASEMENT - dark red brown clay with scattered angular quartz grains and mafic grains of varying sizes.

? MULGATHING COMPLEX - interlayered dark grey quartz + plag + hbl + opx + grt + sill gneiss and qtz + plag + biot + grt gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20129

4614

MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 2

DEPTH : 70.0m ..... INCLINATION: 90° ....

LOGGED BY: A.R.M. .. DATE: 1987 .. DRN: ....

AGE / UNIT	DEPTH (m)	GRAPHIC LOG (C * G)	DESCRIPTION
Qpb			BRIDGEWATER FORMATION - hard brown-pink pisolithic calcreted aeolian grainstone, with scattered quartz grains.
Tmn	10		NULLARBOR LIMESTONE - white and yellow fine-grained recrystallized packstone with scattered quartz grains, interbedded with light grey to white carbonaceous mud.
Tew	20		WILSON BLUFF LIMESTONE - light grey to greenish carbonaceous mud with common quartz grains also glauconitic.
Teh	30		HAMPTON SANDSTONE - khaki green and brick red sandy clay and silt. Contains 30% fine grained quartz which increases to about 60% near the base. Glauconitic.
Tep	40		Light grey-green glauconitic clay with 20% very fine to silt size quartz grains.
	50		PIDINGA FORMATION - dark brown to black lignitic clay.
PE	60		WEATHERED BASEMENT.
	70	E.O.H.	?MULGATHING COMPLEX - grey medium-grained plag + hbl + opx gneiss.

PRELIMINARY PRINT ONLY
SUBJECT TO APPROVAL

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S20130

4614

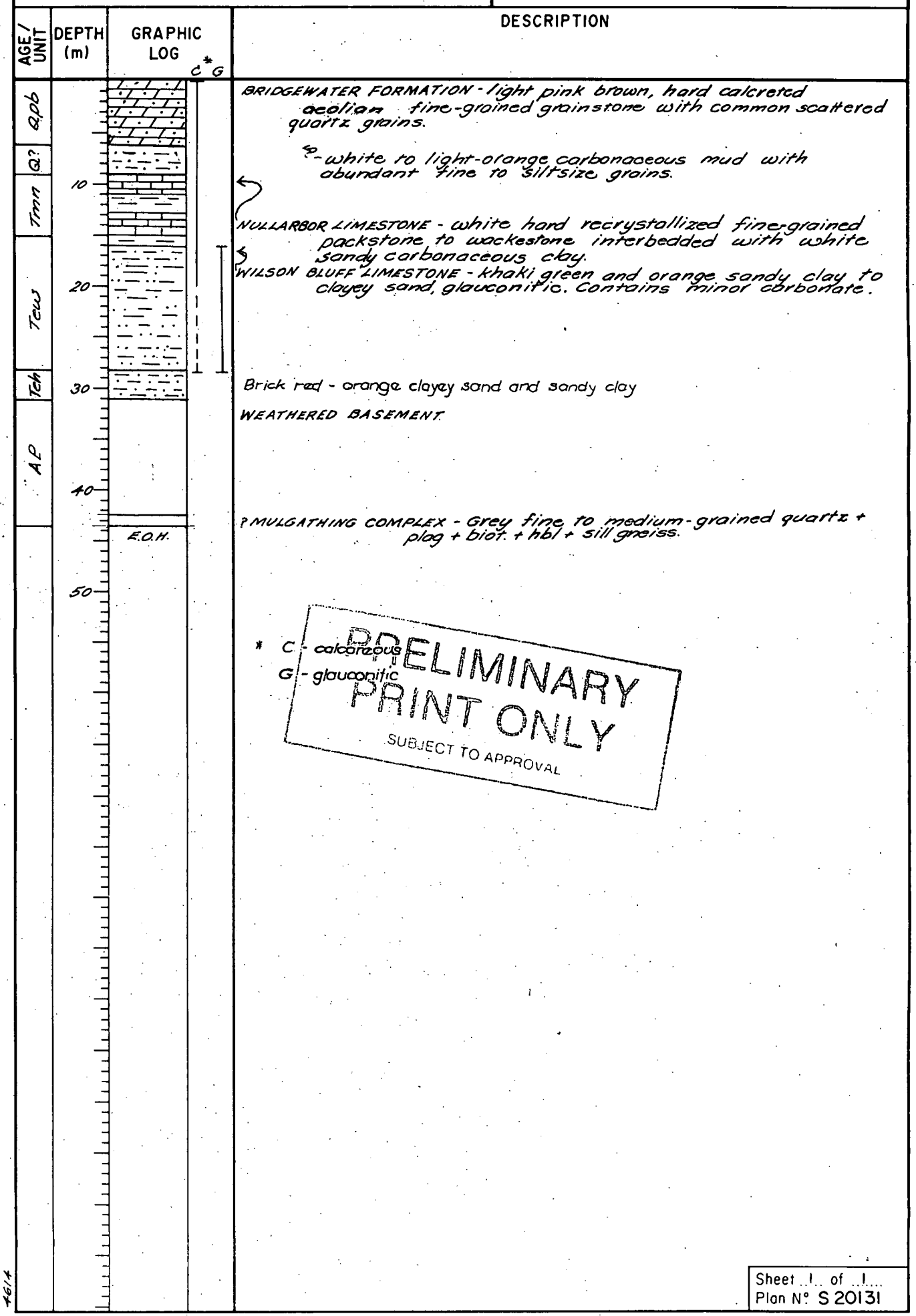
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 3

DEPTH: 43.32m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



Sheet 1 of 1
Plan N° S 20131

4614

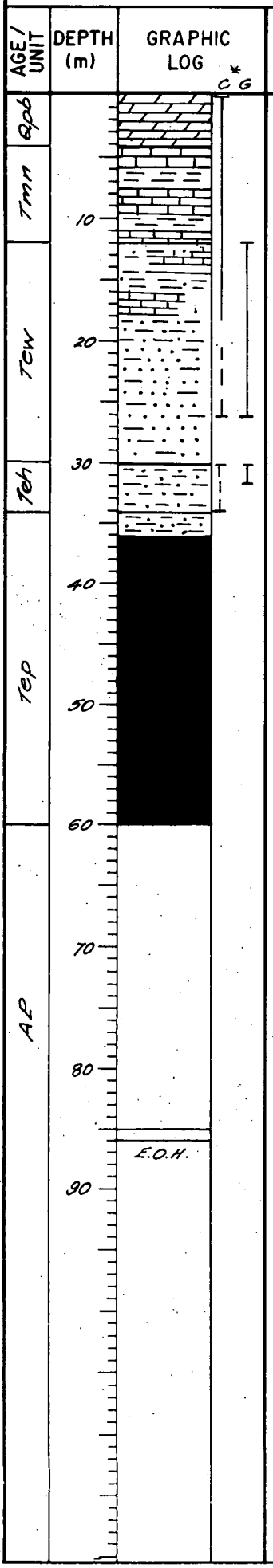
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 4

DEPTH: 86.0m ..... INCLINATION: 90° .....

LOGGED BY: A.R.M. DATE: 1987 DRN: .....



DESCRIPTION

BRIDGEWATER FORMATION - pink hard calcreted aeolianite.

NULLARBOR LIMESTONE - white to light orange recrystallized fine grained packstone with scattered quartz grains. Interbedded with white carbonaceous mud.

WILSON BLUFF LIMESTONE - light greenish grey carbonaceous mud with some interbedded fine-grained white packstone. Glauconitic, carbonaceous.

- light khaki to orange fine to medium-grained clayey sandstone with minor white limestone fragments.

HAMPTON SANDSTONE - light brown and red sandy clay.

- light grey sandy clay.

PIDINGA FORMATION - dark brown to black lignitic clay with minor clean white sand lenses.

WEATHERED BASEMENT - grey clay containing subangular fragments of basement.

?MULGATHING COMPLEX - dark green mylonitic quartz + plag + hbl + opx + sill + opaque + chlorite gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20132

4614

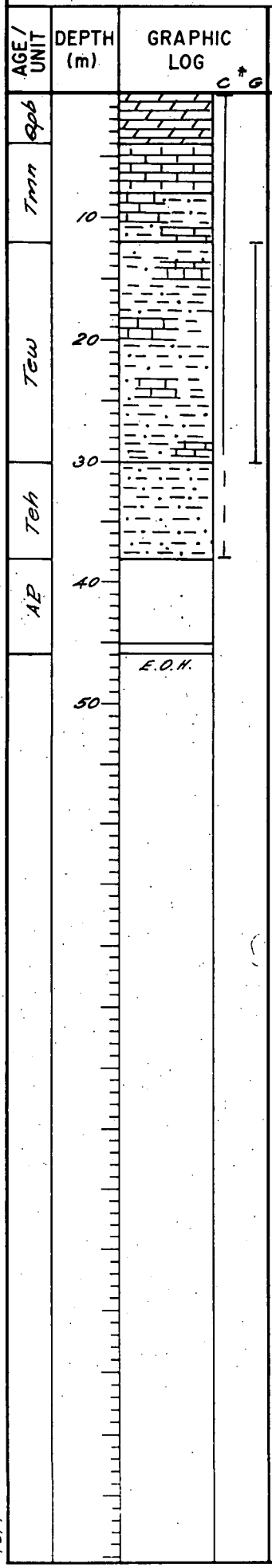
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO - NRD 5

DEPTH: 45.8m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - pink, hard calcreted aeolianite.

NULLARBOR LIMESTONE - orange recrystallized fine grained grainstone to packstone with common scattered quartz grains.

- light grey carbonaceous clay and hard recrystallized white fine grained packstone.

WILSON BUFF LIMESTONE light green and grey carbonaceous sandy clay and totally recrystallized limestone, glauconitic.

- bryozoal fragments.

- bryozoal fragments.

Red brown sandy clay.

WEATHERED BASEMENT - red brown and mauve sandy clay with angular basement fragments.

?MULGATHING COMPLEX - pink and grey coarse to very coarse-grained migmatite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20133

4614

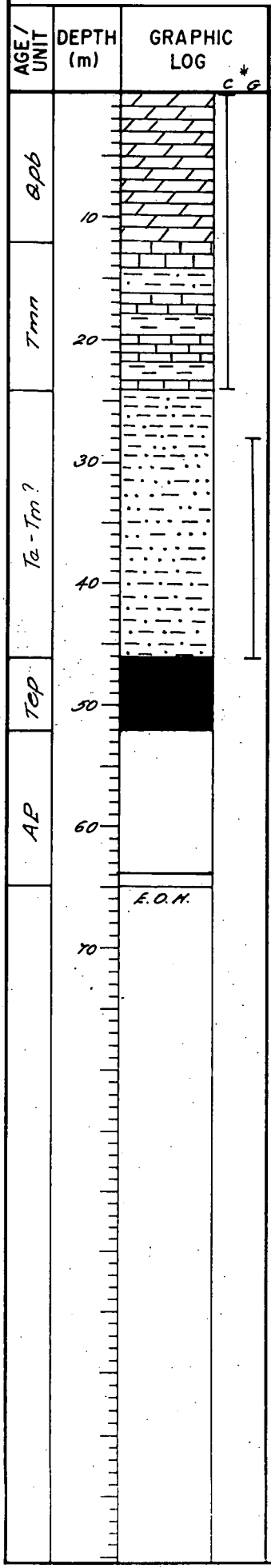
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 6

DEPTH: 64.9m ..... INCLINATION: 90° ....

LOGGED BY: A.R.M. DATE: 1987 DRN: .....



DESCRIPTION

BRIDGEWATER FORMATION - light pink-brown hard, pisolithic, calcreted aeolian grainstone.

NULLARBOR LIMESTONE - white-light orange recrystallized fine-grained packstone with common scattered quartz grains and white sandy carbonaceous mud.

-light grey and orange sandy clay.

-light grey-green medium grained clayey sand.

-light grey-green sandy clay.

PIDINGA FORMATION - dark brown-black lignitic clay.

WEATHERED BASEMENT - green and grey with fragments of mafic material from basement.

? MULGATHING COMPLEX - well foliated quartz + feld. + biot. + hbl gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20134

4614

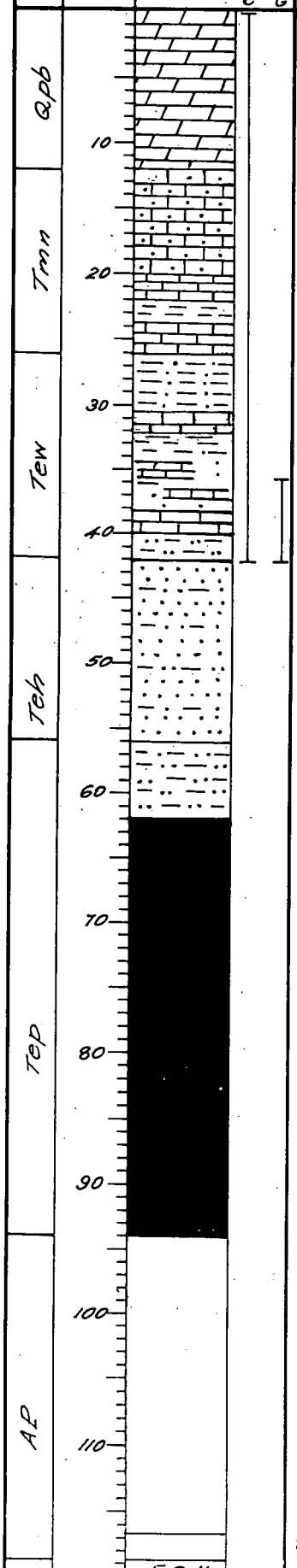
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 7

DEPTH: 118.7m ..... INCLINATION: 90° ....

LOGGED BY: A.R.M. .. DATE: 1987 .. DRN: .....



* C - calcareous
G - glauconitic

DESCRIPTION

BRIDGEWATER FORMATION - Light pink-brown hard pesolithic calcreted aeolian grainstone. Contains a possible wood fragment with calcite filled bore holes. (≃ 0.2mm diameter)

NULLARBOR LIMESTONE - indurated white - light yellow fine-grained sandy grainstone.

- white - light tan hard packstone with scattered quartz grains and minor carbonaceous clay.

WILSON BLUFF LIMESTONE - white malliable sandy carbonaceous clay.

- white clay fine-grained packstone in white sandy and silty carbonaceous clay.
- clays becoming greener, contain minor glauconite.

HAMPTON SANDSTONE - red brown moderately poorly sorted granule bearing fine to medium grained clayey sand.

- yellow - tan fine colour

- light grey - white fine-grained clayey sand.

PIDINGA FORMATION - dark brown - black lignitic clay.

WEATHERED BASEMENT - light grey sandy and silty clay, micaceous in part becoming greener towards the base with fragments of basement material.

?MULGATHING COMPLEX - dark green, coarse grained, massive amphibolite.

Sheet 1 of 1
Plan N° S.20135

4614

MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 10

DEPTH: 18·7m ..... INCLINATION: 90° .....

LOGGED BY: A.R.M. .. DATE: 1987 .. DRN: .....

AGE / UNIT	DEPTH (m)	GRAPHIC LOG	DESCRIPTION
Qpb			BRIDGEWATER FORMATION - light pink grey pesolithic calcreted fine grained aeolianitic grainstone.
AP	10		WEATHERED BASEMENT - grey-green micaceous clay with angular basement fragments.
	20	E.O.H. 18·7m	? MULGATHING COMPLEX - medium to coarse-grained, dark green, massive amphibolite.

* C - calcareous

Sheet 1 of 1
Plan N°: S 20138

461A

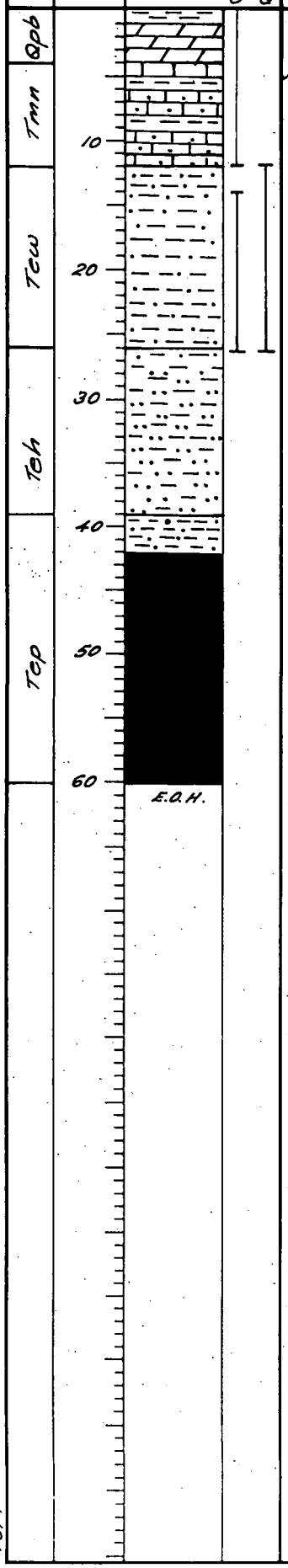
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 12

DEPTH 60·0m ..... INCLINATION: 90° ....

LOGGED BY: A.R.M. DATE: 1987 DRN: .....



DESCRIPTION

Red brown clay.

BRIDGEWATER FORMATION - pink calcreted aeolianite.

NULLARBOR LIMESTONE - white to light orange recrystallized indurated fine to medium-grained grainstone/packstone composed of 20-40% quartz grains in a grey carbonaceous clay.

WILSON BLUFF LIMESTONE:-
L greenish grey and orange sandy clay.

HAMPTON SANDSTONE - red-brown and orange fine to med.-grained silty sandstone.

Light grey clay with 30% fine-grained quartz.

PIDINGA FORMATION - dark brown lignitic clay and silt.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20140

46/4

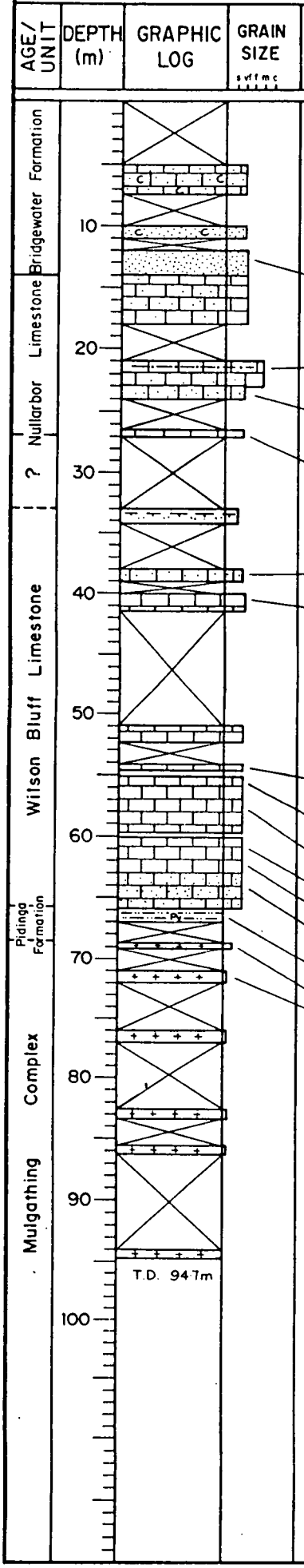
MF 165

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA

NUNDROO NRD - 13

DEPTH . . 94·7 m . . . . . INCLINATION . . 90° . . .

LOGGED BY . . M.C.B. . . DATE . 1987 . .



DESCRIPTION

Calcrated, orange-brown and pink very fine-grained, moderately-well sorted calcarenite or grainstone with 5-20% very fine to silt size quartz grains. Black pisoliths with laminated red halos (3-10mm).

orange-brown, partly calcareous, very fine-grained, well sorted, friable sandstone.

pale brown, calcareous, muddy, very fine-grained, well sorted sand. 10% indurated white chips of sandy limestone.

white, indurated, very fine-grained, recrystallized limestone. Slightly sandy in part.

Brown, medium-grained, well sorted, recrystallized, indurated, skeletal grainstone. Trace miliolids. Thin interbeds (±5mm) of well sorted, fine-grained sand on erosional base, slightly calcareous with mud matrix.

Sandy (10-55%), fine to very fine-grained skeletal grainstone / packstone. Scattered algal bodies skeletal fragments.

Pale grey, fine to very fined-grained, porous, skeletal grainstone / packstone. Trace glauconite Minor quartz < 2·5%.

Greenish grey, moderately indurated, calcareous mudstone to very fine-grained sandstone. Glauconitic. Contains sponge spicules

Pale grey brown, very friable, very fine-grained, skeletal grainstone. < 25% quartz. Spicular. Increase quartz at bottom 35%.

Pale grey, very fine-grained, skeletal, glauconitic, bryozoal wackestone to mudstone. Trace gastropod, bivalve or brachiopod fragments. Glauconitic.

Pale grey, very fine-grained wackestone to mudstone.

Pale grey, very fine-grained, glauconitic, bryozoal, wackestone to mudstone. With 25% coarse grainstone fragments. Trace molluscs, bivalve and brachiopods.

Pale grey, very fine to fine-grained, glauconitic, bryozoal wackestone, local mudstone and packstone.

Darker grey, very fine-grained skeletal, glauconitic wackestone with patches of very dark, organic 'rich' mud.

Grey indurated, skeletal, bryozoal packstone to mudstone. Locally glauconitic small brachiopods

Grey green, very glauconitic, sandy, skeletal, richly bryozoal packstone to wackestone. 5-20% medium-grained quartz.

Black, carbonaceous, partly pyritic, silty clay. Thin, coarse-grained, poorly sorted sandy lenses.

Pale grey, sandy clay with minor muscovite. Weathered basement.

Pale grey-green, gritty clay. Weathered basement.

Pale grey, gritty clay

Pale grey-green, gritty clay.

Pale grey-green, gritty clay.

Pinkish grey, coarse-grained, porphyroblastic quartz-feldspar-biotite - garnet- magnetite gneiss.

SHEET . . 1 . . OF . . 1 . . .

PLAN Nº S20165

4614

MF 179

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 14

DEPTH 20.9m INCLINATION: 90°

LOGGED BY: S.J.D. DATE: 1987 DRN:

AGE / UNIT	DEPTH (m)	GRAPHIC LOG	C * G	DESCRIPTION
Qpb				BRIDGEWATER FORMATION - light pink-brown hard pisolithic, calcreted, aeolian, grainstone.
Qph?	10			orange-brown clayey fine-grained sand with minor carbonate fragments.
Tew				cream silt to very fine-grained quartz sand with minor white fine-grained limestone fragments.
AP				WEATHERED BASEMENT - pinkish-brown clay with abundant basement fragments.
	20	E.O.H.		? MULGATHING COMPLEX - grey-pink, fine to medium-grained, porphyroblastic quartz + plag + biotite cataclasite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20141

4614

MF 165

NUNDROO NRD - 1

LOGGED BY: A.R.M. DATE: 1987 DRN: .....

AGE / UNIT	DEPTH (m)	GRAPHIC LOG (C * G)	DESCRIPTION
Qpb			BRIDGEWATER FORMATION — hard pink calcreted aedianite with scattered quartz grains.
Tmn	10		NULLARBOR LIMESTONE - white to yellow fine to very fine-grained packstone inter-bedded with white carbonaceous mud, becomes glauconitic at base.
Tew	20		WILSON BLUFF LIMESTONE - khaki green clay with approx. 20% very fine grained to fine grained quartz grains. - khaki green to orange sandy clay.
AP	30		WEATHERED BASEMENT - dark red brown clay with scattered angular quartz grains and matic. grains of varying sizes.
	40	E.O.H.	? MULGATHING COMPLEX - interlayered dark grey quartz + plag + hbl + opx + gnt + sill. gneiss and qtz + plag + biot + gnt. gneiss.
	50		

* C - calcareous
G - glauconitic

Sheet ..1.. of ...1...
Plan N°: S 20129

1614

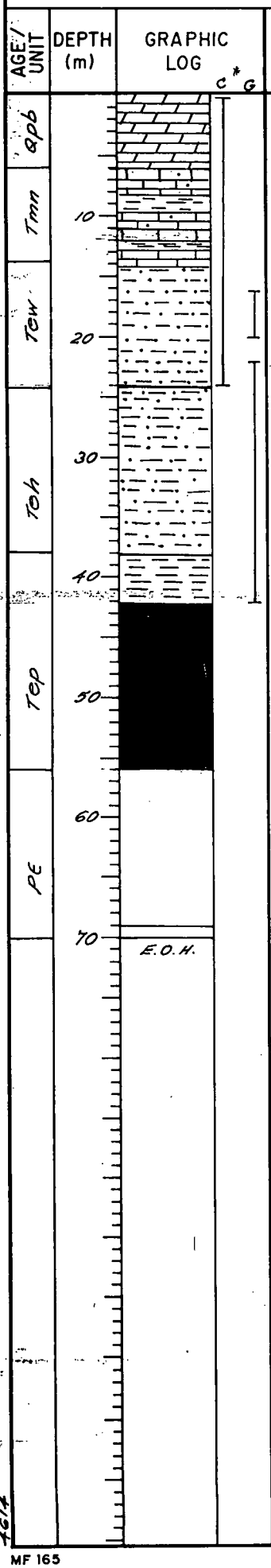
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 2

DEPTH : 70.0m ..... INCLINATION: ..90°.....

LOGGED BY: A.R.M. .. DATE: 1987 .. DRN: .....



DESCRIPTION

BRIDGEWATER FORMATION - hard brown-pink pisolithic calcreted aeolian grainstone, with scattered quartz grains.

NULLARBOR LIMESTONE - white and yellow fine-grained recrystallized packstone with scattered quartz grains, interbedded with light grey to white carbonaceous mud.

WILSON BLUFF LIMESTONE - light grey to greenish carbonaceous mud with common quartz grains also glauconitic.

HAMPTON SANDSTONE - khaki green and brick red sandy clay and silt. Contains 30% fine grained quartz which increases to about 60% near the base. Glauconitic.

Light grey-green glauconitic clay with 20% very fine to silt size quartz grains.

PIDINGA FORMATION - dark brown to black lignitic clay.

WEATHERED BASEMENT.

?MULGATHING COMPLEX - grey medium-grained plag + hbl + opx gneiss.

* C - calcareous
G - glauconitic

Sheet ..1.. of ..1...
Plan N° S20130

4614

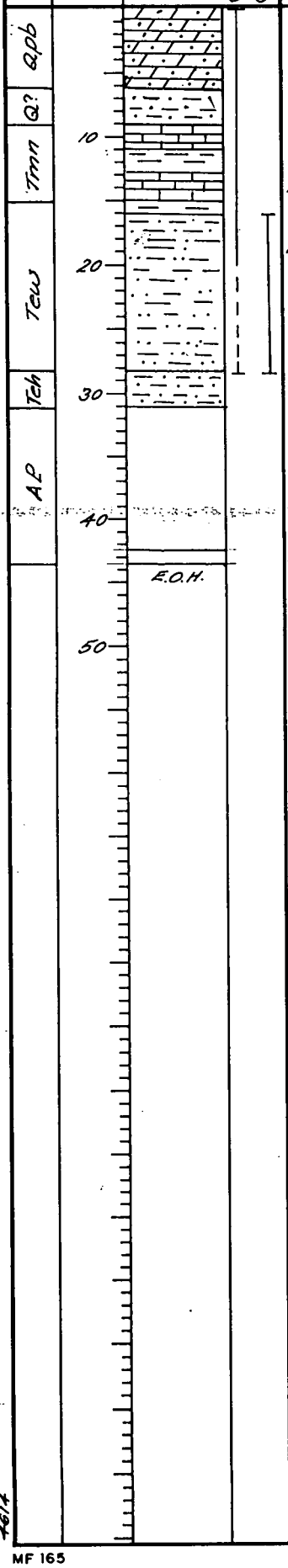
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 3

DEPTH: 43.32m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - light pink brown, hard calcreted aeolian fine-grained grainstone with common scattered quartz grains.

- white to light-orange carbonaceous mud with abundant fine to siltsize grains.

NULLARBOR LIMESTONE - white hard recrystallized fine-grained packstone to wackestone interbedded with white sandy carbonaceous clay.

WILSON BLUFF LIMESTONE - khaki green and orange sandy clay to clayey sand, glauconitic. Contains minor carbonate.

Brick red - orange clayey sand and sandy clay

WEATHERED BASEMENT.

? MULGATHING COMPLEX - Grey fine to medium-grained quartz + plag + biot. + hbl + sill gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20131

4614

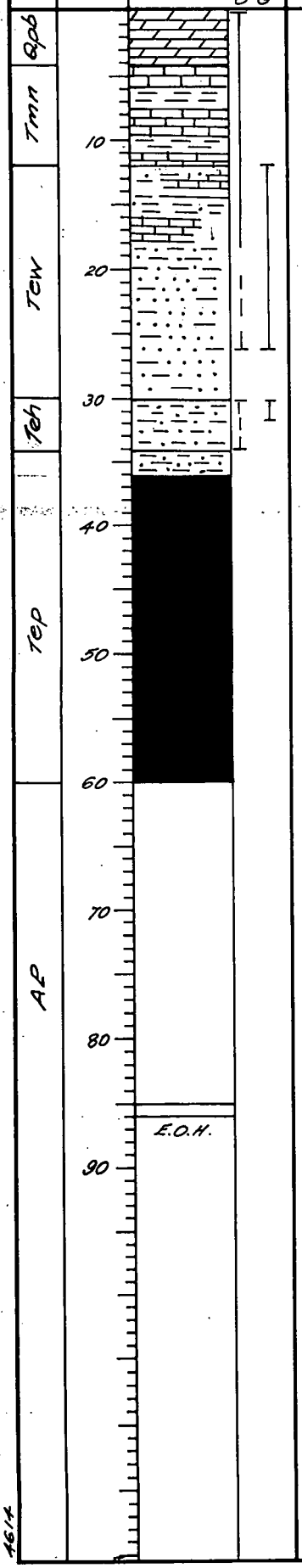
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 4

DEPTH: 86.0m ..... INCLINATION: 90° .....

LOGGED BY: A.R.M. DATE: 1987 DRN: .....



DESCRIPTION

BRIDGEWATER FORMATION - pink hard calcreted aeolianite.

NULLARBOR LIMESTONE - white to light orange recrystallized fine grained packstone with scattered quartz grains. Interbedded with white carbonaceous mud.

WILSON BLUFF LIMESTONE - light greenish grey carbonaceous mud with some interbedded fine-grained white packstone. Glauconitic, carbonaceous.

- light khaki to orange fine to medium-grained dayey sandstone with minor white limestone fragments.

HAMPTON SANDSTONE - light brown and red sandy clay.

- light grey sandy clay.

PIDINGA FORMATION - dark brown to black lignitic clay with minor clean white sand lenses.

WEATHERED BASEMENT - grey clay containing subangular fragments of basement.

?MULGATHING COMPLEX - dark green mylonitic quartz + plag + hbl + opx + sill + opaque + chlorite gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan No: S 20132

4614

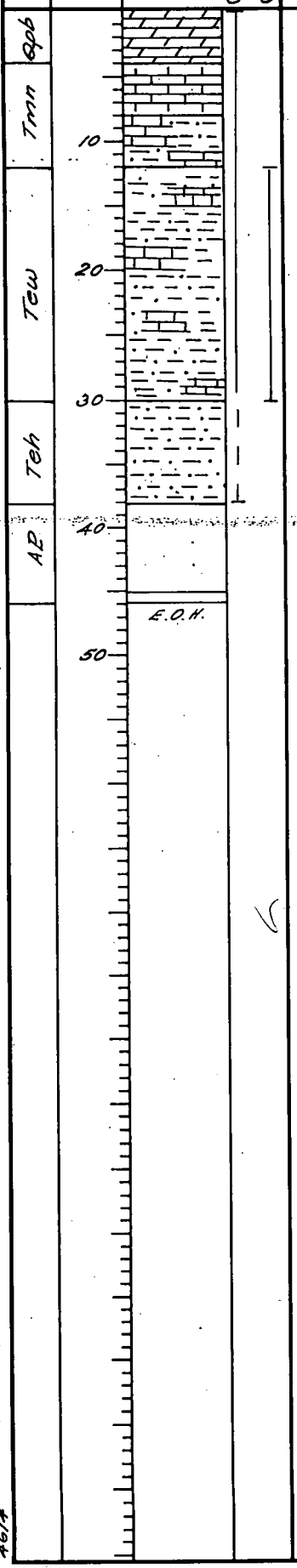
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO - NRD 5

DEPTH: 45.8m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - pink, hard calcreted aeolianite.

