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SHALLOW STRATIGRAPHIC DRILLING IN THE
KAPALGA 1:100 000 SHEET AREA,
ALLIGATOR RIVERS REGION N.T., 1974-6

by

P.G. Stuart-Smith

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SUMMARY

During 1974-6 BMR drilling crews completed 30 shallow stratigraphic holes in the Kapalga and Cahill 1:100 000 Sheet areas. Twenty-eight of the holes were on a traverse on or parallel to the Arnhem Highway in the Kapalga Sheet area. The aims of the drilling were to determine: the stratigraphy and structure of the Koolpin Formation and other Early Proterozoic rocks, the source of certain geophysical anomalies, and the nature and thickness of Cainozoic cover.

Core and cuttings were logged on site, and selected cores were thin-sectioned for petrographic examination. Most holes were logged for radioactivity, single-point resistance, and self-potential.

The basement rock units intersected in the drilling were the Nanambu and Zamu Complexes; Koolpin Formation and Fisher Creek Siltstone; and the 'Mount Hooper Beds', 'Basal Quartzite' and 'Lower Carbonate' (informal names used in this Record).

In the northeast of the Kapalga Sheet area the 'Basal Quartzite', 'Lower Carbonate', 'Mount Hooper Beds', and the Koolpin Formation form a tightly folded westerly-dipping sequence which unconformably overlies the Nanambu Complex. The sequence is very similar to the Batchelor Group at Rum Jungle and is tentatively correlated with it. The presence of silicified carbonate pebbles in conglomerate of the 'Mount Hooper Beds' indicates that the 'Lower Carbonate' underlies the 'Mount Hooper Beds' and is not continuous with the overlying Koolpin Formation. No definite conclusion concerning the correlation of the Koolpin Formation and the Cahill Formation (extensive in the Alligator Rivers Uranium Field to the east) is made; however, a correlation of the 'Lower Carbonate' and the Mount Hooper Beds with the 'lower' and 'upper' members, respectively, of the Cahill Formation is suggested.

Siltstone and carbonaceous shale of the Koolpin Formation and doleritic sills of the Zamu Complex form the limbs of a broad north-plunging syncline (the West Alligator Syncline) in the central part of the Kapalga Sheet area. They are overlain by a feldspathic litharenite and shale sequence (correlated with the Fisher Creek Siltstone) near the centre of the syncline. The Koolpin Formation in this area is separated from the sequence in the northeast of the Kapalga Sheet area by the Jim Jim Fault Zone.

The drilling results also showed that over 80 m of lateritised Tertiary deposits and minor Quarternary sediments unconformably overlies Early Proterozoic rocks over most of the Kapalga Sheet area. Deposition of the sediments appears to have been controlled by reactivated basement faults rather than a pre-Tertiary topography related to resistance of bedrock to weathering.

Drill-hole logs of self-potential, single-point resistance, and radiometrics proved effective in identifying Cainozoic deposits, carbonaceous rocks, and delineating dolomite and quartzite from pelitic rocks. No significant radiometric anomalies were detected.

INTRODUCTION

Recent drilling in the eastern part of the Kapalga 1:100 000 Sheet area by N.T. Water Resources Branch and exploration companies revealed the presence of carbonate and carbonaceous sediment to the east, west, and south of a prominent ridge of feldspathic quartzite on which Kapalga Trig is situated. The sequence west of the Trig correlates with the Koolpin Formation. The sequence east of the Trig (referred to in this Record as the 'Lower Carbonate') probably correlates with the Cahill Formation, which is host to uranium mineralisation in the Alligator Rivers region. Both formations are thought to be facies equivalents which unconformably overlie the feldspathic quartzite (Needham & Stuart-Smith, 1976).

The quartzite previously referred to as Mount Partridge Formation (Walpole et al., 1968) is believed, from current BMR and company work, to antedate the Mount Partridge Formation sensu stricto, and is probably part of the Masson Formation. In this report the quartzite and interbedded siltstone are informally referred to as the 'Mount Hooper Beds'.

A program of shallow stratigraphic drilling in this area was carried out by the Bureau of Mineral Resources during October 1974 and in August to October in 1975 and 1976 to determine the stratigraphy, structure, and relations of the Koolpin and Cahill Formations.

Other aims of the drilling were:

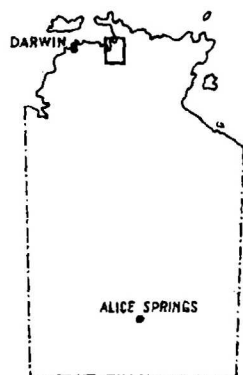
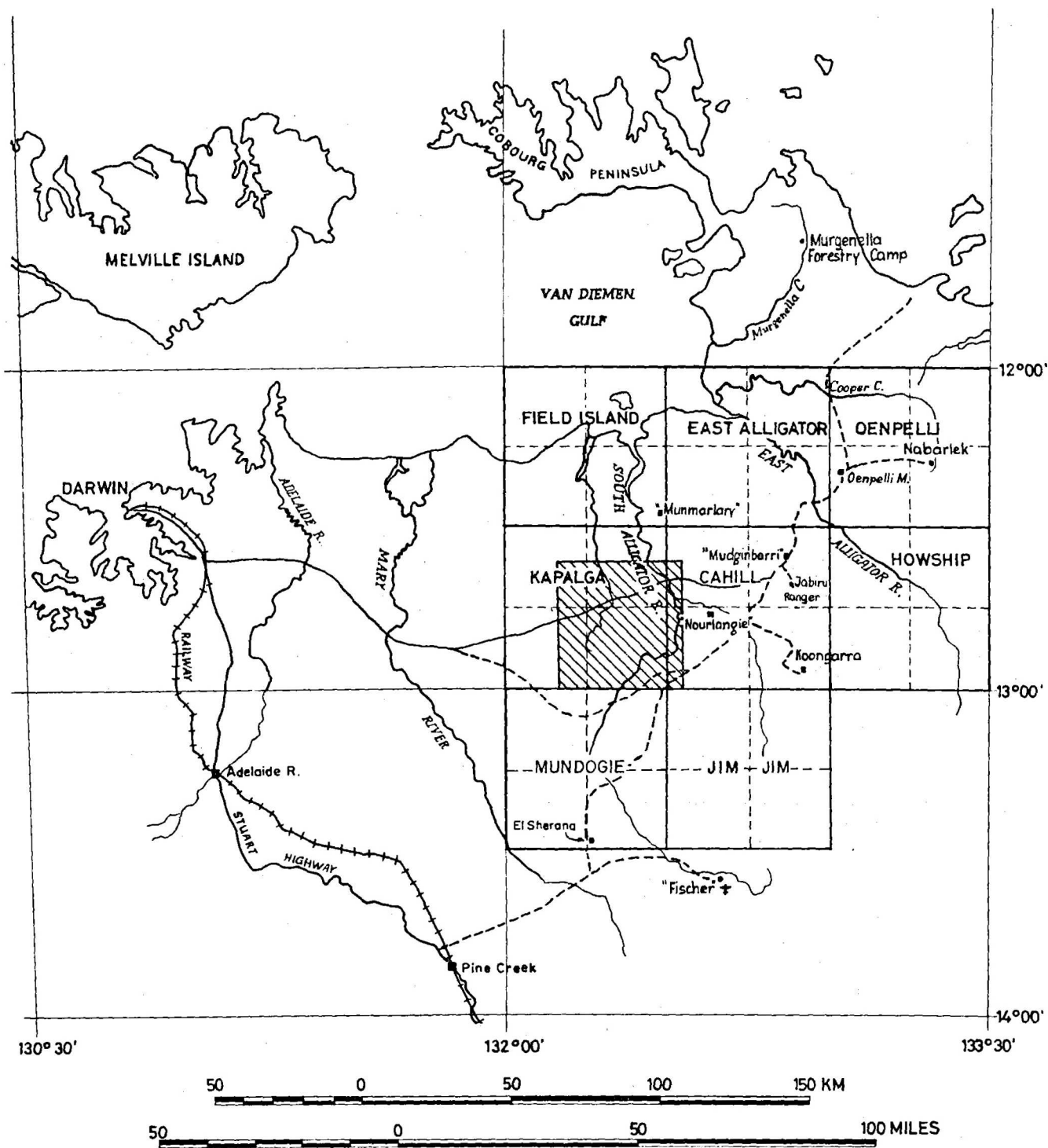
1. to investigate geophysical anomalies;
2. to obtain fresh core samples for petrographic and geochemical investigations;
3. to determine the nature and thickness of the Cainozoic cover.

In conjunction with the drilling program in 1975, a surface geophysical survey was designed to test continuity of carbonaceous strata around Kapalga Trig. A geophysical survey along the drilling traverse was of limited use in identifying subsurface Early Proterozoic rocks (Spies, 1977).

REGIONAL SETTING

The Kapalga 1:100 000 Sheet area lies immediately west of the Alligator Rivers Uranium Field in the central-northern part of the Pine Creek Geosyncline, about 160 km east of Darwin (Fig. 1). Access to the area is by

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LEGEND

KAPALGA 1:100 000 sheet area



Area covered in Fig. 2

Fig.1 LOCALITY MAP

the newly constructed Arnhem Highway and a few tracks constructed by exploration companies and N.T. Water Resources Branch. Since the drilling program, CSIRO have constructed additional tracks north of the highway in much of the survey area.

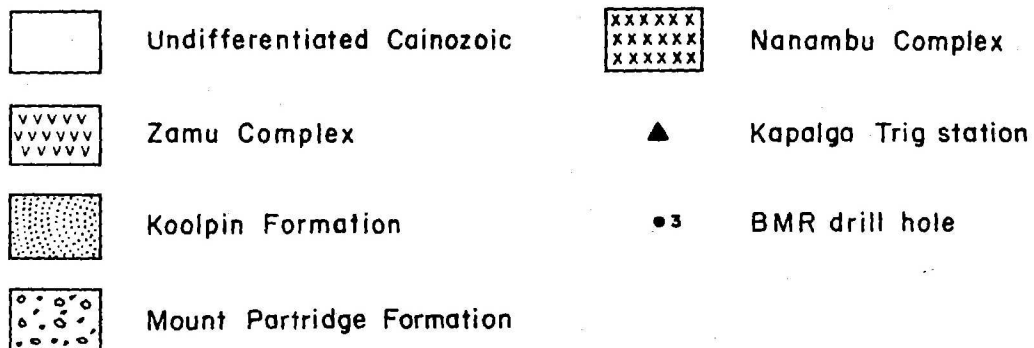
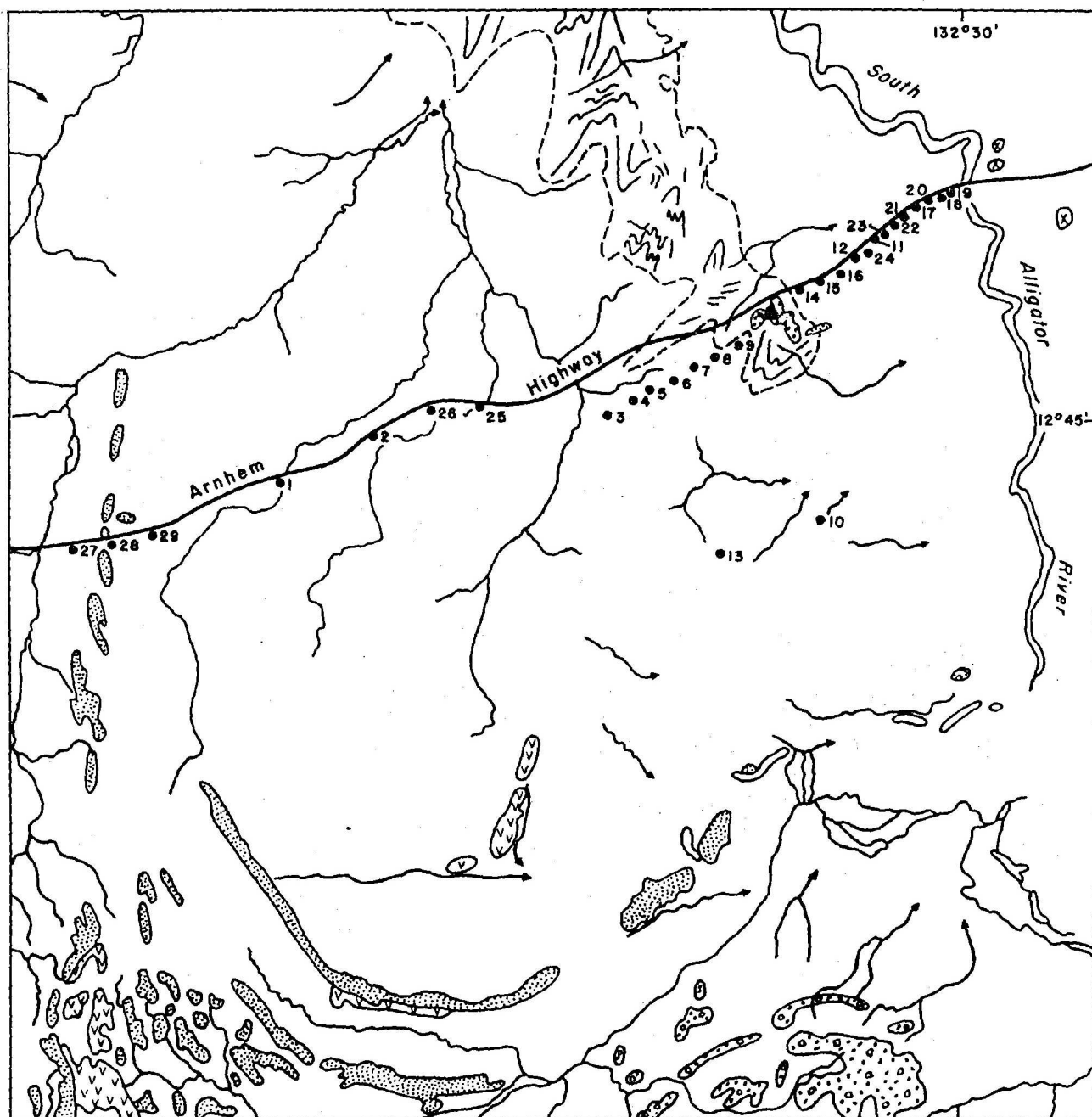
Simplified regional geology for the eastern part of the Kapalga 1:100 000 Sheet area is shown in Figure 2. Early Proterozoic metasediments of the 'Mount Hooper Beds', Masson and Koolpin Formations are exposed in the Sheet area, and form a north-south elongated basin which is laterally displaced by the northwest-trending Jim Jim Fault. The sediments are metamorphosed to greenschist facies, and contrast with the amphibolite-grade metasediments which flank the Nanambu Complex farther to the east, in the Cahill 1:100 000 Sheet area.

Early Proterozoic psammitic metasediments of the 'Mount Hooper Beds' crop out as a series of strike ridges and rubbly rises in the northeast and northwest of the Sheet area.

In the south, a broad north-plunging syncline of Koolpin Formation, intruded by Zamu Complex dolerite, crops out as a crescent-shaped series of ridges of chert-banded siltstone. East of the Sheet area Archaean gneiss of the Nanambu Complex is separated from the Early Proterozoic formations by extensive quaternary sand, silt, and clay of the South Alligator River floodplain.

Much of the central and northern part of the Sheet area is covered by a thick flat sequence of Cainozoic sand and gravel, capped by a thin lateritic veneer which forms the Koolpinyah surface (Storey et al., 1969). In the west of the Sheet area, stripping of this cover in recent times has exposed small rubbly outcrops of Masson Formation. The surface is covered by numerous internal drainage depressions, some of which are similar to the subsidence dolines described by Vanden Broek (1975), which are thought to be collapse structures over Early Proterozoic carbonates.

A more detailed account of the regional geology of the area will be incorporated in the 1973-75 Progress Record of the Alligator River Party. Proterozoic and Archaean rock units mentioned in this Record are summarized in Table 1.



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Fig. 2 Generalised geology and drill-hole locations

BMR DRILLING PROGRAM

BMR drilling crews, using Mayhew 1000 rotary mobile rigs, completed a total of 30 holes with an average depth of 99.6 m and a maximum depth of 189.6 m (see Table 2). Drill-hole locations are shown in Figure 2.

In 1974, holes KA 1 (Kapalga) and KA 2, sited adjacent to the Arnhem Highway about 28 and 24 km respectively west of the South Alligator River bridge, were completed after a major drilling program in the Jim Jim and Cahill 1:100 000 Sheet areas (Stuart-Smith & Hone, 1975).

In 1975, a 15-km traverse along the Arnhem Highway was completed. The holes were spaced at 1-km intervals except for KA 5 which was sited 900 m from KA 4, to intersect a Transient Electro-Magnetic (TEM) anomaly. Of the planned seven holes to the east of Kapalga Trig, only two were completed and another abandoned (KA 12), owing to the great depth and unconsolidated nature of the Cainozoic sands and gravels which overlie the Early Proterozoic rocks. The remainder were completed in 1976. The traverse was then extended 2500 m to the east with five extra holes at 500-m spacing. Two holes KA 25 and 26 were also drilled 19 and 21 km west of the South Alligator River floodplain.