NULLARBOR LIMESTONE - orange recrystallized fine grained grainstone to packstone with common scattered quartz grains.

- light grey carbonaceous clay and hard recrystallized white fine grained packstone.

WILSON BUFF LIMESTONE light green and grey carbonaceous sandy clay and totally recrystallized limestone, glauconitic.

- bryozoal fragments.

- bryozoal fragments.

Red brown sandy clay.

WEATHERED BASEMENT - red brown and mauve sandy clay with angular basement fragments.

?MULGATHING COMPLEX - pink and grey coarse to very coarse-grained migmatite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20133

4614

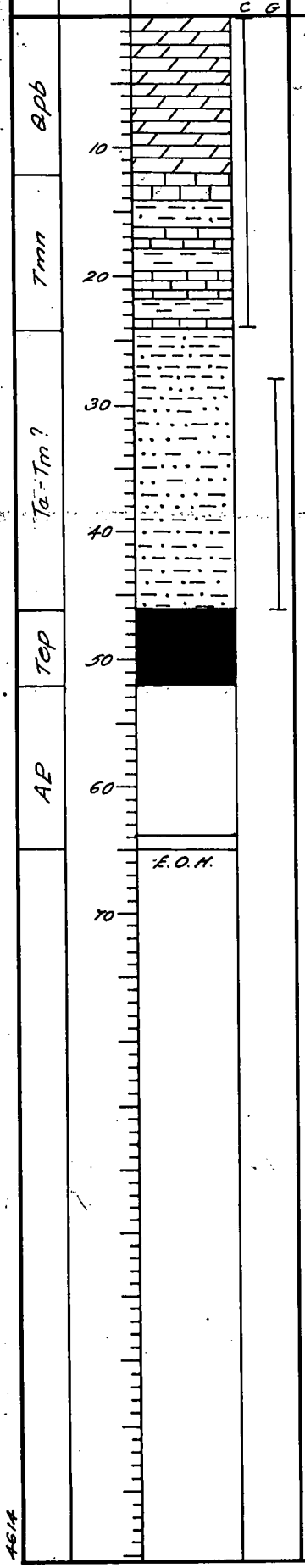
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 6

DEPTH: 64.9m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - light pink-brown hard, pisolithic, calcreted aeolian grainstone.

NULLARBOR LIMESTONE - white-light orange recrystallized fine-grained packstone with common scattered quartz grains and white sandy carbonaceous mud.

-light grey and orange sandy clay.

-light grey-green medium grained clayey sand.

-light grey-green sandy clay.

PIDINGA FORMATION - dark brown-black lignitic clay.

WEATHERED BASEMENT - green and grey with fragments of mafic material from basement.

? MULGATHING COMPLEX - well foliated quartz + feld. + biot. + hbl gneiss

* C - calcareous
G - glauconitic

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MF 165

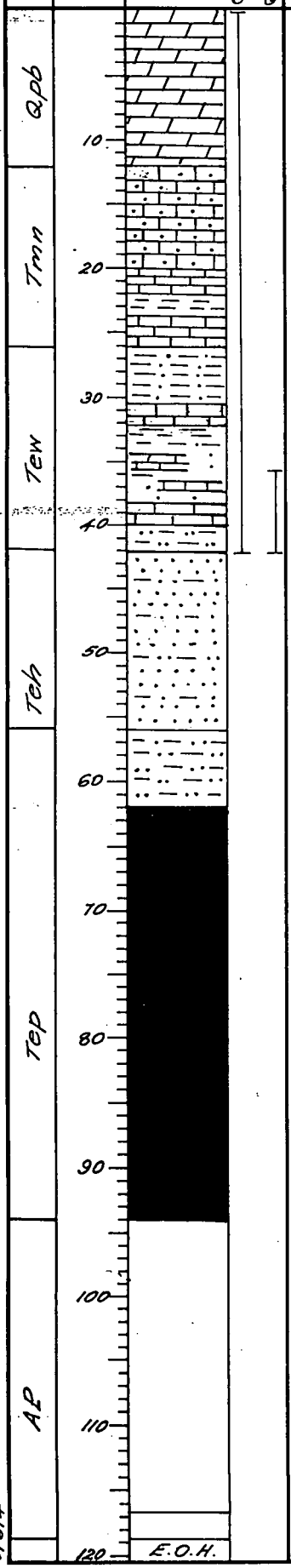
Sheet 1 of 1
Plan No: S 20134

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 7

DEPTH: 118.7m ..... INCLINATION: 90° ....

LOGGED BY: A.R.M. .. DATE: 1987 .. DRN: .....



* C - calcareous
G - glauconitic

DESCRIPTION

BRIDGEWATER FORMATION - Light pink-brown hard oolithic calcreted aeolian grainstone. Contains a possible wood fragment with calcite filled bore holes. (≃ 0.2mm diameter)

NULLARBOR LIMESTONE - indurated white - light yellow fine-grained sandy grainstone.

- white - light tan hard packstone with scattered quartz grains and minor carbonaceous clay.

WILSON BLUFF LIMESTONE - white malliable sandy carbonaceous clay

- white clay fine-grained packstone in white sandy and silty carbonaceous clay.
- clays becoming greener, contain minor glauconite.

HAMPTON SANDSTONE - red brown moderately poorly sorted granule bearing fine to medium grained clayey sand.

- yellow - tan in colour.

- light grey - white fine-grained clayey sand.

PIDINGA FORMATION - dark brown - black, lignitic clay.

WEATHERED BASEMENT - light grey sandy and silty clay, micaceous in part becoming greener towards the base with fragments of basement material.

?MULGATHING COMPLEX - dark green, coarse grained, massive amphibolite.

Sheet ..1.. of ..1...
Plan N° S 20135

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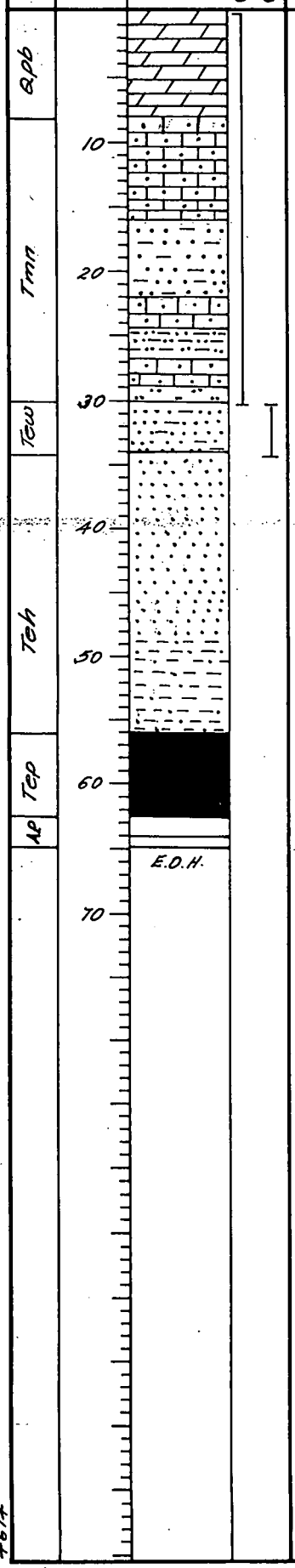
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 8

DEPTH: 64.7m ..... INCLINATION: 90° ....

LOGGED BY: A.R.M. .. DATE: 1987 .. DRN: .....



DESCRIPTION

BRIDGEWATER FORMATION - pink-orange, pisolithic calcreted aeolian grainstone with scattered quartz grains.

NULLARBOR LIMESTONE - light yellow-orange fine-grained sandy grainstone.

- fine to very fine-grained quartz sand in an orange malleable clay matrix.

- white fine-grained sandy packstone and fine to very fine grain sand in white carbonaceous clay.

WILSON BLUFF LIMESTONE - khaki green fine to medium-grained quartz sand with minor green clay.

HAMPTON SANDSTONE - red brown, orange and grey medium-grained quartz sand with minor clay.

- red brown, orange and green clay with fine to very fine-grained quartz (20-40%).

PIDINGA FORMATION - dark brown lignitic clay with minor very fine-grained quartz more common towards the base.

WEATHERED BASEMENT - grey micaceous clay and sand.
? MULGATHING COMPLEX - grey phenocrystic qtz+feld+biotite+mylonite

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20136

1614

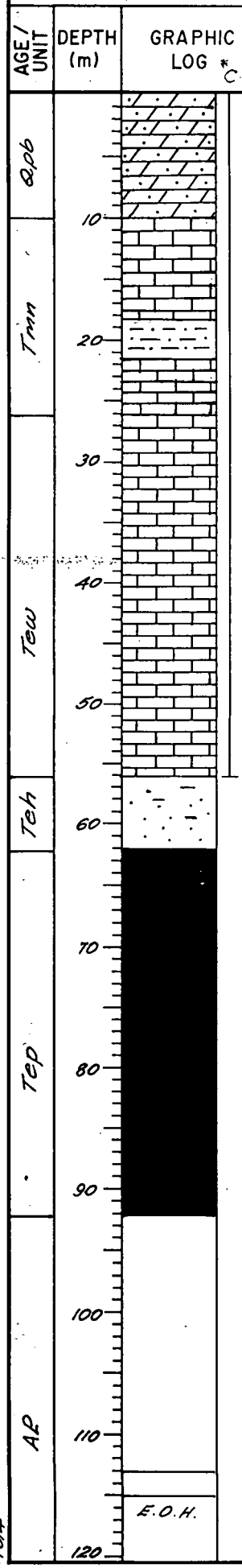
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 9

DEPTH: 115.0m ..... INCLINATION: 90° .....

LOGGED BY: S.J.D. .. DATE: 1987 .. DRN: .....



DESCRIPTION

* C - calcareous

BRIDGEWATER FORMATION - pink-brown pisolithic calcreted aeolian

NULLARBOR LIMESTONE - cream to pale pink, fine grained quartz sand with 20% carbonate mud.
- cream to pale brown recrystallized fine-grained packstone with carbonaceous mud.
- soft friable pale orange silty to fine-grained wackestone.

WILSON BLUFF LIMESTONE - recrystallized cream fine-grained packstone.

HAMPTON SANDSTONE - red brown to pink brown and yellow clay with 10-20% fine grained quartz sand.

PIDINGA FORMATION - dark-brown to black lignitic clay with minor silt size quartz sand.

WEATHERED BASEMENT - grey to brown clay with fine-grained to grit size, sub-rounded to angular quartz grains. Angular chips of basement near the base.

? MULGATHING COMPLEX - grey quartz+feldspar+biotite+mylonite.

Sheet ..1.. of ..1....
Plan N°: S 20137

T614

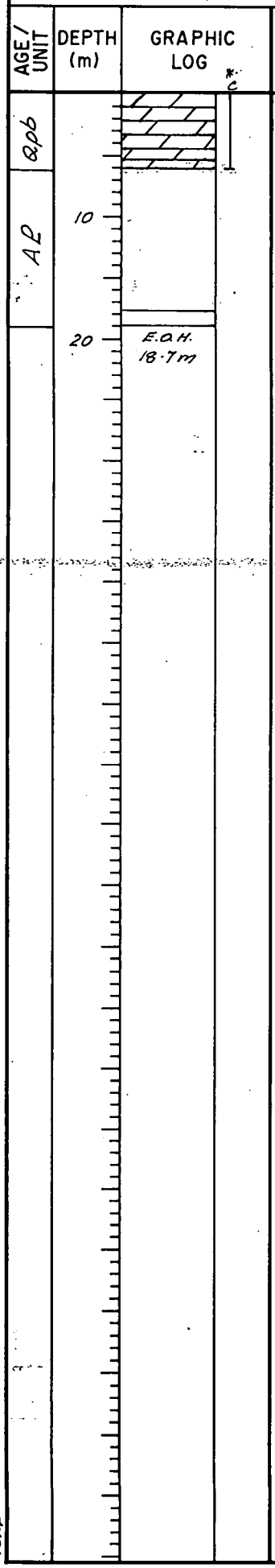
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 10

DEPTH: 18·7m ..... INCLINATION: 90° .....

LOGGED BY: A.R.M. .. DATE: 1987 .. DRN: .....



DESCRIPTION

BRIDGEWATER FORMATION - light pink grey pesolithic calcreted fine grained aeolianitic grainstone.

WEATHERED BASEMENT - grey-green micaceous clay with angular basement fragments.

? MULGATHING COMPLEX - medium to coarse-grained, dark green, massive amphibolite.

* C - calcareous

Sheet 1 of 1
Plan N° S 20138

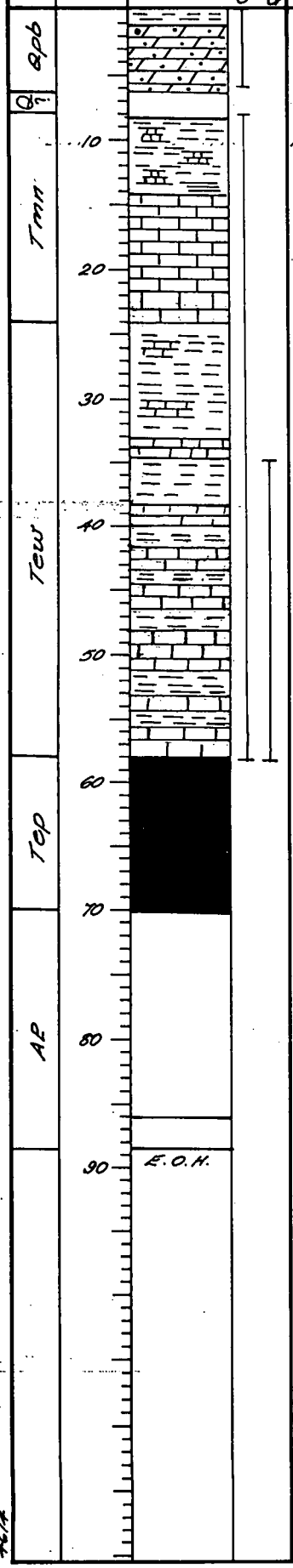
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 11

DEPTH 88·6 m ..... INCLINATION: 90° ....

LOGGED BY: A.R.M. ... DATE: 1987 .. DRN: .....



DESCRIPTION

Red brown clay.

BRIDGEWATER FORMATION - hard, pink, pisolithic, calcreted, aeolian, grainstone.

- red brown clay.

NULLARBOR LIMESTONE - white carbonaceous clay with fragments of white recrystallized limestone containing scattered quartz grains.

- white recrystallized fine-grained packstone with scattered quartz grains.

WILSON BLUFF LIMESTONE.

- hard white partly recrystallized wackestone to packstone with scattered quartz grains, contains common sponge spicules and less common bryozoal and bivalve fragments. Interbedded with white carbonaceous clay.

- glauconitic in base.

PIDINGA FORMATION - dark brown to black lignitic clay with minor clean quartz interbeds.

WEATHERED BASEMENT - grey clay containing angular quartz feldspar and hornblende grains and minor pyrite and larger basement fragments at the base.

? MULGATHING COMPLEX - green-grey mylonitic quartz + k-spar + biot + chlor. gneiss.

* C - calcareous
G - glauconitic

Sheet ..1.. of ..1....
Plan N° S 20139

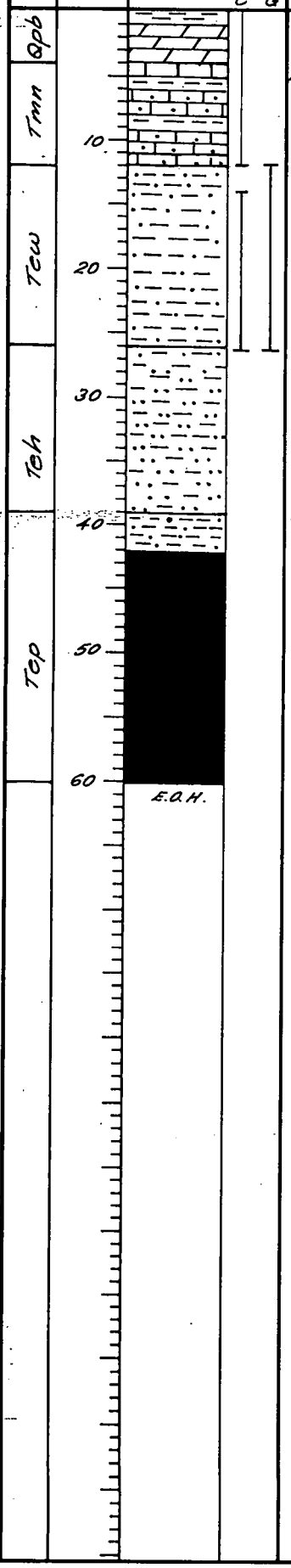
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 12

DEPTH 60.0m ..... INCLINATION: 90° ....

LOGGED BY: A.R.M. DATE: 1987 DRN: .....



DESCRIPTION

Red brown clay:
BRIDGEWATER FORMATION - pink calcreted aeolianite.

NULLARBOR LIMESTONE - white to light orange recrystallized indurated fine to medium-grained grainstone/packstone composed of 20-40% quartz grains in a grey carbonaceous clay.

WILSON BLUFF LIMESTONE:-
L greenish grey and orange sandy clay.

HAMPTON SANDSTONE - red-brown and orange fine to med.-grained silty sandstone.

Light grey clay with 30% fine-grained quartz.
PIDINGA FORMATION - dark brown lignitic clay and silt.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20140

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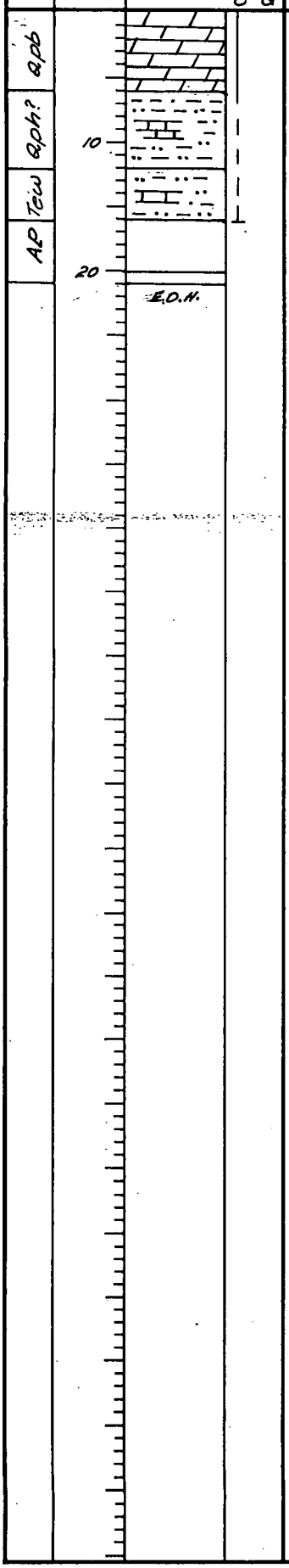
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 14

DEPTH 20.9m INCLINATION: 90°

LOGGED BY: S.J.D. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - light pink-brown hard pisolithic, calcreted, aeolian, grainstone.

orange-brown clayey fine-grained sand with minor carbonate fragments.

cream silt to very fine-grained quartz sand with minor white fine-grained limestone fragments.

WEATHERED BASEMENT - pinkish-brown clay with abundant basement fragments.

? MULGATHING COMPLEX - grey-pink, fine to medium-grained, porphyroblastic quartz + plag + biotite cataclasite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20141

4614

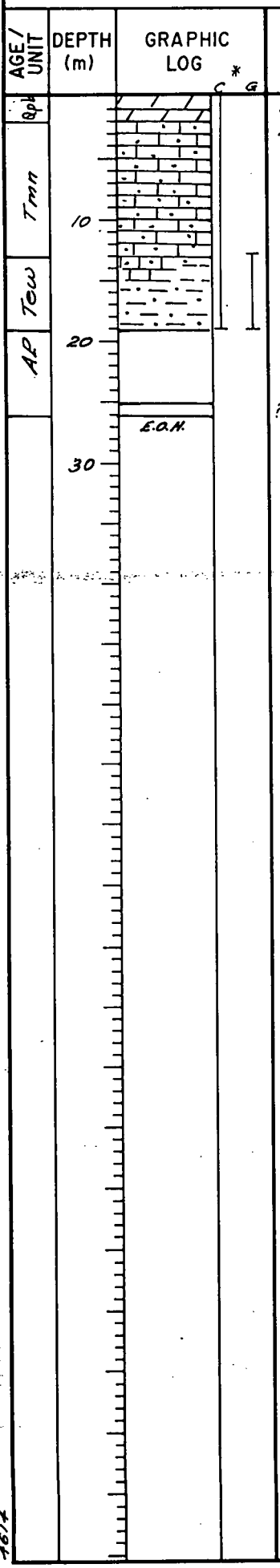
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 15

DEPTH 26.06m INCLINATION: 90°

LOGGED BY: S.J.D. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION.

NULLARBOR LIMESTONE - cream to pale-yellow hard grainstone with 20% of very fine grained quartz sand.

WILSON BLUFF LIMESTONE - cream to green sandy calcareous mudstone with minor fragments of recrystallized grainstone

WEATHERED BASEMENT - cream to orange brown sondy clay with fragments of basement near the base.

?MULGATHING COMPLEX - green-black, medium grained, homogeneous amphibolite.

* C - calcareous

G - glauconitic

1614

Sheet 1 of 1

Plan N° S 20142

MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 16

DEPTH . . . 5.9m . . . . . INCLINATION: . . 90° . . . .

LOGGED BY: . S.J.D. . . DATE: . 1987 . .

AGE/UNIT	DEPTH (m)	GRAPHIC LOG	DESCRIPTION
Qpb			BRIDGEWATER FORMATION - hard pale pink calcreted aeolian grainstone with scattered quartz grains. Occasional black pisoliths
Taw?	5		Wilson Bluff Limestone - cream recrystallised very fine-grained grainstone with 10-20% very fine-grained subangular quartz.
		E.O.H.	
	10		

Sheet .1.. of ...1...
Plan N° S 20166

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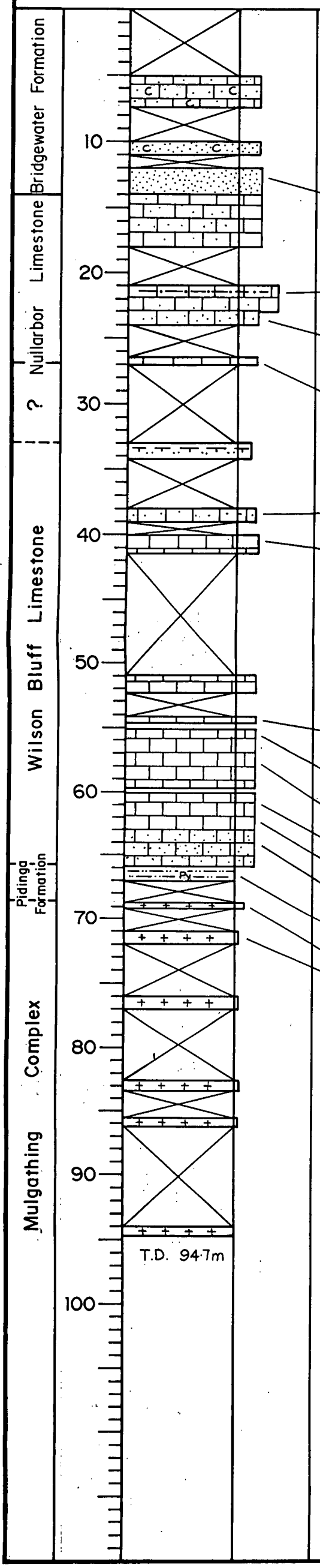
MF 165

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA

NUNDROO NRD - 13

DEPTH . . 94·7 m . . . . . INCLINATION . . 90° . . .

LOGGED BY . . M.C.B. . . DATE . 1987 . .



Calcreted, orange-brown and pink very fine-grained, moderately-well sorted calcarenite or grainstone with 5-20% very fine to silt size quartz grains. Black pisoliths with laminated red halos (3-10mm).

orange-brown, partly calcareous, very fine-grained, well sorted, friable sandstone.

pale brown, calcareous, muddy, very fine-grained, well sorted sand. 10% indurated white chips of sandy limestone.

white, indurated, very fine-grained, recrystallized limestone. Slightly sandy in part.

Brown, medium-grained, well sorted, recrystallized, indurated, skeletal grainstone. Trace miliolids. Thin interbeds (≈5mm) of well sorted, fine-grained sand on erosional base, slightly calcareous with mud matrix.

Sandy (10-55%), fine to very fine-grained skeletal grainstone / packstone. Scattered algal bodies skeletal fragments.

Pale grey, fine to very fined-grained, porous, skeletal grainstone / packstone. Trace glauconite. Minor quartz < 2·5%.

Greenish grey, moderately indurated, calcareous mudstone to very fine-grained sandstone. Glauconitic. Contains sponge spicules.

Pale grey brown, very friable, very fine-grained, skeletal grainstone. <25% quartz. Spicular. Increase quartz at bottom 35%.

Pale grey, very fine-grained, skeletal, glauconitic, bryozoal wackestone to mudstone. Trace gastropod, bivalve or brachiopod fragments. Glauconitic.

Pale grey, very fine-grained wackestone to mudstone.

Pale grey, very fine-grained, glauconitic, bryozoal, wackestone to mudstone. With 25% coarse grainstone fragments. Trace molluscs, bivalve and brachiopods.

Pale grey, very fine to fine-grained, glauconitic, bryozoal wackestone, local mudstone and packstone.

Darker grey, very fine-grained skeletal, glauconitic wackestone with patches of very dark, organic 'rich' mud.

Grey indurated, skeletal, bryozoal packstone to mudstone. Locally glauconitic small brachiopods

Grey green, very glauconitic, sandy, skeletal, richly bryozoal packstone to wackestone. 5-20% medium-grained quartz.

Black, carbonaceous, partly pyritic, silty clay. Thin, coarse-grained, poorly sorted sandy lenses.

Pale grey, sandy clay with minor muscovite. Weathered basement.

Pale grey-green, gritty clay. Weathered basement.

Pale grey, gritty clay

Pale grey-green, gritty clay.

Pale grey-green, gritty clay.

Pinkish grey, coarse-grained, porphyroblastic quartz-feldspar-biotite-garnet-magnetite gneiss.

SHEET . . 1 . . OF . . 1 . . .

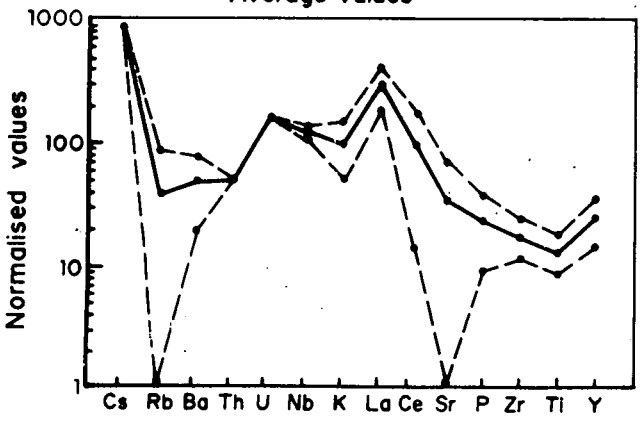
PLAN Nº S20165

4614

MF 179

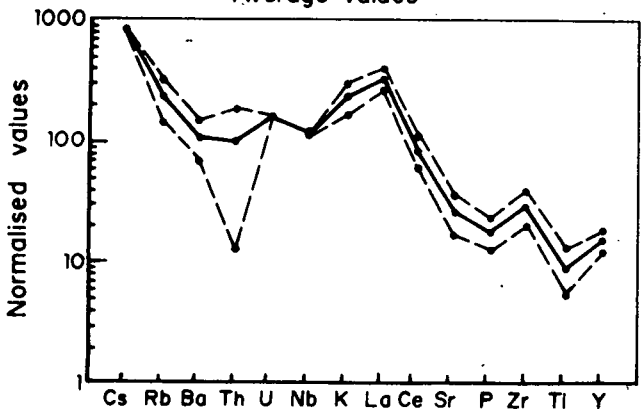
AMPHIBOLITES

Chondrite normalised plot (std dev.)
Average values



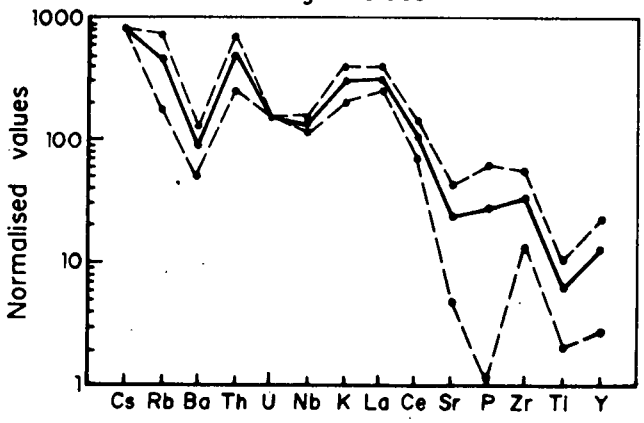
HBL PLAG GNEISS

Chondrite normalised plot (std dev.)
Average values



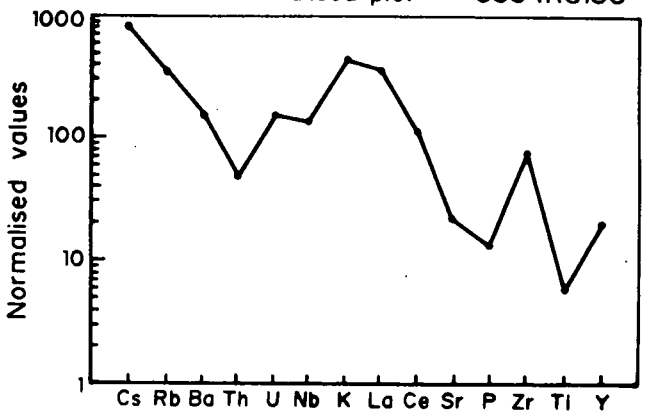
MYLONITES

Chondrite normalised plot (std dev.)
Average values



QTZ FELD BIOT GNEISS

Chondrite normalised plot 5334RS136



MIGMATITE

Chondrite normalised plot 5334RS107

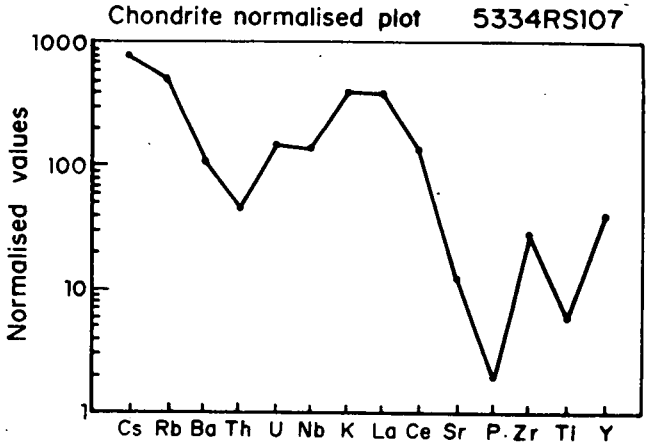


FIG. 13

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NUNDROO ROTARY DRILLHOLES

CHONDRITE NORMALISED DIAGRAMS

COMPILED A.R. Martin	C.D.O. DATE
DRAWN L.A.W.	SCALE
DATE 19·5·88	PLAN NUMBER S20157
CHECKED	

46/4

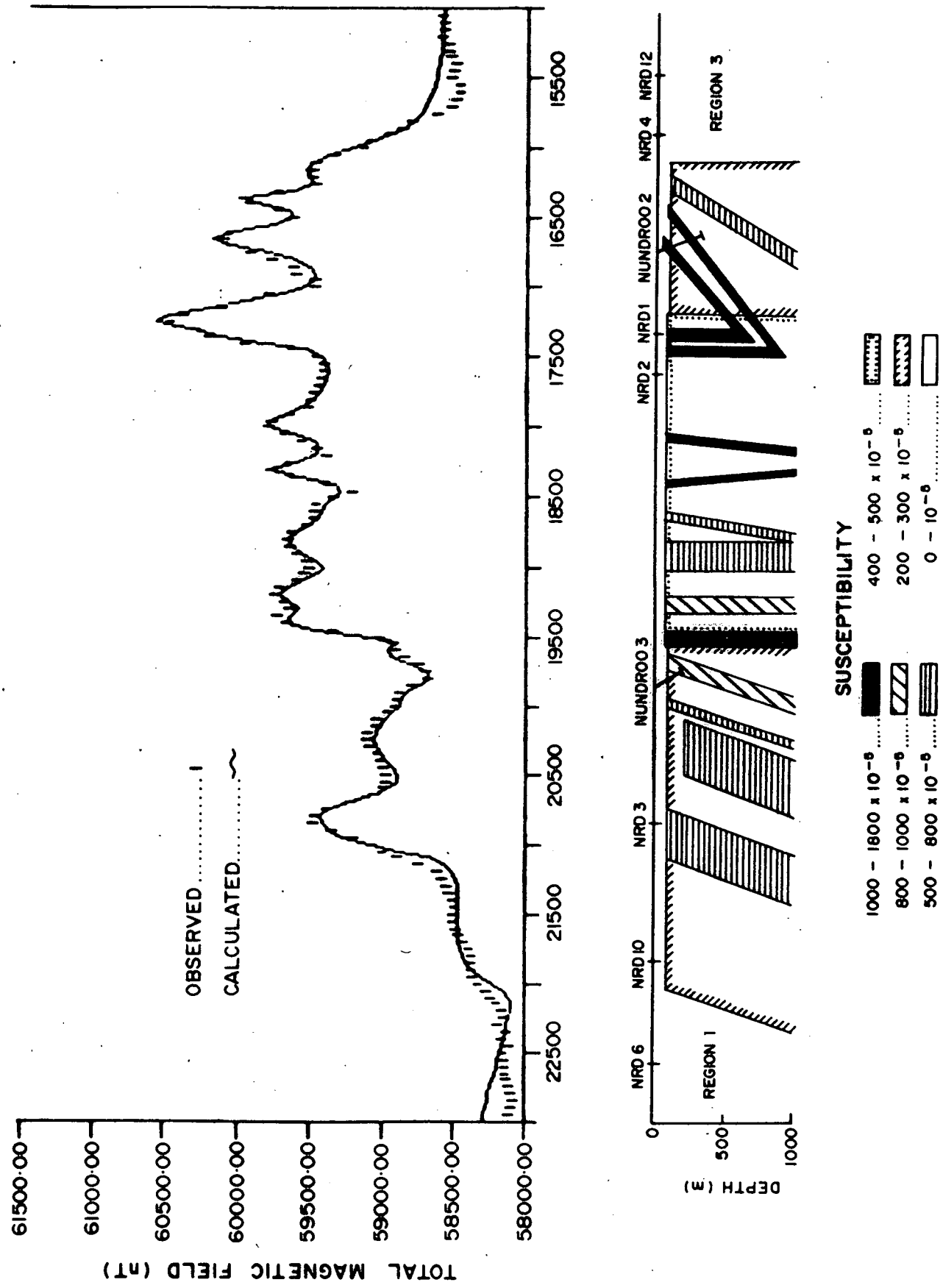


FIG. 8

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED: A. Martin
DRAWN: E. Calabio
DATE: 12/5/88
CHECKED:
C.D.O.
DATE
SCALE: graph
PLAN NUMBER: S 20154

NUNDROO ROTARY DRILLHOLES

TRAVERSE 1

GROUND MAGNETIC PROFILE -(REGION 2)

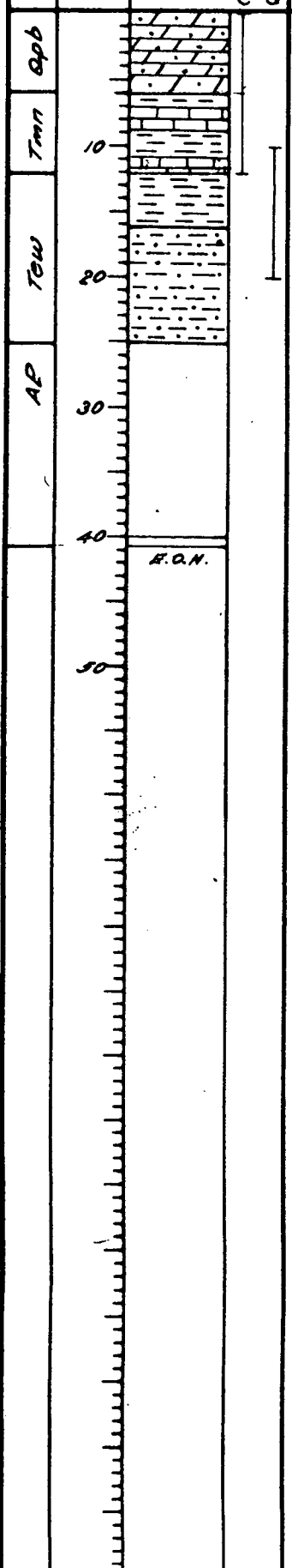
4614

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 1

DEPTH: 41.1 m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION — hard pink calcreted aedianite with scattered quartz grains.

NULLARBOR LIMESTONE - white to yellow fine to very fine-grained packstone inter-bedded with white carbonaceous mud, becomes glauconitic at base.

WILSON BLUFF LIMESTONE - khaki green clay with approx. 20% very fine grained to fine grained quartz grains.
- khaki green to orange sandy clay.

WEATHERED BASEMENT - dark red brown clay with scattered angular quartz grains and mafic grains of varying sizes.

? MULGATHING COMPLEX - interlayered dark grey quartz + plag + hbl + opx + gnt + sill gneiss and qtz + plag + biot + gnt gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan No: S 20129

1614

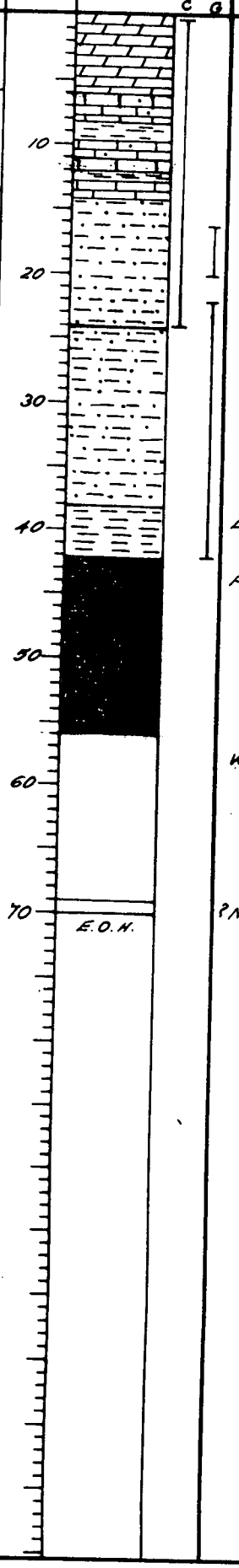
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 2

DEPTH: 70.0m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - hard brown-pink pisolithic calcreted aeolian grainstone, with scattered quartz grains.

NULLARBOR LIMESTONE - white and yellow fine-grained recrystallized packstone with scattered quartz grains, interbedded with light grey to white carbonaceous mud.

WILSON BLUFF LIMESTONE - light grey to greenish carbonaceous mud with common quartz grains also glauconitic.

HAMPTON SANDSTONE - khaki green and brick red sandy clay and silt. Contains 30% fine grained quartz which increases to about 60% near the base. Glauconitic.

Light grey-green glauconitic clay with 20% very fine to silt size quartz grains.

PIDINGA FORMATION - dark brown to black lignitic clay.

WEATHERED BASEMENT.

?MULGATHING COMPLEX - grey medium-grained plag + hbl + opx gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S20130

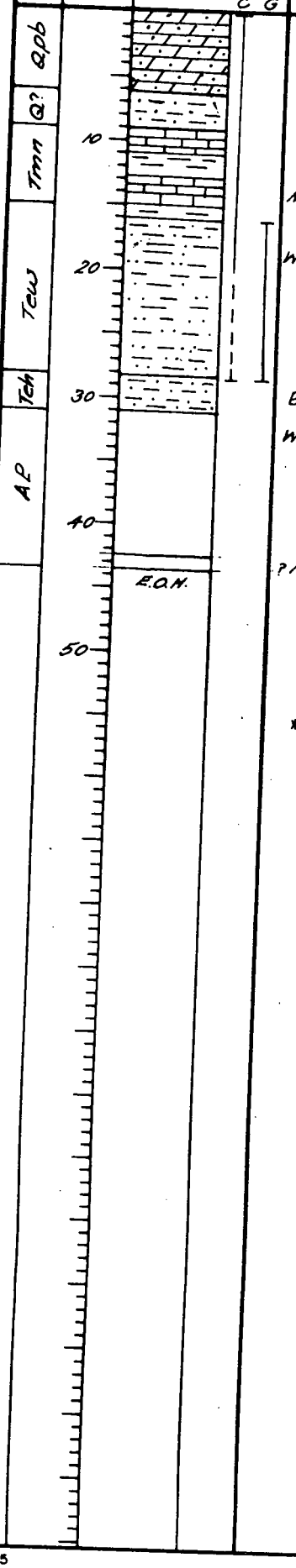
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 3

DEPTH: 43.32m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - light pink brown, hard calcreted aeolian fine-grained grainstone with common scattered quartz grains.

- white to light-orange carbonaceous mud with abundant fine to siltsize grains.

NULLARBOR LIMESTONE - white hard recrystallized fine-grained packstone to wackestone interbedded with white sandy carbonaceous clay.

WILSON BLUFF LIMESTONE - khaki green and orange sandy clay to clayey sand, glauconitic. Contains minor carbonate.

Brick red - orange clayey sand and sandy clay

WEATHERED BASEMENT

? MULGATHING COMPLEX - Grey fine to medium-grained quartz + plag + biot. + hbl + sill gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20131

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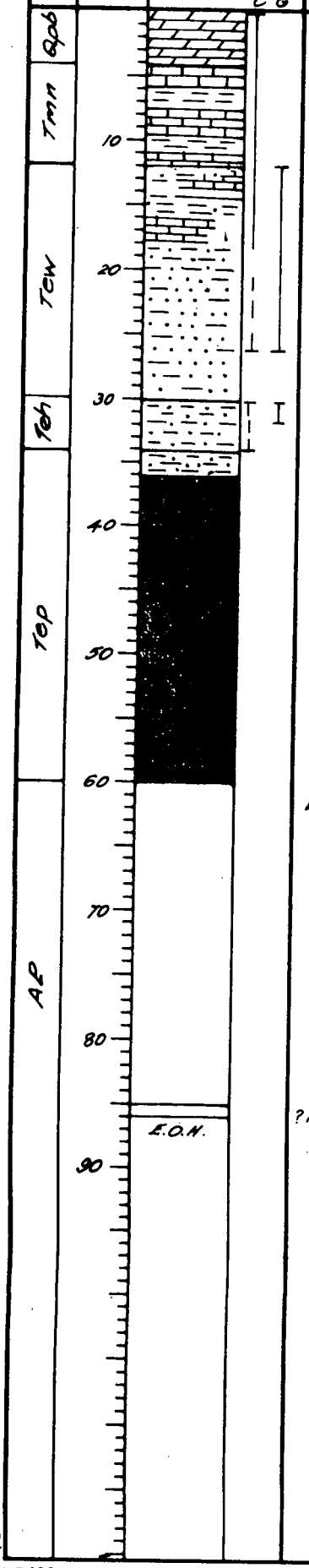
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 4

DEPTH: 86.0m ..... INCLINATION: 90° .....

LOGGED BY: A.R.M. DATE: 1987 DRN: .....



DESCRIPTION

BRIDGEWATER FORMATION - pink hard calcreted aeolianite.

NULLARBOR LIMESTONE - white to light orange recrystallized fine grained packstone with scattered quartz grains. Interbedded with white carbonaceous mud.

WILSON BLUFF LIMESTONE - light greenish grey carbonaceous mud with some interbedded fine-grained white packstone. Glauconitic, carbonaceous.

- light khaki to orange fine to medium-grained clayey sandstone with minor white limestone fragments.

HAMPTON SANDSTONE - light brown and red sandy clay.

- light grey sandy clay.

PIDINGA FORMATION - dark brown to black lignitic clay with minor clean white sand lenses.

WEATHERED BASEMENT - grey clay containing subangular fragments of basement.

?MULGATHING COMPLEX - dark green mylonitic quartz + plag + hbl + opx + sill + opaque + chlorite gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan No: S 20132

4614

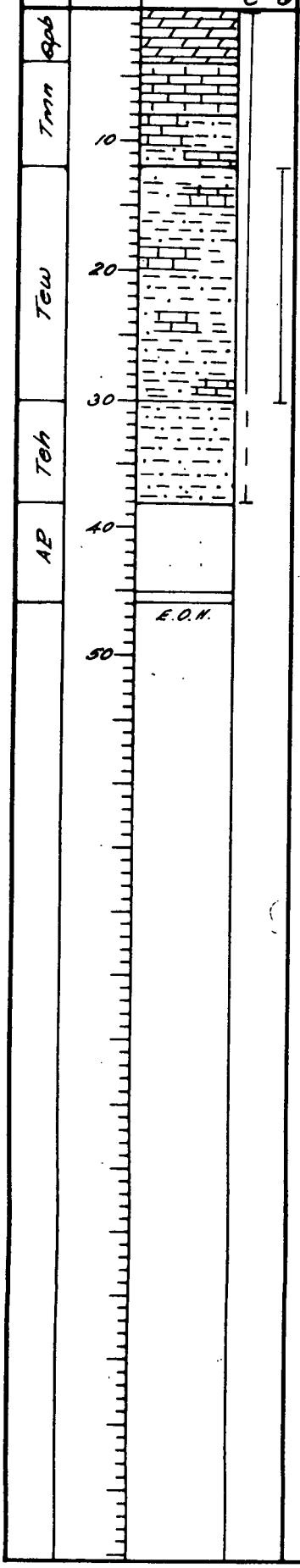
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO - NRD 5

DEPTH: 45.8m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - pink, hard calcreted aeolianite.

NULLARBOR LIMESTONE - orange recrystallized fine grained grainstone to packstone with common scattered quartz grains.

- light grey carbonaceous clay and hard recrystallized white fine grained packstone.

WILSON BUFF LIMESTONE light green and grey carbonaceous sandy clay and totally recrystallized limestone, glauconitic.

- bryozoal fragments.

- bryozoal fragments.

Red brown sandy clay.

WEATHERED BASEMENT - red brown and mauve sandy clay with angular basement fragments.

?MULGATHING COMPLEX - pink and grey coarse to very coarse-grained migmatite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20133

46/4

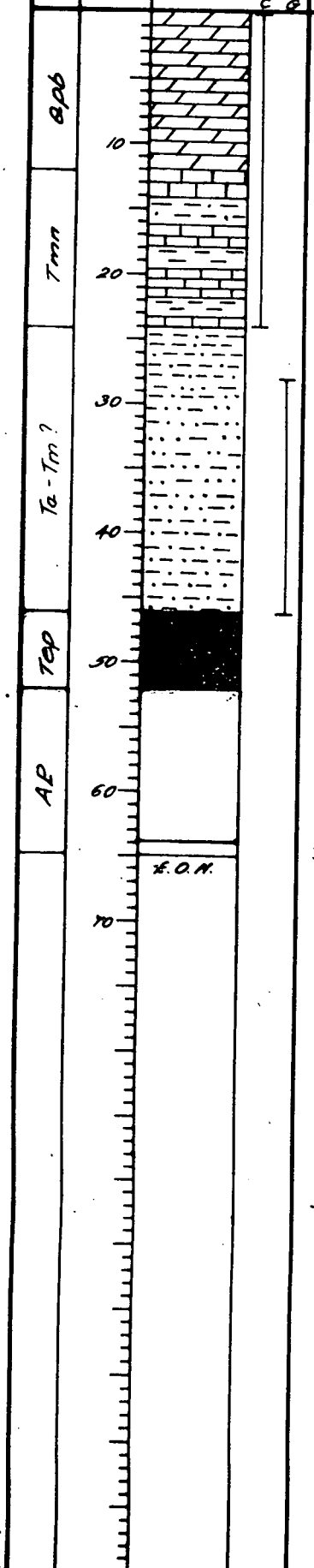
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 6

DEPTH: 64.9m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - light pink-brown hard, pisolithic, calcreted aeolian grainstone.

NULLARBOR LIMESTONE - white-light orange recrystallized fine-grained packstone with common scattered quartz grains and white sandy carbonaceous mud.

-light grey and orange sandy clay.

-light grey-green medium grained clayey sand.

-light grey-green sandy clay.

PIDINGA FORMATION - dark brown-black lignitic clay.

WEATHERED BASEMENT - green and grey with fragments of mafic material from basement.

? MULGATHING COMPLEX - well foliated quartz + feld. + biot. + hbl gneiss.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20134

4614

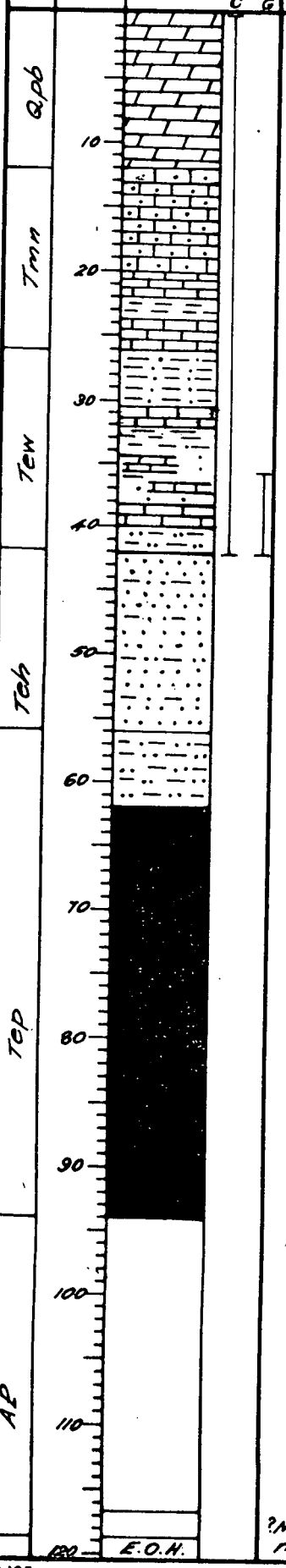
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 7

DEPTH: 118.7m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



* C - calcareous
G - glauconitic

DESCRIPTION

BRIDGEWATER FORMATION - Light pink-brown hard oolithic calcreted aeolian grainstone. Contains a possible wood fragment with calcite filled bore holes. (≈ 0.2mm diameter)

NULLARBOR LIMESTONE - indurated white - light yellow fine-grained sandy grainstone.

- white - light tan hard packstone with scattered quartz grains and minor carbonaceous clay.

WILSON BLUFF LIMESTONE - white malliable sandy carbonaceous clay.

- white clay fine-grained packstone in white sandy and silty carbonaceous clay.
- clays becoming greener, contain minor glauconite.

HAMPTON SANDSTONE - red brown moderately poorly sorted granule bearing fine to medium grained clayey sand.

- yellow - tan in colour.

- light grey - white fine-grained clayey sand.

PIDINGA FORMATION - dark brown - black lignitic clay.

WEATHERED BASEMENT - light grey sandy and silty clay, micaceous in part becoming greener towards the base with fragments of basement material.

?MULGATHING COMPLEX - dark green, coarse grained massive amphibolite.

Sheet 1 of 1
Plan N° S 20135

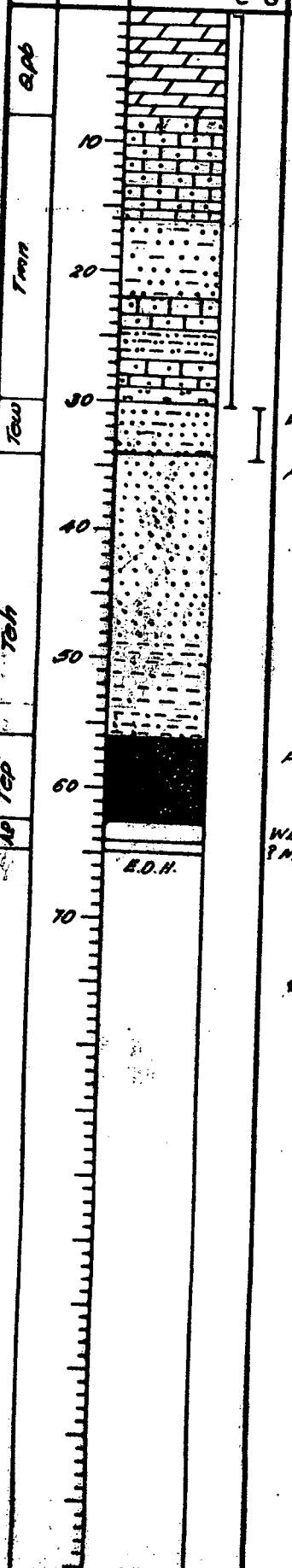
MF 168

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 8

DEPTH: 64.7m ..... INCLINATION: 90° ....

LOGGED BY: A.R.M. .. DATE: 1987 .. DRN: .....



DESCRIPTION

BRIDGEWATER FORMATION - pink-orange, pisolithic calcreted aeolian grainstone with scattered quartz grains.

NULLARBOR LIMESTONE - light yellow-orange fine-grained sandy grainstone.

- fine to very fine-grained quartz sand in an orange malleable clay matrix.

- white fine-grained sandy packstone and fine to very fine grain sand in white carbonaceous clay.

WILSON BLUFF LIMESTONE - Khaki green fine to medium-grained quartz sand with minor green clay.

HAMPTON SANDSTONE - red brown, orange and grey medium-grained quartz sand with minor clay.

- red brown, orange and green clay with fine to very fine-grained quartz (20-40%).

PIDINGA FORMATION - dark brown lignitic clay with minor very fine-grained quartz more common towards the base.

WEATHERED BASEMENT - grey micaceous clay and sand.
? MULGATHING COMPLEX - grey phenocrystic grz+feld+biotite+mylonite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20136

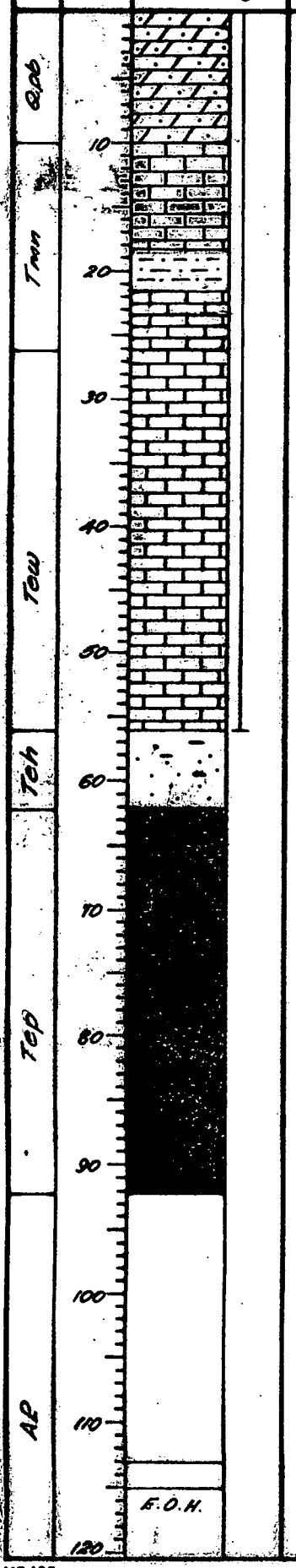
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 9

DEPTH: 115.0m ..... INCLINATION: 90° .....

LOGGED BY: S.J.D. ... DATE: 1987 .. DRN: .....



DESCRIPTION

• C - calcareous

BRIDGEWATER FORMATION - pink-brown pisolithic calcreted aeolian.

NULLARBOR LIMESTONE - cream to pale pink, fine grained quartz sand with 30% carbonate mud.
- cream to pale brown recrystallized fine-grained packstone with carbonaceous mud.
- soft friable pale orange silty to fine-grained wackestone.

WILSON BLUFF LIMESTONE - recrystallized cream fine-grained packstone.

HAMPTON SANDSTONE - red brown to pink brown and yellow clay with 10-20% fine grained quartz sand.

PIDINGA FORMATION - dark-brown to black lignitic clay with minor silt size quartz sand.

WEATHERED BASEMENT - grey to brown clay with fine-grained to grit size, sub-rounded to angular quartz grains. Angular chips of basement near the base.

? MULGATHING COMPLEX - grey quartz+feldspar+biotite+mylonite.

Sheet 1 of 1
Plan No. S 20137

MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 10

DEPTH: 18·7m ..... INCLINATION: 90° ....

LOGGED BY: A.R.M. .. DATE: 1987 .. DRN: .....

AGE / UNIT	DEPTH (m)	GRAPHIC LOG	DESCRIPTION
Qpb			BRIDGEWATER FORMATION - light pink grey pesolithic calcreted fine grained oolianitic grainstone.
A2	10		WEATHERED BASEMENT - grey-green micaceous clay with angular basement fragments.
	20	E.O.H. 18·7m	? MULGATHING COMPLEX - medium to coarse-grained, dark green, massive amphibolite.

C - calcareous

Sheet .1.. of ..1....
Plan N° S 20138

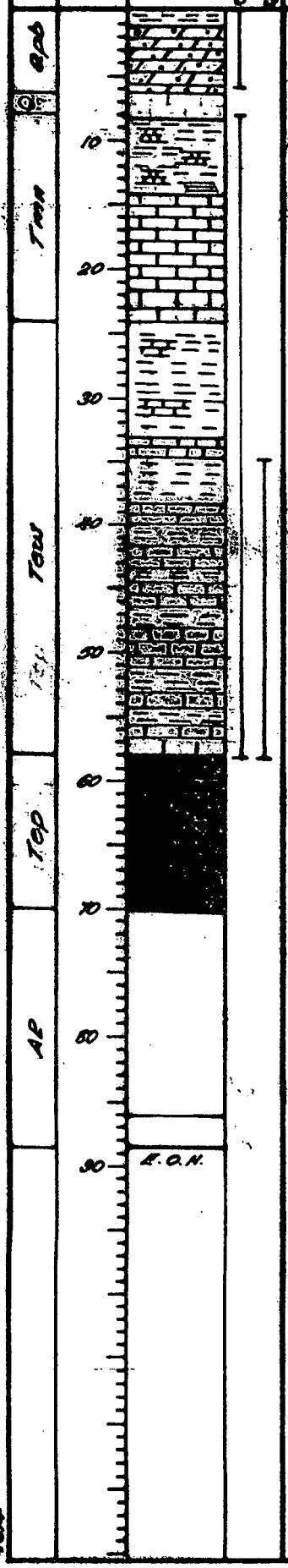
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 11

DEPTH 88·6m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

Red brown clay.

BRIDGEWATER FORMATION - hard, pink, pisolithic, calcreted, aeolian grainstone.

- red brown clay.

NULLARBOR LIMESTONE - white carbonaceous clay with fragments of white recrystallized limestone containing scattered quartz grains.

- white recrystallized fine-grained packstone with scattered quartz grains.

WILSON BLUFF LIMESTONE.

- hard white partly recrystallized wackestone to packstone with scattered quartz grains, contains common sponge spicules and less common bryozoal and bivalve fragments. Interbedded with white carbonaceous clay.

- glauconitic in base.

PIDINGA FORMATION - dark brown to black lignitic clay with minor clean quartz interbeds.

WEATHERED BASEMENT - grey clay containing angular quartz feldspar and hornblende grains and minor pyrite and larger basement fragments at the base.

? MULGATHING COMPLEX - green-grey mylonitic quartz + k-spar + biot + chlor gneiss.

C - calcareous
G - glauconitic

Sheet 1 of 1
Plan No: S 20139

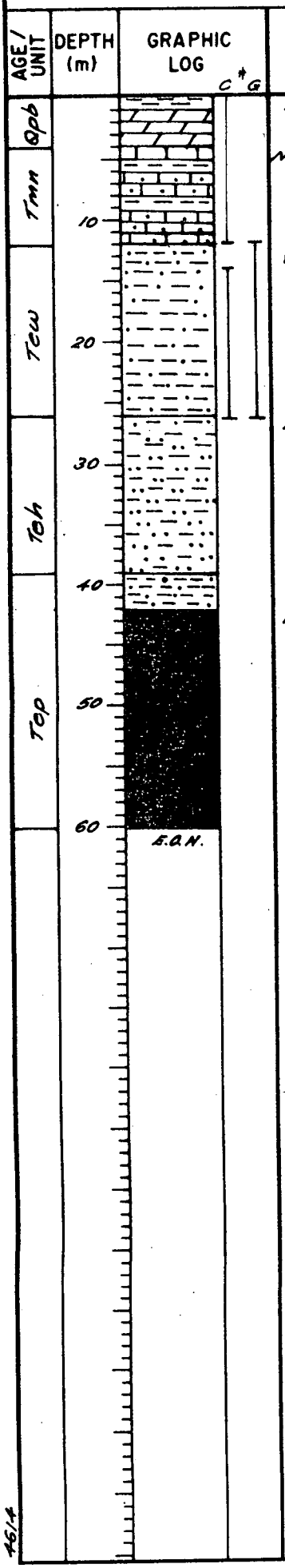
MP 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 12

DEPTH 60.0m INCLINATION: 90°

LOGGED BY: A.R.M. DATE: 1987 DRN:



DESCRIPTION

Red brown clay.
BRIDGEWATER FORMATION - pink calcreted aeolianite.

NULLARBOR LIMESTONE - white to light orange recrystallized indurated fine to medium-grained grainstone/packstone composed of 20-40% quartz grains in a grey carbonaceous clay.

WILSON BLUFF LIMESTONE:-
L greenish grey and orange sandy clay.

HAMPTON SANDSTONE - red-brown and orange fine to med.-grained silty sandstone.