Five holes, KA 10, 13, 27, 28 and 29, were drilled in 1975-6 to investigate the source of TEM and resistivity anomalies obtained during the 1975 regional geophysical program. Stratigraphic results only of these holes are discussed in this Record - the geophysical results are discussed by Spies (1977).

METHODS

Typically, holes were begun with a $7\frac{3}{8}$ inch diameter roller bit and cased to 20 ft (6 m). A $4\frac{1}{2}$ inch diameter 'Hawthorne' tungsten bit or roller bit was used until fresh rock was reached. Fresh rock was cored with a $3\frac{15}{16}$ inch diameter diamond or tungsten bit which yields a $2\frac{1}{2}$ inch diameter core. Twenty-nine cores were taken with an average length of 0.99 m and a maximum of 3.43 m. Core recovery was often 100 percent but very poor in some shales and phyllites. Core was lost through jamming of the drill pipes in KA 14. During the drilling, chip samples were collected at 10 ft (3 m) intervals, and examined on site by binocular microscope.

TABLE 1. ROCK UNITS MENTIONED IN THIS REPORT

UNIT	LITHOLOGY	RELATIONSHIPS	AGE
Zamu Complex	Dolerite, granophyre	Intrudes older units as sills	Early Proterozoic
Fisher Creek Siltstone	Siltstone, greywacke siltstone micaceous greywacke	Transitionally overlies Koolpin Formation	Early Proterozoic
Koolpin Formation	Siltstone with chert bands and nodules, phyllite, carbonaceous shale, dolomite, siltstone	Probably unconformable on Mount Partridge Formation	Early Proterozoic
Mount Partridge Formation	Arkose, siltstone, medium quartz sandstone, conglomerate, and minor quartz greywacke	Possibly correlates with 'Mount Hooper Beds', transitional into Masson Formation	Early Proterozoic
Cahill Formation	Quartzite, quartzo-feldspathic schist, micaceous schist, minor carbonaceous schist, carbonate and calc-silicate rock	Probably unconformable on Mount Basedow Gneiss and Nanambu Complex	Early Proterozoic
Mount Basedow Gneiss	Meta-arkose, biotite gneiss, schist	Where migmatized transitional into Nanambu Complex	Early Proterozoic
'Mount Hooper Beds'	Feldspathic quartzite, quartzite siltstone, (magnetic), phyllite, minor chert pebble conglomerate	Transitional into Masson Formation	Early Proterozoic
'Lower Carbonate'	Dolomite, hematitic quartz-mica schist, calcareous mica-quartz schist	Overlies basal quartzite may correlate with Cahill Formation (lower member)	Early Proterozoic
'Basal Quartzite'	Feldspathic arenite, quartzite	Unconformably overlies Nanambu Complex	Early Proterozoic
Masson Formation	Quartz greywacke, siltstone, con- glomerate, quartz sandstone, pyritic and carbonaceous siltstone, and dolomite sediments	Pelitic facies variant of the Mount Hooper beds	Early Proterozoic
BATCHELOR GROUP			
Coomalie Dolomite	Silicified and metamorphosed algal dolomite, calcilutite, siltstone, and tremolite schist	Transitional into Golden Dyke Formation	Early Proterozoic
Crater Formation	Quartz greywacke, greywacke arkose, fine pebble conglomerate, and silt- stone; pyritic carbonaceous dolomitic marl	Unconformably overlies Celia Dolomite, Beestons Formation, and Rum Jungle and Waterhouse Complexes	Early Proterozoic
Celia Dolomite	Algal dolomite, silicified dolomite breccia	Overlies Beestons Formation	Early Proterozoic
Beestons Formation	Arkose, greywacke, siltstone, con- glomerate, and arkosic conglomerate	Unconformably overlies Rum Jungle and Waterhouse Complexes	Early Proterozoic
Nanambu Complex	Leucocratic gneiss, biotite gneiss, granite, schist	Contains Archaean granite and gneiss and metamorphosed partly differentiated Early Proterozoic material	Archaean - Early Proterozoic (2500-1800 m.y.) (R. Page, 1976)

TABLE 2. DRILL HOLE DATA

YEAR	No. of holes	Total depth (m)	Average depth (m)	Max depth (m)	<u>CORE</u>			
					No. of cores	Total length (m)	Average length (m)	Max. length (m)
1974	2	132.9	66.5	68.3	2	1.22	0.61	0.61
1975	12	1298.0	108.2	189.6	11	15.10	1.37	3.43
1976	16	1558.3	97.4	180.3	16	12.52	0.78	1.52
<u>TOTAL</u>	30	2989.2	99.6		29	28.84	0.99	

Holes were logged for self-potential, single-point resistance, and radiometrics using a Widco Porta-logger in 1975 and a Well Reconnaissance Geo-logger (suitcase) in 1976. No logs were taken in 1974. Where holes had partly collapsed, geophysical logs could not be recorded for the total depth. Absolute values could not be obtained by either instrument because of the limited capabilities of the suitcase logger and a malfunction in the Widco Porta-logger. All geophysical logs are presented with geological logs in the Appendix.

GEOLOGY

ARCHAEAN-EARLY PROTEROZOIC

Nanambu Complex

Foliated granite of the Nanambu Complex was intersected in drill hole KA 19, 500 m west of South Alligator River (Fig. 5(a), (b)). Similar granite crops out about 1500 m east of KA 19, on the eastern side of the river, and was also intersected in drill holes put down by the Department of Housing and Construction, Darwin, to test the foundations for a bridge across the South Alligator River. Rb/Sr isotopic dating of a specimen from the outcrop yields a total rock isochron age of 2520 ± 30 m.y. (Page, 1976).

The granite is composed of quartz, microcline, plagioclase, biotite, muscovite, and minor opaques. Microcline occurs both as porphyroblasts up to 3 cm long and in the groundmass with granoblastic plagioclase, quartz, biotite, and muscovite. The feldspars are mostly altered to sericite. Vertical foliation is defined by parallel alignment of the microcline porphyroblasts and micas in the groundmass.

Quartz-biotite schist and quartz-feldspar gneiss were intersected in CA 78 (Cahill), 11.6 km east of the South Alligator River (Fig. 4). Similar rocks of the Nanambu Complex yield Rb/Sr total rock isochron ages between 2000 m.y. and 1800 m.y. with a strong metamorphic overprint at 1800 m.y. (Page, 1976).

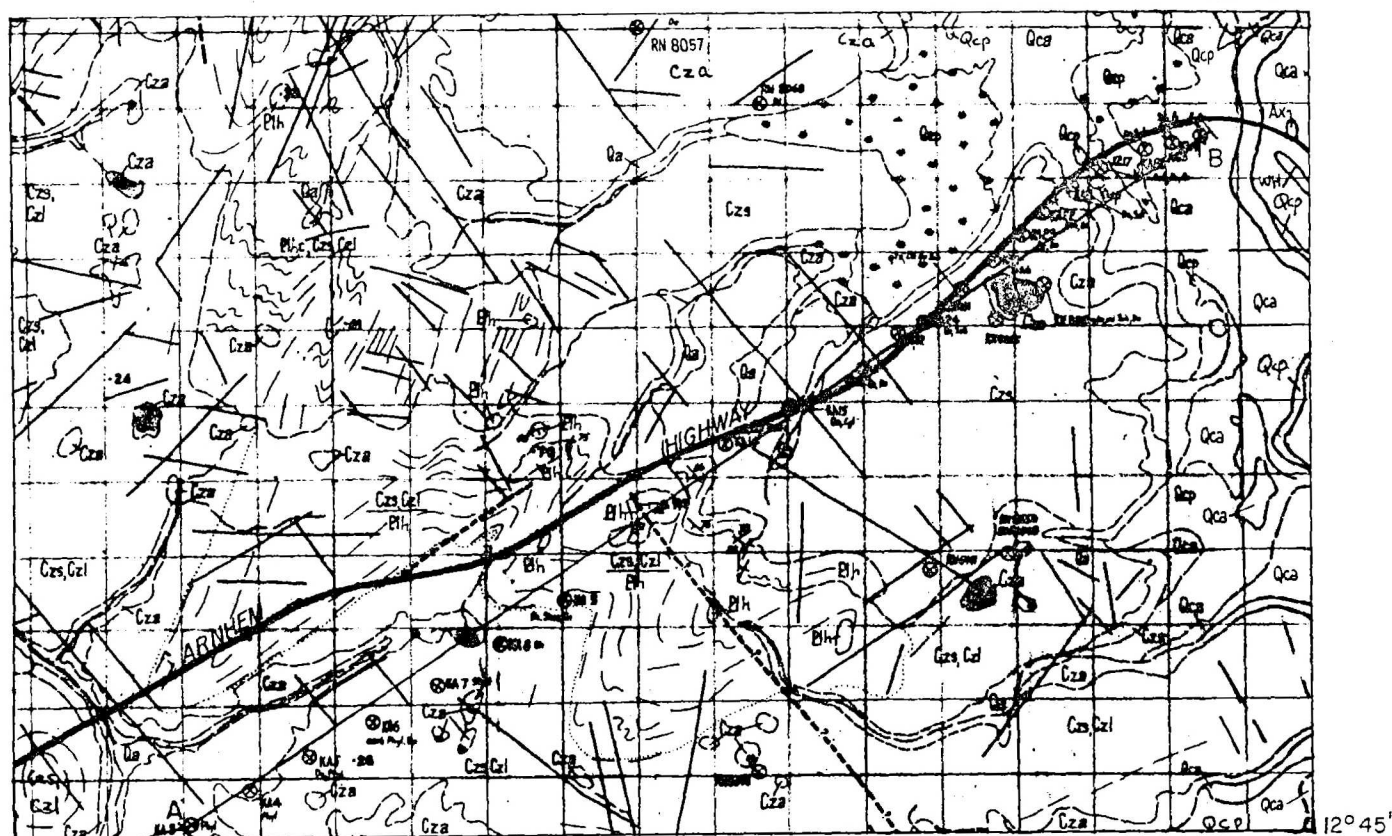


Fig.5(a) Geology and drill-hole locations, Kapalga Trig area

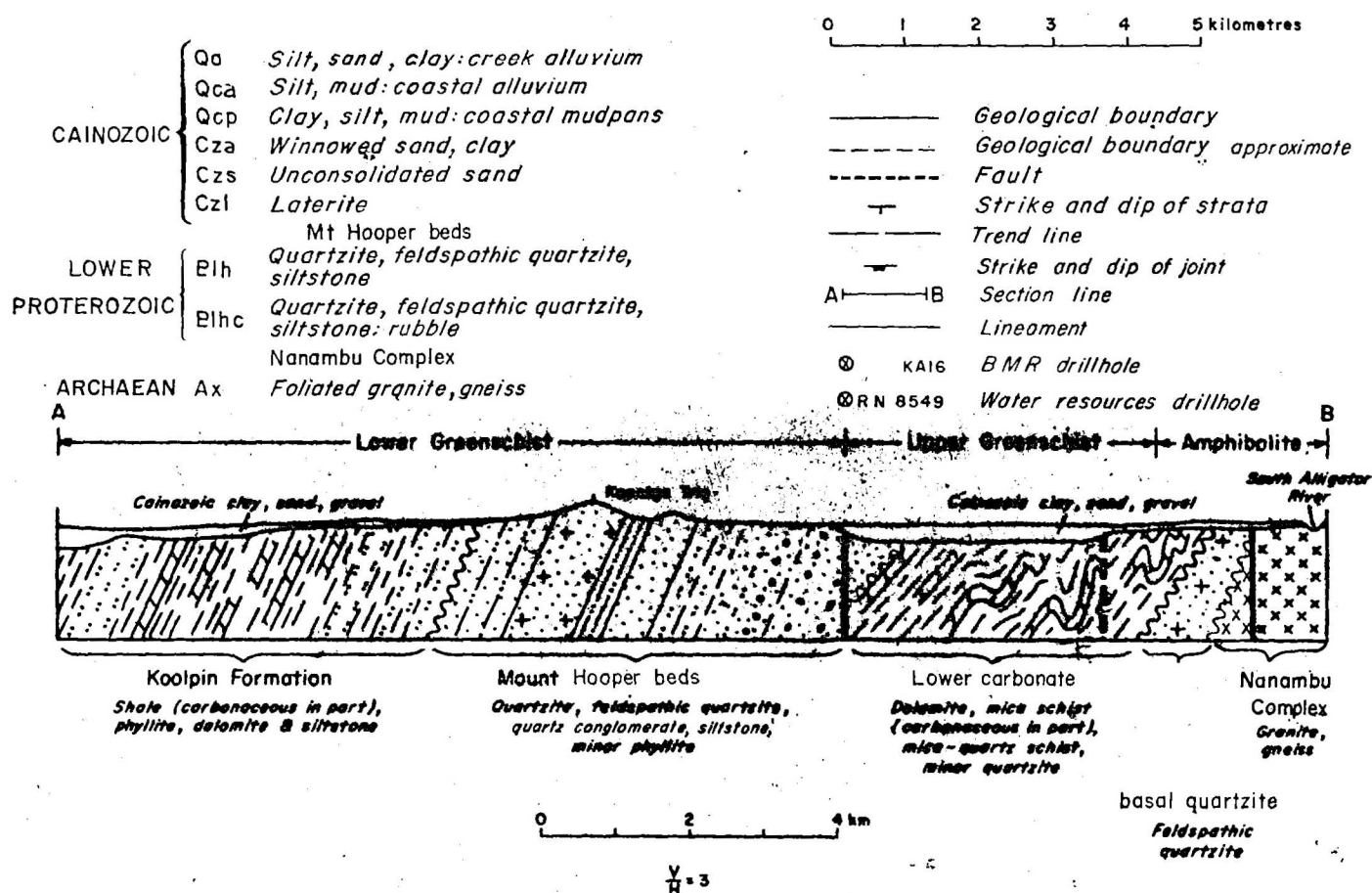


Fig. 5 (b) Diagrammatic cross - section along drill traverse, Kapalga Trig area, Kapalga 1:100 000 Sheet area

EARLY PROTEROZOIC

'Basal Quartzite'

Feldspathic quartzite was intersected in KA 18, 1000 m west of the South Alligator River. It underlies magnetite-biotite schist of the 'Lower Carbonate' sequence (in KA 18) and unconformably overlies foliated granite of the Nanambu Complex. It consists of well-rounded granules of quartz and minor feldspar in a matrix of fine-grained recrystallised quartz and sericitised feldspar.

Similar feldspathic quartzite and quartzite overlying the Nanambu Complex crop out near Patonga homestead to the southeast and near Munmarlary homestead to the north. These outcrops possibly correlate with the 'Mount Basedow Gneiss' which crops out in the Jim Jim Sheet area (Needham pers. comm.).

'Lower Carbonate'

East of Kapalga Trig nine holes (KA 11, 16, 17, 18, 20, 21, 22, 23, 24) intersected interbedded hematite-quartz-mica schist, carbonate-mica-quartz schist, thin layers of arenaceous metasediments and dolomite. The sequence underlies quartzite of the 'Mount Hooper Beds' (KA 16) and overlies the 'Basal Quartzite' in KA 18; it is probably continuous under the South Alligator River floodplain as far north as Munmarlary homestead, and south to Cooinda where it is terminated by the Jim Jim Fault Zone.

Most of the schist is isoclinally folded and crenulated. Carbonate, a common mineral in the schist and arenite, is interstitial to quartz and feldspar grains, and is probably recrystallised cement.

Only one schist intersected was carbonaceous - (KA 11). It was characterised by the highest radioactivity recorded in the survey.

An increase in metamorphic grade from lower greenschist facies west of Kapalga Trig, to amphibolite facies east of the South Alligator River is indicated in the pelitic rocks of the 'Lower Carbonate' and the other Early Proterozoic formations by: an increase eastwards in grainsize and in the proportion of muscovite to sericite, small xenoblastic porphyroblasts of

dark yellow biotite (possible stilpnomelane) in phyllite from KA 6, the appearance of chlorite and biotite east of Kapalga Trig and the presence of magnetite, garnet, and andalusite in mica schist intersected in KA 18.

Dark grey, brown, pink, or white dolomite in holes (KA 11, 17, 21, 22) forms hard bands 1 to 7 m thick within mica schist. The dolomite is massive, thinly bedded, and consists essentially of granuloblastic dolomite, minor quartz, and trace amounts of chlorite. Black staining, common along grain boundaries of weathered dolomites, is probably manganese oxides.

Only one dolomite intersected was silicified (KA 23). It consists of a fine-grained mosaic of granuloblastic quartz containing small inclusions of calcite. Some quartz grains partially replace calcite and retain ghost calcite cleavage rhombohedra.