Light grey clay with 30% fine-grained quartz.
PIDINGA FORMATION - dark brown lignitic clay and silt.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20140

4614

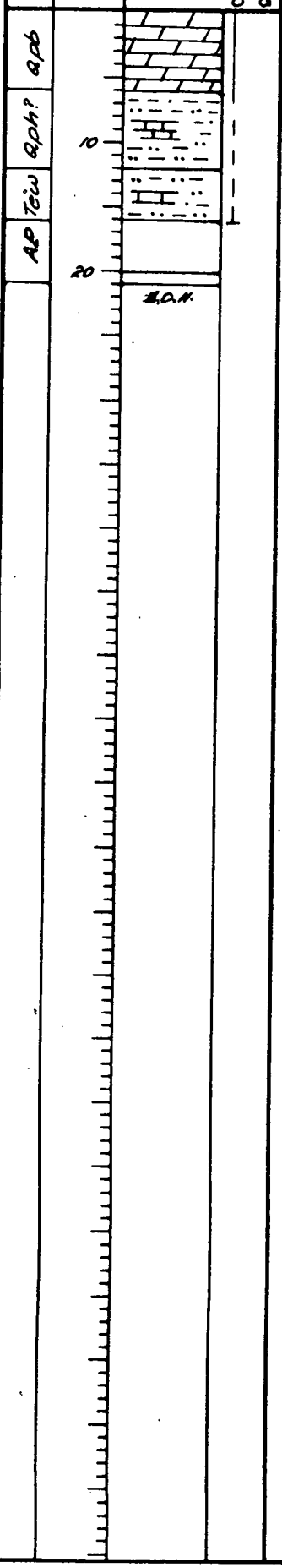
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 14

DEPTH 20.9m INCLINATION: 90°

LOGGED BY: S.J.D. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION - light pink-brown hard pisolithic, calcreted, aeolian, grainstone.

orange-brown clayey fine-grained sand with minor carbonate fragments.

cream silt to very fine-grained quartz sand with minor white fine-grained limestone fragments.

WEATHERED BASEMENT - pinkish-brown clay with abundant basement fragments.

? MULGATHING COMPLEX - grey-pink, fine to medium-grained, porphyroblastic quartz + plag + biotite cataclasite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20141

4614

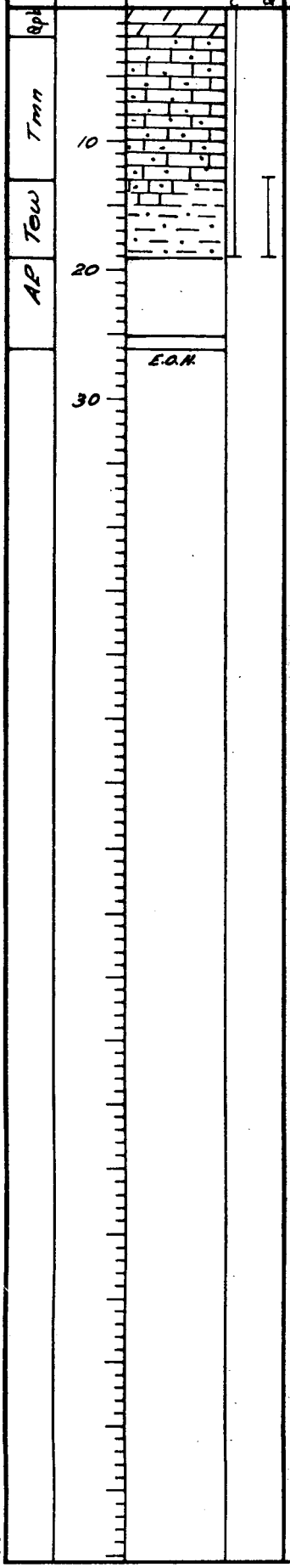
MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 15

DEPTH 26.06m INCLINATION: 90°

LOGGED BY: S.J.D. DATE: 1987 DRN:



DESCRIPTION

BRIDGEWATER FORMATION.

NULLARBOR LIMESTONE - cream to pale-yellow hard grainstone with 20% of very fine grained quartz sand.

WILSON BLUFF LIMESTONE - cream to green sandy calcareous mudstone with minor fragments of recrystallized grainstone

WEATHERED BASEMENT - cream to orange brown sandy clay with fragments of basement near the base.

?MULGATHING COMPLEX - green-black, medium grained, homogeneous amphibolite.

* C - calcareous
G - glauconitic

Sheet 1 of 1
Plan N° S 20142

1614

MF 165

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

NUNDROO NRD - 16

DEPTH . . . 5.9m . . . . . INCLINATION: . . 90° . . . .

LOGGED BY: . S.J.D. . . DATE: . 1987 . .

AGE / UNIT	DEPTH (m)	GRAPHIC LOG	DESCRIPTION
Qpb			BRIDGEWATER FORMATION - hard pale pink calcreted aeolian grainstone with scattered quartz grains. Occasional black pisoliths
Tow?	5	E.O.H.	Wilson Bluff Limestone - cream recrystallised very fine-grained grainstone with 10-20% very fine-grained subangular quartz.
	10		

Sheet . 1 . . of . . 1 . . .
Plan N° S 20166

4614

MF 165

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA

NUNDROO NRD - 13

DEPTH . . 94·7 m . . . . INCLINATION . . 90° . . .

LOGGED BY . M.C.B. . . DATE . 1987 . .

AGE/UNIT	DEPTH (m)	GRAPHIC LOG	GRAIN SIZE (s v f f m c)	DESCRIPTION
Bridgewater Formation				Calcreted, orange-brown and pink very fine-grained, moderately-well sorted calcarenite or grainstone with 5-20%, very fine to silt size quartz grains. Black pisoliths with laminated red halos (3-10mm).
	10			orange-brown, partly calcareous, very fine-grained, well sorted, friable sandstone.
Nullarbor Limestone				pale brown, calcareous, muddy, very fine-grained, well sorted sand. 10% indurated white chips of sandy limestone.
				white, indurated, very fine-grained, recrystallized limestone. Slightly sandy in part.
	20			Brown, medium-grained, well sorted, recrystallized, indurated, skeletal grainstone. Trace miliolids. Thin interbeds (≈5mm) of well sorted, fine-grained sand on erosional base, slightly calcareous with mud matrix.
?				Sandy (10-55%), fine to very fine-grained skeletal grainstone / packstone. Scattered algal bodies skeletal fragments.
	30			Pale grey, fine to very fined-grained, porous, skeletal grainstone / packstone. Trace glauconite. Minor quartz < 2·5%.
Wilson Bluff Limestone				Greenish grey, moderately indurated, calcareous mudstone to very fine-grained sandstone. Glauconitic. Contains sponge spicules.
	40			Pale grey brown, very friable, very fine-grained, skeletal grainstone. <25% quartz. Spicular. Increase quartz at bottom 35%.
				Pale grey, very fine-grained, skeletal, glauconitic, bryozoal wackestone to mudstone. Trace gastropod, bivalve or brachiopod fragments. Glauconitic.
	50			Pale grey, very fine-grained wackestone to mudstone.
				Pale grey, very fine-grained, glauconitic, bryozoal, wackestone to mudstone. With 25% coarse grainstone fragments. Trace molluscs, bivalve and brachiopods.
	60			Pale grey, very fine to fine-grained, glauconitic, bryozoal wackestone, local mudstone and packstone.
				Darker grey, very fine-grained skeletal, glauconitic wackestone with patches of very dark, organic 'rich' mud.
				Grey indurated, skeletal, bryozoal packstone to mudstone. Locally glauconitic small brachiopods
Pidinga Formation		Py		Grey green, very glauconitic, sandy, skeletal, richly bryozoal packstone to wackestone. 5-20% medium-grained quartz.
	70			Black, carbonaceous, partly pyritic, silty clay. Thin, coarse-grained, poorly sorted sandy lenses.
				Pale grey, sandy clay with minor muscovite. Weathered basement.
Mulgathing Complex				Pale grey-green, gritty clay. Weathered basement.
				Pale grey, gritty clay
	80			Pale grey-green, gritty clay.
				Pale grey-green, gritty clay.
	90			Pinkish grey, coarse-grained, porphyroblastic quartz-feldspar-biotite-garnet-magnetite gneiss.
		T.D. 94·7m		
	100			

SHEET . . 1 . . OF . . 1 . . .

PLAN Nº S20165

4614

MF 179

N

boundary of aboriginal land

NUNDROO SIROTEM LINE 0000

NUNDROO SIROTEM LINE 100

NUNDROO SIROTEM LINE 10

Nundroo Motel

Pintumba

Coorabie Well

Coorabie

M00191

M00001

23000W

26000W

28000W

NRD 1
NRD 2
NRD 4
NRD 12
NRD 5
NRD 15
NRD 16
NRD 14
NRD 10
NRD 7
NRD 6
NRD 3
NRD 8
NRD 9
NRD 11
NRD 13

DDH Nundroo 2
DDH Nundroo 1
Nundroo Well
DDH Nundroo 3

6491-9119

Coorabie Sheep Well

EYRE HIGHWAY

NUNDROO GEOPHYSICAL TRAVERSE 1

NUNDROO GEOPHYSICAL TRAVERSE 2

NUNDROO GEOPHYSICAL TRAVERSE 3

4100S

BROWNS HILL

18300W

Nallanipple Well

Chintulda Well

Colona

42700W

• NRD 6 ..... Rotary Drillhole

• DDH Nundroo 1 ..... Diamond Drillhole

▲ 6491-9119 ..... Gravity Station (ANGN)

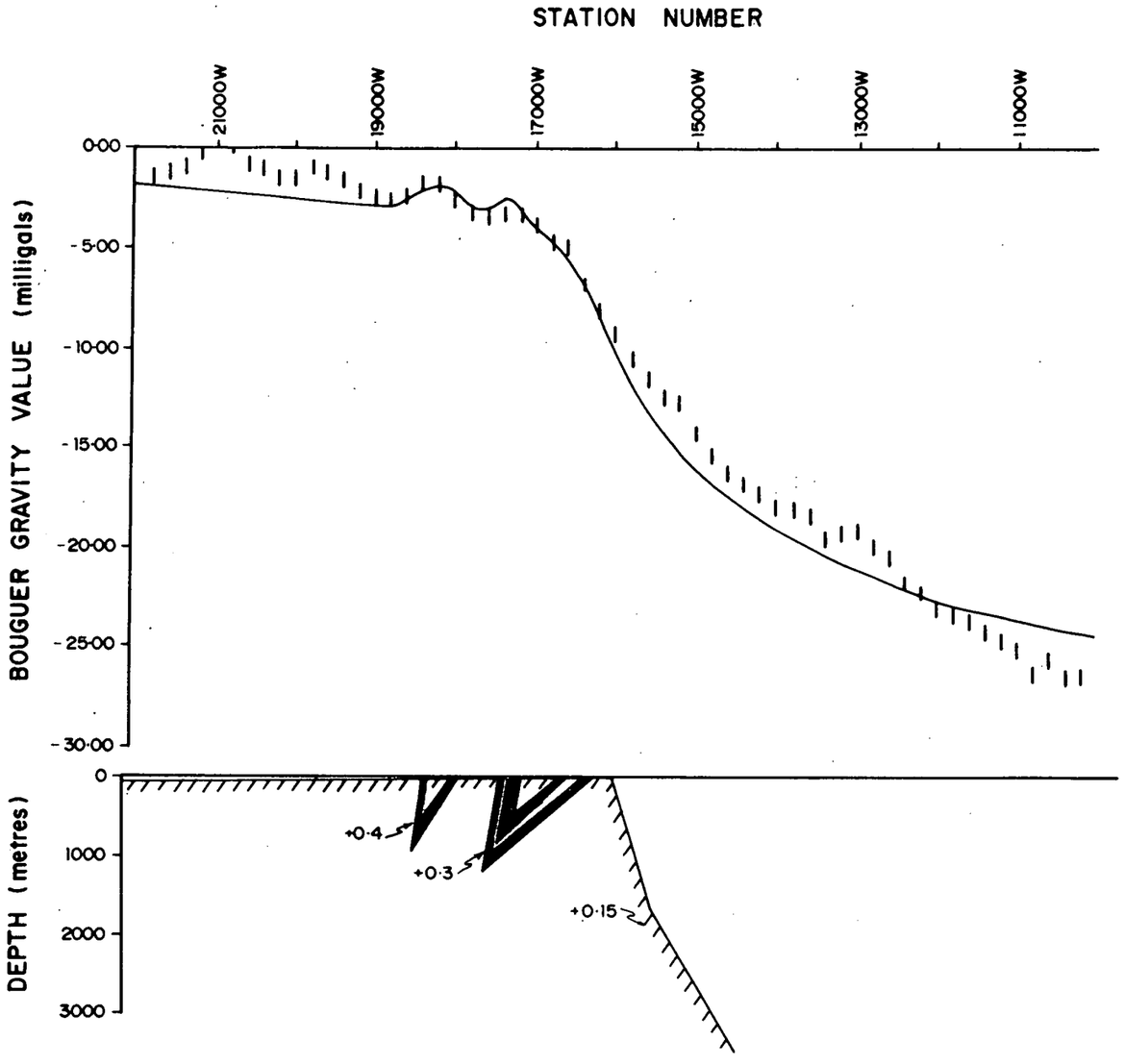
SCALE IN KILOMETRES

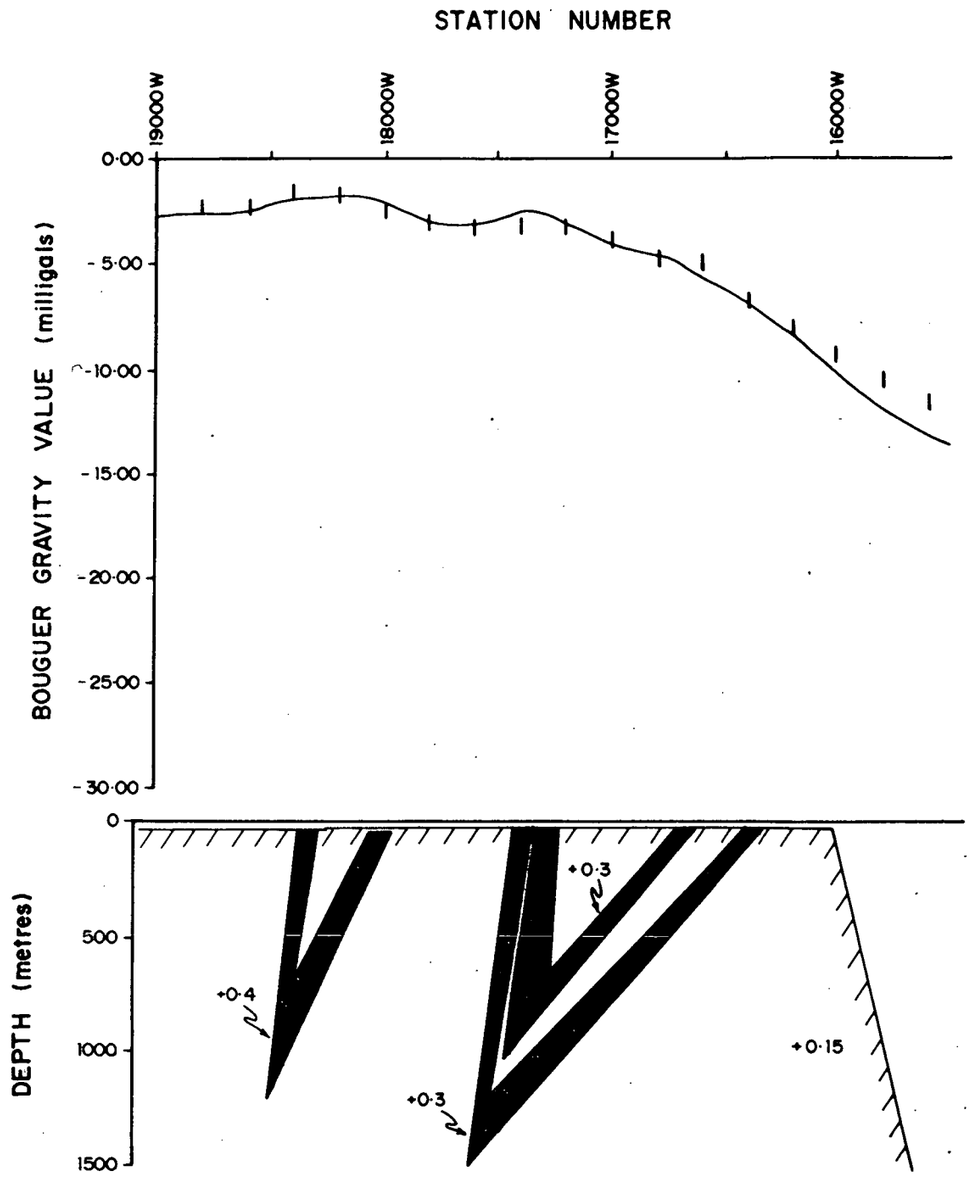
6 4 2 0 2

FIG. 7

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED A. Martin	C.D.O. DATE
	DRAWN E. Calabio	SCALE 1:100 000
NUNDROO ROTARY DRILLHOLES	DATE 12/5/88	PLAN NUMBER
LOCALITY PLAN	CHECKED	88-377

4614





OBSERVED.....I

CALCULATED.....~

DENSITY CONTRASTS....t/m^3

FIG. 9

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

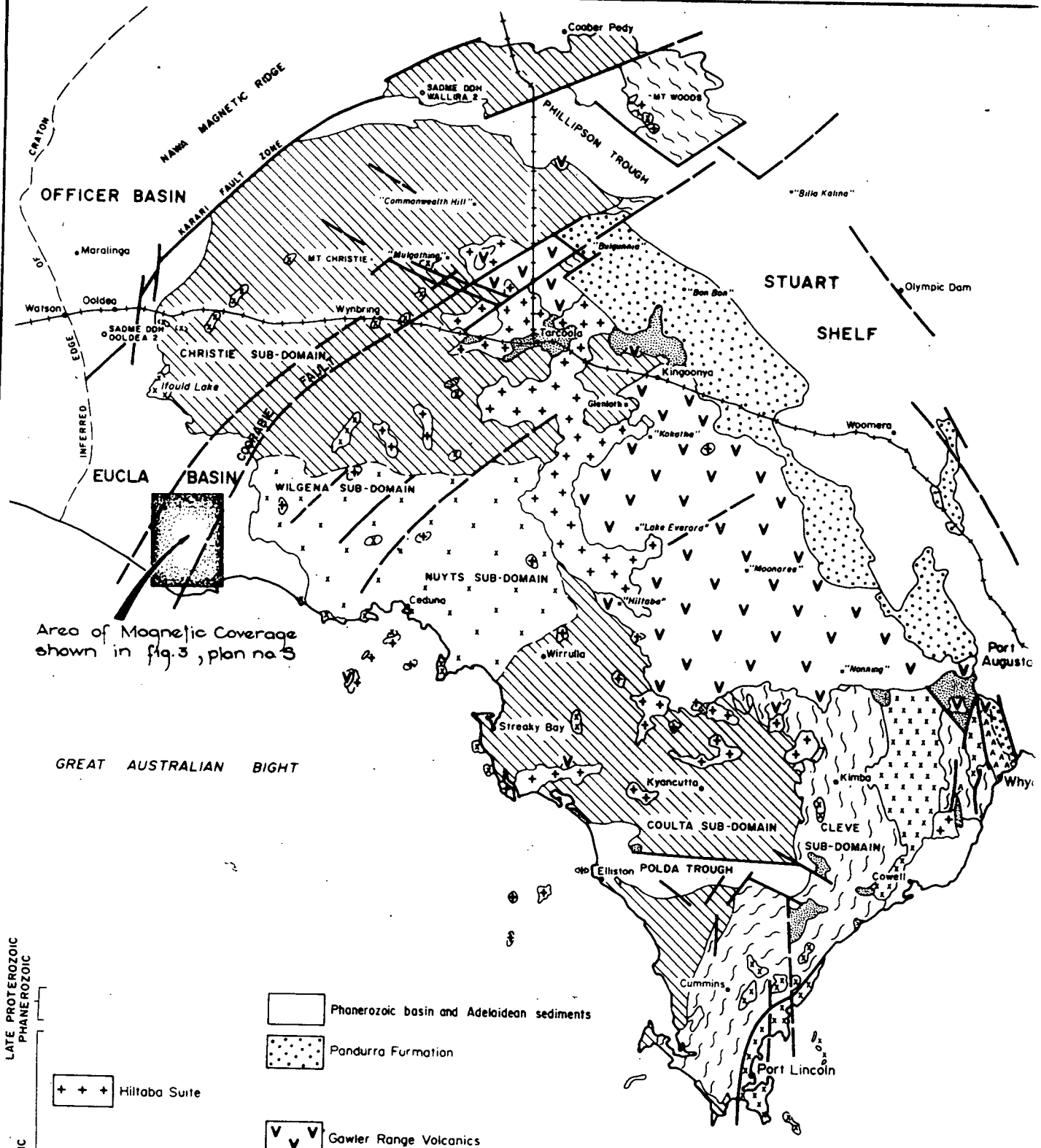
NUNDROO ROTARY DRILLHOLES

GEOPHYSICAL MODELLING - TRAVERSE 1

BOUGUER GRAVITY PROFILE

COMPILED A. Martin	C.D.O. DATE
DRAWN E. Calabio	SCALE
DATE 12/5/88	PLAN NUMBER 88-378
CHECKED	

4614



NUNDROO DIAMOND DRILLHOLES
GAWLER CRATON
TECTONIC MAP OF EXPOSED REGIONS

Fig.....

SADME

S20726

4736

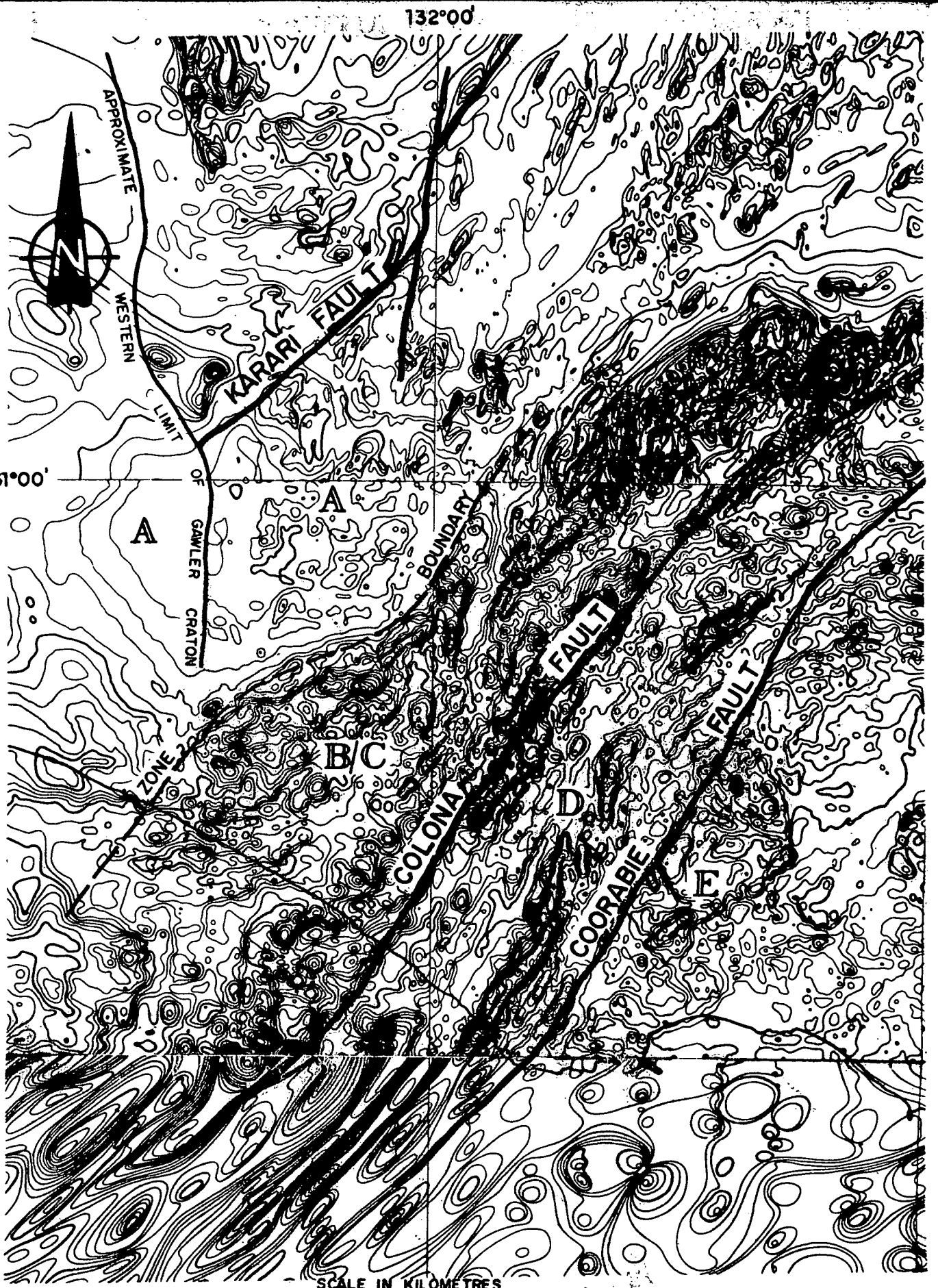


Figure....2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NUNDROO DIAMOND DRILLHOLES
SOUTH-EAST GAWLER CRATON
TOTAL MAGNETIC INTENSITY PLUS MAGNETIC ZONE BOUNDARIES

COMPILED S. Daly	C.D.O. DATE
DRAWN L.H.F.	SCALE 1:1000 000
DATE March '89	PLAN NUMBER S 20727
CHECKED	

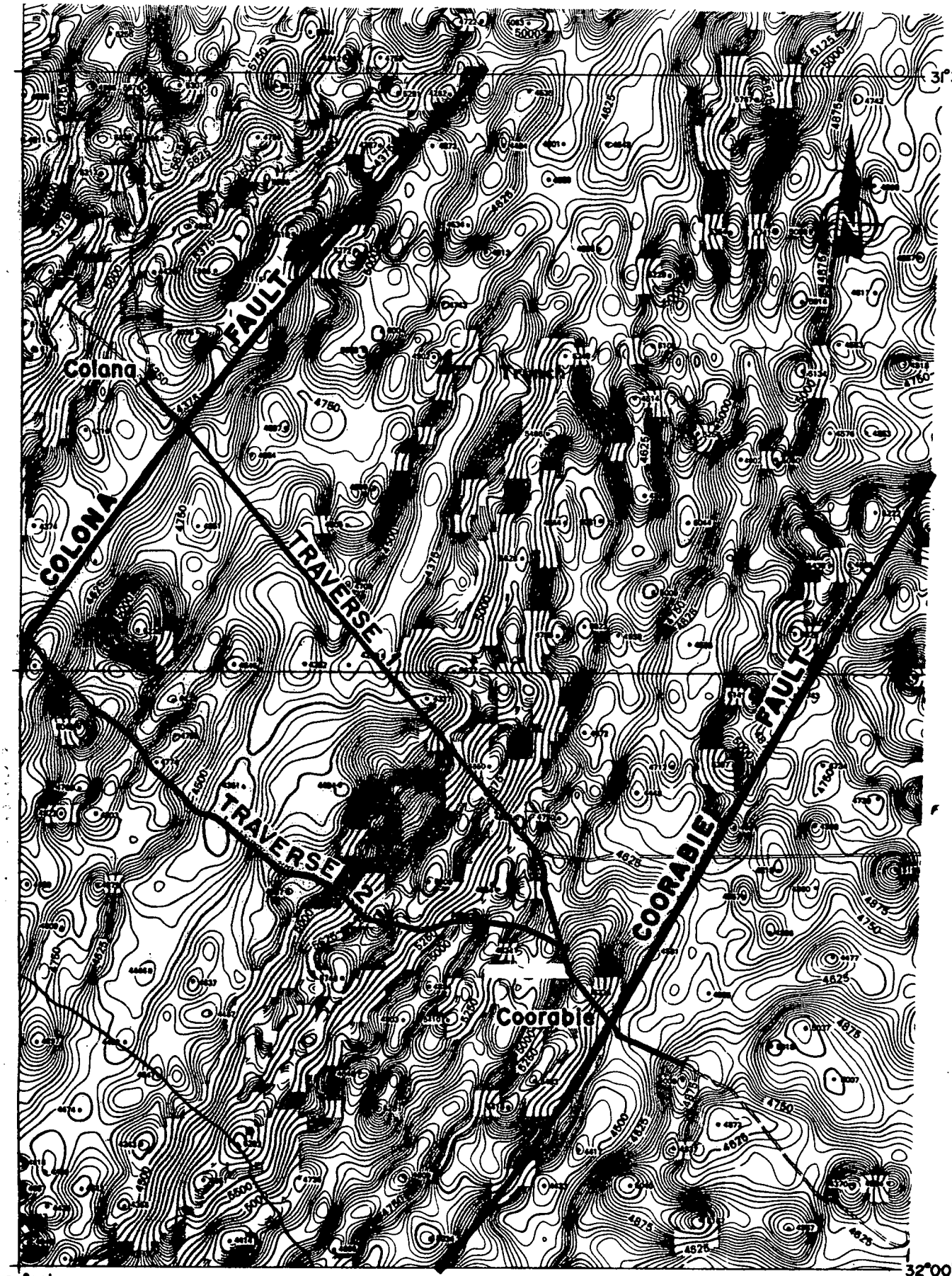


FIG. 3

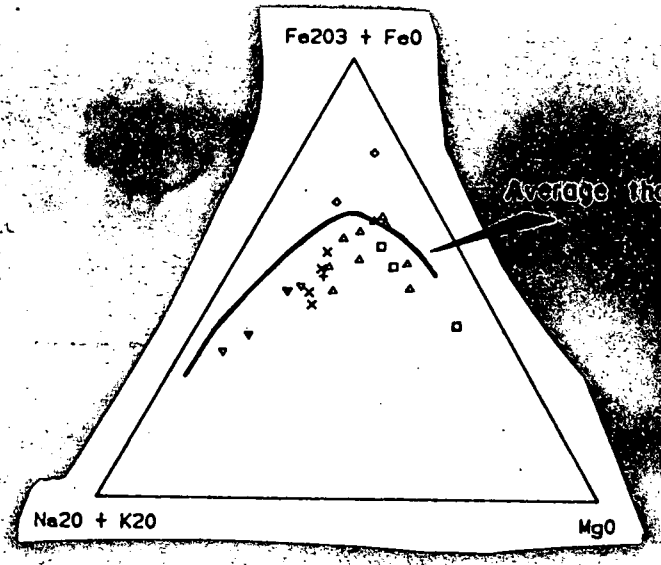
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

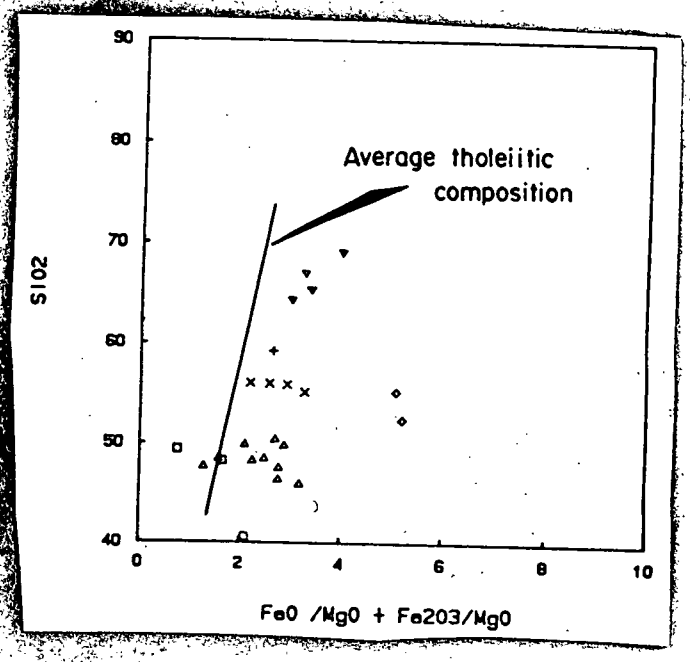
COMPILED S. Daly	C.D.O. DATE
DRAWN L.H.F.	SCALE 1:250 000
DATE March '89	PLAN NUMBER S 20728
CHECKED	

NUNDROO DIAMOND DRILLHOLES

NUNDROO REGION

TOTAL MAGNETIC INTENSITY





- Basic Melanocratic
- Basic Mesocratic
- Basic Leucocratic
- Basic Intermediate
- Basic Intermediate + Garnet
- Acid / Sediments
- Pegmatite

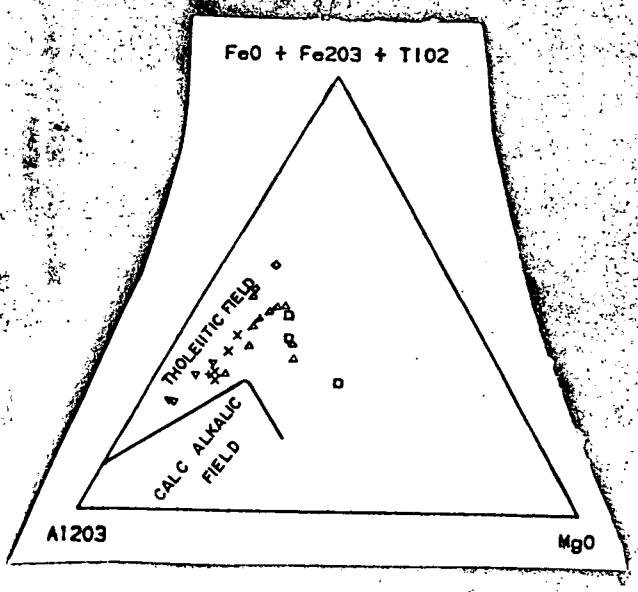


Figure.... 5

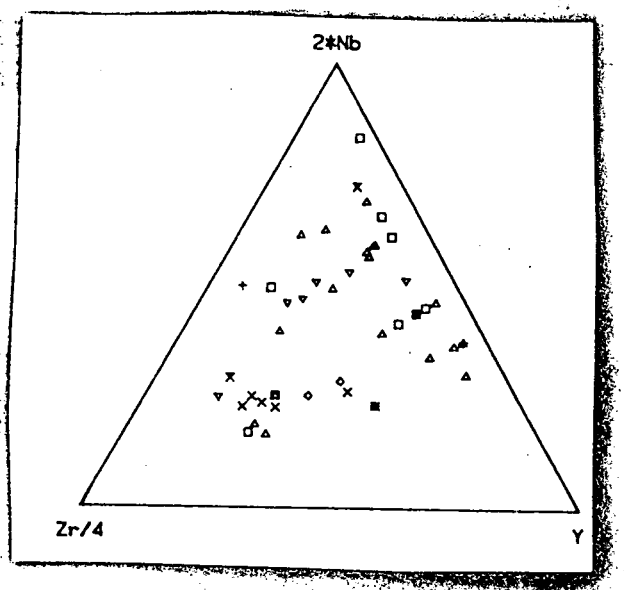
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

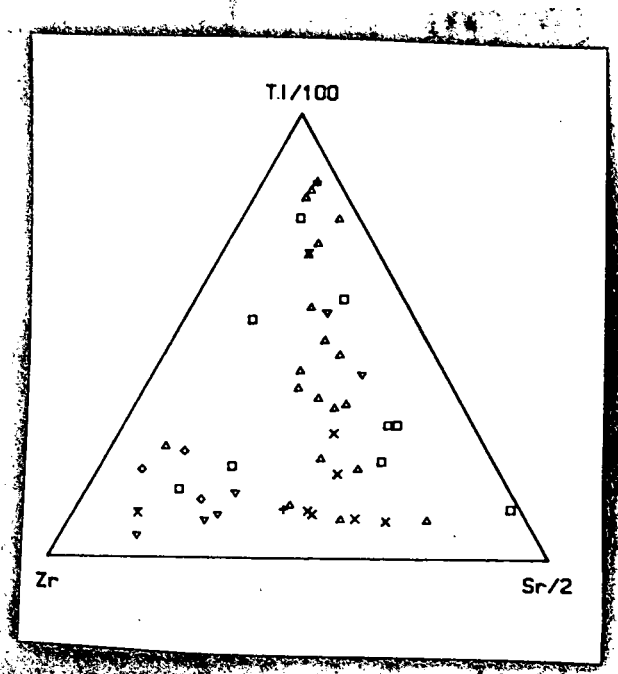
NUNDROO DDH 1, 2 & 3 WELL COMPLETION REPORT

MAJOR ELEMENT GEOCHEMISTRY

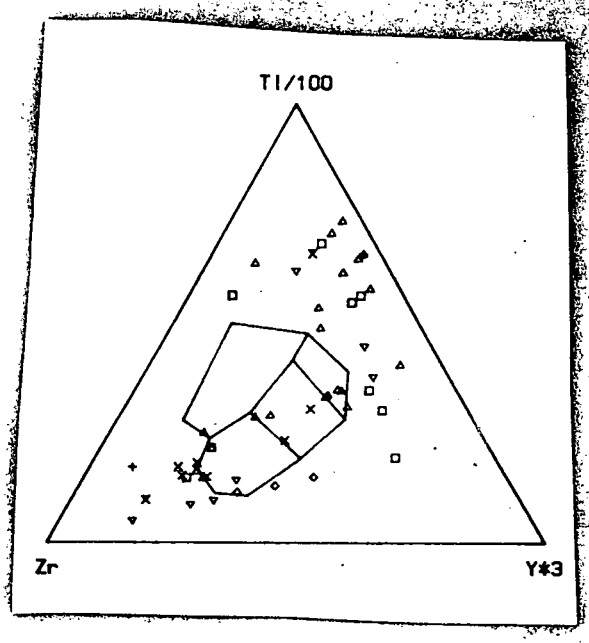
SHOWING THOLEIITIC TRENDS

COMPILED S. Daly	C.D.O. DATE
DRAWN L.H.F.	SCALE
DATE March '89	PLAN NUMBER S 20729
CHECKED	





- Basic Melanocratic
- Basic Mesocratic
- Basic Leucocratic
- Basic Intermediate
- Basic Intermediate + Garnet
- Acid / Sediments
- Pegmatite



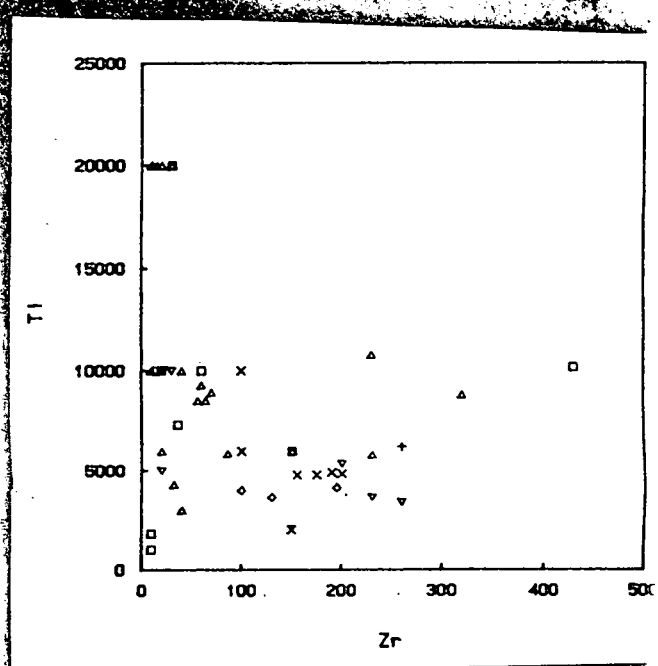


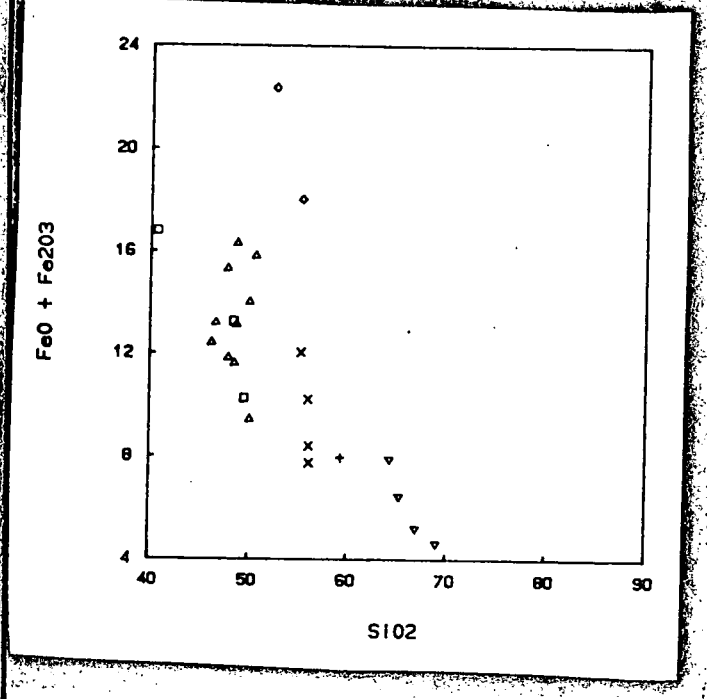
Figure.... 6

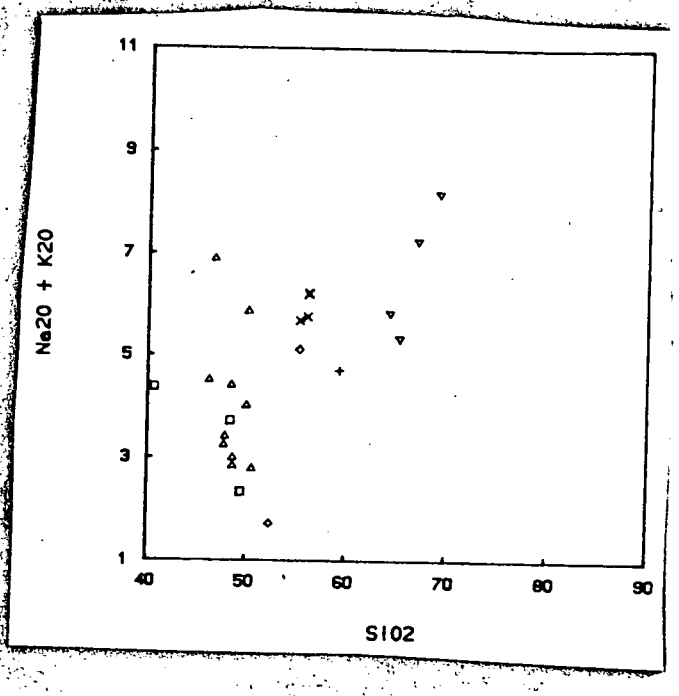
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

NUNDROO DDH 1, 2 & 3 WELL COMPLETION REPORT

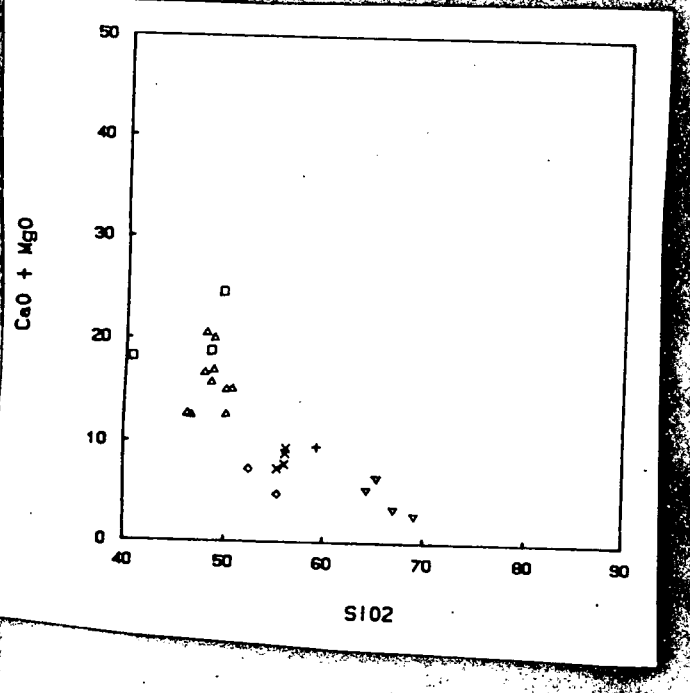
TRACE ELEMENT DISCRIMINATION DIAGRAMS FOR BASIC ROCKS

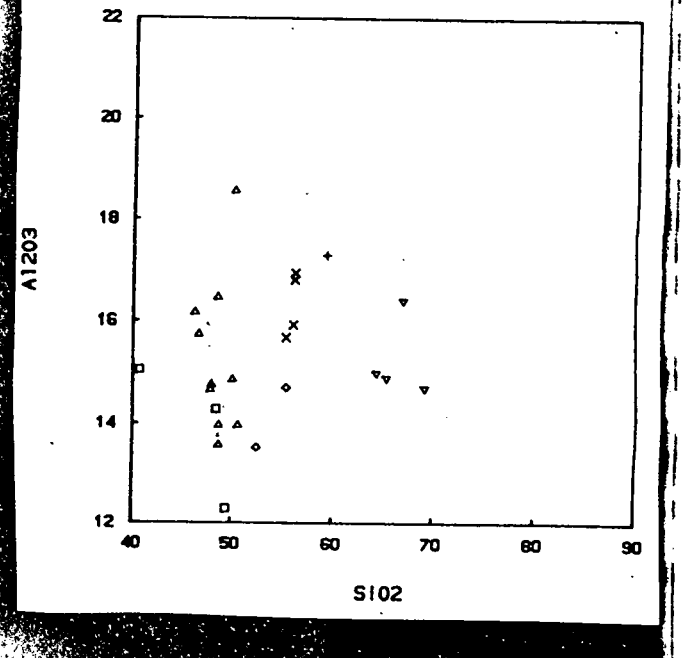
COMPILED S. Daly	C.O.O DATE
DRAWN L.H.F.	SCALE
DATE March '89	PLAN NUMBER S 20730
CHECKED	





- Basic Melanocratic
- Basic Mesocratic
- Basic Leucocratic
- Basic Intermediate
- Basic Intermediate + Garnet
- Acid / Sediments
- Pegmatite





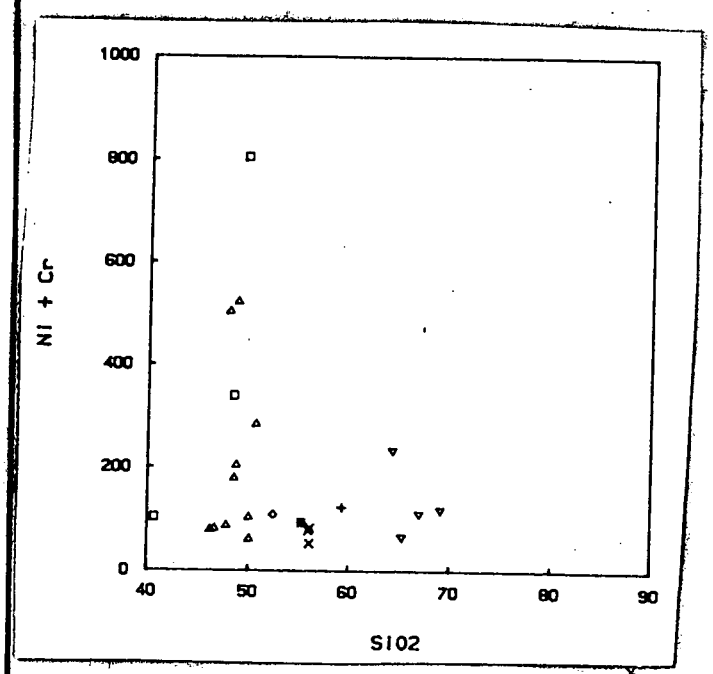
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

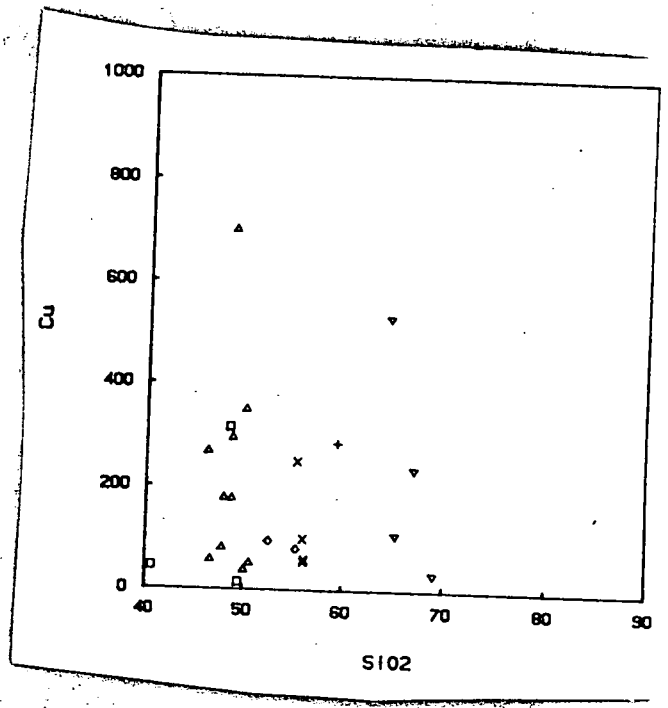
NUNDROO DDH 1, 2 & 3 WELL COMPLETION REPORT

SUMMARY MAJOR ELEMENT VARIATION DIAGRAMS

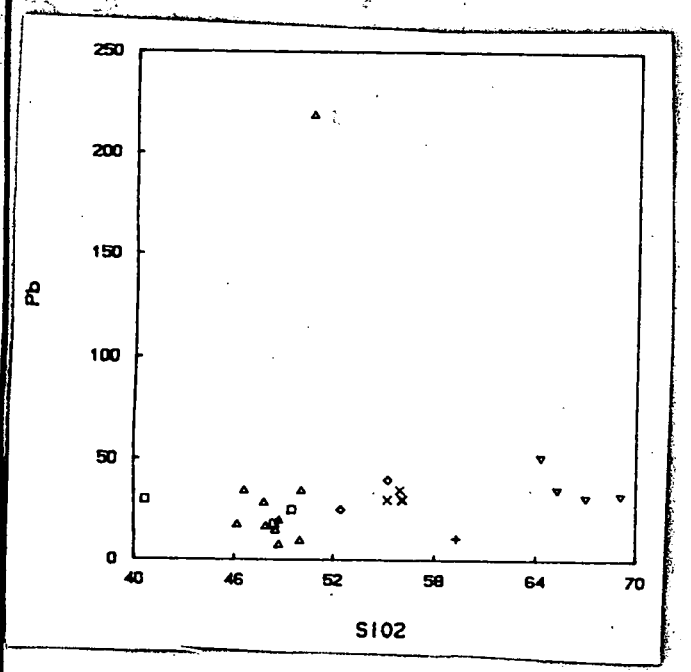
SiO_2 vs Al_2O_3, CaO+MgO, Na_2O+K_2O, FeO+Fe_2O_3

DRAWN L.H.F.	SCALE
DATE March '89	PLAN NUMBER
CHECKED	S 20731





- Basic Melanocratic
- Basic Mesocratic
- Basic Leucocratic
- Basic Intermediate
- Basic Intermediate + Garnet
- Acid / Sediments
- Pegmatite



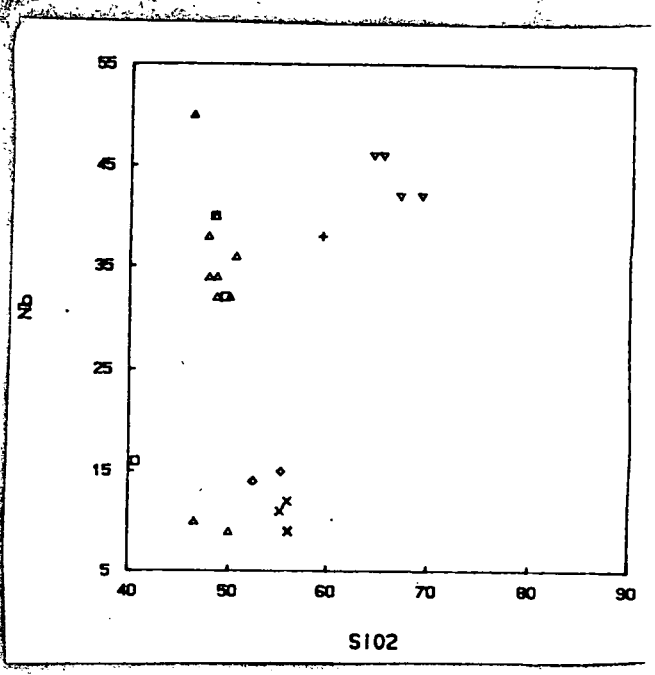


Figure 8

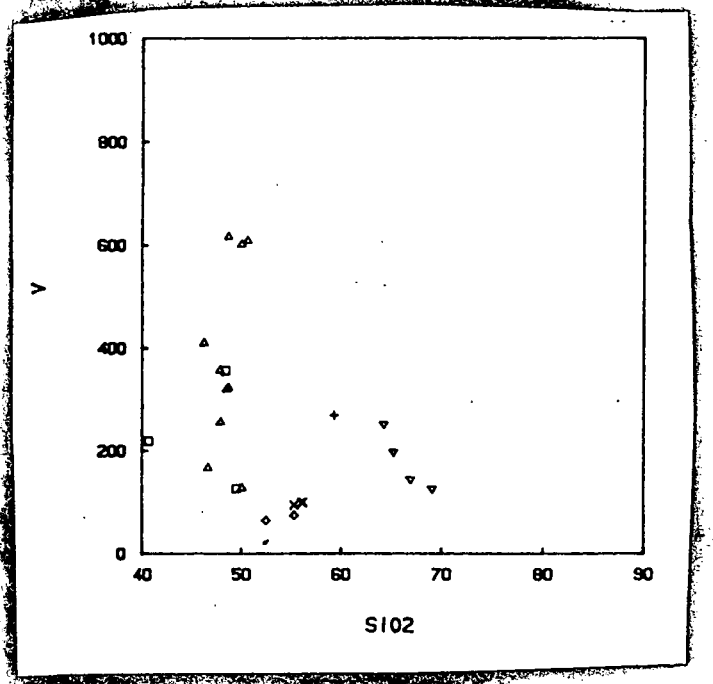
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NUNDROO DDH 1, 2 & 3 WELL COMPLETION REPORT

SUMMARY TRACE ELEMENT VARIATION DIAGRAMS

SiO_2 vs Ni+Cr, Cu, Pb, Nb

COMPILED S. Daly	C.D.G. DATE
DRAWN L.H.F.	SCALE
DATE March '89	PLAN NUMBER
CHECKED	S 20732



- Basic Melanocratic
- Basic Mesocratic
- Basic Leucocratic
- Basic Intermediate
- Basic Intermediate + Garnet
- Acid / Sediments
- Pegmatite

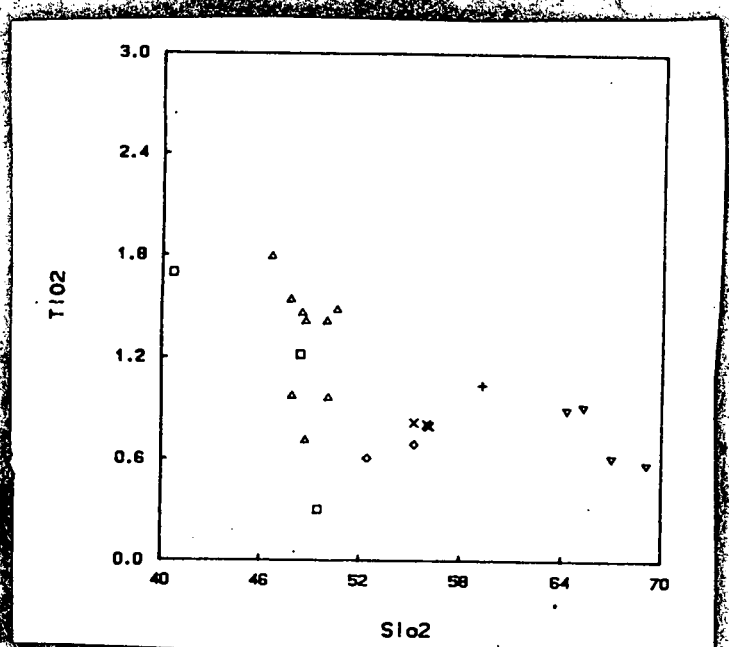


Figure 9

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

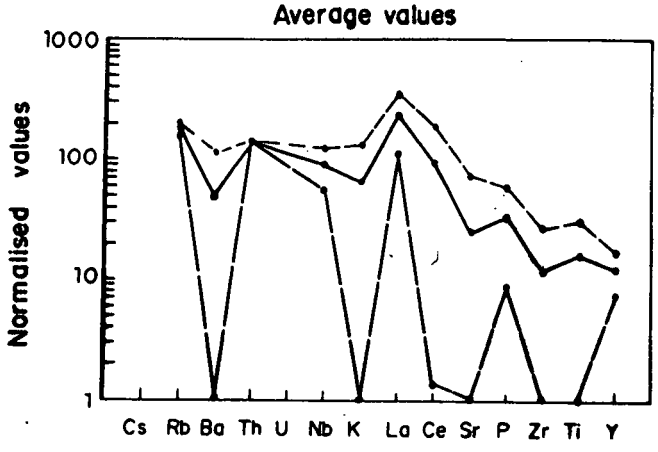
NUNDROO DDH 1, 2 & 3 WELL COMPLETION REPORT

SUMMARY VARIATION DIAGRAMS
SiO_2 vs V, TiO_2

COMPILED S.D.C.	CDO	DATE
DRAWN L.H.F.	SCALE	
DATE March '89	PLAN NUMBER S 20733	
CHECKED		

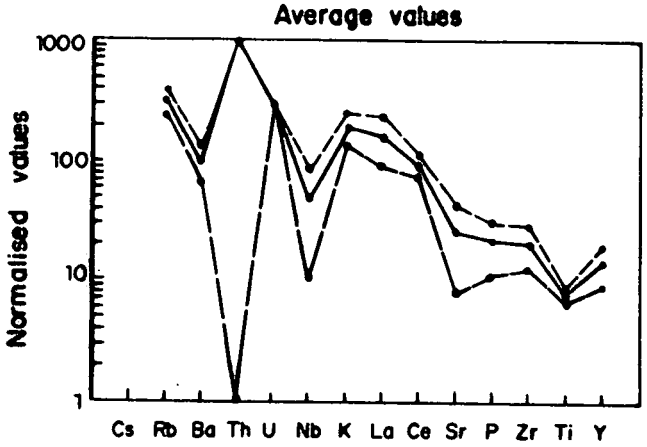
BASICS

Chondrite normalised plot (std.dev.)
Average values



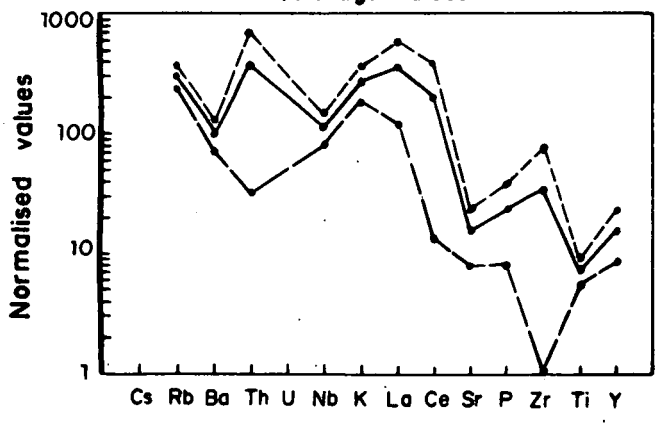
INTERMEDIATE ROCKS

Chondritic normalised plot (std.dev.)
Average values



GNEISSES. ~~SEDIMENTS~~

Chondrite normalised plot (std. dev.)
Average values



MEAN CHONDRITIC VALUES FOR THE 3 GROUPS

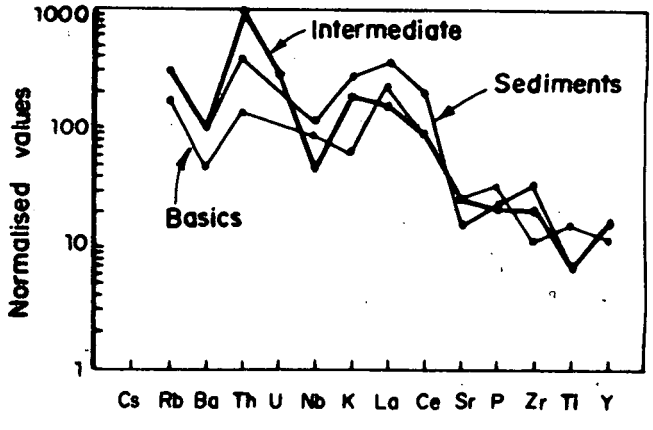


Figure.... 10

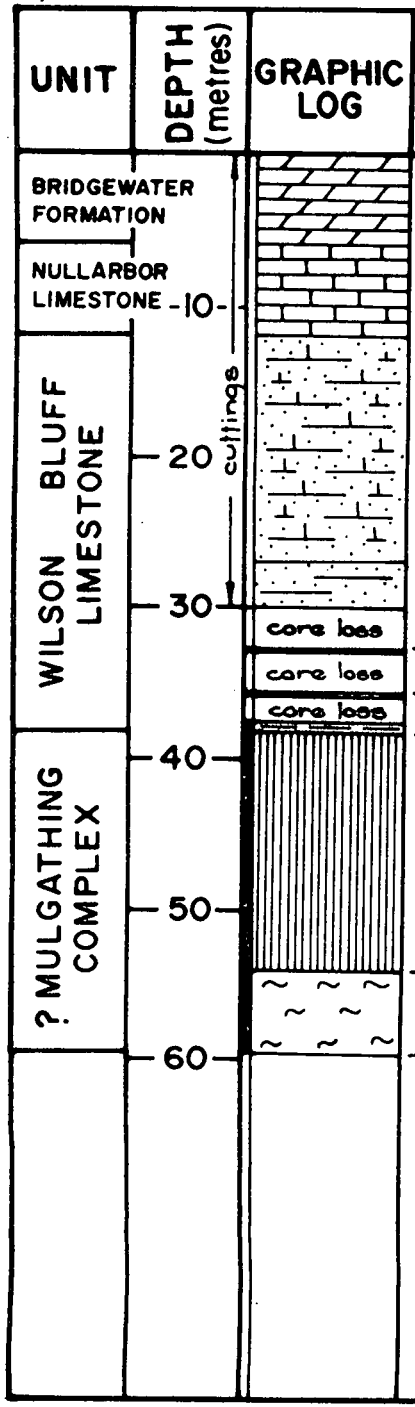
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NUNDROO DDH 1, 2 & 3 WELL COMPLETION- REPORT
CHONDRITIC NORMALISED DISCRIMINATION DIAGRAMS FOR THE METABASICS, METAINTERMEDIATE BASICS AND METASEDIMENTS

COMPILED S. Daly	C.D.O. DATE
DRAWN L.H.F.	SCALE as shown
DATE March '89	PLAN NUMBER
CHECKED	S 20734

4736

4736



LITHOLOGICAL DESCRIPTION

6m

Cream to reddish brown fine-medium grained grainstone with 10-20% silty to very fine grained sub-angular quartz sand. Grainstone is calcreted ie recrystallised and contains red-brown to black pisoliths.