'Mount Hooper Beds'

A sequence of arkose, magnetite-siltstone, and quartzite crops out at Kapalga Trig (Fig. 5(a)). The outcrop is the southernmost of a discontinuous series extending north-northwest from Kapalga Trig to the Van Diemen Gulf. Between exposures the sequence is deeply weathered, and forms rubbly rises, or is covered by a thin veneer of Cainozoic laterite and winnowed sand. The rocks are tightly folded about southwest-trending axes, and faulted parallel to the fold axes.

Drill holes KA 14 and 15, situated east of Kapalga Trig, intersected a lower part of the sequence consisting of siltstone, quartzite, quartz conglomerate, and phyllite, beneath a thin veneer of sand. Drill hole KA 9 located west of Kapalga Trig intersected quartzite, siltstone, and shale.

The 'Mount Hooper Beds' exposed at Kapalga Trig differ considerably, particularly north and west of the Trig, from the thicker, less magnetic and more arkosic sequence of the type Mount Partridge Formation with which they are correlated.

Koolpin Formation

Eleven drill holes in the central and eastern parts of the Kapalga Sheet area (KA 3, 4, 5, 6, 7, 8, 10, 13, 25, 27, 28) intersected mainly pelitic metasediments, rare quartzite and dolomite, characteristic of the Koolpin Formation. The metasediments flank the 'Mount Hooper Beds' at Kapalga Trig and are exposed on the limbs of the West Alligator Syncline in the west and south of the Sheet area. The underlying 'Mount Hooper Beds' are distinguished from the Koolpin Formation by the presence of quartzite and the absence of carbonaceous shale and dolomite.

West of Kapalga Trig the boundary between the two units lies between drill holes KA 8 and KA 9. Bedding dips in cores of the Koolpin Formation are steeper than those in the underlying 'Mount Hooper Beds'. This may indicate an unconformable contact, or differential behaviour during folding, owing to differences in the competencies of the two units.

Pelitic rocks: Siltstone, shale, phyllite, and mudstone form the bulk of the Koolpin Formation. They consist of fine-grained, foliated sericite and muscovite with minor silt-size quartz grains, and trace amounts of tourmaline and feldspar.

Much of the shale and phyllite, especially where interbedded with dolomite, is carbonaceous. The carbonaceous matter is mostly disseminated, fine, non-graphitic grains, and constitutes up to 50 percent of the rock. In KA 28 carbonaceous-rich laminae containing disseminated pyrite are separated by sandy quartz-calcite bands. Graphite is present along some sheared foliation and crementation surfaces.

Ferruginous siltstone containing chert bands and nodules is the predominant rock type of the upper part of the Koolpin Formation, and crops out in the southern part of the Kapalga Sheet area. It was only intersected in drill hole KA 27, where it forms the western limb of the West Alligator Syncline. Because of the displacement along the Jim Jim Fault, similar siltstone was not intersected on the eastern limb of the syncline immediately west of Kapalga Trig.

Minor siltstone and fine-grained quartzite occur as small bands interbedded with other rocks of the Koolpin Formation. They typically

consist of well to subrounded quartz grains in a matrix of sericite and muscovite with trace amounts of tourmaline. Where they occur as thin laminations in shale they commonly exhibit soft sediment deformation structures such as 'ball and pillow'.

Dolomite was intersected in three holes (KA 5, 6 and 25) west of Kapalga Trig. It is indistinguishable from dolomite of the 'Lower Carbonate' except for its more granoblastic texture, which reflects a lower metamorphic grade.

Fisher Creek Siltstone

Drill holes KA 1, 2 and 26 intersected a deeply weathered, shallow-dipping sequence of feldspathic litharenite, silty shale, and phyllite, beneath Cainozoic sandy clay. The feldspathic litharenite (nomenclature after Cook, 1960) is a fine to coarse-grained, massive pink to grey sandstone consisting of poorly sorted, subangular fragments of quartz, feldspar, metamorphic rocks, and shale clasts (up to 2 cm) in a matrix of finer-grained quartz and feldspar. The arenite is highly indurated, and apart from hair-like quartz veins and a weakly developed cleavage, shows little sign of metamorphic alteration or tectonic deformation. Most of the matrix feldspars (alkali feldspar, sodic plagioclase) and some of the larger grains are altered to fine-grained muscovite which forms an incipient foliation parallel to bedding. Minor amounts of fine-grained chlorite and granular epidote and clinozoisite are scattered through the matrix. Most of the feldspars and rock fragments are clearly of metamorphic origin: deformed twins, polygonal growths, irregular deformational lamellae, and idiomorphic textures in the rock and mineral fragments contrast with undeformed shale clasts.

In drill holes KA 1 and 2 the litharenite contains minor shale interbeds and a 20-m thick bed of thinly laminated grey, brown, and green shale and silty shale. Similar dark greenish grey phyllite overlies feldspathic litharenite dipping at 15° in hole KA 26. The shale and phyllite consist of rounded fine grains of quartz and minor feldspar in a matrix of fine-grained sericite, chlorite, and muscovite.

There appears to be good correlation between the sedimentary sequences intersected in the three drill holes indicating that feldspathic litharenite and shale form an almost flat-lying sequence in the centre of the

West Alligator Syncline. The sequence overlies the Koolpin Formation and probably correlates with the Fisher Creek Siltstone. The high proportion of feldspar and metamorphic rock fragments may reflect a near source, possibly Archaean granite and metasediments of the Nanambu Complex.

Zamu Complex

Granophyre similar to that of the Zamu Complex described by Bryan (1962) from the South Alligator Valley, was intersected in drill hole KA 29. The granophyre consists of idiomorphic hornblende and feldspar in a mesostasis of graphically intergrown quartz and alkali feldspar. Hornblende and feldspar are strongly chloritized, and the rock is cut by veinlets of calcite and quartz.

The granophyre is probably an acid differentiate of a doleritic magma; Zamu Complex dolerite crops out in the southern part of the Kapalga Sheet area.

CAINOZOIC

Tertiary deposits

Unfossiliferous, poorly cemented quartz sandstone and gravel are exposed in a road cutting on the Arnhem Highway about 11.6 km east of the South Alligator River (Fig. 4). The gravel, in the eastern part of the exposure, dips steeply to the west and is faulted against amphibolite grade schist of the Cahill Formation. A drill hole (CA 78) sited 500 m west of the fault intersected 20 m of sand unconformably overlying schist and gneiss of the Nanambu Complex. Coarser sediment and steep dips adjacent to the faulted contact suggest an original steep depositional dip caused by deposition adjacent to an active fault scarp. Some modification to the dip by drag folding or draping may have occurred.

Seventeen drill holes along the Arnhem Highway traverse (Fig. 3) intersected up to 81 m of Tertiary sediments similar to those exposed in the road cutting. They consist of clay, sandy clay, fine to coarse-grained sand, and unconsolidated gravels. The gravels form poorly consolidated bands up to 40 m thick, at or near the unconformity with the Early Proterozoic rocks, and consist of predominantly subrounded to well-rounded milky quartz with minor quartzite, chert, and ferricrete, in a sand and clay matrix.

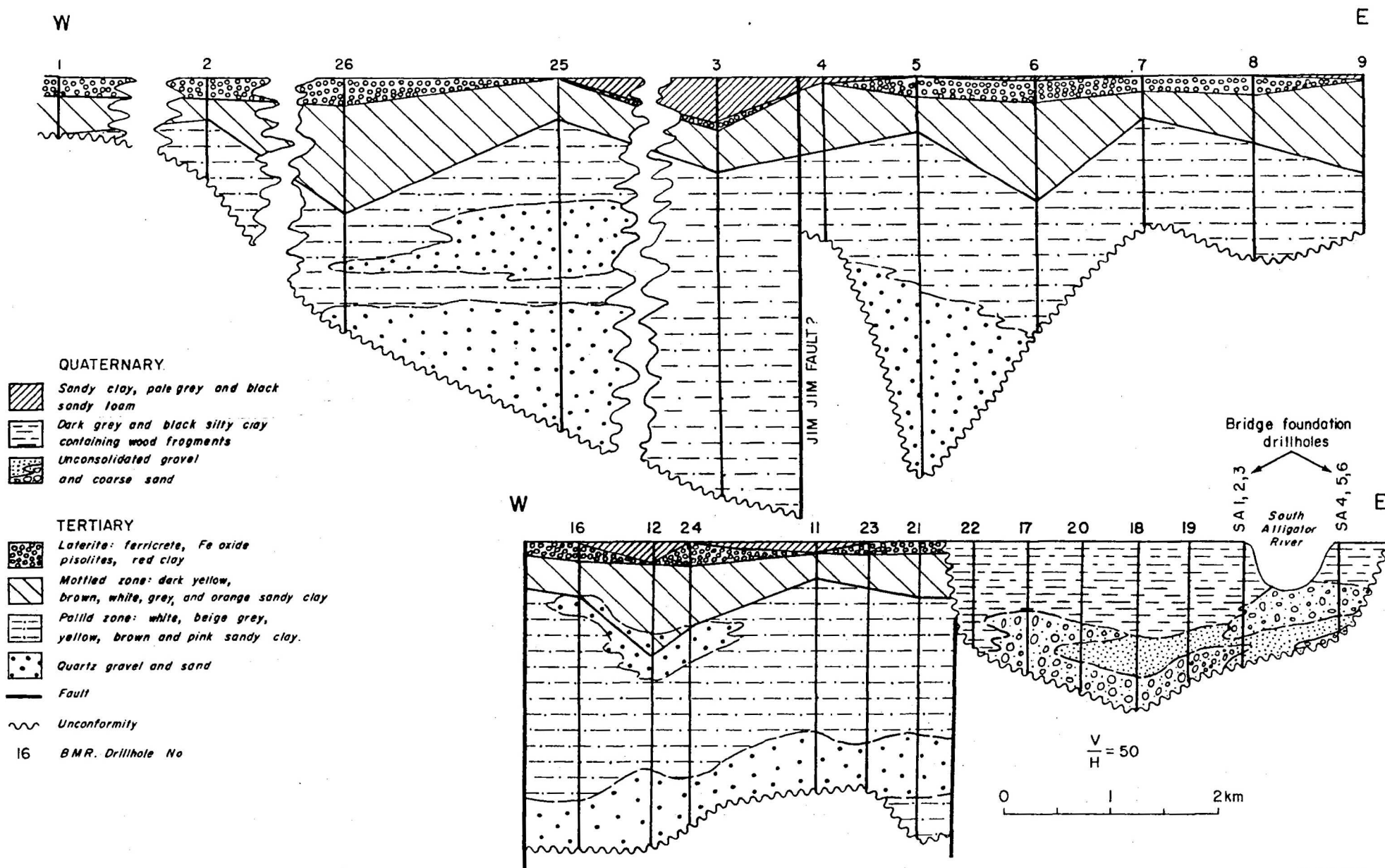


Fig. 3 Diagrammatic cross-section of Cainozoic deposits, along drill traverse, Kapalga 1:100 000 Sheet area

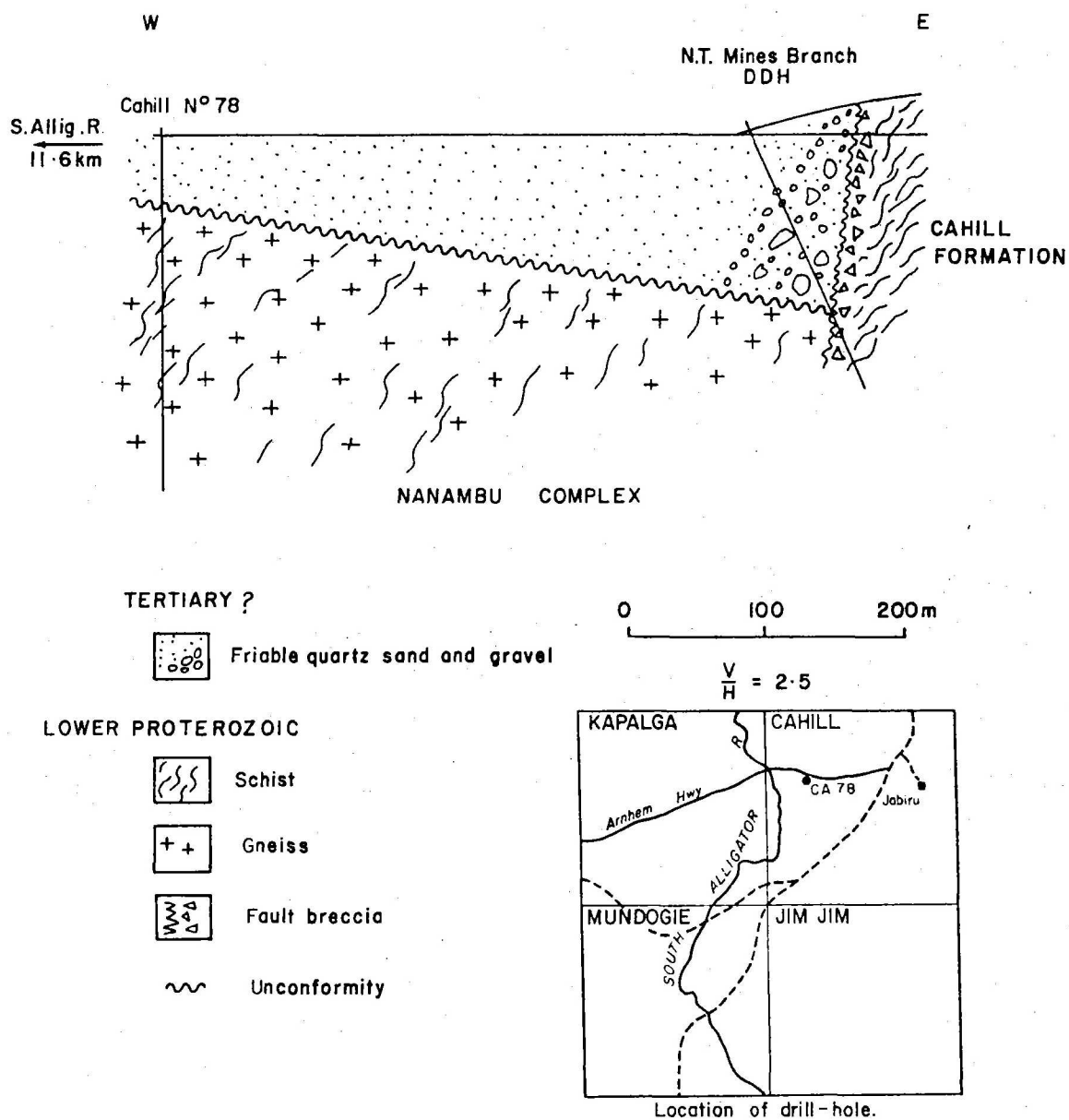


Fig.4 Location and diagrammatic cross-section of Tertiary deposit, Cahill 1:100 000 Sheet area.

The relief of the unconformity appears to be largely controlled by faulting rather than resistance of bedrock to weathering. For example, the Tertiary sequence does not thicken over Early Proterozoic carbonates. East of Kapalga Trig, Tertiary deposits occupy a trough bounded by northwest-trending faults which correspond to photo-lineaments. The projected extension of the Jim Jim Fault (between CA 3 and 4) also corresponds to a marked change in the depth of the unconformity.

These deposits formed as extensive colluvial mantles on the Early Proterozoic erosional surface during the Middle to Late Tertiary (Storey et al., 1969). Gravels were deposited in valley floors, on lower wash slopes, and locally adjacent to active fault scarps. The predominance of milky quartz and the minor occurrence of chert and quartzite in gravels suggest that they were derived from Early Proterozoic rocks in the region, which are commonly veined by milky quartz.

Monsoonal climatic conditions throughout the Cainozoic resulted in the development of a lateritic weathering profile during a sedimentary hiatus in the Late Tertiary (Storey et al., 1969). The presence of ferricrete pebbles in gravels (e.g. KA 13) and a ferruginised zone in some of the Early Proterozoic rocks beneath the unconformity indicates that laterite also developed before Tertiary sedimentation. Three distinct zones are recognisable in the lateritic Late Tertiary weathering profile (see Fig. 3): ferricrete capping; mottled zone; a pallid zone which extends into the underlying Early Proterozoic rocks. The ferricrete capping, 1 to 3 m thick, consists of Fe oxide pisolites, clear and milky quartz sand and pebbles in a ferruginous cement commonly underlain by a thin zone of dark red clay. The mottled zone has an average thickness of 10 m, and consists of dark yellow, brown, white, grey, red, and minor orange clay. The mottled zone grades into the pallid zone which is recognised by the pale colour of the clays - typically white, beige, and grey and less commonly light yellow, brown, and pink. The zone extends into the Early Proterozoic rocks to an average depth about 100 m.

Quaternary deposits

Five drill holes (KA 17, 18, 19, 20, 21) sited on the South Alligator River floodplain intersected up to 32 m of Quaternary sediments (Fig. 3). The deposits onlap Tertiary sediments to the west, and unconformably overlie Early Proterozoic metasediments and Archaean gneissic granite in the east. They consist of mainly dark grey clay, underlain by unconsolidated sand and gravel.

The gravel and sand, deposited as bed-load material or point bars, consist of well-rounded pebbles of quartz, quartzite, ferricrete, iron oxide pisolites, and brown, grey and black chert. They grade upwards into dark grey organic muds. Fragments of Quaternary arthropods, bivalves, gastropods and wood occur in calcareous nodules exposed in clay on the South Alligator river-bank about 4 m below the level of the floodplain. The arthropods are Thalassina squamifera de Man, and have been previously reported 7 km upstream from the mouth of the river (Campbell & Woods, 1967). These clays were probably deposited in a tidal mangrove swamp environment, similar to present conditions in estuaries of the South Alligator River and other rivers along the north coast of Australia. The organic-rich clays grade into saline grey clays, deposited during seasonal flooding.

Other Quaternary deposits intersected include sheet wash deposits of sandy and gravelly clay up to 4 m thick, and a thin surface soil of light grey sandy loam. Both deposits overlies the Koolpinyah surface and do not have a lateritic weathering profile.

GEOPHYSICS

Radiometric, self-potential, and resistance logs of drill holes enabled accurate positioning of lithological boundaries, which was not always possible from examination of cuttings.

None of the radiometric anomalies detected indicated significant mineralisation. However, owing to the limited effective range of the method, mineralisation a metre or more from the hole would not have been detected.

Generally self-potential values gradually increased and resistance values gradually decreased down the hole. This possibly reflects decreasing clay content in the weathering profile with increasing depth.

Relative radiometric and electrical responses of different Early Proterozoic rock types are shown in Figure 6. Quantitative comparisons of responses were not possible with the suitcase logger used in 1976. These holes included the only intersections of dolerite and granite.

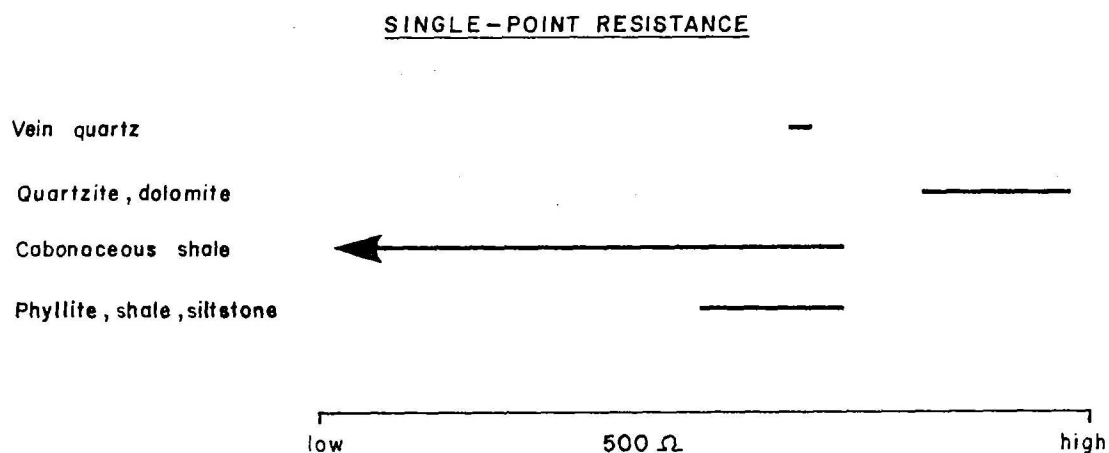
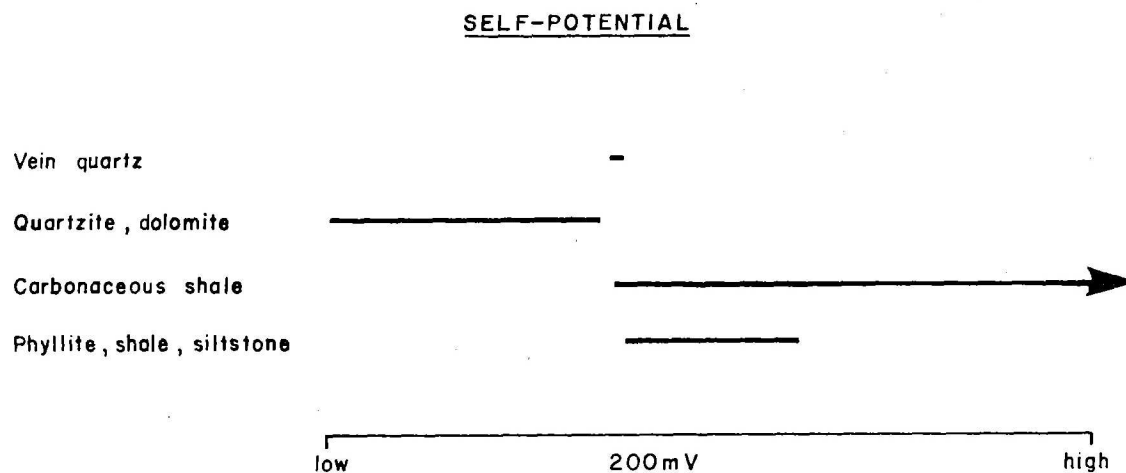
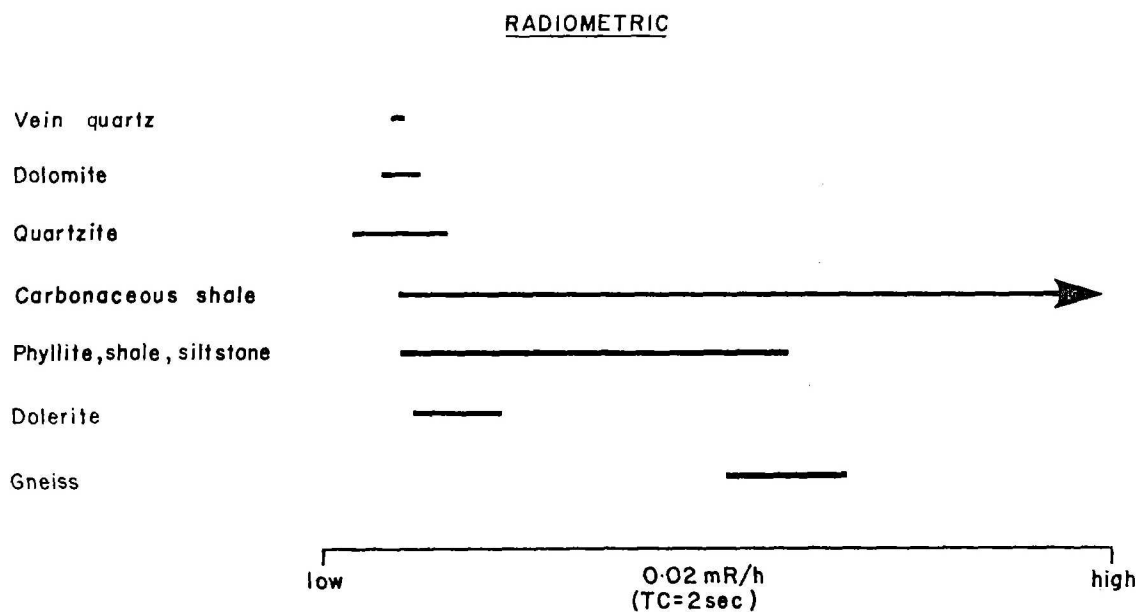


Fig. 6 Relative radiometric and electric response of Early Proterozoic rocks

ARCHAEOAN-EARLY PROTEROZOIC

Quartzite and dolomite

Quartzite and dolomite produce a radiometric response which is flatter and about 0.005 mR/h lower than from pelitic rocks. They also produce lower self-potential values (approximately 100 mV less) and higher resistance values (approximately 200 Ω more) than pelitic rocks. The difference in electrical response between quartzite and dolomite, and pelitic rocks decreased where pelitic interbeds were abundant.

Pelitic rocks

Chlorite-quartz-schist, phyllite, siltstone, shale, and carbonaceous pelites could not be differentiated from each other in the radiometric or electrical logs, except in the log of KA 14 where phyllite produces a radiometric response 0.010 mR/h higher than that of siltstone.

Radioactivity of the pelitic rocks ranges widely, particularly in carbonaceous pelite. The maximum recorded radiometric value was 0.025 mR/h above average in a carbonaceous chlorite-quartz schist (KA 11, 136 m). Most pelites contain minor amounts of carbon; this may explain their wide range of radiometric values, which overlaps that of carbonaceous pelite.

Self-potential and resistance values ranges over 50mV and 100 Ω respectively, and tended to be highest in carbonaceous pelites.

Dolerite

Dolerite, which was intersected only in one drill hole (KA 29), produced lower radiometric and self-potential values, and slightly higher resistance values than adjacent phyllite.

Granite

Electrical and radiometric logs of KA 19 show that granite produces higher radiometric and resistance values and lower self-potential values than the overlying Quaternary sediments.

25

CAINOZOIC

The low radioactivity of Cainozoic deposits is readily identified in the radiometric logs: the response is characteristically flatter than the response of Early Proterozoic rocks and radiometric values are 0.005 to 0.01 mR/h lower; the unconformity between the Cainozoic deposits and the Early Proterozoic rocks is typically marked by an abrupt change in radioactivity (e.g. KA 9, 11, 17, 22, 23, 25, 26).

Changes in radiometric values within the Cainozoic deposits generally reflect oxidation and leaching of radioactive minerals during lateritisation. Typically, ferricrete is more radiometric than highly leached mottled clay zones.

Some gravel gives noticeably higher radiometric values than clay. This may be caused by increased concentration of radioactive heavy minerals such as monazite in the gravel.

The electrical responses of Cainozoic deposits and Early Proterozoic rocks are generally indistinguishable except in KA 9 where an abrupt change in response corresponds to the position of the unconformity, and in KA 4 where the style of the response differs between the two units. In holes KA 4, 7 and 8 small anomalies in the self-potential and resistance responses appear to correspond to the unconformity.

The electrical logs showed little correlation with the radiometric or geological logs, except in KA 9 and KA 11 where anomalies in electrical and radiometric responses correspond to an off-white sandy clay zone.

CONCLUSIONS

Early Proterozoic stratigraphy

Since the completion of the drilling program, pebbles of silicified dolomite have been identified in conglomerate of the 'Mount Hooper Beds'. They provide the only direct evidence of the relative ages of the Koolpin Formation, 'Mount Hooper Beds' and the 'Lower Carbonate'. Because the Koolpin Formation is known to unconformably overlies correlatives of the 'Mount Hooper Beds' in the Mundogie 1:100 000 Sheet area, the pebbles must have been derived from the

'Lower Carbonate' which is the only other formation to contain dolomite in the area. Therefore the Early Proterozoic rocks intersected by the drilling form a westerly-younging sequence which unconformably overlies the Nanambu Complex (see Fig. 5(b)). The stratigraphy of the sequence is summarised in Table 3.

The sequence intersected during the drilling program can be correlated with the Batchelor Group sediments at Rum Jungle. Like the Batchelor Group, the sequence was probably deposited in a littoral and neritic environment adjacent to an Archaean basement high. The 'Basal Quartzite' probably formed part of an old transgressive shoreline deposit around the Archaean basement. Pelitic and carbonate ('Lower Carbonate') sedimentation followed deposition of the 'Basal Quartzite', but was temporarily interrupted by a regressive phase, in which the 'Lower Carbonate' was partly uplifted and eroded, and the psammitic 'Mount Hooper Beds' were deposited. Following a hiatus in deposition, and possibly some deformation of the sediments, pelitic and carbonate sedimentation resumed, forming the Koolpin Formation.

Hitherto the Batchelor Group has only been identified in the area around the Rum Jungle and Waterhouse Complexes. If correlation of the sequence near Kapalga Trig with the Batchelor Group is correct, the Batchelor Group was probably continuous at least around the margins of the Pine Creek Geosyncline. Massive dolomite crops out 6 km east of Mount Saunders (Pine Creek 1:100 000 Sheet area) and has been intersected in holes drilled by Kewanee Oil on the Mary River floodplain (P. Cogar, personal communication). Both these occurrences probably underlie Masson Formation, which suggests that the Batchelor Group or its equivalent may extend across much if not all of the Pine Creek Geosyncline.

Correlation of the Koolpin and Cahill Formations

The drilling results show that the 'Lower Carbonate' unit, intersected by the drilling program, is probably equivalent to the lower member of the Cahill Formation. Previously the Cahill Formation was thought to be a lateral and time equivalent of the Koolpin Formation (Needham & Stuart-Smith, 1976). Both the 'Lower Carbonate' and the lower member of the Cahill Formation have a higher metamorphic grade, a higher proportion of quartzite, and are more feldspathic than the Koolpin Formation. Neither the 'Lower Carbonate' nor the Cahill Formation contain nodular and chert-banded siltstone typical

TABLE 3. STRATIGRAPHY AND CORRELATION OF LOWER PROTEROZOIC METASEDIMENTS
INTERSECTED BY DRILLING IN THE KAPALGA 1:100 000 SHEET AREA

UNIT	ESTIMATED MAX. THICKNESS (m)	DESCRIPTION	CORRELATION
Fisher Creek Siltstone	unknown	feldspathic litharenite, shale, phyllite	
Koolpin Formation	3000 +	nodular and chert banded siltstone, phyllite (minor carbonaceous), dolomite	
UNCONFORMITY?			
'Mount Hooper Beds'	3000	quartzite, feldspathic quartzite, siltstone (magnetic), phyllite, conglomerate	Cahill Formation (upper member)
UNCONFORMITY			
'Lower Carbonate'	2000	dolomite, hematitic quartz-mica schist, calcareous mica-quartz' schist, minor carbonaceous chlorite schist	Cahill Formation (lower member)
'Basal Quartzite'	200	feldspathic quartzite, quartzite	Mount Basedow Gneiss
MAJOR UNCONFORMITY			
ARCHAEAN BASEMENT COMPLEX			

} Batchelor
Group

of the Koolpin Formation. Correlation of the lower member of the Cahill Formation with the 'Lower Carbonate' is supported by correlation of 'Basal Quartzite' with the Mount Basedow Gneiss, which underlies the Cahill Formation.

Needham & Stuart-Smith (1976) described the upper member of the Cahill Formation as a 2500-m thick sequence of metamorphosed well-bedded feldspathic arenite and siltstone, minor conglomerate, and thin bands of pelite. The 'Mount Hooper Beds' are a similar, 3000-m thick sequence, although somewhat coarser and more pebbly. A correlation between the upper member of the Cahill Formation and the 'Mount Hooper Beds' seems feasible - both formations give a high magnetic response.

Correlation of the Cahill Formation with the 'Lower Carbonate' unit and the 'Mount Hooper Beds' (Batchelor Group equivalents?) rather than the Koolpin Formation is a more reasonable interpretation of the stratigraphy of the Pine Creek Geosyncline. Differences in metamorphic grade, which are gradational between the Koolpin and Cahill Formations, can be explained by depth of burial. The drilling results indicate that the Cahill Formation is stratigraphically between 3 and 5 km below the Koolpin Formation. This difference in depth is sufficient for a change from greenschist to amphibolite facies.

If the Cahill Formation is equivalent to the Batchelor Group the Koolpin Formation, if present in the northern part of the Alligator Rivers region, would overlies the upper member. Mica schist, the predominant rock type exposed in the area, has been tentatively correlated with the Fisher Creek Siltstone. This correlation is based upon the concept that the Koolpin and Cahill Formations are equivalents. Apart from an outcrop of ironstone in the East Alligator River area (G. Eupene, pers. comm.) rock types typical of the Koolpin Formation such as the nodular and chert banded siltstone have not been identified.

No definite conclusion can be drawn concerning the relations of the Koolpin and Cahill Formations until the stratigraphy above the Cahill Formation is known. The drilling results indicate that the Cahill Formation rather than being a facies and time equivalent of the Koolpin Formation is an older formation that may be a correlative of the Batchelor Group.

Geophysical logging

Drill hole logs of self-potential, single point resistance, and radiometrics proved effective in identifying Cainozoic deposits, carbonaceous rocks, and delineating dolomite and quartzite from pelitic rocks. No significant radiometric anomalies were detected.

Other conclusions

1. Basement faults were active during the Cainozoic.
2. The Jim Jim Fault Zone extends across the Kapalga Sheet area.
3. Metamorphic grade increases gradationally from lower greenschist facies west of Kapalga Trig to amphibolite facies at the South Alligator River.
4. Collapse of Lower Proterozoic carbonate does not appear to influence the relief of the Cainozoic unconformity.

ACKNOWLEDGEMENTS

I would like to thank S. Needham and I. Hone for their many helpful discussions in compiling this record.

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APPENDIX

Geological and geophysical logs

GEOLOGICAL LOG OF DRILL HOLE

LOCATION 28 Km west of S. Allig. R. on Arnhem hwy.