12m

Cream recrystallized very fine grained grainstone with 20-30% silt to very fine grained translucent subangular quartz.

Pink to orange brown calcareous mudstone containing a low but persistent content of glauconite and 10% of fine grained subrounded quartz. Mudstone contains thin interbeds of cream very fine grained recrystallized limestone.

32.75 - 33m

35.75m

38.3m

Pale green to orange-brown glauconitic very fine grained quartz sand with calcareous mud matrix.

Dark red-brown to orange-brown very weathered gneiss, with relict quartz and mica.

54.0m

Interlayered fine to very coarse grained magnetitic and porphyroblastic quartz feldspar amphibole quartz garnet biotite gneiss.

59.6m

Enclosure 2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

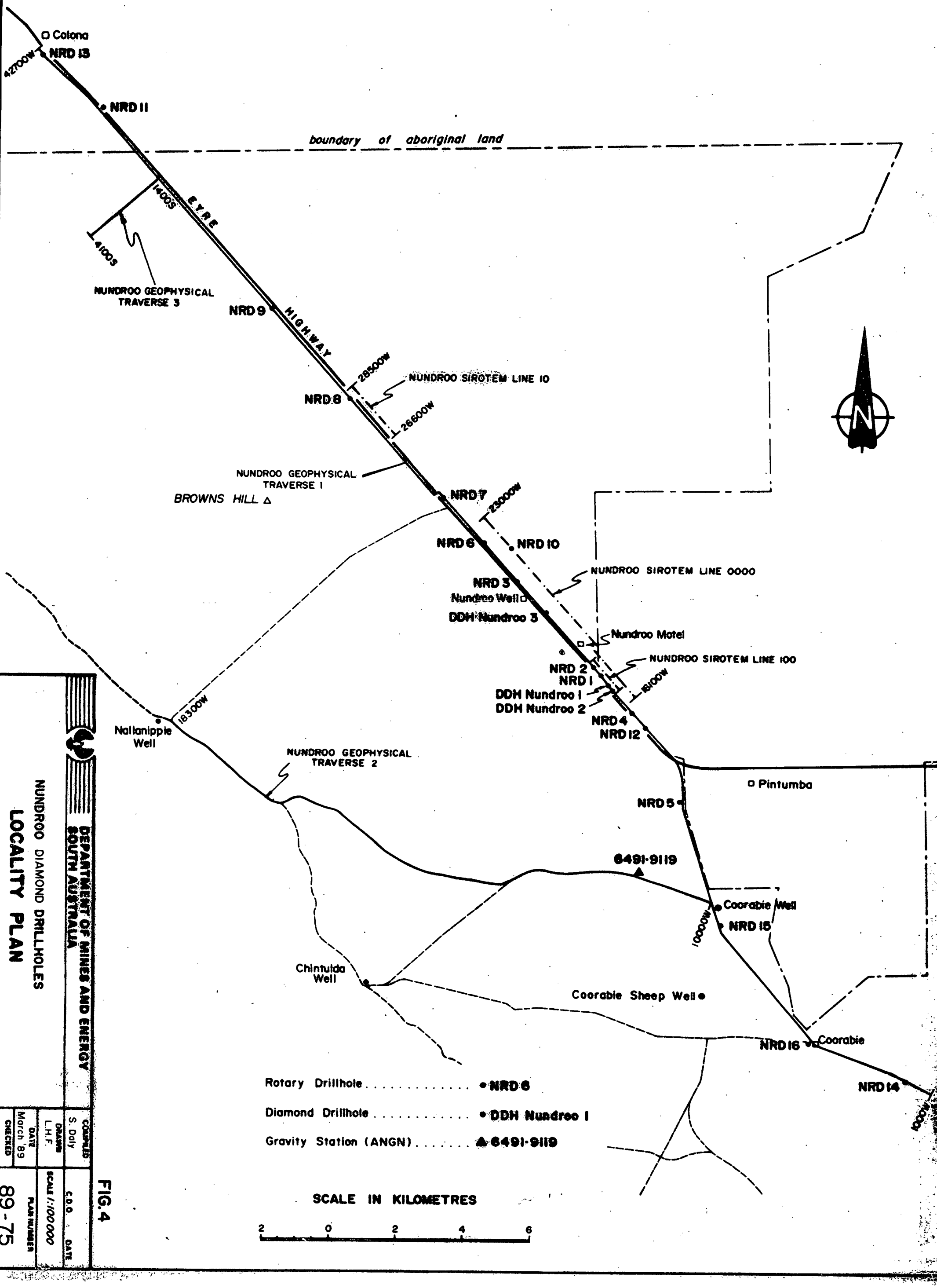
COMPILED S.D.
DRAWN E.C.
DATE Nov.'88
CHECKED
CDO DATE
SCALE As shown
PLAN NUMBER
S 20639

NUNDROO DDH 1

WELL COMPLETION REPORT

GEOLOGICAL LOG SUMMARY

NUNDROO DIAMOND DRILLHOLES
LOCALITY PLAN



DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED	DRAWN	DATE	CHECKED	DATE
S. Daly	L.H.F.	March '89		

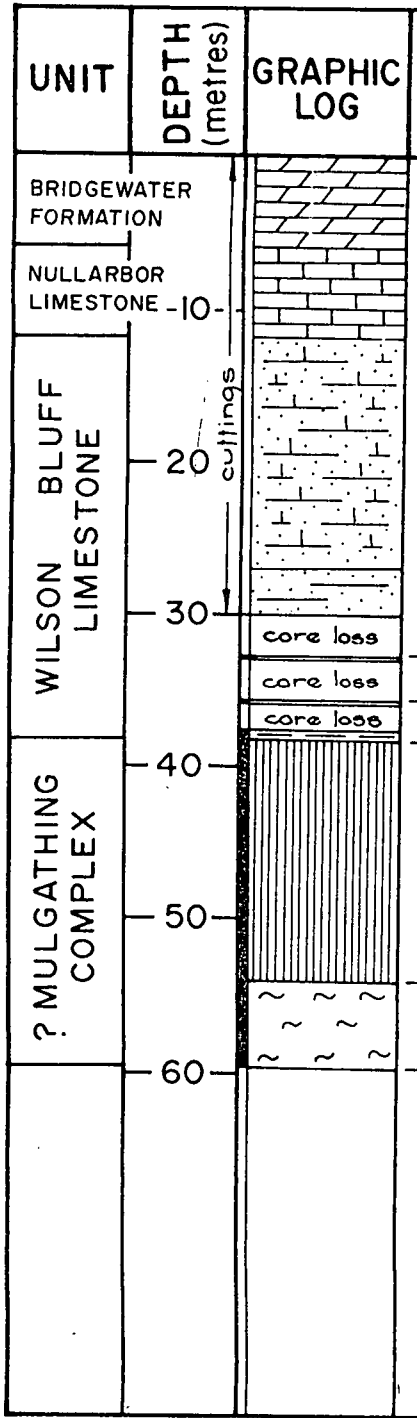
SCALE 1:100 000

C.D.O. DATE

PLAN NUMBER 89-75

FIG. 4

4736



LITHOLOGICAL DESCRIPTION

6m — Cream to reddish brown fine-medium grained grainstone with 10-20% silty to very fine grained sub-angular quartz sand. Grainstone is calcreted ie recrystallised and contains red-brown to black pisoliths.

12m — Cream recrystallized very fine grained grainstone with 20-30% silt to very fine grained translucent subangular quartz.

Pink to orange brown calcareous mudstone containing a low but persistent content of glauconite and 10% of fine grained subrounded quartz. Mudstone contains thin interbeds of cream very fine grained recrystallized limestone.

32.75 - 33m
35.75m
38.3m — Pale green to orange-brown glauconitic very fine grained quartz sand with calcareous mud matrix.

Dark red-brown to orange-brown very weathered gneiss, with relict quartz and mica.

54.0m

Interlayered fine to very coarse grained magnetitic and porphyroblastic quartz feldspar amphibole quartz garnet biotite gneiss.

59.6m

Enclosure 2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

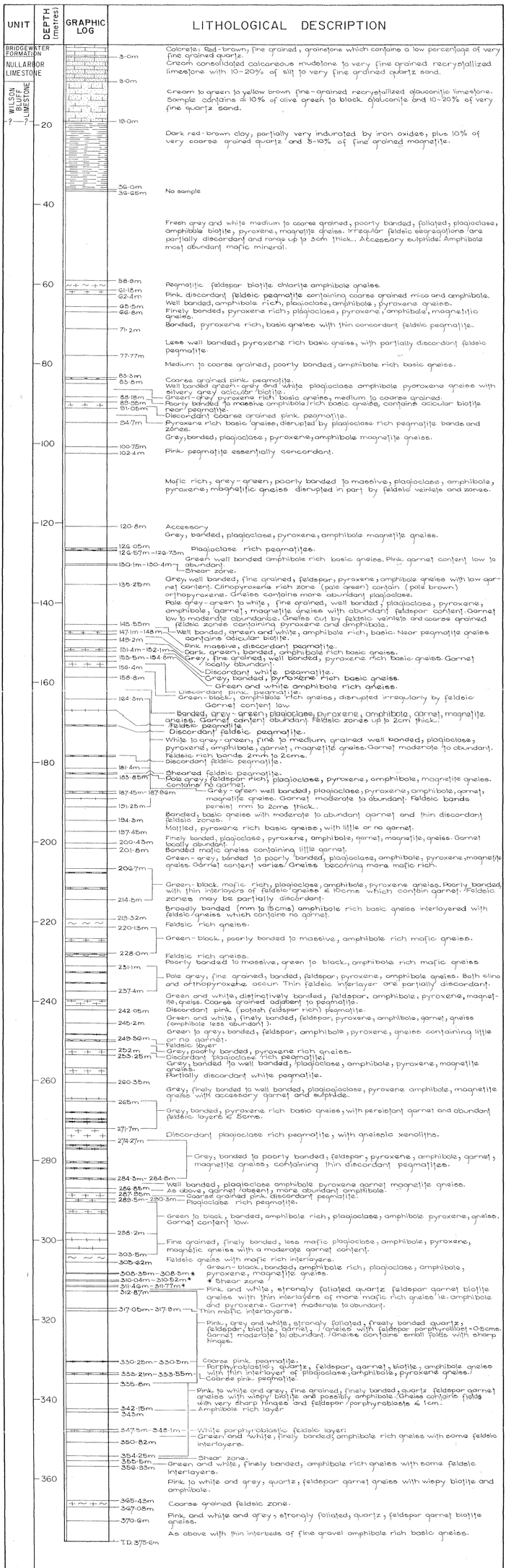
COMPILED S.D.
DRAWN E.C.
DATE Nov.'88
CHECKED
C.D.D. DATE
SCALE As shown
PLAN NUMBER
S 20639

NUNDROO DDH 1

WELL COMPLETION REPORT

GEOLOGICAL LOG SUMMARY

89-33



Enclosure 4

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

COMPILED	S.D.
DRAWN	E.C.
DATE	Jan '89
CHECKED	
S.D.D. DATE	
PLANS	As shown
PLAN NUMBER	89-33

NUNDROO DDH 2

WELL COMPLETION REPORT

GEOLOGICAL LOG SUMMARY

4736

LITHOLOGICAL DESCRIPTION

UNIT	DEPTH (metres) / annotations	LITHOLOGICAL DESCRIPTION
BRIDGEWATER FORMATION	0–5 (cuttings only)	Calcrete: Pale grey-brown calcareous mud with fragments of cream to orange to black very fine grained grainstone. Low percentage of very fine-grained subrounded translucent quartz.
		Reddish-brown to orange very fine-grained grainstone with 20%-30% of subrounded very fine-grained translucent Quartz. Sand contains a few fragments (fine-grained) of white recrystallised limestone.
? NULLARBOR LIMESTONE	5	Pale cream to brown sandy calcareous mudstone with thin interbeds of cream recrystallised limestone. Mudstone contains 20-30% of very fine-grained to fine-grained subrounded translucent quartz. Low percentage of green to black glauconite.
		Pale orange-brown sandy calcareous mudstone with thin interbeds of white recrystallised limestone. Mudstone contains 30-40% of very fine grained subrounded translucent quartz.
		Cream to orange sandy calcareous mudstone with a low percentage of green to black glauconite and 20-30% of very fine grained to fine grained subrounded translucent quartz.
	10	No sample.
		Pale brown to reddish-brown sandy calcareous mudstone to a sandy recrystallised limestone. Quartz content 10-40% very fine grained to fine grained subrounded and translucent.
WILSON BLUFF LIMESTONE	15	Pinkish-brown to orange-brown sandy calcareous mudstone contains a low percentage of glauconite and 30-40% of very fine-grained to fine-grained subrounded translucent quartz.
		As above, quartz content 20-40%.
		As above, quartz content 40-50%.
	20	Cream to orange-brown sandy calcareous mudstone. Mudstone contains 100% of very fine-grained green to black glauconite agglutinates to form soft to moderately hard pellets and 20-40% of very fine-grained to fine-grained translucent to subtranslucent to subrounded quartz. Also a low percentage of coarse-grained to very coarse subrounded milky quartz.
		As above, cream to pale brown, quartz 10-20%.
	25	As above.
HAMPTON SANDSTONE		Greenish-brown clayey sand. Quartz is very fine-grained to coarse grained subrounded and translucent. A low percentage of quartz is milky. Clay content is ~ 50% and is slightly calcareous. Low percentage of greenish-black glauconite.
		As above, clay content ~ 40%.
	30	Orange brown-green clayey sand. Quartz is fine-grained to coarse grained translucent and subrounded. Sample includes reddish-brown ferruginized clayey sand fragments. Clay content ~20% slightly calcareous. Low percentage of fine grained green-black glauconite.
		As above, no glauconite.
	35	As above, clay content 40%, no glauconite.
		Pale orange-brown sandy clay. Quartz content 40-50%. Predominantly medium to very coarse grained (a low percentage of fine grained quartz) milky and translucent subrounded quartz.
		As above.
	40	As above.
PIDINGA FORMATION		Lignite: Black carbonaceous clay with 10% subangular to subrounded, translucent very fine grained quartz sand.
	45	As above, with 30% fine-grained to very coarse-grained translucent to milky quartz.
		As above, with less than 10% of very fine-grained to medium-grained translucent and milky quartz.
		As above (contains mica used for lost circulation).
	50	As above (contains mica used for lost circulation).
		Black carbonaceous clay wiyh ~30% of fine to very coarse-grained quartz.
	55	Medium to coarse grained subrounded to subangular quartz with 10-20% pale-grey clay matrix. Sand contains quartz feldspar mica gneiss fragments.
		Medium to coarse-grained subangular quartz with 10-20% pale grey clay matrix. Sand contains quartz feldspar biotite pyrite gneiss fragments.
		As above.
WEATHERED ? MULGATHING COMPLEX	60	Weathered quartz feldspar biotite gneiss pyritic in part.
	65	No sample.
	70; 45° to c.a	Pink-grey fine grained well banded (mm to 3cm) feldsic quartz, feldspar, garnet, biotite, gneiss (subordinate chlorite on the broken surfaces).
		Gneiss is very slightly magnetic and presumably contains a low percentage of magnetite. Garnet content is abundant to very abundant.Gneiss contains essentially conformable coarse grained cream to pale green pegmatite layers (5mm to 4cm thick). Green sericitic plagioclase predominates. Pyrite is abundant locally on discordant broken surfaces.
	RS 230; RS 231(A)	RS230 Garnet, quartz, biotite, Kspar, palgioclase. magnetic gneiss, (in order of abundance).
	75; 40° to c.a; RS 232	RS232 Quartz, garnet, Kspar, plagioclase biotite, magnetic gneiss.
	80; 40° to c.a; RS233(A)	
	82.20	Discordant broken zone, broken peices are chlorite rich and contain abundant porphyroblastic coarse-grained feldspar.
	83.40	Discordant broken zone, fine grained feldsic gneiss with garnet and coarse-grained porphyroblastic pegmatite, chlorite and pyrite on some broken surfaces.
	85	Less well banded, medium grained, pegmatitic, quartz feldspar garnet biotite gneiss very broken core, chlorite rich on broken surfaces.
	87.90	Pink and grey feldsic gneiss: Fine-medium grained well layered to poorly layered quartz feldspar garnet biotite gneiss. Garnet content moderate to abundant.
	88.95; 89.08; 40° to c.a	Feldsic gneiss: Medium grained quartz feldspar garnet biotite with abundant pegmatite both concordant and discordant.
	89.90	Pegmatite: greenish grey and cream coarse-grained pegmatite essentially concordant containing a few medium grained pink garnet.
	90.35	Pink and grey fine to medium grained well layered to poorly layered pegmatitic quartz feldspar garnet biotite gneiss with abundant garnet. (Gneiss is folded 92.0-92.60m).
	92.60; RS 234; RS 235	Discordant, foliated, poorly compositionally banded coarse grained greenish-cream pegmatite. Green sericitic plagioclase is most abundant and is crudely interlayered with cream potash feldspar.The feldspar porphyroblasts are interlayered with ribbon-like quartz black biotite and garnet clusters. Feldspar porphyroblasts ≤ 1.5cms. RS234 Quartz plagioclase, garnet, sericite, Kspar, biotite. RS235 Kspar, plagioclase, quartz, sericite, biotite.
	94.35	Medium grained, layered, quartz feldspar garnet biotite gneiss. Garnet abundant.
	94.16; RS236; 94.89	Conformable coarse grained foliated porphyroblastic quartz plagioclase, potash feldspar biotite pegmatite. Pegmatite has auger like texture. Porphyroblasts ≤ 1-2cms. RS236 Kspar, plagioclase, quartz, biotite, garnet.
	95.28; 95.40	Pegmatite zone bottom contact concordant.
	96.40	Pinkish grey gneiss. Foliated, poorly compositionally layered. Quartz feldspar biotite gneiss. Biotite content higher, garnet less abundant. Gneiss contains pale grey green sericitic plagioclase porphyroblasts ≤ 7mm. Pyrite on fracture surfaces.
	97.14	Pinkish grey layered medium grained quartz feldspar (plagioclase predominates) biotite garnet gneiss. Gneiss contains less porphyroblasts of sericitic plagioclase (grey-green) and a large garnet porphyroblast ~3cm. Thin pegmatitic segregations.
	98.12	Broken zone containing a greater abundance of coarse grained pegmatite.
	RS 237; 45° to c.a	Layered to well layered pinkish-white gneiss. Quartz feldspar (plagioclase predominates) garnet biotite gneiss. Garnet is moderate to abundant. Banding is picked out by pale greenish conformable pegmatite and biotite rich layers. Pyrite on broken surfaces. Pegmatite up to 5cm thick.
	98.36; 98.41; 40° to c.a	Sheared zone, porphyroblasts ≤ 5mm. RS237 Quartz, plagioclase, biotite, garnet, sericite magnetic gneiss.
	100.12; 100.89	Mafic gneiss: upper contact conformable, lower contact not preserved. Greenish-black, foliated homogenous, biotite, plagioclase, amphibole/pyroxene gneiss. Veined by greenish feldsic pegmatite. Pyrite on broken surfaces. Non magnetic. Likely a sheared mafic intensive.
	101.65	Very broken core. Predominantly coarse grained pegmatite with scattered garnet with some gneissic interlayers.
	102.70	No core.
		Pink and grey fine grained well layered to layered quartz feldspar garnet biotite gneiss. Garnet abundant. (103.50-103.88 biotite/chlorite rich zone porphyroblastic in part 51.5cm). Sulphide on broken surfaces.
	RS239(A); 105; RS 238	RS238 Quartz, garnet, biotite, plagioclase, sericite magnetic gneiss.
	103.50; 40° to c.a	Pink and grey fine to medium grained quartz feldspar garnet biotite gneiss. Well layered with a greater abundance of conformable pale greenish feldsic or pegmatitic layers. porphyroblastic in part. Porphyroblasts are both plagioclase (green) and potash feldspar (cream).
	107.25	Basic gneiss (mainly an intensive-host gneiss foliation 40° to c.a. planar contact is 25° to c.a. Host gneiss is porphyroblastic along contact.) Basic is fine grained greenis-black homogenous and foliated.
	107.61	Plagioclase amphibole? biotite gneiss. Gneiss only very slightly magnetic. Lower contact discordant.
	107.75	Transition zone between basic and feldsic gneiss.
		Pink and grey layered to poorly layered quartz feldspar garnet biotite gneiss with numerous concordant and discordant porphyroblastic very coarse grained pale green (plagioclase and cream (potash feldspar) pegmatites with scattered medium grained pink garnet. Wisps of biotite and quartz ribbons.
	110; 110.50	Predominatly mafic with some acid gneiss remnants and very coarse grained porphyroblastic pegmatite ie. transitition zone. Upper contact discordant.
	110.95; 40° to c.a; 111.90; 112.07	Basic intensive foliated homogenous veined by coarse grained pegmatite (111.44-111.57) (111.60-111.68). Pegmatite contains coarse grained reddish garnets. Basic is green plagioclase amphibole biotite ?pyroxene gneiss. (111.90-112.07 very coarse grained pegmatite discordant).
	112.80; 112.86; 112.96	Non layered foliated porphyroblastic biotite rich quartz feldspar biotite garnet gneiss with abundant very coarse feldspar porphyroblasts. (112.80-112.96 very coarse grained foliated pegmatite conformable).
	113.12; 113.38	Basic intrusive (112.86-116.66, intrudes pegmatite with a steep contact) fine grained, homogenous foliated containing (elongate parallel to foliation) porphyritic pegmatitic xenoliths. Slightly magnetic (113.12-113.38. Pegmatitic quartz feldspar biotite garnet gneiss xenolith. Upper contact with basic shows basic intruding garnet gneiss, lower contact gradational.) Plagioclase amphibolite biotite pyroxene gneiss.
	115; RS 241(A); RS 240; 50° to c.a	RS 240 Plagioclase, hornblende, biotite, potassium feldspar, clinopyroxene, epidote gneiss.
	116.66	Xenolith of quartz feldspar biotite garnet gneiss porphyroblastic in part with a few thin basic layers.
	117.66-117.76	Fine grained foliated basic.
	118.06	Medium-coarse grained foliated pegmatite.
		Fine grained basic intrusive, foliated, containing pegmatitic xenoliths.
	118.95	Foliated pegmatitic xenolith of feldsic basic gneiss. Gneiss medium to very coarse grained, plagioclase amphibole, biotite gneiss. More pegmatitic zones contain large clots of amphibole. Slightly magnetic.
	120; RS 242	RS 242 Plagioclase, hornblende, biotite, sericite gneiss.
	120.70	Fine grained basic with pegmatitic xenoliths. Upper contact of fine grained basic compositionally banded.
	120.80; 121.10	Coarse grained pegmatite: pink, green-grey, feldsic porphyroblastic pegmatite.
	50° to c.a	Fine-grained grey foliated homogenous basic (upper contact with pegmatite discordant) containing wispy and rounded xenoliths of fine-medium grained pegmatitic material orientated parallel to foliation direction.
	RS 243; 122.88	RS 243 Hornblende, plagioclase, kspar, biotite, quartz magnetite gneiss. Lower contact with amphibole gneiss slightly discordant.
	50° to c.a; 124.15-128	Green-black and white medium grained mafic gneiss. Foliated effectively homogenous, banding produced by irregular pegmatitic layers. Plagioclase, (deep green) amphibole (black) biotite magnetite gneiss ($2x10^{-3}$ SI units).
	125	Porphyroblastic essentially conformable pegmatite, contains both plagioclase and potash feldspar porphyroblasts ≤ 2cm.
	RS 244; RS 245(A)	RS 244. Plagioclase hornblende biotite quartz gneiss.
	126.95; 45° to c.a; RS 246; RS 247(A)	RS 246 Plagioclase biotite quartz garnet hornblende magnetite gneiss.
	130; 132.0-132.10	Coarse grained porphyroblastic foliated pegmatite.
	134.10; 134.18	Coarse grained amphibole concordant.
	135; 45° to c.a	Black-green medium-grained foliated homogenous plagioclase, amphibole gneiss with subordinate biotite garnet and magnetite. Contains thin conformable to slightly discordant pegmatites. Garnet content low.
	137.94; 138.03	Coarse grained amphibole concordant.
		Black-green and white medium grained well foliated homogenous plagioclase, amphibole gneiss with subordinate biotite. Rare garnet only. White pegmatites concordant to slightly discordant persist.
	140; 140.55; 140.78	Coarse grained dark green conformable amphibole and plagioclase.
	142.55; 40° to c.a; RS 248(A); 145	As above, garnet and biotite content overall low but irregularly abundant. Gneiss contains a greater abundance of discordant pegmatite and feldspar porphyroblasts. Overall less persistently foliated.
	148.60	Pegmatitic gneiss with abundant biotite and garnet.
	149.03	Pegmatitic green-black and white gneiss. Plagioclase, amphibole, biotite garnet gneiss. Garnet content erratic, low to moderate.
	149.72-.76	Pool of coarse grained green amphibole.
	150	Green-black and white medium grained basic gneiss. Gneiss is foliated homogenous plagioclase and amphibole rich with minor biotite. Garnet absent to rare. Gneiss contains white pegmatite both concordant and discordant. Foliation less disrupted than in previous interval.
	152.40; 152.65	Shear zone, porphyroblastic, plane of foliation, rotated. Garnet rich gneiss.
	153.55	Shear zone, porphyroblastic, plane of foliation, rotated.
	154.36-154.46	Coarse grained amphibolite rich zone, concordant.
	155; RS 249(A); 50° to c.a	Green-black and white medium to coarse grained porphyroblastic plagioclase, biotite, amphibole garnet gneiss. Garnet content persistent, locally very abundant. Gneiss more pegmatitic, foliation less well defined.
	158.20	Zone with variable foliation, fold picked out by zone of very coarse grained amphibole.
	159.00; 160; 50° to c.a	
	RS 251(A); 165; RS 250	RS250 Plagioclase biotite hornblende quartz garnet.
	165.70; 50° to c.a; 170	Green and white medium to coarse grained foliated homogenous plagioclase, amphibole gneiss with subordinate biotite. Garnet absent. Gneiss contains both conformable old discordant pegmatites. Foliation more persistent than in garnet rich zones.
	174.27-.31; 174.62-.70; 175	Coarse grained pod of green hornblende.
	60° to c.a	Green-black and white fine-medium grained feldspar biotite, garnet, quartz, amphibole gneiss. Garnet persistent, some discordant pegmatites.
	180; 180.16	Green and white fine-medium grained foliated homogenous plagioclase amphibole gneiss with subordinate biotite. Garnet absent.
	181.80	Green and white fine to coarse grained foliated basic gneiss containing abundant amphibole. Gneiss is disrupted by white (plagioclase rich) pegmatite. Amphibole in contact with pegmatite is coarse grained.
	183.05	Pegmatite plagioclase amphibole gneiss. (Note pegmatite contains potassium feldspar.)
	184.54; 185	Plagioclase biotite amphibole gneiss with a low garnet content.
	185.72; 50° to c.a	Green and white medium grained foliated homogenous plagioclase amphibole gneiss with subordinate biotite. Garnet absent. Gneiss pegmatite and porphyroblastic in part.
	RS 253(A); RS 252	RS252 Plagioclase hornblende, biotite, quartz gneiss.
		Pegmatite zone with coarse grained amphibole.
	190; 195; 196.20-.45; 196.65-.75	Coarse grained green amphibole essentially conformable.
	RS 254(A); 50° to c.a	Green and white medium grained foliated homogenous plagioclase amphibole gneiss with subordinate biotite and no garnet. Foliation is overall less distinct because of pegmatitic segregation.
	200; 201.05; 201.25; 201.07	Coarse grained green amphibole. (Note 201-201.25 depth discrepancy.)
	203.25-.40	Ptygmatic quartz vein.
	204.10; 204.30	Ptygmatic quartz vein.
	205; 207.16; 207.32	Coarse grained amphibole, essentially concordant.
	RS 256(A); RS 255	RS255 Plagioclase, hornblende, quartz, biotite gneiss.
	210; 55° to c.a	Green and white, fine to medium grained, homogenous with a few layers of more abundant amphibole, plagioclase amphibole gneiss. Subordinate biotite, no garnet.
	213.93; 214.14	Foliated white discordant pegmatite.
	215	Basic gneiss, foliation less distinct, more porphyroblastic and pegmatitic.
	216.04-.14	Coarse grained pink pegmatite, discordant. Contains potash feldspar.
		As above, gneiss contains irregular zones of medium-coarse grained amphibole.
	218.11-.24	Fine grained basic intrusive.
	218.52; RS 257	Basic gneiss, porphyritic, contains medium-coarse grained amphibole.
	218.96	Green very fine grained basic intrusive, foliated. 218.96-218.99 Contact zone between basic intrusive and gneiss, invaded by potash rich pegmatite. Pegmatite contains fragments of basic intrusive.
	220; 50° to c.a	Green and white, foliated, homogenous, fine to medium grained plagioclase, amphibole gneiss with subordinate biotite. Gneiss contains some discordant pegmatitic segregation.
	224.56; 225; 50° to c.a	Gneiss overall paler, i.e. more feldsic, fine grained and more distinctively foliated.
	226.70-.84	Concordant zone of coarse grained, amphibole rich gneiss.
	226.83-227.[illegible]; 227.42-.52	Green and white basic gneiss, foliated, amphibole content increasing.
	228.09	Predominantly concordant, coarse grained amphibole, some appear as regular clusters with host gneiss.
	228.57-.80; RS 259(A); RS 258	Green medium to coarse grained amphibole rich gneiss.
	229.90; 230; 230.36; RS 260; 230.49	Green and white basic fine to medium grained, foliated to porphyroblastic and pegmatitic gneiss. 230.36-230.40 Pod of fine grained basic intrusive, 230.40-230.49. Fine grained foliated quartz feldspa (potash feldspar) biotite gneiss, appears concordant. Basic gneiss with abundant medium to coarse grained amphibole.
	231.75	Green and white fine to medium grained foliated homogenous plagioclase, amphibole gneiss. Biotite content subordinate, no garnet.
	T.D. 234	