CO-ORDINATES - $12^{\circ} 46'$ - - - - $132^{\circ} 16'$

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

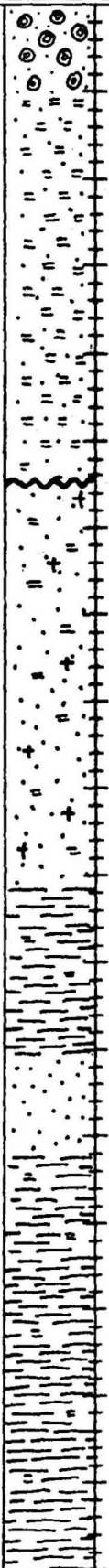
HOLE NO. BMR KAPALGA 1

CO-ORDINATES

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERSLOCATION 24 km west of S. Allig. R. on Arnhem hwy.HOLE NO. BMR KA 2CO-ORDINATES 12° 46' 132° 17'

DEPTH ft. m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
10						ferricrete, Fe oxide pisolites
5						mottled white, yellow and red sandy clay
20						light grey sandy clay
30						
40						light grey and brown sandy clay
50						
60						
70						
80						light grey and brown sandy clay weathered and ferruginised grey feldspathic arenite (medium grained) minor silcrete.
90						
100						
110						red brown ferruginised shale minor light grey clay
120						
130						fine grained brown micaceous arenite
140						
150						grey and brown shale and clay
160						
170						
180						
180.55						
DRILLER		AIR <u>0-35'</u>		COMMENCED <u>16/10/1974</u>		LOGGED BY <u>PES-S</u>
TYPE		WATER <u>35-224'</u>		COMPLETED <u>17/10/1974</u>		DRAWN BY <u>PES-S</u>

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

BMK KA 2

CO-ORDINATES

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERSLOCATION 15000 m westHOLE NO. BMR KAPALGA 3CO-ORDINATES 12° 44' 40" 132° 22' 40"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
10			0.005 TC = 1 sec.			light grey sandy clay
5						mottled orange & white clay, f.g. well rounded quartz.
20						
30						laterite: Fe oxide pisolites, ferricrete
10						
40						mottled white & yellow clay
50						
15						
60						
20						
70						beige sandy clay, c.g. quartz sand.
25						
80						
25						
90						
30						
100						
35						beige, off-white & minor yellow brown sandy clay, milky quartz
110						
35						
120						
40						
130						
45						
140						
45						
150						
50						
160						
50						
170						ferruginised yellow brown & reddish sand, off white & yellow brown clay
180						
55						
DRILLER <u>KH</u>		AIR <u>0 - 15'</u>		COMMENCED <u>2/8/75</u>		LOGGED BY <u>P.G.S-S</u>
TYPE <u>MAYHEW 1000</u>		WATER <u>15' - 326' 6"</u>		COMPLETED <u>5/8/75</u>		DRAWN BY <u>P.G.S-S</u>

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

BMR KAPALGA 3

CO-ORDINATES

DEPTH Ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
190						
60						
200						
210						
65						
220						
70						
230						
240						white + pink clay, ferruginised yellow and brown sandstone, milky quartz
75						
250						
260						
80						
270						pale brown + pink phyllite, milky quartz
85						
280						
90						
290						
95						
300						
310						pale yellow + offwhite bleached phyllite ferruginised quartzite
320						
100						
330						
340						
105						
350						
360						
110						
DRILLER		AIR		COMMENCED		LOGGED BY
TYPE		WATER		COMPLETED		DRAWN BY

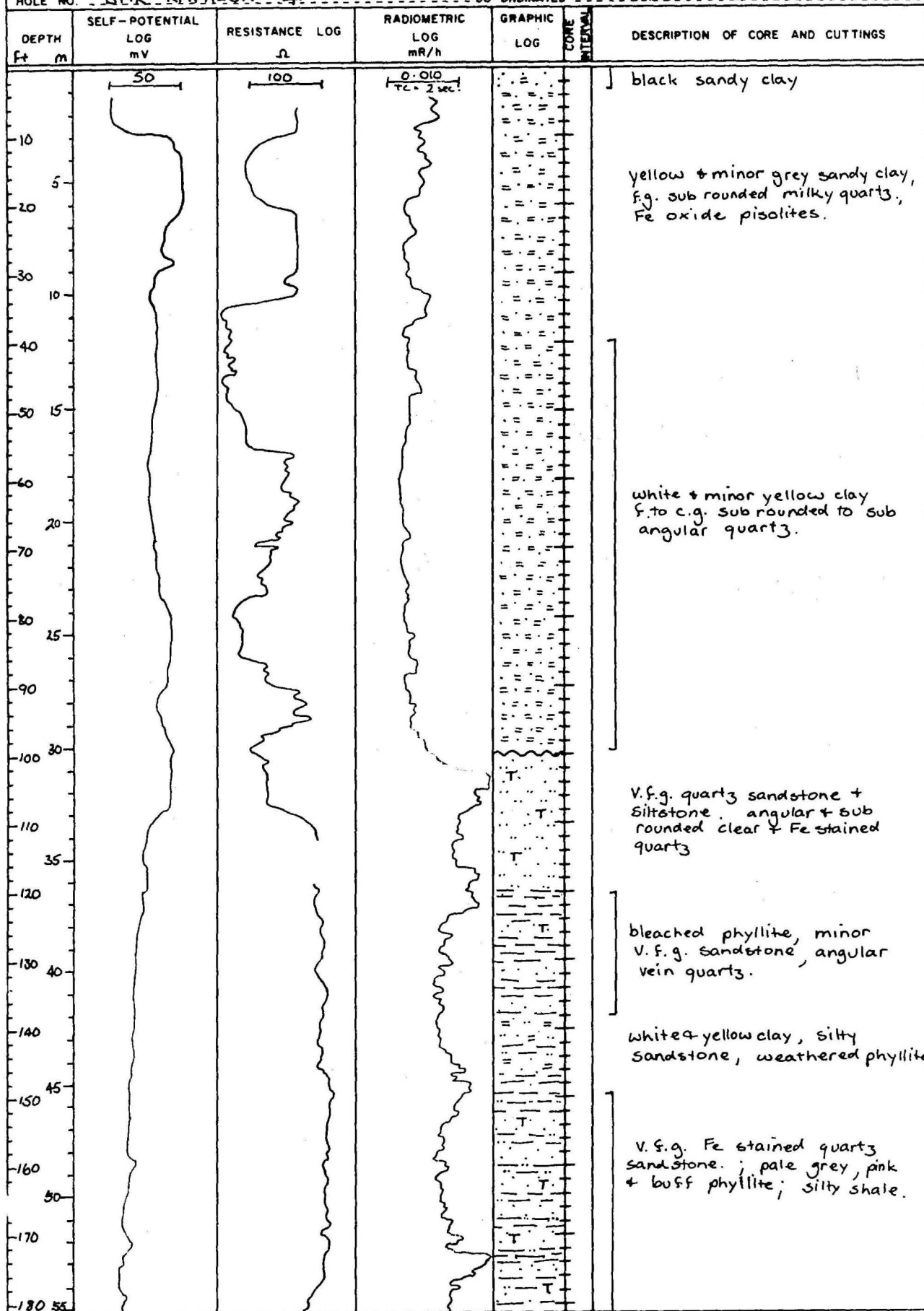
GEOLOGICAL LOG OF DRILL HOLE

LOCATION

CO-ORDINATES

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERSLOCATION 14.000m WestHOLE NO. BMR KAPALGA 4CO-ORDINATES 12° 44' 30" 132° 22' 40"DRILLER KH

AIR

COMMENCED 5/8/75LOGGED BY RSNTYPE MAYHEW 1000WATER 0' - 234' 6"COMPLETED 7/8/75DRAWN BY P.G. S-S.

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

CO-ORDINATES

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERS LOCATION 131° 00' west
 HOLE NO. BMB KAPALGA 5 CO-ORDINATES 12° 44' 15" 132° 23' 25"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIO-METRIC LOG CPA/N	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
	100	200	0.005 76.25 sec		
10					laterite: Fe oxide pisolites, clear, milky & Fe stained quartz
5					white, yellow & brown clay, small bands of ferruginised quartz sand.
20					
30					
10					
40					
50					
15					
60					
20					
70					
80					light grey and minor yellow brown & red sandy clay; f.g. quartz sand.
25					
90					
100					
30					
110					
35					
120					
40					
130					
45					
140					
150					light grey clay; v.c. milky quartz gravel.
50					
160					
170					
180					
65					
DRILLER <u>KH</u>		AIR		COMMENCED <u>7/8/75</u>	LOGGED BY <u>RSN. P.G.S-S.</u>
TYPE <u>MAYHEW 1000</u>		WATER <u>0' - 384' 6"</u>		COMPLETED <u>12/8/75</u>	DRAWN BY <u>P.G. S-S.</u>

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

BMR KAPALGA 5

CO-ORDINATED

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO. BMR KAPALGA 5

CO-ORDINATES

BMR - - KAPALGA

5

CO-ORDINATES

DEPTH
4 m

SELF - POTENTIAL
LOG
mV

RESISTANCE LOG
Ω

**RADIOMETRIC
LOG
mR/h**

GRAPH
LOG

COME

DESCRIPTION OF CORE AND CUTTINGS

-370

115-

120-

core:

373'- 375': dark grey dolomite
375- 382'6": weathered & sheared
brown dolomite and brown
phyllite; poor recovery.

382'6"-384'6": dark grey dolomite
foliation + bedding dips
45° to 60°

core recovery ~ 60%.

DRILLER

AIR

COMMENCED

LOGGED BY

TYPE.

WATER

COMPLETED

DRAWN BY_

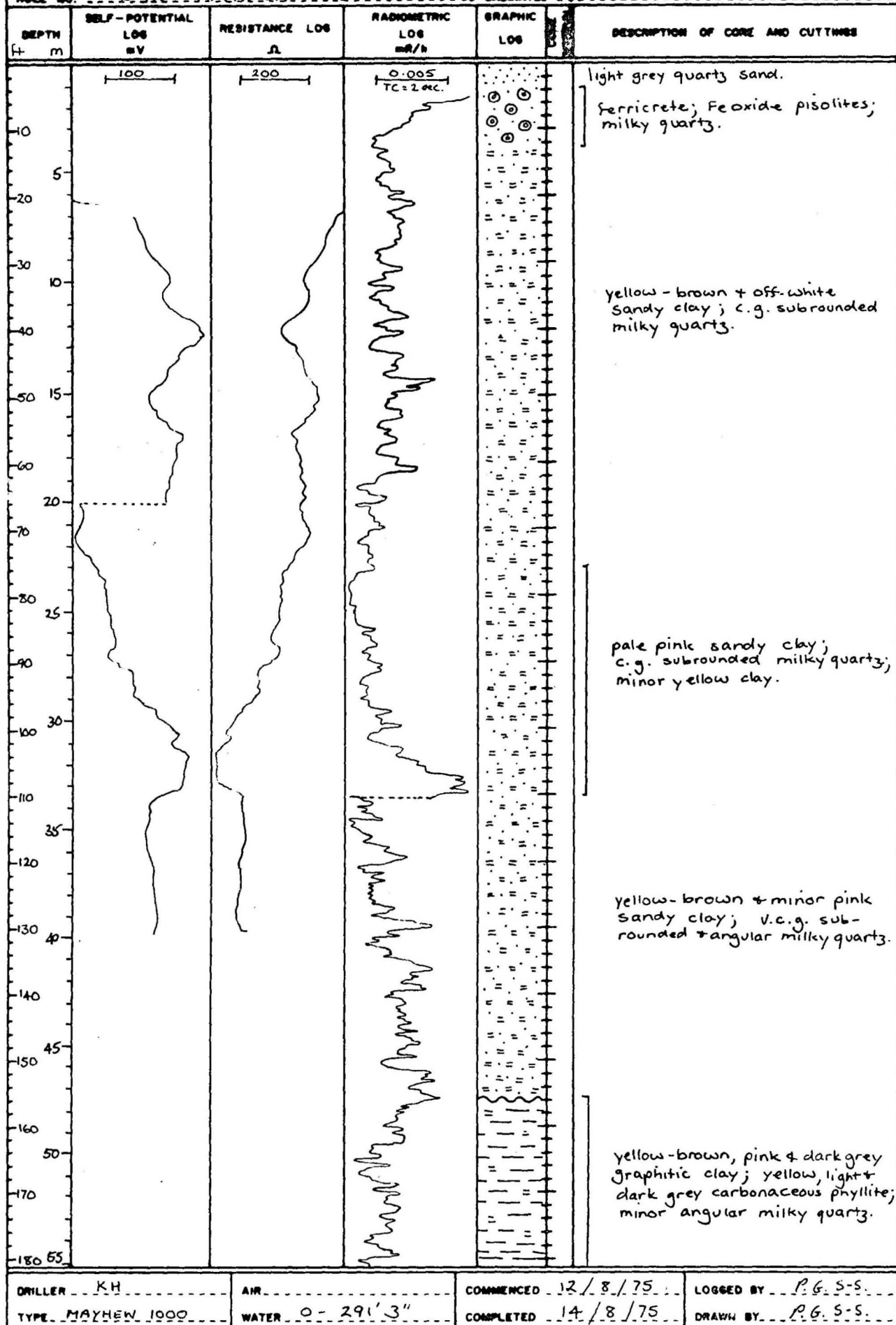
GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERS

LOCATION 1200m West

HOLE NO. BMR KAPALGA 6

CO-ORDINATES 12° 44' 00" 132° 23' 55"



GEOLOGICAL LOG OF DRILL HOLE

PROJECT _____ LOCATION _____
HOLE NO. BMR KAPALGA 6 CO-ORDINATES _____

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
190 60					
200					
210 65					
220					
230 70					
240					
250 75					Core 1: 240-244'6": dark purple-grey carbonaceous phyllite. 244'6"-247': weathered spotted brown talc schist. pale green + brown talc schist.
260 80					
270					pink dolomite
280 85					pale green talc schist; phyllite; minor pink dolomite.
290					Core 2: weathered pink dolomite + quartz-talc-chlorite schist. average dip of bedding + foliation ~ 60°
300 90					

DRILLER _____

AIR _____

COMMENCED _____

LOGGED BY _____

TYPE _____

WATER _____

COMPLETED _____

DRAWN BY _____

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERS LOCATION 11000 West.
 HOLE NO. BMR KAPBLGA 7 CO-ORDINATES 12° 43' 45" 132° 24' 25"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG MR/h	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
	200	500	0-001 TC = 2.3 sec	① ② ③	grey loam; Fe oxide pisolites } red-brown ferruginous clay.
10				" " "	
5				" " "	bleached white yellow brown + red ferruginous clays.
20				" " "	
30				" " "	
10				" " "	
40				" " "	white clay; minor bleached clays as above.
50				" " "	
15				" " "	
60				" " "	
20				" " "	white + buff sandy clay
70				" " "	
80				" " "	
25				" " "	
90				" " "	
30				" " "	weathered buff siltstone; sub rounded + angular quartz.
100				" " "	
110				" " "	
35				" " "	
120				" " "	
40				" " "	mottled white, grey, yellow + red brown siltstone; minor silicified siltstone.
130				" " "	
45				" " "	
140				" " "	
150				" " "	
50				" " "	hematite - quartz breccia; minor siltstone.
160				" " "	
50				" " "	
170				" " "	
180				" " "	
55				" " "	
DRILLER <u>KH</u>		AIR <u>0-20'</u>		COMMENCED <u>15/8/75</u>	
TYPE <u>MAYHEW 1000</u>		WATER <u>20-321'</u>		COMPLETED <u>19/8/75</u>	
				LOGGED BY <u>ASN</u>	
				DRAWN BY <u>P.E.S.S.</u>	

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

CO-ORDINATES

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERS.LOCATION 10,000 m West.HOLE NO. BMR KAPALGA 8CO-ORDINATES 12° 43' 25" 132° 24' 50"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
10						Ironstone; Fe stained yellow, brown & clear angular quartz; red clay
5						mottled white, yellow & brown sandy clay.
20						
30						mottled white c. sandy clay, minor yellow brown clay.
40						
50						yellow brown sandy clay (minor white)
60						mauve sandy clay.
70						
80						white f-to c.g. sandy clay (minor yellow-brown)
90						
100						yellow brown clay, Fe oxide pisolites, angular quartz
110						
120						mottled white brown, mauve, yellow & red-brown clay. minor quartz sand and angular quartz.
130						
140						
150						mottled blue, yellow brown, white & red clay; minor siltstone & v.f.g. sandstone.
160						
170						
180						

DRILLER KH

AIR

COMMENCED 20/8/75LOGGED BY RSNTYPE MAYHEW 1000WATER 0' - 265'COMPLETED 21/8/75DRAWN BY P.G.S-S.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT		LOCATION			
HOLE NO. <u>BMR KAPALGA 8</u>		CO-ORDINATES			
DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
190					
60					
200					
210					blue grey clay & shale (carbonaceous?); minor mottled brown clay.
65					
220					
230					buff siltstone; grey blue shale; clear milky c.g. quartz gravel.
70					
240					
75					
250					grey-blue & buff shale
260					
80					core: 260-261': blue mudstone 261'-263'8": weathered mottled claystones, (black earthy & buff) 263'8"-265': soft blue mudstone reduction spots bedding dips 40° cleavage dips 50° (120° from bed. around C.A.) 100% recovery.
270					
85					
DRILLER		AIR		COMMENCED	
TYPE		WATER		COMPLETED	
				LOGGED BY	
				DRAWN BY	

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERS LOCATION 9,000 m west
 HOLE NO. BMR KAPALGA 9 CO-ORDINATES 12° 43' 10" 132° 25' 20"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG MR/h	GRAPHIC LOG	CORE INTERNAL	DESCRIPTION OF CORE AND CUTTINGS
10 5 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180	50	800	0.0025 TC = 2 sec			mottled sandy clay; (Ferruginous red brown, yellow + white); milky quartz. white sandy clay. mottled white, brown + yellow sandy clay; rounded quartz grains (< 5mm) ferruginised red brown shale, white, red-brown + yellow sandy clay. pale + dark grey clay. (minor brownish); ferruginised brown + grey shale (slightly graphitic) pinkish brown + grey clay; ferruginised brown siltstone + hematite-quartz breccia. minor light + dark grey shale
DRILLER <u>K.H.</u>	AIR <u>0-50'</u>		COMMENCED <u>22/8/75</u>		LOGGED BY <u>P.G. S.S.</u>	
TYPE <u>MAYHEW 1000</u>	WATER <u>50'</u>		COMPLETED <u>29/8/75</u>		DRAWN BY <u>P.G. S.S.</u>	

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

BMR KAPALGA 9

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
190 60						dark grey + brown clay; dark + light grey shale; Fe stained angular quartz; trace ferruginised siltstone.
200 65						
210 70						
220 75						
230 80						yellow, grey + white clay; light + dark grey shale; yellow-brown ferruginous siltstone; angular milky quartz
240 85						
250 90						
260 95						light + dark grey shale; brown hematitic siltstone; yellow brown quartzite; angular milky quartz
270 100						
280 105						ferruginised brown siltstone; light grey shale; angular milky quartz.
290 110						
300						
310						
320						
330						
340						
350						
360						

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

BMR KAPALGA 9

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
370						brown siltstone; minor yellow brown quartzite; light grey shale; angular milky quartz
115						
380						
390						
120						yellow brown quartzite; angular milky quartz; minor pale brown & grey shale; brown siltstone & off white clay.
400						
410						
125						
420						pale brown silty shale; yellow brown quartzite; trace angular milky quartz
130						
430						
440						
135						light brown shale yellow brown quartzite
450						
460						
140						
470						yellow brown quartzite; brown & grey silty shale
145						
480						
490						
150						
500						
155						
510						
520						
160						
530						
540						
165						

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

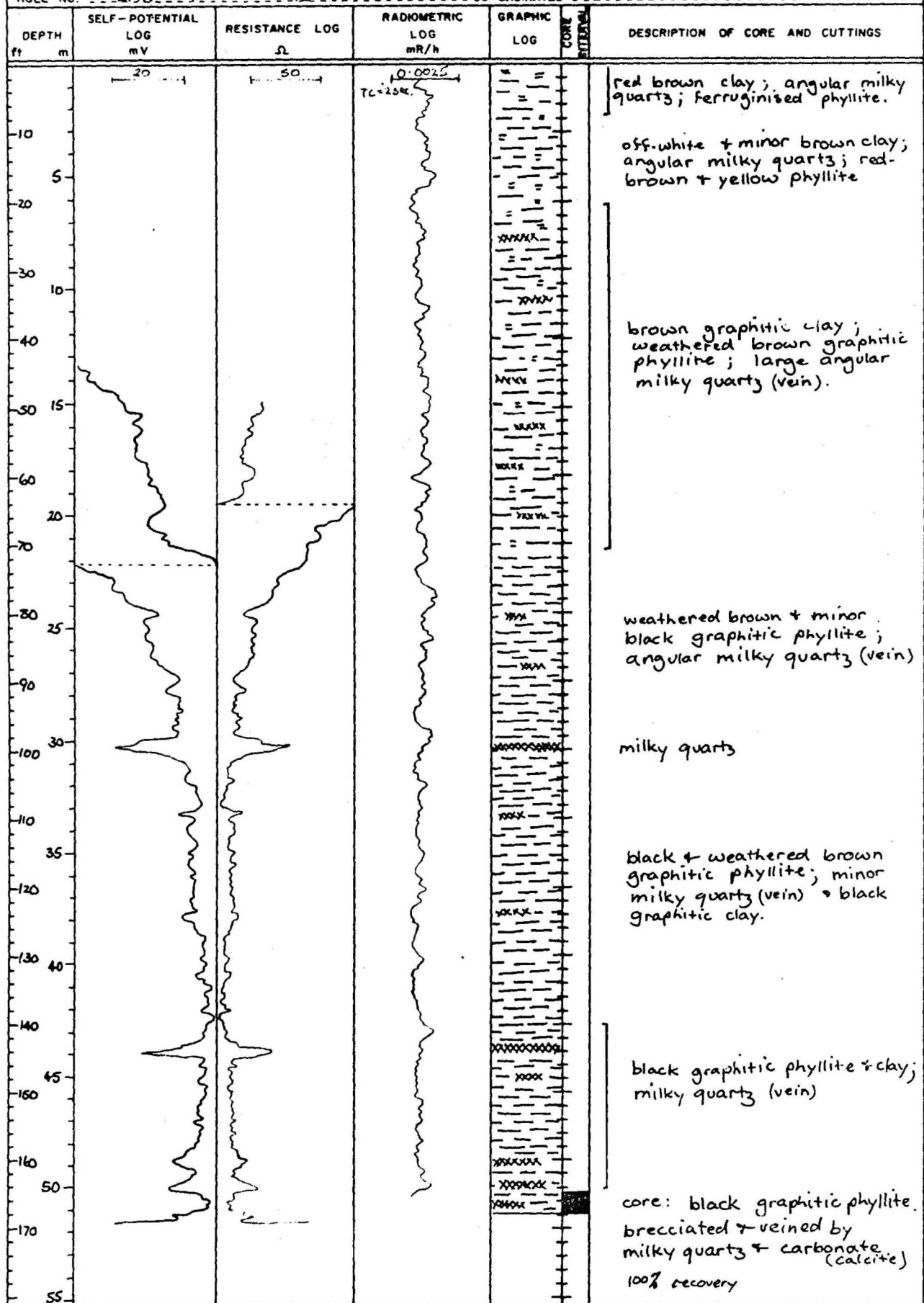
BMR KAPALGA 9

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
550 170 560 570 175						pale yellow, brown & pink shale; minor quartzite & angular milky quartz. core: 563'6" - 564'9" thinly laminated yellow, brown & pink shale 564'9" - 567' c.g. quartzite with bands (< 2cm) of above shale. (badly weathered) 100% recovery. average dip of bedding - 15°
DRILLER		AIR		COMMENCED		LOGGED BY
TYPE		WATER		COMPLETED		DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

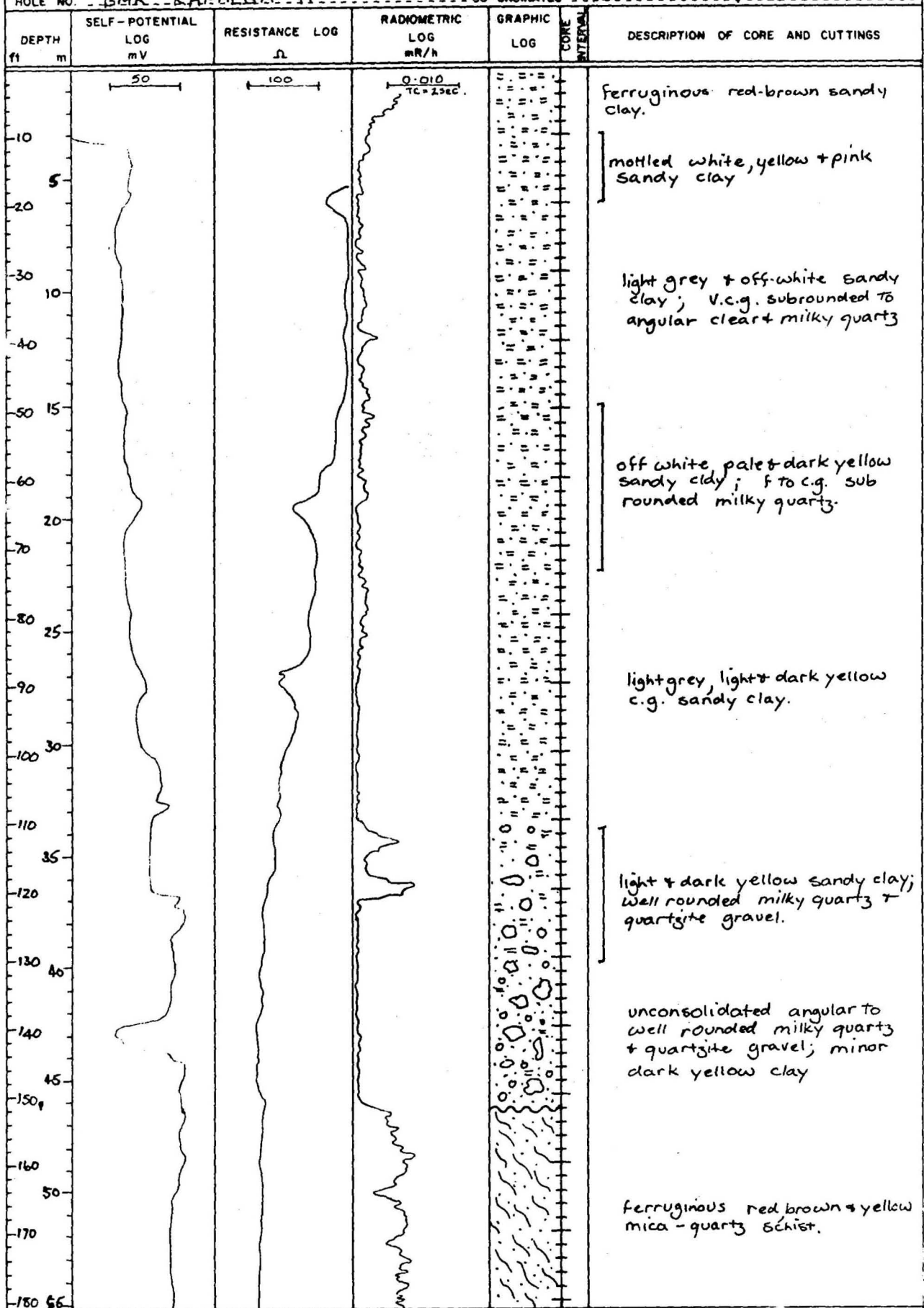
PROJECT ALLIGATOR RIVERS LOCATION Anglo American Red Lily prospect.
 HOLE NO. BMB KAPALGA 10 CO-ORDINATES 12° 47' 00" 132° 27' 20"



DRILLER KH AIR 0 - 60' COMMENCED 1/9/75 LOGGED BY P.G.S-S
 TYPE MAYHEN 1000 WATER 60' - 167'6" COMPLETED 2/9/75 DRAWN BY P.G.S-S

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERS LOCATION 1500 m. west.
 HOLE NO. BMR-KAPALGA-11 CO-ORDINATES 12° 40' 15" 132° 28' 30"

DRILLER KH. C.R.AIR 0 - 15'COMMENCED 11/9/75LOGGED BY P.G.S-STYPE MAYHEW 1000WATER 15' - 622'COMPLETED 18/9/75DRAWN BY P.G.S-S

GEOLOGICAL LOG OF DRILL HOLE

PROJECT _____ LOCATION _____
 HOLE NO. BMR KAPALGA 11 CO-ORDINATES _____

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
190						ferruginous mica-quartz schist; white, mauve & pale yellow clay
60						
200						dark yellow clay; yellow mica-quartz schist.
210						
65						
220						brown & yellow clay; weathered mica-quartz schist; quartz hematite (veins)
230						
70						
240						light brown & pale green clay; chlorite schist; angular milky quartz (vein)
250						
75						
260						
80						
270						
85						olive & olive brown clay; minor pink clay; angular milky quartz; carbonaceous chlorite schist.
280						
90						
300						pale & dark green chloritic carbonaceous clay; carbonaceous quartz-chlorite schist; minor chlorite-quartz schist; angular milky quartz (vein).
310						
95						
320						
100						
330						
105						
340						
350						
360						
110						
DRILLER _____		AIR _____		COMMENCED _____		LOGGED BY _____
TYPE _____		WATER _____		COMPLETED _____		DRAWN BY _____

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

BMR KAPALEA II

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
370 115				XXXXXX XXXXXX XXXXXX XXXXXX		
380						
390 120						
400						
410 125						yellow, brown & pink dolomite
420						
430 130						pinkish brown clay; angular milky quartz; minor dolomite & chlorite-quartz schist.
440						
450 135						olive brown & minor grey clay; angular milky quartz (vein); minor pink & yellow-brown dolomite, chlorite-quartz schist.
460						
470 140						
480						
490 146						
500						pink & yellow-brown dolomite; mica-quartz schist; pink, brown & grey clay.
510 150						
520						
530 155						
540 160						
550 165						

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

CO-ORDINATES

59

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERS LOCATION 3000 m west.
 HOLE NO. GMR KAPALGA 12 CO-ORDINATES 12° 41' 10" 132° 27' 50"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
10					pinkish brown, c.g. well rounded quartz sand; ferricrete + Fe stained quartz
5					
20					off white, dark yellow + brick red sandy clay; angular to sub rounded milky quartz pebbles
30					
10					
40					streaked brown, white + yellow clayey sand; well rounded milky quartz gravel.
50					
15					
60					v.c.g. milky quartz sand + gravel; trace yellow-brown + pink sandy clay.
70					
20					
80					
25					
90					
30					
100					off white, pale + dark yellow-brown sandy clay; minor well rounded milky quartz pebbles.
110					
35					
120					
40					
130					
45					clear + milky quartz v.c.g. sand + gravel. (sub to well rounded); minor grey sandy clay.
140					
50					
150					
55					off white + dark yellow sandy clay; well rounded milky quartz + chert pebbles.
160					
50					
170					
180					
55					
DRILLER <u>K. R.</u>		AIR		COMMENCED <u>18/9/75</u>	LOGGED BY <u>P.G.S.-S.</u>
TYPE <u>MAYHEW 1000</u>		WATER <u>0 - 190'</u>		COMPLETED <u>29/9/75</u>	DRAWN BY <u>P.G.S.-S.</u>