REFERENCE

Rock sample .... RS 61
Inclination .... 70°
Declination

ENCLOSURE 5

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

COMPILED S.D.
DRAWN L.F.
DATE May '89
CHECKED
SCALE As shown
PLAN NUMBER 89-117

NUNDROO DDH 3
WELL COMPLETION REPORT
GEOLOGICAL LOG

89-34

UNIT	DEPTH (metres)	GRAPHIC LOG	LITHOLOGICAL DESCRIPTION
BRIDGEWATER FORMATION			
NULLARBOR LIMESTONE		4m	Reddish - brown to orange very fine-grained grainstone which contains some recrystallized limestone fragments and is calcret . Grainstone contains 20% - 30% of very fine grained quartz. Calcrete development grainstone boundaries ie becomes a calcareous mudstone with reddish - orange to black pisolithe.
?		14m	Cream to orange - brown sandy, calcareous, mudstone to sandy recrystallized limestone with thin interbeds of white recrystallized limestone. Mudstone contains 20-40% of very fine gravel quartz sand.
WILSON BLUFF LIMESTONE	20		Pinkish - brown to orange - brown sandy calcareous mudstone containing persistent glauconite and 20-40% of fine grained quartz sand.
?		26m	
HAMPTON SANDSTONE	cuttings		Green to orange - brown clayey sand. Quartz is very fine grained to coarse grained translucent and milky clay content varies between 20-50%. Upper part contains glauconite. Clay is slightly calcareous.
	40	42m	Pale orange - brown sandy clay. Quartz content 40-50%, predominantly medium to very coarse grained milky to translucent subrounded quartz.
PABINGA FORMATION			Lignite: Black carbonaceous mud with 10-30% of very fine grained to medium grained translucent and milky quartz.
		54m	
?	60	60m	Medium coarse grained subangular to subrounded quartz with 10-20% pale grey clay matrix. Sand contains quartz feldspar mica gneiss fragments.
WEATHERED GNEISS			Weathered quartz feldspar biotite gneiss pyritic in part.
?		69m	
			Pink to grey fine-grained well banded (mm to 3cms) feldsic quartz, feldspar, garnet, biotite gneiss. Garnet content is abundant. Gneiss contains essentially conformable cream (potash feldspar) to pale green (plagioclase) pegmatitic layers (5mm to 4cm thick). Pyrite is abundant locally on discordant broken surfaces.
	80		
		84m	Very broken core, pegmatitic quartz feldspar garnet biotite gneiss.
		88.95m	Coarse grained essentially concordant pegmatite.
		90.35m	Quartz feldspar biotite gneiss with abundant garnet.
		92.6m	Discordant pegmatites.
		95.4m	Quartz feldspar, biotite, garnet gneiss with moderately abundant garnet and feldspar porphyroblasts.
	100	100.2-100.89m	Green-black foliated homogenous plagioclase amphibole pyroxene biotite gneiss.
		101.65m No core	Broken core, predominantly coarse grained pegmatite.
		102.7m	
		107.25m	Quartz feldspar biotite gneiss with abundant garnet and abundant conformable feldsic pegmatitic layers.
		107.78m	Quartz feldspar biotite garnet gneiss with concordant and slightly discordant
		110.50m	porphyroblastic plagioclase and potash feldspar rich pegmatites.
		111.9m	Matic intrusive.
		112.96m	Porphyroblastic quartz feldspar biotite garnet gneiss.
		116.66m	Basic intrusive: fine grained foliated, homogenous plagioclase, hornblende, biotite, pyroxene gneiss, enlarge pegmatitic xenoliths.
		117.66m	Xenolith of quartz quartz feldspar biotite garnet gneiss.
	120	120.70m	As above.
		122.88m	Xenolith of plagioclase hornblende , biotite gneiss.
		126.95m	Fine grained basic intrusive.
			Plagioclase and potashfeldspar porphyroblastic pegmatite.
		132-132.1m	Plagioclase hornblende biotite quartz gneiss with thin irregular plagioclase rich pegmatites.
		137.94m	Plagioclase biotite garnet quartz amphibole magnetite gneiss. Garnet content low to moderately abundant. Gneiss contains thin discordant pegmatites.
	140		Plagioclase amphibole gneiss with biotite and garnet. Gneiss contains
		142.55m	thin conformable to slightly discordant pegmatites.
			Plagioclase amphibole gneiss with more garnet only. Plagioclase rich pegmatites persist.
		148.6m	
		149.03m	Plagioclase amphibole gneiss with garnet and biotite content overall low but
		150m	irregularly abundant. Abundant discordant pegmatite and feldspar
		152.4m	porphyroblasts.
		153.55m	Pegmatitic gneiss with abundant biotite garnet.
			Pegmatitic gneiss with abundant amphibole.
	160	158.2m	Plagioclase amphibole gneiss.
			Porphyroblastic shear zone plane of foliation, rotated.
			Fold picked out by very coarse grained amphibole.
		165.7m	Green-black and white medium to coarse grained porphyroblastic plagioclase, biotite, amphibole, garnet gneiss. Garnet content persistant, locally very abundant.
			Green and white plagioclase amphibole gneiss with subordinate biotite. Garnet rare or absent. Gneiss contains conformable and discordant pegmatites.
		174.7m	Green-black and white fine - medium grained feldspar biotite garnet quartz amphibole gneiss. Garnet persistant, feldspar porphyroblastic.
	180	180.16m	
		181.9m	Green and white fine to medium grained homogenous plagioclase amphibole gneiss.
		183.05m	Basic gneiss containing abundant amphibole and plagioclase rich pegmatite.
		184.94m	Pegmatitic plagioclase amphibole, potash feldspar gneiss.
		185.72m	Plagioclase biotite amphibole gneiss with a low garnet content.
		189-	Pegmatitic zone with coarse grained amphibole.
		189.4m	Green and white medium grained foliated homogenous plagioclase amphibole gneiss with subordinate biotite. Gneiss pegmatitic and porphyroblastic in part.
		196.2-	Coarse grained amphibole essentially conformable.
		196.7m	
	200		Green and white medium grained foliated homogenous plagioclase amphibole gneiss with subordinate biotite and no garnet. Foliation is overall less distinct because of pegmatitic segregations and parts of coarse grained amphibole.
			Green and white homogenous foliated plagioclase amphibole gneiss with biotite and no garnet. Gneiss contains a few layers of more abundant amphibole and irregular zones of medium to coarse grained amphibole.
		213.93-214.14m	Foliated white discordant pegmatitic.
		216.04-216.14m	Coarse grained pink pegmatite discordant.
		218.11m	Fine grained basic intrusive foliated.
	220	218.96m	
		224.56m	Green and white, foliated homogenous, fine to medium grained plagioclase, amphibole gneiss with biotite. Gneiss contains some discordant pegmatitic segregations.
		226.7m	Gneiss overall paler and more felsic, fine grained and more distinctively foliated.
		230.4-230.49m	Green and white fine to coarse grained amphibole rich plagioclase amphibole gneiss.
		T.D. 234.94m	(230.4 - 230.49m Fine grained basic intrusive)
	240		

Enclosure 6

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

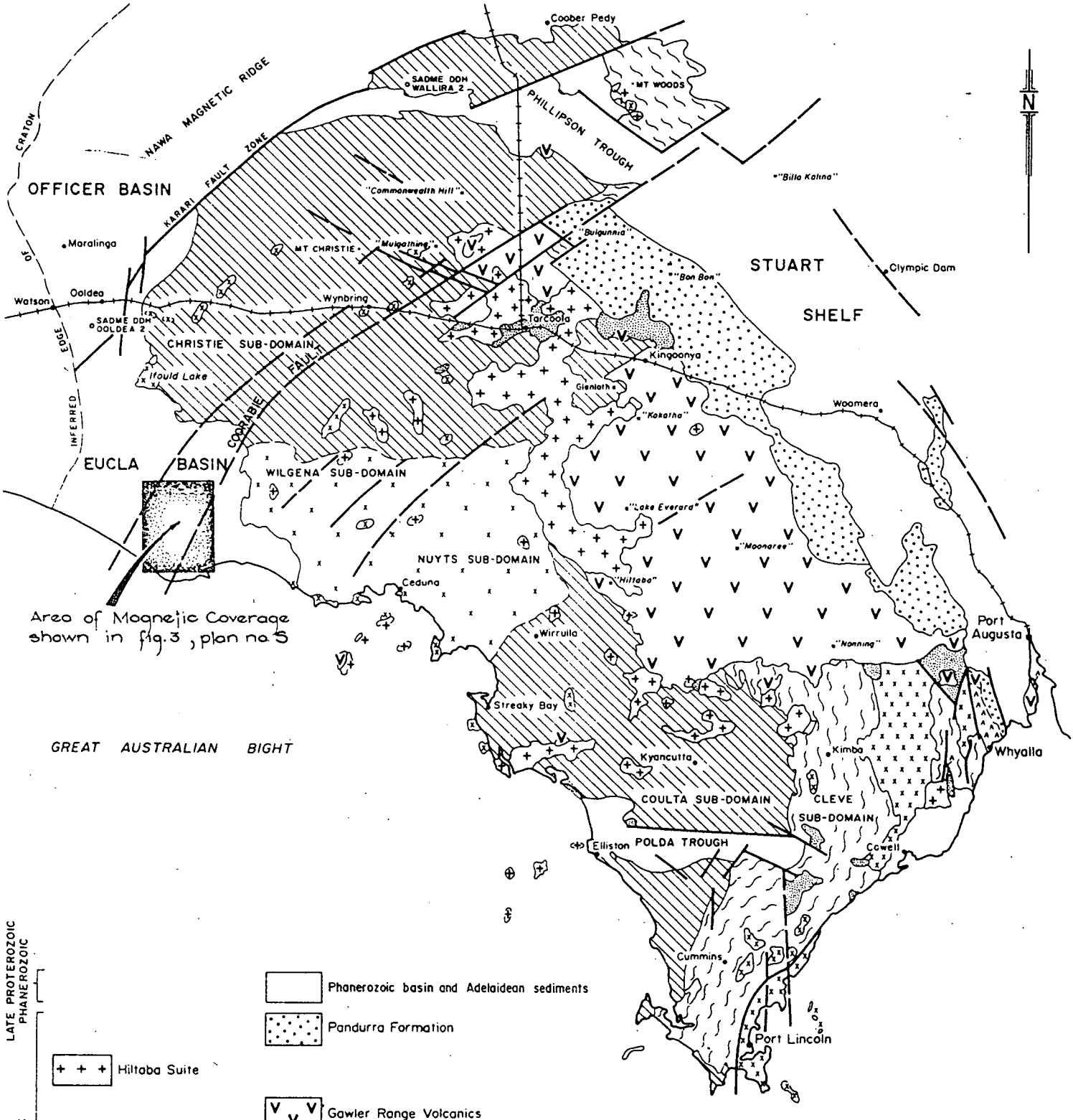
NUNDROO DDH 3

WELL COMPLETION REPORT

GEOLOGICAL LOG SUMMARY

COMPILED S.D.
DRAWN E.C.
DATE Dec.'88
CHECKED
COO DATE
SCALE As shown
PLAN NUMBER 89-34

4736



NUNDROO DIAMOND DRILLHOLES
GAWLER CRATON
TECTONIC MAP OF EXPOSED REGIONS

Fig.....1

SADME

S20726

4736

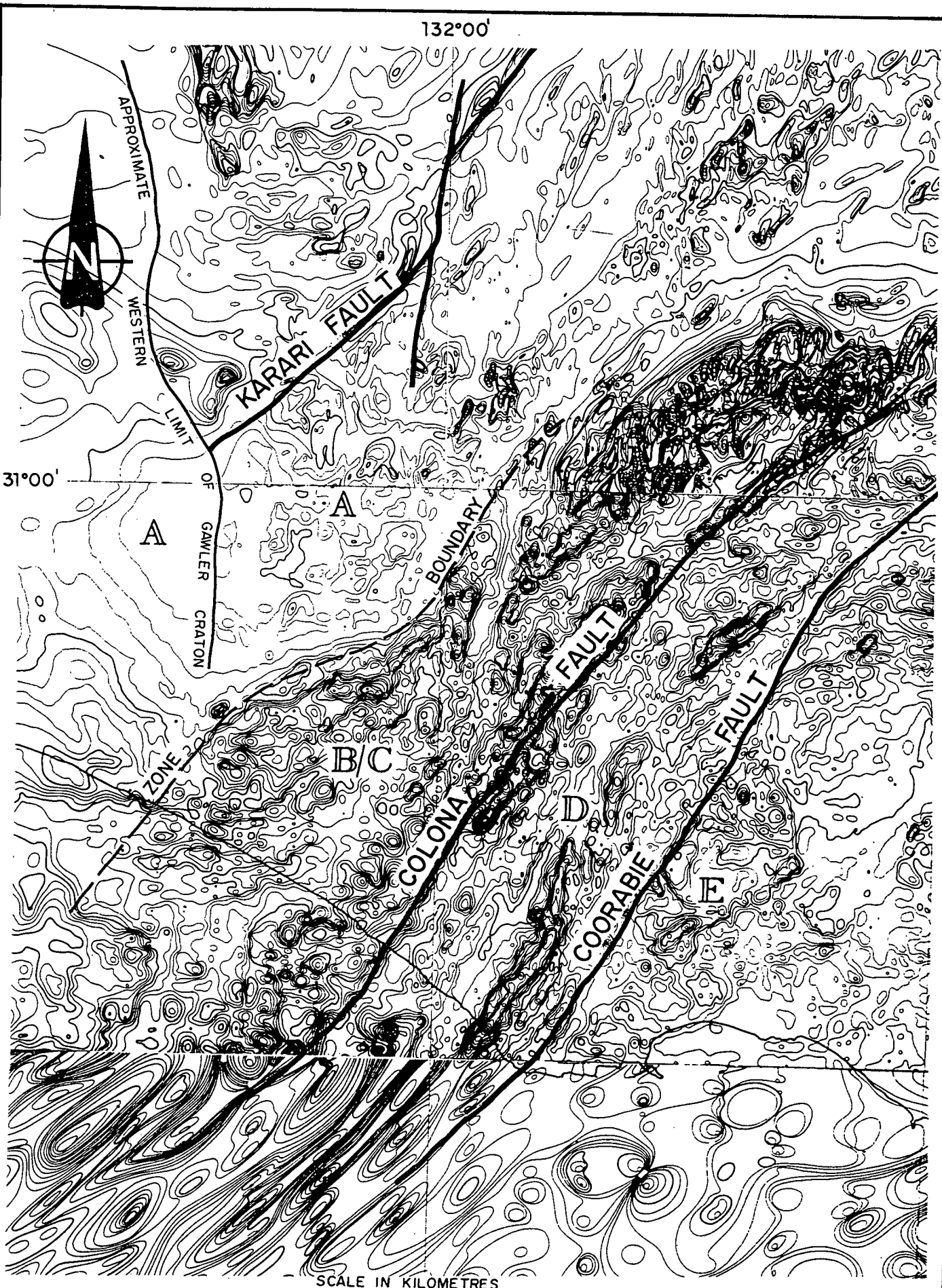


Figure.....2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NUNDROO DIAMOND DRILLHOLES
SOUTH-EAST GAWLER CRATON
TOTAL MAGNETIC INTENSITY PLUS MAGNETIC ZONE BOUNDARIES

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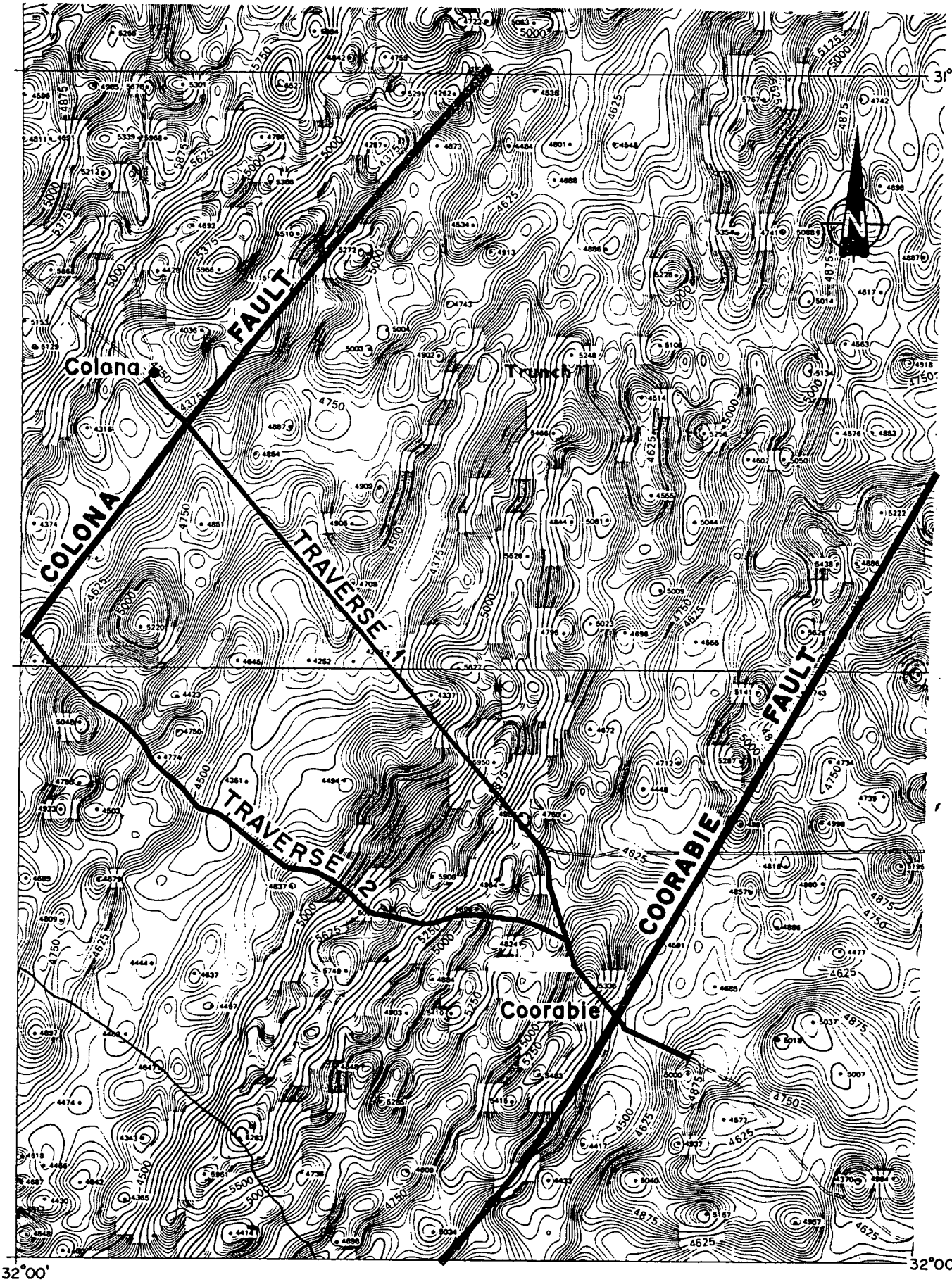
DRAWN L.H.F.	SCALE 1:1000 000
DATE March '89	PLAN NUMBER S 20727
CHECKED	



SCALE IN KILOMETRES

5 0 5 10

FIG. 3

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED S. Daly	C.D.O. DATE
DRAWN L.H.F.	SCALE 1:250 000
DATE March '89	PLAN NUMBER S 20728
CHECKED	

NUNDROO DIAMOND DRILLHOLES

NUNDROO REGION

TOTAL MAGNETIC INTENSITY

boundary of aboriginal land

NUNDROO SIROTEM LINE 0000

NUNDROO SIROTEM LINE 100

NUNDROO SIROTEM LINE 10

Nundroo Motel

Pintumba

Coorabie Well

Coorabie

Coorabie Sheep Well

Chintulda Well

Nallanippie Well

BROWNS HILL

HIGHWAY

EYRE

Colona

NRD 1
NRD 2
NRD 3
NRD 4
NRD 5
NRD 6
NRD 7
NRD 8
NRD 9
NRD 10
NRD 11
NRD 12
NRD 13
NRD 14
NRD 15
NRD 16

DDH Nundroo 1
DDH Nundroo 2
DDH Nundroo 3

6491-9119

M00191
M00001
23000W
26600W
28500W
42700W
14005
41005
18300W

NUNDROO GEOPHYSICAL TRAVERSE 1
NUNDROO GEOPHYSICAL TRAVERSE 2
NUNDROO GEOPHYSICAL TRAVERSE 3

Rotary Drillhole ..... • NRD 6
Diamond Drillhole ..... • DDH Nundroo 1
Gravity Station (ANGN) ..... ▲ 6491-9119

SCALE IN KILOMETRES

6 4 2 0 2 4 6

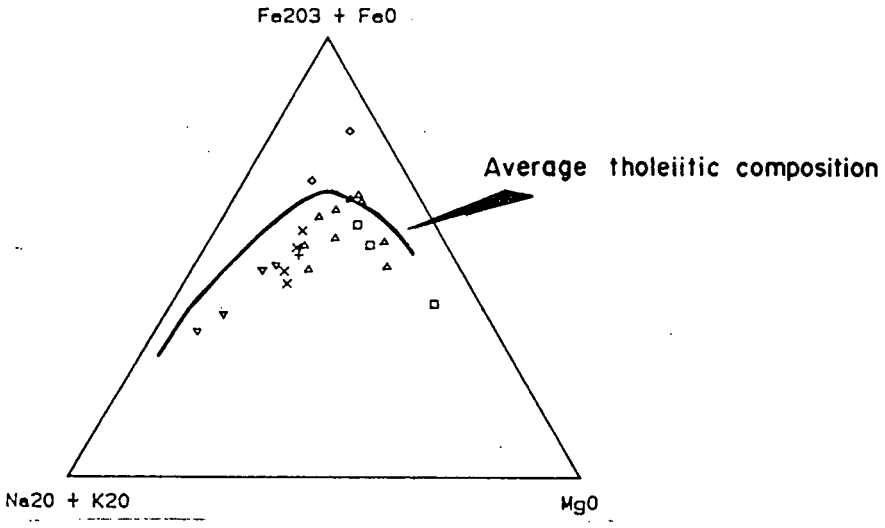
FIG. 4

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

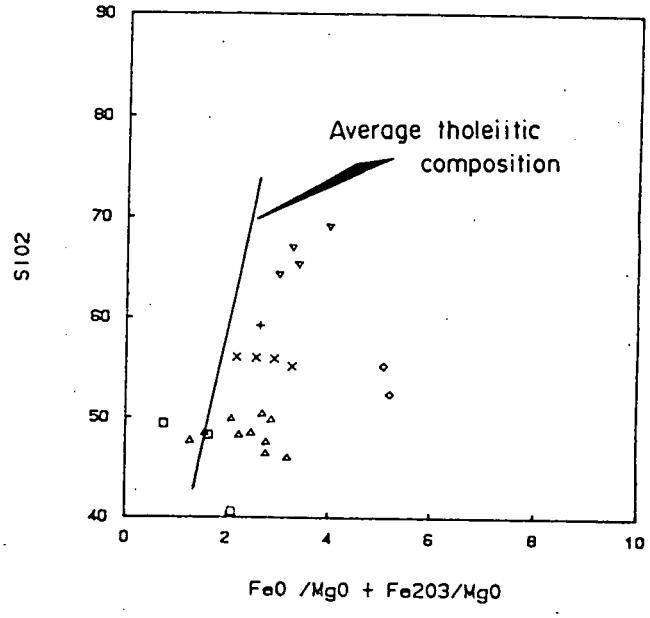
NUNDROO DIAMOND DRILLHOLES
LOCALITY PLAN

COMPILED S. Daly	C D O DATE
DRAWN L.H.F.	SCALE 1:100 000
DATE March '89	PLAN NUMBER 89-75
CHECKED	

4736



- Basic Melanocratic
- Basic Mesocratic
- Basic Leucocratic
- Basic Intermediate
- Basic Intermediate + Garnet
- Acid / Sediments
- Pegmatite



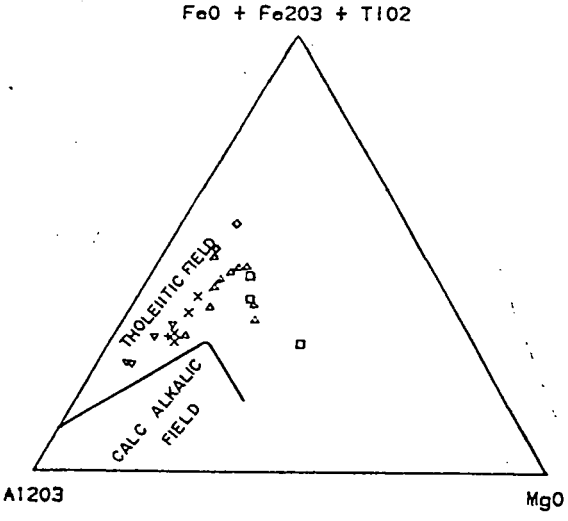
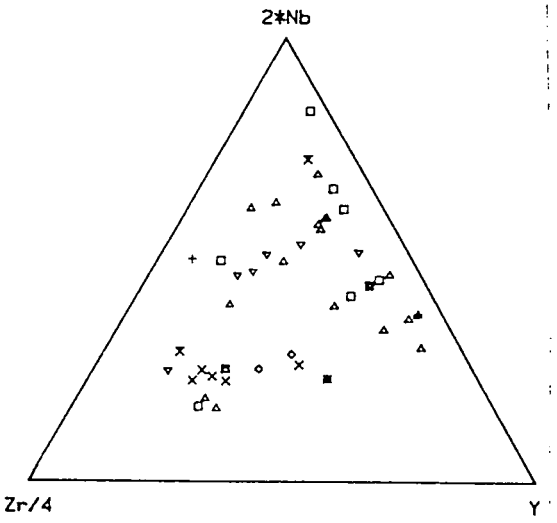
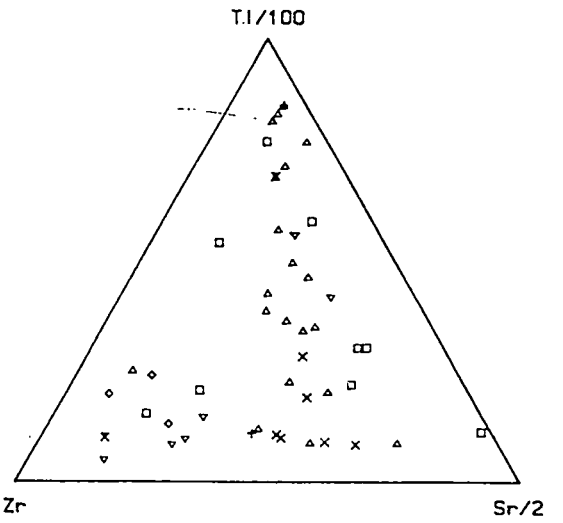


Figure.... 5

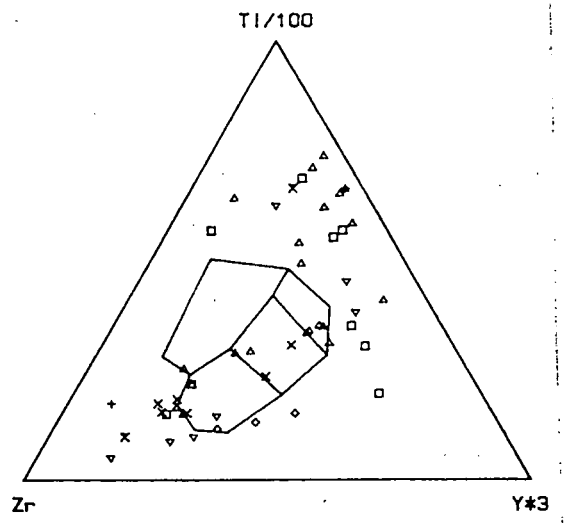
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA		COMPILED S. Daly	C D O DATE
NUNDROO DDH 1, 2 & 3 WELL COMPLETION REPORT		DRAWN L.H.F.	SCALE
MAJOR ELEMENT GEOCHEMISTRY SHOWING THOLEIITIC TRENDS		DATE March '89	PLAN NUMBER S 20729
		CHECKED	

4736





- Basic Melanocratic
- Basic Mesocratic
- Basic Leucocratic
- Basic Intermediate
- Basic Intermediate + Garnet
- Acid / Sediments
- Pegmatite



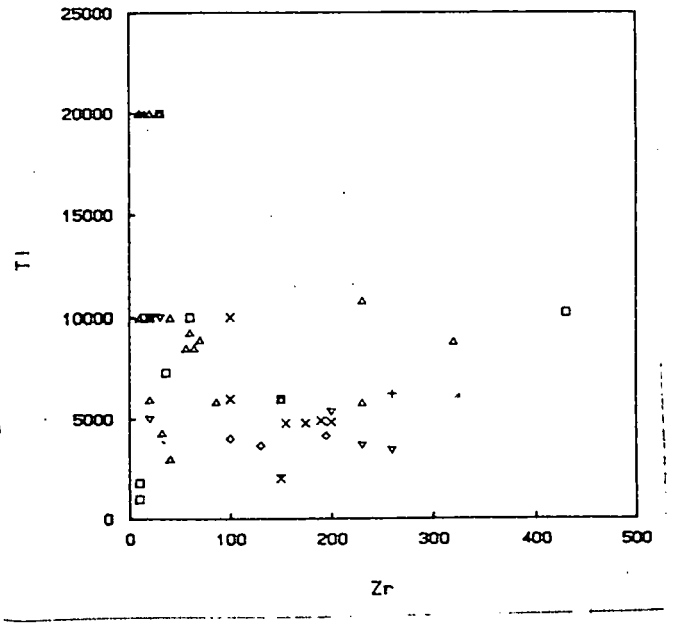
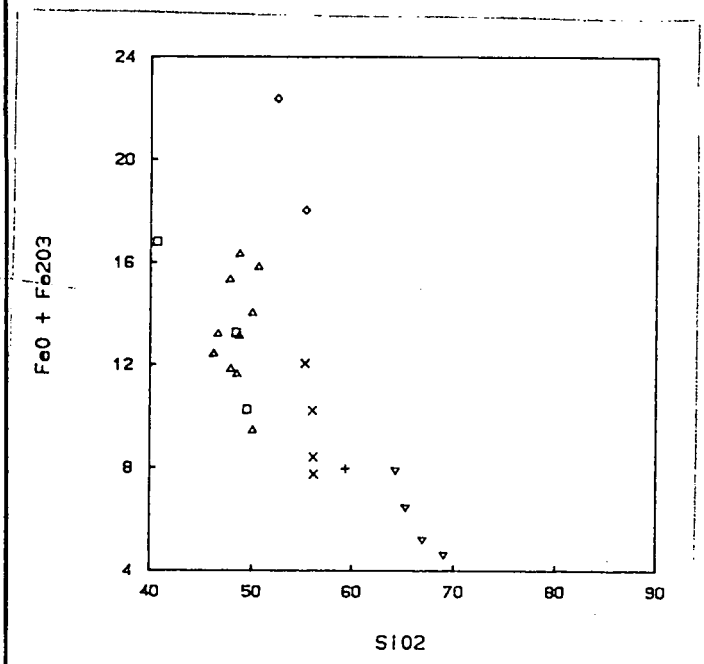
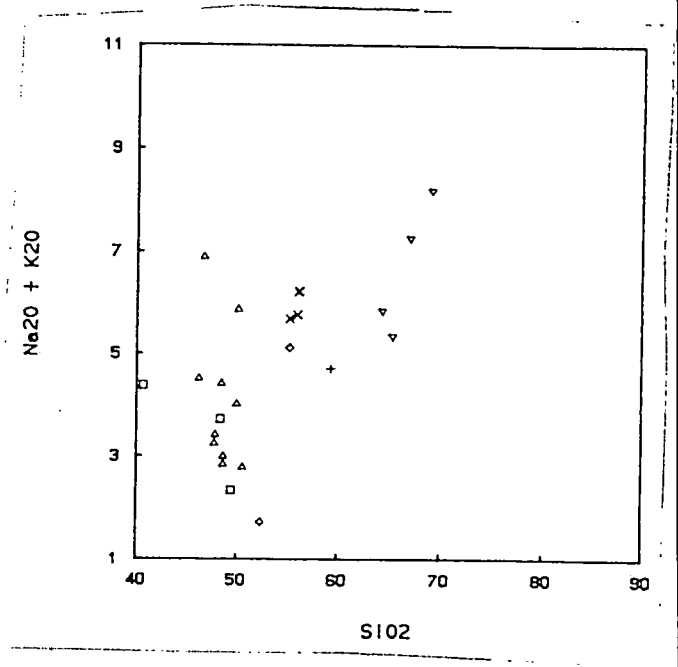