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

BMR KAPALGA 12

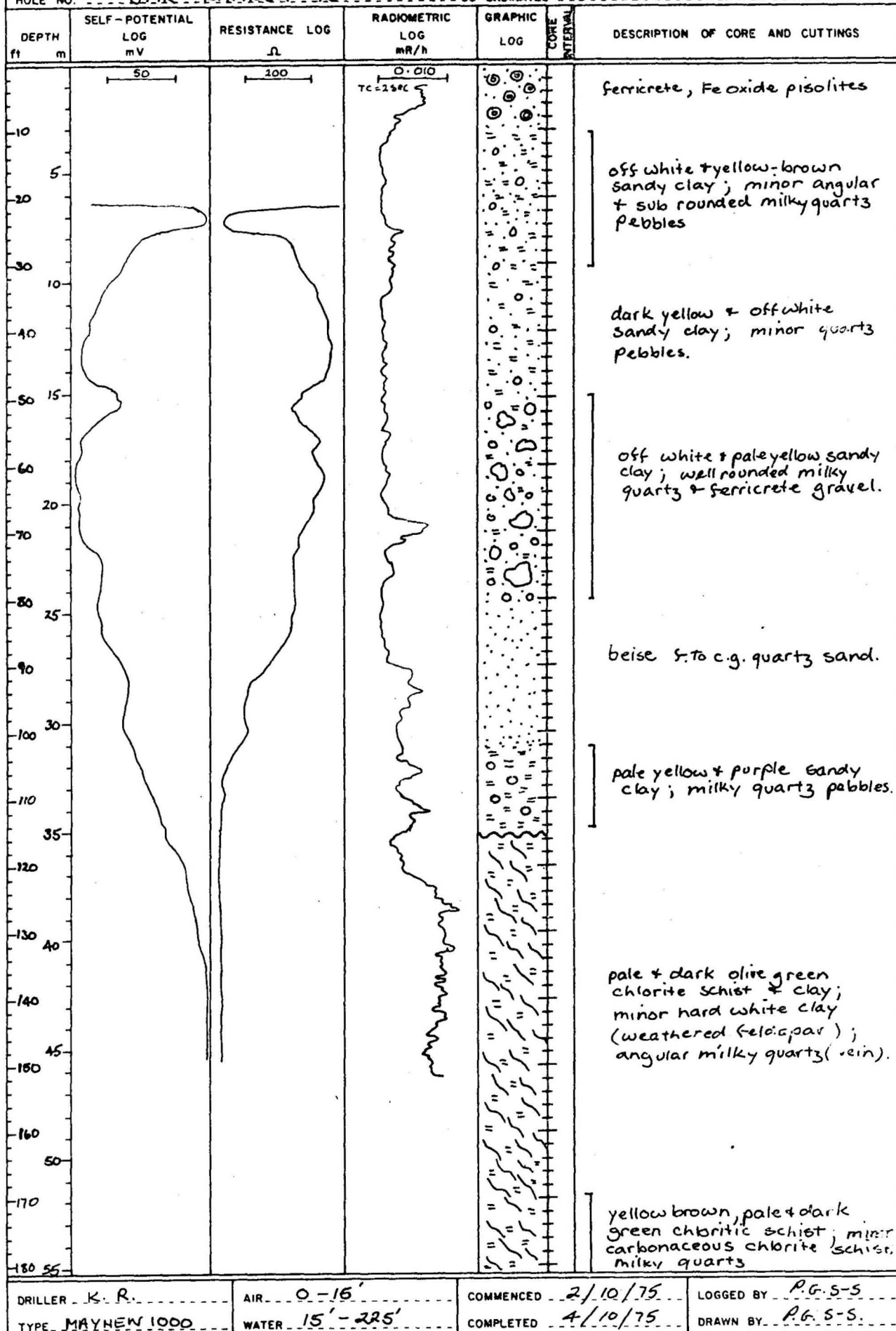
CO-ORDINATES

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERS

LOCATION

HOLE NO. BMR KAPALGA 13CO-ORDINATES 12° 47' 40" 132° 25' 00"DRILLER K. R.AIR 0-16'COMMENCED 2/10/75LOGGED BY P.G.S-STYPE MAYNEW 1000WATER 15'-225'COMPLETED 4/10/75DRAWN BY P.G.S-S

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

CO-ORDINATES

63

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERS LOCATION 5700 m West
 HOLE NO. BMR KAPALGA 14 CO-ORDINATES 12° 42' 00" 132° 26' 40"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
	100	200	0.010 TC = 2 sec		
10					brick red ferricrete & clay; minor yellow & pink clay.
5					
20					off white & pink clay; angular milky quartz.
30					
10					pinkish brown, dark yellow & off white clay; angular milky quartz.
40					
50					
15					
60					
20					dark red-brown & minor dark yellow-brown clay; red-brown & black ferruginised siltstone; minor angular milky quartz (vein)
70					
80					
25					
90					
100					
30					
110					
35					yellow quartzite
120					
130					
40					dark yellow brown & off white clay; minor quartzite & yellow brown siltstone.
140					
45					yellow-brown quartzite; minor angular milky quartz.
150					
160					
40					yellow-brown clay; ferruginised brown siltstone; trace quartzite & phyllite; angular milky quartz (vein)
170					
180					
55					
DRILLER <u>K.R.</u>	AIR <u>0-15'</u>	COMMENCED <u>6/10/75</u>	LOGGED BY <u>P.G.S-S.</u>		
TYPE <u>MAYHEW 1000</u>	WATER <u>15-564</u>	COMPLETED <u>13/10/75</u>	DRAWN BY <u>P.G.S-S.</u>		

GEOLOGICAL LOG OF DRILL HOLE

PROJECT _____ LOCATION _____
 HOLE NO. BMR KAPOLGA J4 CO-ORDINATES _____

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
190 60					yellow-brown quartzite
200					
210 65					yellow-brown & spotted black quartzite. (spots are coatings of Mn oxides in small pits, formed by weathering of feldspar?); minor yellow, red & brown clay; pale yellow-brown, green & purple phyllite.
220					
230 70					spotted quartzite (as above)
240					
250 75					
260					
270 80					
280					
290 85					pale green phyllite; angular milky quartz & minor pink feldspar (vein); trace spotted quartzite
300					
310 90					
320					
330 95					
340					
350 100					brown quartzite; angular milky quartz (vein); minor pale green phyllite & light brown clay.
360 105					
370 110					
DRILLER _____		AIR _____		COMMENCED _____	
TYPE _____		WATER _____		COMPLETED _____	
				LOGGED BY _____	
				DRAWN BY _____	

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

KAPALGA 14

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG mR/h	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
370					
115					
380					
390					
120					
400					
125					
410					
420					
130					
430					
440					
135					
450					
140					
460					pale green phyllite; brown quartzite; minor light brown clay; angular milky quartz.
470					
145					
480					
490					
150					
500					
155					
510					
520					
160					
530					
540					
165					

DRILLER

AIR

COMMENCED

LOGGED BY

TYPE

WATER

COMPLETED

DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

CO-ORDINATES

core: complete core
loss due to jamming of
pipes.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERLOCATION 4700 m westHOLE NO. BMR KAPALGA 15CO-ORDINATES 12° 41' 45" 132° 27' 05"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG arbitrary units	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
0	50	5	50 R = 2500			reddish brown + yellow ferricrete, dark red + yellow clay
5						yellow, white + orange clay
20						yellowish brown + white sandy clay
						off white sandy clay, minor yellowish brown + pink clay, well rounded quartz pebbles
15						yellowish brown clay, minor white + pink clay
						beige + pale yellowish brown clay
70						dark yellow + brown clay
80						
25						
90						dark yellowish + reddish brown clay. minor angular quartz trace hematized siltstone or quartzite?
100						
30						
110						
35						
120						
130						streaked offwhite, dark yellowish + reddish brown clay, trace hematized quartzite + angular quartz
40						
140						
45						
150						
50						yellowish brown + off-white sandy clay. minor angular quartz + ferruginized quartzite.
160						
50						
170						
180						
65						
DRILLER <u>L. KEAST</u>		AIR <u>0 - 6'</u>		COMMENCED <u>9/8/76</u>		LOGGED BY <u>P.G. S-S.</u>
TYPE <u>MAYHEW 1000</u>		WATER <u>6' - 593'</u>		COMPLETED <u>12/8/76</u>		DRAWN BY <u>P.G. S-S.</u>

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO. BMR KAPALGA 15

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
190 60					reddish + yellowish brown sandy clay. minor: quartz pebbles, quartzite trace: ferruginized brown phyllite
200					
210 65					
220					
230 70					
240					yellowish brown clay, angular to well rounded quartz pebbles, trace: quartzite + ferruginized phyllite
250 75					
260					reddish brown clay
270 80					
280					yellowish brown clay, angular to well rounded quartz pebbles. trace: quartzite + ferruginized phyllite
290 85					
300					offwhite + pale yellowish brown sand clay. trace quartz.
310 90					
320					quartzite + offwhite clay
330 100					
340					off-white clay, angular quartz (quartz grit)
350 105					
360 110					pink quartzite, yellowish brown and reddish brown clay, trace: angular quartz

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

K118 KAPALGA 15

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
115						
125						white quartzite minor: yellowish brown clay. trace: white + pale green phyllite, angular quartz.
130						
135						
140						
145						angular quartz, white clay (weathered quartz grit + conglomerate) minor quartzite
150						
155						white quartzite minor quartz grit + white + brown clay.
160						
165						quartz grit + conglomerate, white + brown clay. minor: white quartzite trace: pale green phyllite

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

PROJECT _____ LOCATION _____

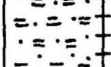
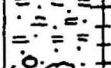
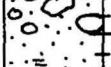
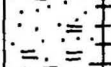
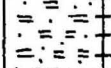
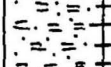
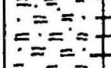
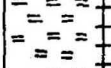
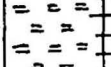
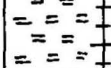
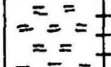
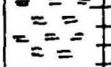
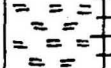
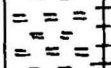
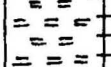
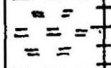
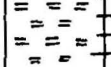
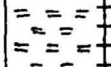
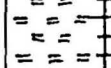
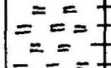
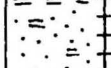
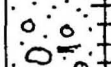
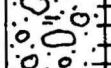
HOLE NO. BMR KAPALGA 15 CO-ORDINATES _____

DEPTH ft m	SELF-POTENTIAL LOG mv	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
550					
170					
560					
570					
175					
580					
180					
590					
600					
185					
					core: quartzite and quartz pebble conglomerate quartzite contains clasts (2cm) of pale green phyllite matrix of conglomerate consists of a white sericitic clay dips of bedding vary 25° to 55° 40% recovery

DRILLER _____	AIR _____	COMMENCED _____	LOGGED BY _____
TYPE _____	WATER _____	COMPLETED _____	DRAWN BY _____

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERLOCATION 3700 m westHOLE NO. BMR KAPALGA 16CO-ORDINATES 12° 41' 35" 132° 27' 10"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
10						grey sandy loam unconsolidated well rounded quartz + quartzite gravel, Fe oxide pisolites, ferricrete.
5						off-white, reddish + yellowish brown sandy clay.
20						unconsolidated quartz sand + gravel. minor pebbles of chert, quartzite + trace mica flakes.
30						beise to pale yellow clayey sand
40						dark yellowish brown clay, minor quartz sand.
50						off-white clay, minor quartz sand.
60						dark yellowish brown clay, minor: off white clay, hard reddish brown limonitic clay, angular quartz.
70						
80						
25						
90						
100						dark yellow + off-white clay
110						
35						
120						
130						dark yellow clay minor: off white clay, trace: reddish brown + pink clay, slightly micaceous
40						
140						
45						
150						coarse grained quartz sand. trace: mica + dark yellow clay
50						
160						unconsolidated well rounded quartz gravel + sand. minor: dark yellow sandy clay, pebbles of quartzite, grey chert, + tourmaline
170						
55						
180						

DRILLER L. KEAST

AIR

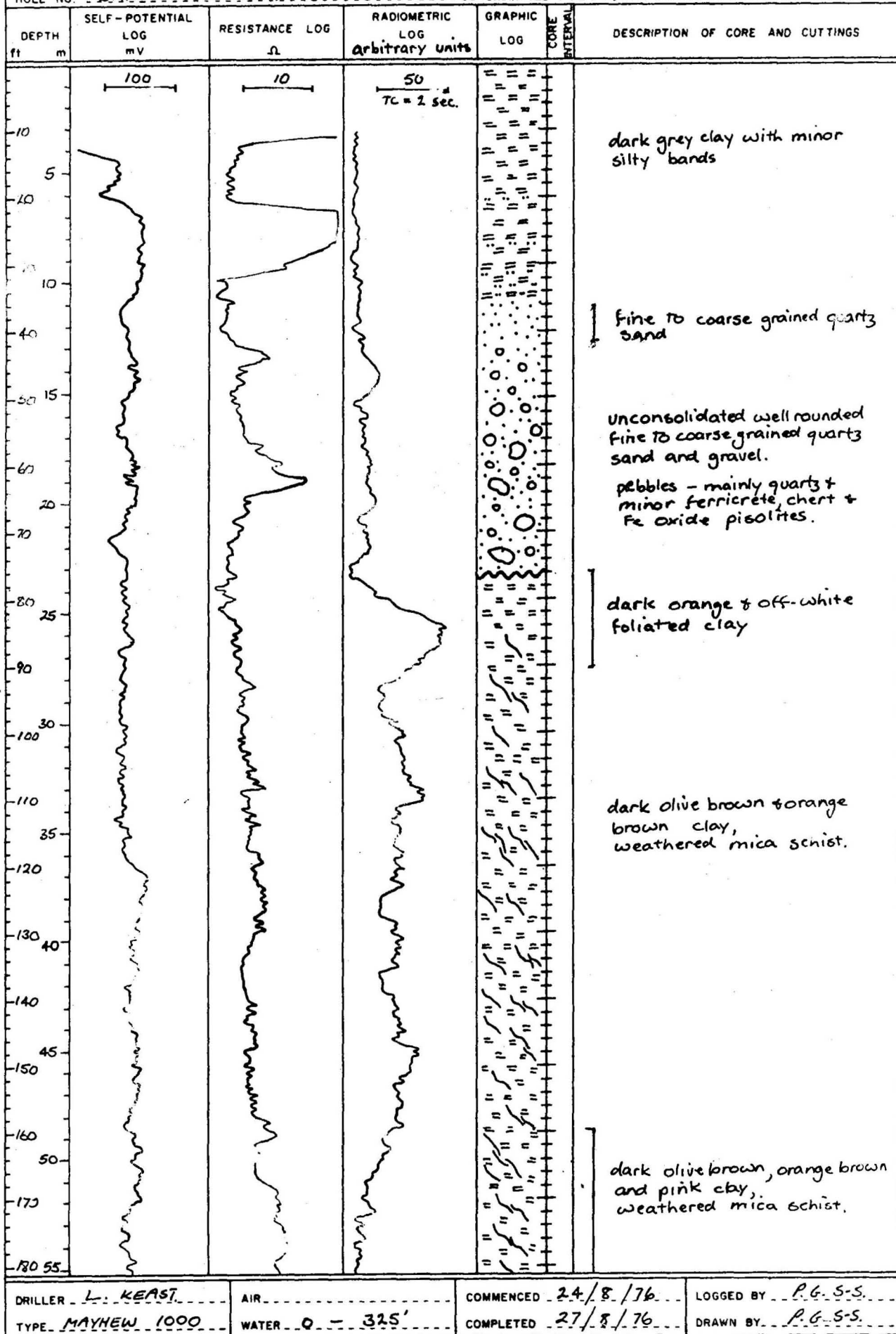
COMMENCED 12/8/76LOGGED BY P.G. S-STYPE MAYHEW 1000WATER 0' - 260'COMPLETED 24/8/76DRAWN BY P.G. S-S

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

CO-ORDINATES

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERLOCATION 500 m eastHOLE NO. BMR KAPALGA 17CO-ORDINATES 12° 40' 05" 132° 29' 15"DRILLER L. KEAST

AIR

COMMENCED 24/8/76LOGGED BY P.G. S-S.TYPE MAYHEW 1000WATER 0 - 325'COMPLETED 27/8/76DRAWN BY P.G. S-S.

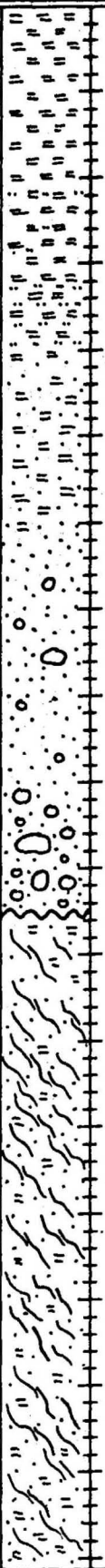
GEOLOGICAL LOG OF DRILL HOLE

PROJECT		LOCATION				
HOLE NO. <u>BMR KARALGA 17</u>		CO-ORDINATES				
DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
17						
60						
210						hematite-quartz-biotite-muscovite schist, muscovite-quartz schist, angular quartz.
220						
230						
240						hematite-muscovite schist, hematite-muscovite-quartz schist, angular quartz, brown + mauve clay.
250						
260						yellow quartzite
270						
280						quartz-hematite-muscovite schist
290						hematite-muscovite schist, yellow quartzite
300						
310						hematite-quartz-biotite-muscovite schist, pink dolomite.
320						core: pink dolomite + hematite-chlorite-muscovite schist: veined by quartz-chlorite-hematite breccia isoclinally folded & brecciated.
330						core 2: massive brown dolomite bedding dips 45°

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVER LOCATION 1500 m east
 HOLE NO. BMR KAPALGA 18 CO-ORDINATES 12° 39' 45" 132° 29' 40"

HOLE NO.	DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
	10 5 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180						dark grey clay with minor silty + sandy bands. pale grey + brown sandy clay yellowish brown, coarse grained, well rounded quartz sand, + minor pebbles. unconsolidated gravel & coarse grained sand. well rounded pebbles of quartz, quartzite, brown + black chert mauve clay + ferruginized mica-quartz schist mauve + dark yellowish brown clay, ferruginized mica-quartz schist + quartzite.
DRILLER	L. KEAST		AIR	COMMENCED		28/8/76	
TYPE	MAYHEM 1000		WATER	COMPLETED		3/9/76	
				LOGGED BY		P.G.S.S.	
				DRAWN BY		P.G.S.S.	