Figure.... 6

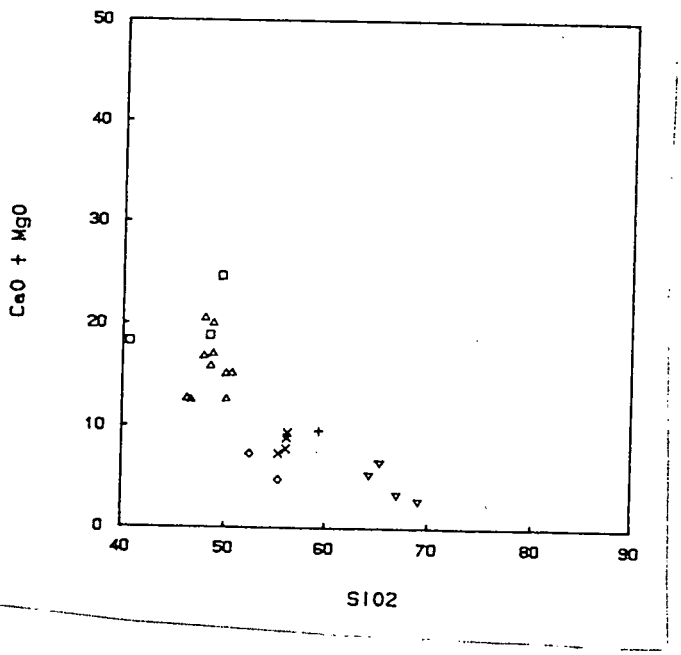
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED S. Daly	C D O DATE
NUNDROO DDH 1, 2 & 3 WELL COMPLETION REPORT	DRAWN L.H.F.	SCALE
TRACE ELEMENT DISCRIMINATION DIAGRAMS FOR BASIC ROCKS	DATE March '89	PLAN NUMBER S 20730
	CHECKED	

4736





- Basic Melanocratic
- Basic Mesocratic
- Basic Leucocratic
- Basic Intermediate
- Basic Intermediate + Garnet
- Acid / Sediments
- Pegmatite



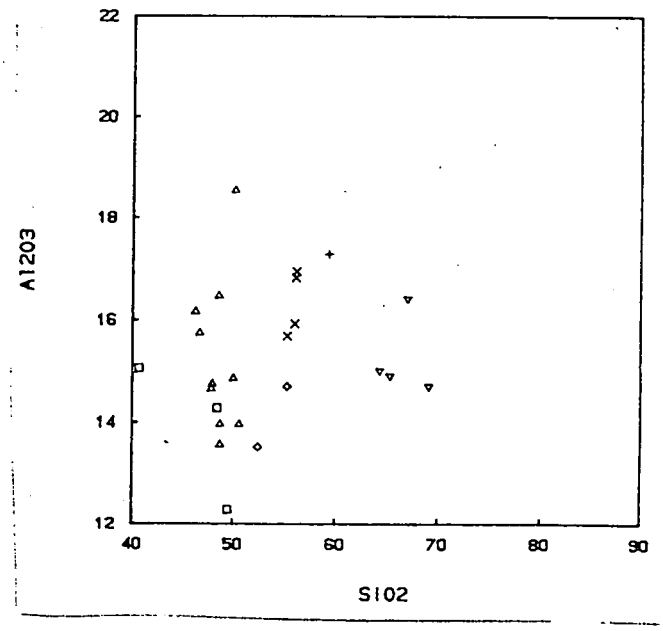
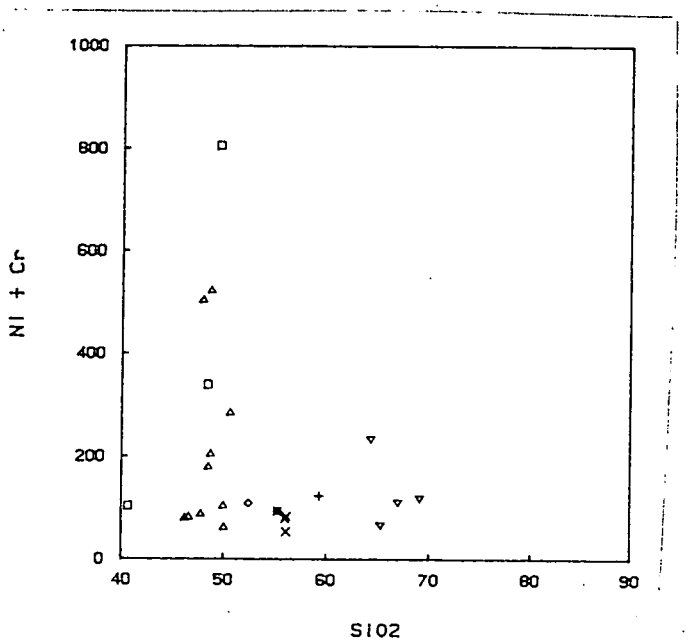
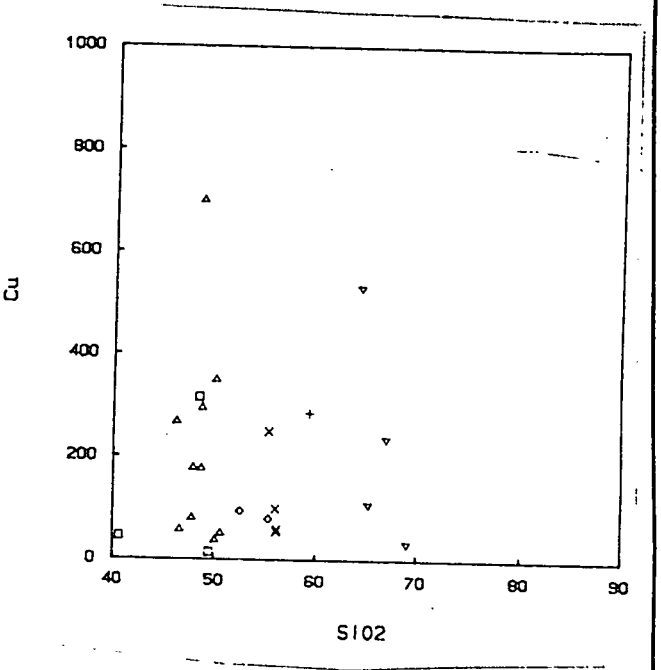


Figure.... 7

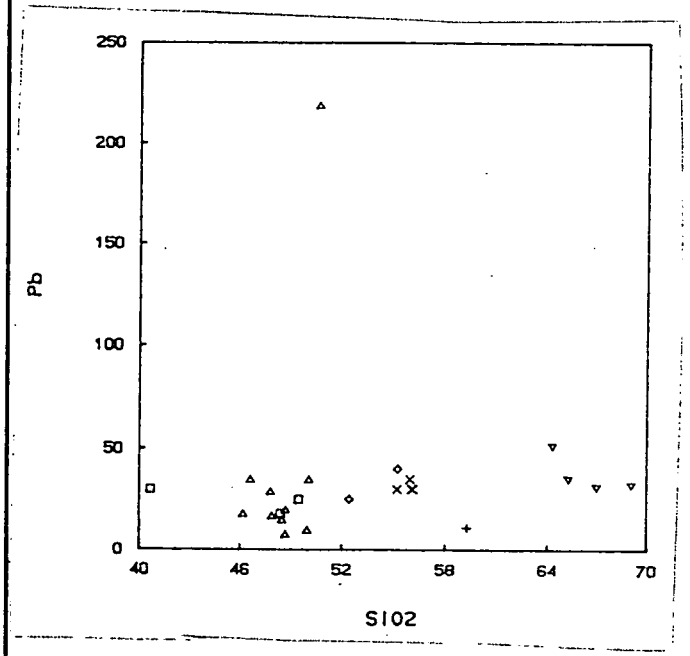
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED S. Daly	C.D.O DATE
NUNDROO DDH 1, 2 & 3 WELL COMPLETION REPORT	DRAWN L.H.F.	SCALE
SUMMARY MAJOR ELEMENT VARIATION DIAGRAMS SiO_2 vs Al_2O_3, $CaO+MgO$, Na_2O+K_2O, $FeO+Fe_2O_3$	DATE March '89	PLAN NUMBER S 20731
	CHECKED	

4736





- Basic Melanocratic
- Basic Mesocratic
- Basic Leucocratic
- Basic Intermediate
- Basic Intermediate + Garnet
- Acid / Sediments
- Pegmatite



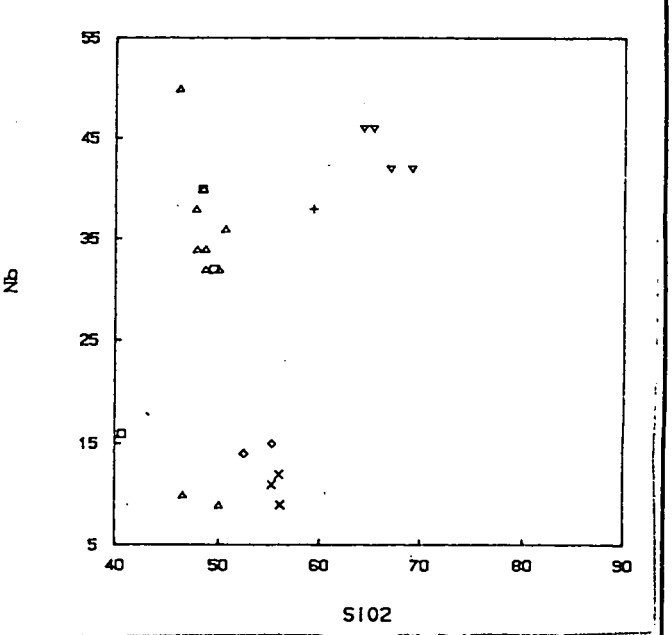
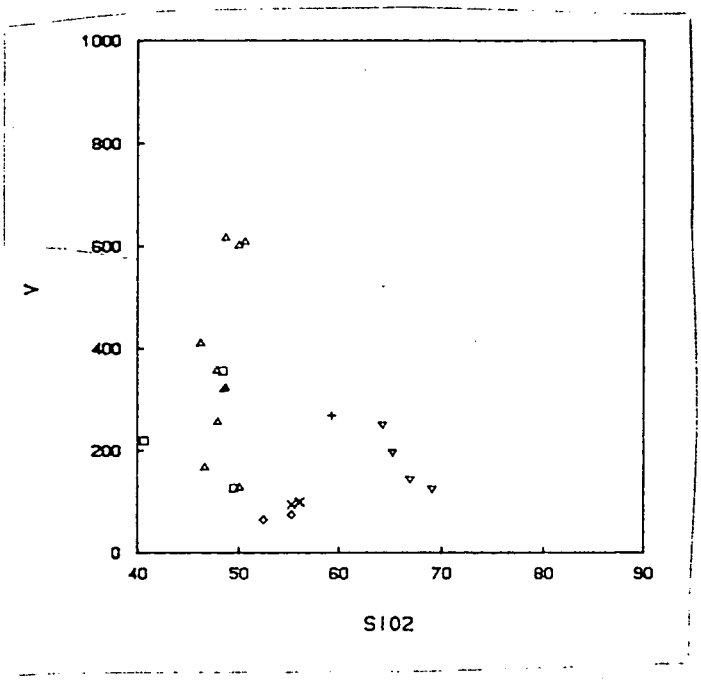


Figure....8

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED S. Daly	C.D.O. DATE
NUNDROO DDH 1, 2 & 3 WELL COMPLETION REPORT	DRAWN L.H.F.	SCALE
SUMMARY TRACE ELEMENT VARIATION DIAGRAMS SiO_2 vs Ni+Cr, Cu, Pb, Nb	DATE March '89	PLAN NUMBER S.20732
	CHECKED	

4736



- Basic Melanocratic
- Basic Mesocratic
- Basic Leucocratic
- Basic Intermediate
- Basic Intermediate + Garnet
- Acid / Sediments
- Pegmatite

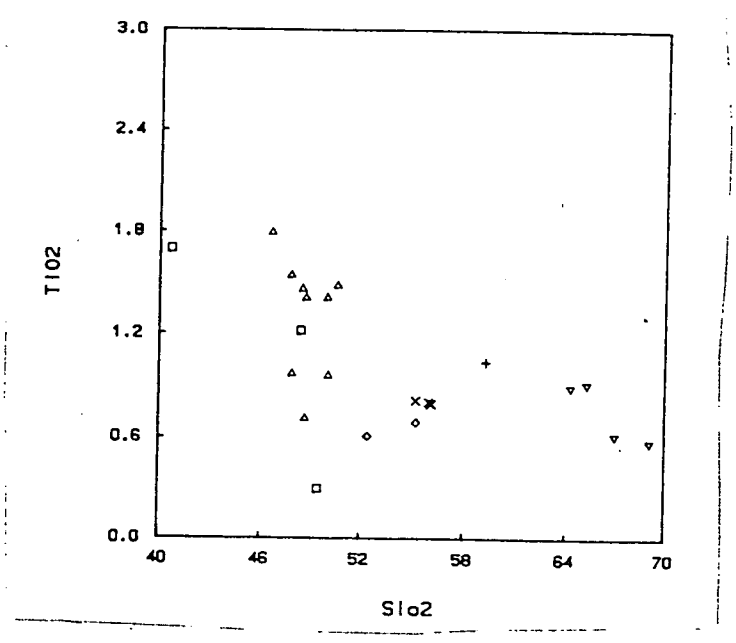


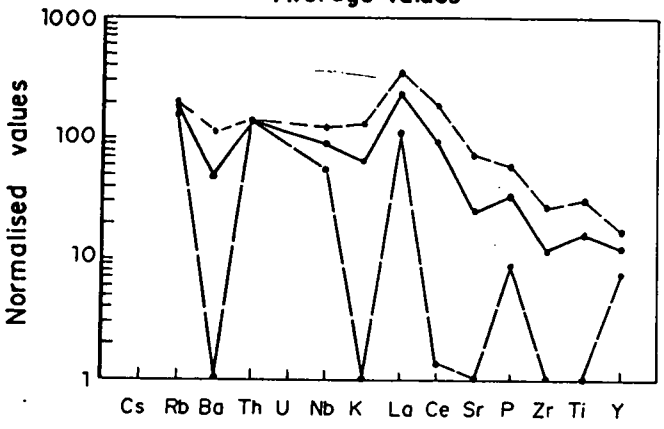
Figure....9

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA		COMPILED S. Daly	C D O. DATE
NUNDROO DDH 1, 2 & 3 WELL COMPLETION REPORT		DRAWN L.H.F.	SCALE
SUMMARY VARIATION DIAGRAMS SiO_2 vs V, TiO_2		DATE March '89	PLAN NUMBER S 20733
		CHECKED	

4736

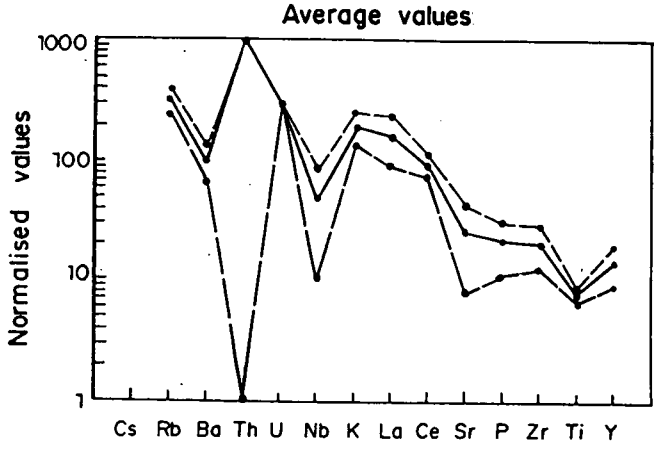
BASICS

Chondrite normalised plot (std.dev.)
Average values



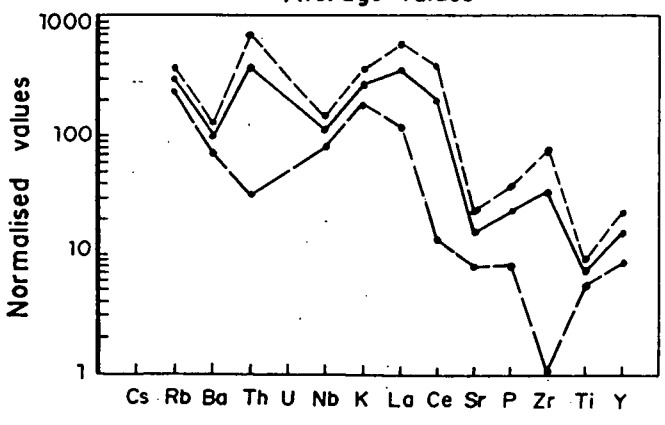
INTERMEDIATE ROCKS

Chondritic normalised plot (std.dev.)
Average values



SEDIMENTS

Chondrite normalised plot (std. dev.)
Average values



MEAN CHONDRITIC VALUES FOR THE 3 GROUPS

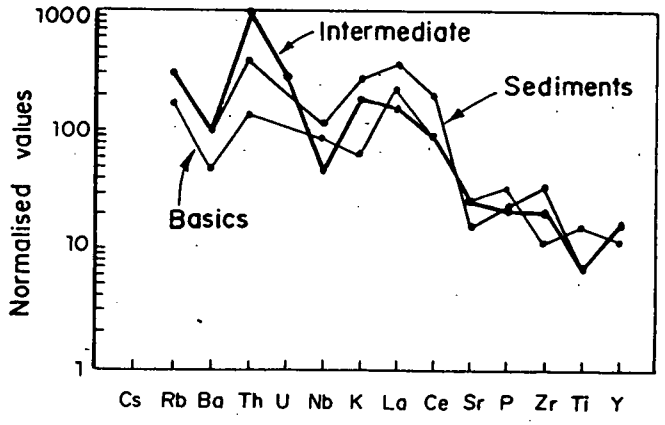


Figure....10

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA		COMPILED S. Daly	C.D.O. DATE
NUNDROO DDH 1, 2 & 3 WELL COMPLETION-REPORT CHONDRITIC, NORMALISED DISCRIMINATION DIAGRAMS FOR THE METABASICS, METAINTERMEDIATE BASICS AND METASEDIMENTS		DRAWN L.H.F.	SCALE as shown
		DATE March '89	PLAN NUMBER S 20734
		CHECKED	

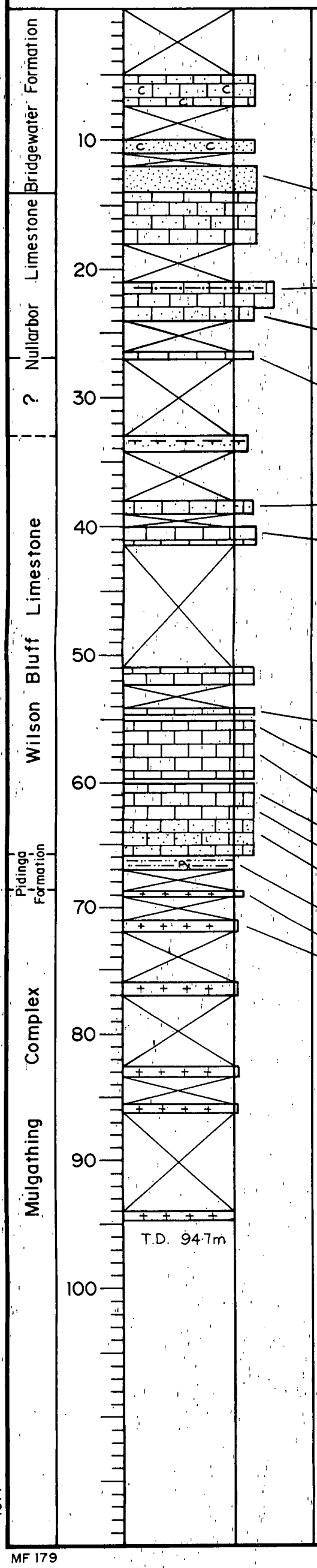
4736

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA

NUNDROO NRD - 13

DEPTH 94.7 m INCLINATION 90°

LOGGED BY M.C.B. DATE 1987



DESCRIPTION

Calcreted, orange-brown and pink very fine-grained, moderately-well sorted calcarenite or grainstone with 5-20% very fine to silt size quartz grains. Black pisoliths with laminated red halos (3-10mm).

orange-brown, partly calcareous, very fine-grained, well sorted, friable sandstone.

pale brown, calcareous, muddy, very fine-grained, well sorted sand. 10% indurated white chips of sandy limestone.

white, indurated, very fine-grained, recrystallized limestone. Slightly sandy in part.

Brown, medium-grained, well sorted, recrystallized, indurated, skeletal grainstone. Trace miliolids. Thin interbeds (≈5mm) of well sorted, fine-grained sand on erosional base, slightly calcareous with mud matrix.

Sandy (10-55%), fine to very fine-grained skeletal grainstone/packstone. Scattered algal bodies skeletal fragments.

Pale grey, fine to very fined-grained, porous, skeletal grainstone/packstone. Trace glauconite. Minor quartz < 2.5%.

Greenish grey, moderately indurated, calcareous mudstone to very fine-grained sandstone. Glauconitic. Contains sponge spicules.

Pale grey brown, very friable, very fine-grained, skeletal grainstone. < 25% quartz. Spicular. Increase quartz at bottom 35%.

Pale grey, very fine-grained, skeletal, glauconitic, bryozoal wackestone to mudstone. Trace gastropod, bivalve or brachiopod fragments. Glauconitic.

Pale grey, very fine-grained wackestone to mudstone.

Pale grey, very fine-grained, glauconitic, bryozoal, wackestone to mudstone. With 25% coarse grainstone fragments. Trace molluscs, bivalve and brachiopods.

Pale grey, very fine to fine-grained, glauconitic, bryozoal wackestone, local mudstone and packstone.

Darker grey, very fine-grained skeletal, glauconitic wackestone with patches of very dark, organic 'rich' mud.

Grey indurated, skeletal, bryozoal packstone to mudstone. Locally glauconitic small brachiopods

Grey green, very glauconitic, sandy, skeletal, richly bryozoal packstone to wackestone. 5-20% medium-grained quartz.

Black, carbonaceous, partly pyritic, silty clay. Thin, coarse-grained, poorly sorted sandy lenses.

Pale grey, sandy clay with minor muscovite. Weathered basement.

Pale grey-green, gritty clay. Weathered basement.

Pale grey, gritty clay

Pale grey-green, gritty clay.

Pale grey-green, gritty clay.

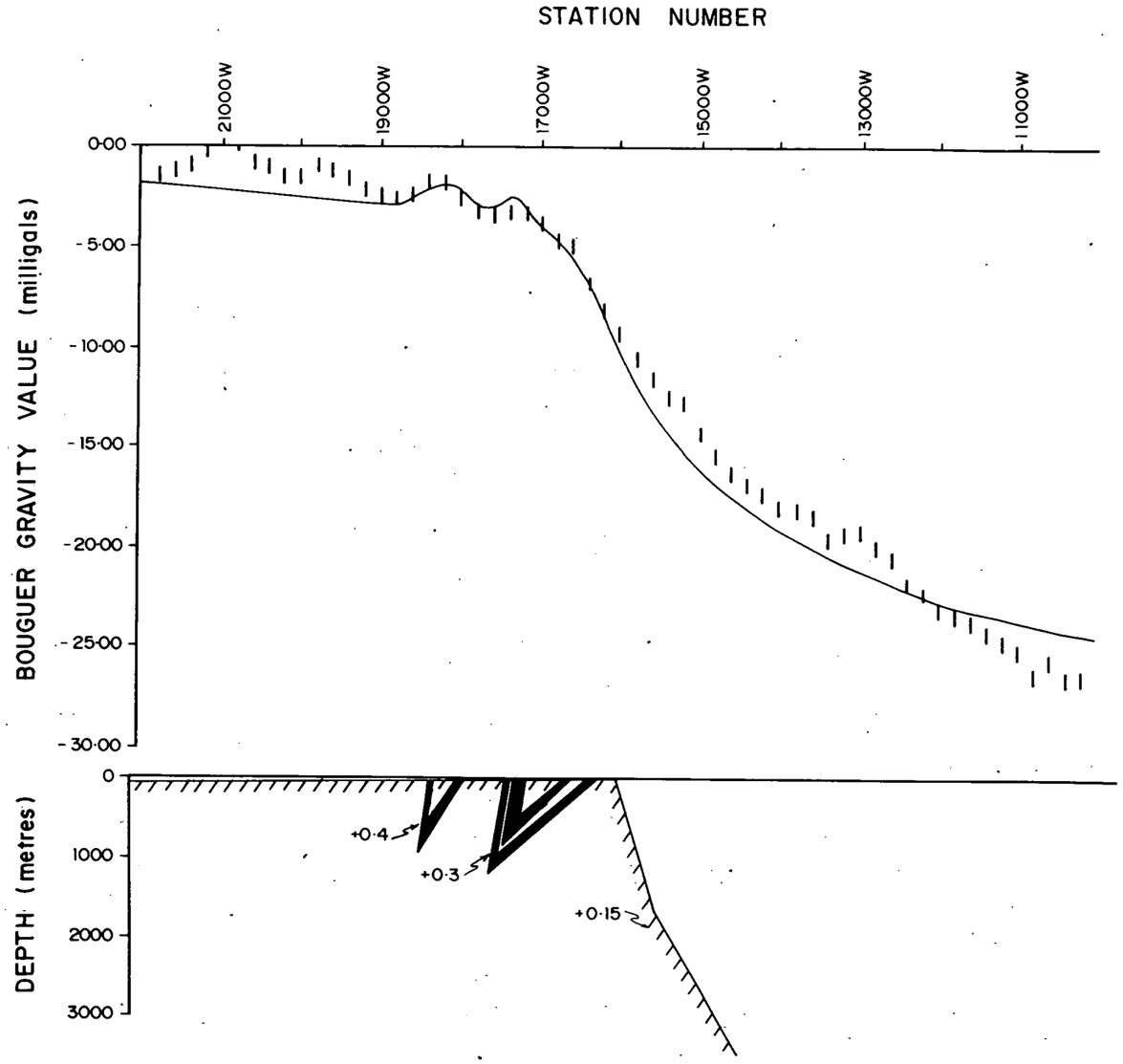
Pinkish grey, coarse-grained, porphyroblastic quartz-feldspar-biotite-garnet-magnetite gneiss.

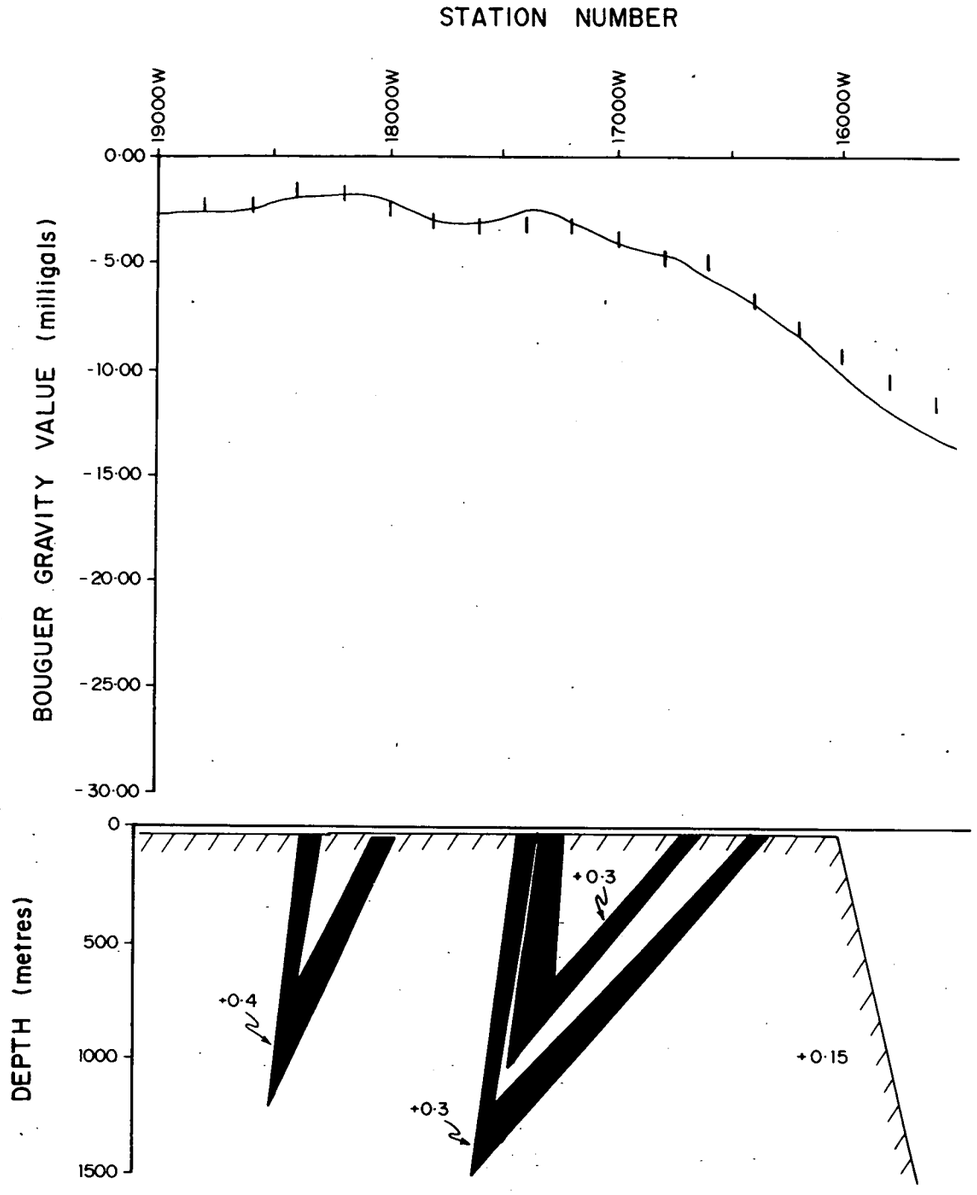
SHEET 1 OF 1

PLAN Nº S20165

4614

MF 179





OBSERVED.....I

CALCULATED.....~

DENSITY CONTRASTS....t/m³

FIG. 9

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NUNDROO ROTARY DRILLHOLES

GEOPHYSICAL MODELLING - TRAVERSE 1

BOUGUER GRAVITY PROFILE

COMPILED A. Martin	C.D.O. DATE
DRAWN E. Calabio	SCALE
DATE 12/5/88	PLAN NUMBER 88-378
CHECKED	

4614

N

boundary of aboriginal land

EYRE HIGHWAY

NUNDROO SIROTEM LINE 0000

NUNDROO SIROTEM LINE 100

NUNDROO SIROTEM LINE 10

M00191

M00001

230000W

286000W

288000W

427000W

1400S

4100S

Nundroo Motel

Pintumba

Coorabie

Coorabie Well

Coorabie Sheep Well

Chintulda Well

Nallanippie Well

Colona

BROWNS HILL △

6491-9119

NRD 1
NRD 2
NRD 3
NRD 4
NRD 5
NRD 6
NRD 7
NRD 8
NRD 9
NRD 10
NRD 11
NRD 12
NRD 13
NRD 14
NRD 15
NRD 16

DDH Nundroo 1
DDH Nundroo 2
DDH Nundroo 3
Nundroo Well

NUNDROO GEOPHYSICAL TRAVERSE 1
NUNDROO GEOPHYSICAL TRAVERSE 2
NUNDROO GEOPHYSICAL TRAVERSE 3

Rotary Drillhole
Diamond Drillhole
Gravity Station (ANGN)

SCALE IN KILOMETRES
6 4 2 0 2

FIG. 7

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NUNDROO ROTARY DRILLHOLES

LOCALITY PLAN

COMPILED A. Martin		C.D.O. DATE
DRAWN E. Calabio	SCALE 1:100000	
DATE 12/5/88	PLAN NUMBER 88-377	
CHECKED		

4614

1:250,00

"? Fault"

? Large fold axis

B.

C →

TMI

NRD 13

? Large fold axis

MAG

D.

E →

NRD 3

NRD 2

DDH 1

NRD 9

NRD 6

NRD 7

NRD 6

DDH 3

NRD 1, DDH 2

NRD 12

NRD 5

NRD 15

NRD 16

NRD 14

CORRABIE FAULT

-40000

-20000

0

20000

IST - NUNDROO GRAVITY

- 1987 NUNDROO GRAVITY