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO. BMR KAPALGA 18

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
190						
60						
200						
210						
65						
220						ferruginized mica schist + mica-quartz schist.
230						
70						
240						
75						
250						
260						pale green mica schist + mica-quartz schist.
80						
270						
85						
280						
290						
90						
300						
310						
95						
320						weathered olive brown mica schist (biotite?), angular quartz
100						
330						
340						
105						
350						
360						
110						
DRILLER	AIR	COMPLETED	LOGGED BY			
TYPE	WATER	COMPLETED	DRAWN BY			

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

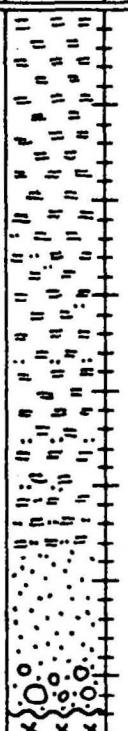
BMR KAPALGA 18

CO-ORDINATES

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVER LOCATION 2000 m east
 HOLE NO. 61/5 KAPA-SH 19 CO-ORDINATES 12° 39' 45" 132° 30' 00"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG arbitrary units	GRAPHIC LOG	CORE INTERNAL	DESCRIPTION OF CORE AND CUTTINGS
10 5 20 30 10 40 50 15 60 20 70 20 25						dark grey clay with minor silty bands. + wood fragments. unconsolidated well rounded coarse grained quartz sand. unconsolidated, well rounded quartz gravel. foliated granite. core: foliated granite large (<3cm) rectangular + rounded phenocrysts of white feldspar with thin red rims in a foliated matrix of finer grained quartz, feldspar + biotite. 100% recovery
DRILLER <u>L. KEAST</u>	AIR		COMMENCED <u>3/9/76</u>		LOGGED BY <u>P.G.S-S.</u>	
TYPE <u>MAYHEM 1000</u>	WATER <u>0 - 79'</u>		COMPLETED <u>6/9/76</u>		DRAWN BY <u>P.G.S-S.</u>	

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERLOCATION 1000 m eastHOLE NO. BUR KARV-A 20CO-ORDINATES 12° 39' 55" 132° 29' 25"

DEPTH ft m	SELF-POTENTIAL LOG mv	RESISTANCE LOG Ω	RADIOMETRIC LOG arbitrary units	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
10 5 20 30 10 40 50 15 60 20 70 25 80 30 100 110 35 120 130 40 140 150 45 160 50 170 180 55					dark grey clay with minor silty bands + wood fragments. unconsolidated coarse grained sand + gravel (well rounded pebbles of quartz, quartzite, Fe oxide pisolites, grey + brown chert) yellow + off white clay off-white + greenish yellow clay, mica-quartz schist. dark yellowish brown micaceous clay, mica schist, angular quartz. dark yellowish brown clay crenulated mica schist + mica-quartz schist. minor brown quartzite. dark yellowish brown clay mica schist (slightly carbonaceous) minor quartzite + angular quartz
DRILLER <u>L. KEAST</u>	AIR		COMMENCED <u>6/9/76</u>	LOGGED BY <u>P.G.S-S.</u>	
TYPE <u>MAYHEW 1000</u>	WATER <u>0 - 306'</u>		COMPLETED <u>9/9/76</u>	DRAWN BY <u>P.G.S-S.</u>	

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO. BMR KAPALGA 20

CO-ORDINATES

DEPTH		SELF-POTENTIAL LOG	RESISTANCE LOG	RADIOMETRIC LOG	GRAPHIC LOG	CORE	DESCRIPTION OF CORE AND CUTTINGS
ft	m	mV	Ω			STRENGTH	
190							dark yellowish brown & mauve clay
60							
200							dark yellow clay, weathered mica schist, angular quartz
210							
65							
220							
230							
70							
240							
75							
250							yellowish brown micaceous dolomite.
260							minor: mica schist & dark yellowish brown clay, angular quartz
80							
270							
280							
85							
290							
90							
300							core: micaceous dolomitic quartz schist.
310							thin bands tightly folded, crenulation cleavage dip ~45°
95							100% recovery

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERLOCATION 00HOLE NO. B.M.'s KAPALGA 21CO-ORDINATES 12° 40' 20" 132° 29' 00"

DEPTH ft m	SELF-POTENTIAL LOG mv	RESISTANCE LOG Ω	RADIOMETRIC LOG arbitrary units	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
1					brick red + off-white clay, angular quartz.
5					
20					yellowish brown clay, minor silt, angular quartz
30					
40					yellowish brown + off-white clay, angular quartz.
50					
60					
70					reddish brown micaceous clay, angular quartz.
80					
90					bleached mica schist, angular quartz.
100					
110					bleached hematite-mica schist, angular quartz brown clay
120					
130					reddish brown + yellowish brown micaceous silt. grey mica schist. minor: angular quartz trace: black carbonaceous? clay.
140					
150					
160					
170					
180					

DRILLER L. KEAST

AIR

COMMENCED 9/9/76LOGGED BY M.R.TYPE MAYHEW 1000WATER 0 - 221' 10"COMPLETED 10/9/76DRAWN BY P.G.S.S.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

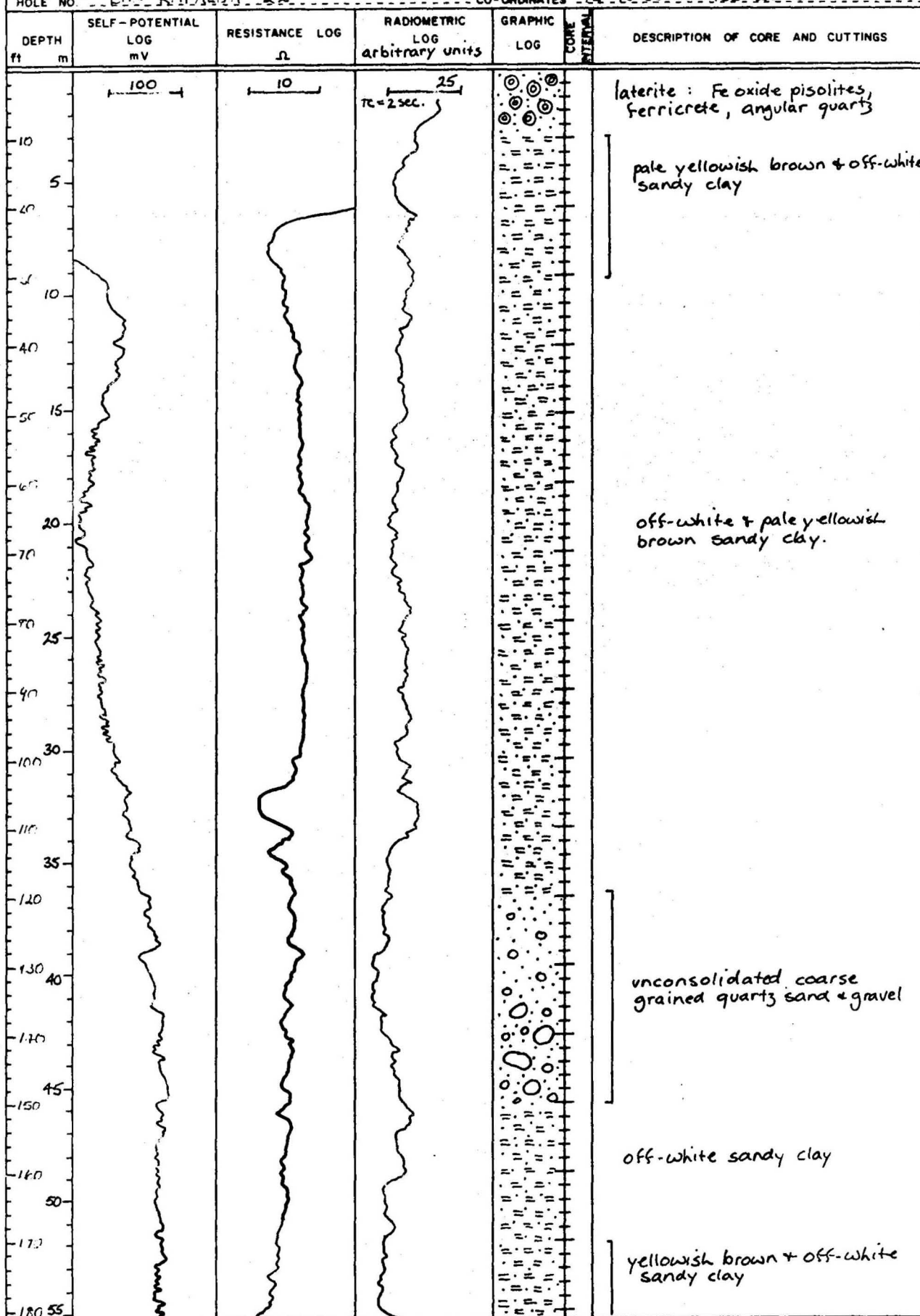
HOLE NO. BMR KAPAL-A 21

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERNAL	DESCRIPTION OF CORE AND CUTTINGS
190 60 200 210 65 220 230 70						white + pink massive dolomite minor mica schist. core: white + pink massive dolomite. fractures filled with calcite rhombs. 100% recovery
DRILLER		AIR		COMMENCED		LOGGED BY
TYPE		WATER		COMPLETED		DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVER LOCATION 500 m. West
 HOLE NO. BM KAPALUA 22 CO-ORDINATES 12° 40' 30" 132° 28' 50"



DRILLER L. KERST
 TYPE MAYHEW 1000

AIR _____
 WATER 0' - 332'

COMMENCED 13/ 9/ 76
 COMPLETED 15/ 9/ 76

LOGGED BY M.R.
 DRAWN BY P.G. S-S.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

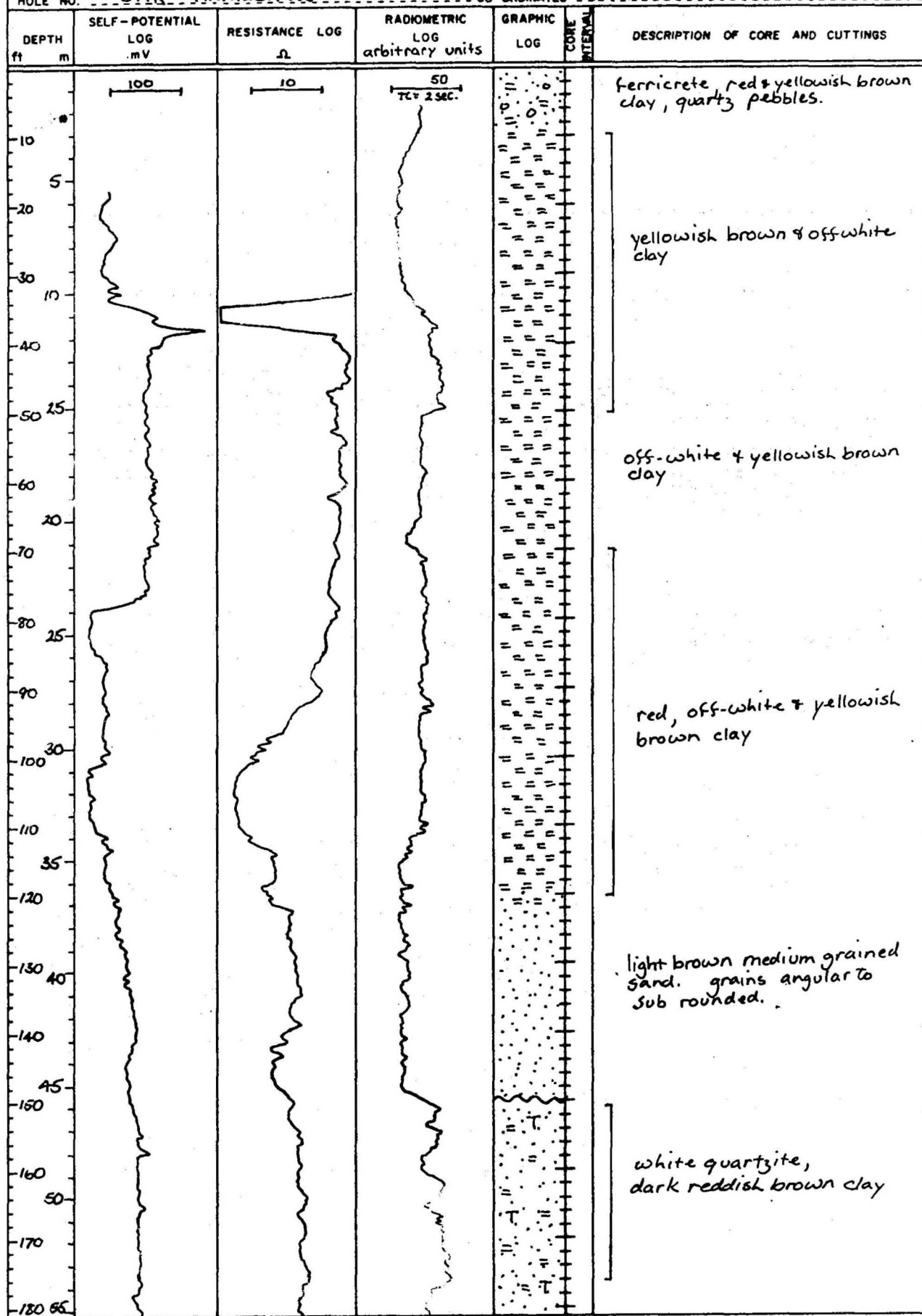
HOLE NO. BLK KAPALPA 22

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
19 60 200 210 65 220 70 230 75 240 80 250 85 260 90 270 95 280 100 300 310 320 330 340 105					yellowish brown mica schist, brown quartzite, angular quartz brown + grey mica schist yellowish brown quartzite, minor grey + pale green phyllite. white + pale pink quartzite, minor yellowish brown phyllite quartz-mica schist (carbonaceous?) core: muscovite-chlorite schist and white dolomite bedding dips ~ 55° to 60°
DRILLER	AIR	COMMENCED	LOGGED BY		
TYPE	WATER	COMPLETED	DRAWN BY		

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVER LOCATION 1000 m west
 HOLE NO. BMR KAPALGA 23 CO-ORDINATES 12° 40' 40" 132° 28' 40"

DRILLER L. KEAST

AIR

COMMENCED 16/9/76LOGGED BY M.R.TYPE MAYHEM 1000WATER 0' - 398' 4"COMPLETED 22/9/76DRAWN BY P.G.S.S.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT		LOCATION				
HOLE NO. <u>BMR KAPALGA 23</u>		CO-ORDINATES				
DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERNAL	DESCRIPTION OF CORE AND CUTTINGS
190 60						silicified dolomite, angular quartz, minor phyllite & white clay
200						
210 65						
220						
230 70						
240						
250 75						
260						
270 80						
280						
290 85						silicified dolomite, angular quartz, white phyllite, light brownish yellow clay.
300						
310 90						
320						
330 95						
340						
350 100						
360						
370 105						
380						
390 110						white & pale reddish orange silicified dolomite, white phyllite
400						

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

PROJECT _____

LOCATION _____

HOLE NO. 13A-APALGA 23

CO-ORDINATES _____

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
20						silicified dolomite reddish + yellowish brown clay, minor white phyllite white, pink + yellowish brown, silicified dolomite. trace mica schist, angular quartz core: silicified dolomite
30						
40						
50						
60						
70						
80						
90						
100						
110						
120						
130						
140						
150						
160						
170						
180						
190						
200						
210						
220						
230						
240						
250						
260						
270						
280						
290						
300						
310						
320						
330						
340						
350						
360						
370						
380						
390						
400						
410						
420						
430						
440						
450						
460						
470						
480						
490						
500						
510						
520						
530						
540						
550						
560						
570						
580						
590						
600						
610						
620						
630						
640						
650						
660						
670						
680						
690						
700						
710						
720						
730						
740						
750						
760						
770						
780						
790						
800						
810						
820						
830						
840						
850						
860						
870						
880						
890						
900						
910						
920						
930						
940						
950						
960						
970						
980						
990						
1000						

DRILLER _____

AIR _____

COMMENCED _____

LOGGED BY _____

TYPE _____

WATER _____

COMPLETED _____

DRAWN BY _____

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERLOCATION 2700 m WestHOLE NO. BMR KAPALGA 24CO-ORDINATES 12° 41' 20" 132° 27' 05"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
10		5			ferricrete, quartz pebbles
5					
20					yellowish brown & off-white sandy clay
30					
40					yellowish brown & purple sandy clay
50					
60					pale yellowish brown & off-white sandy clay, minor quartz pebbles.
70					
80					fine to medium grained pale brown quartz sand, minor off-white & pale yellowish brown clay
90					
100					
110					
120					unconsolidated coarse grained quartz sand (sub angular to sub rounded) minor clay
130					
140					
150					
160					unconsolidated gravel & coarse grained sand (well rounded quartz pebbles)
170					
180					
55					
DRILLER <u>L. KEAST</u>		AIR		COMMENCED <u>22/9/76</u>	
TYPE <u>MAYHEW 1000</u>		WATER <u>0' - 332'</u>		COMPLETED <u>30/9/76</u>	
				LOGGED BY <u>M.R. P.G.S.S.</u>	
				DRAWN BY <u>P.G.S.S.</u>	

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

BMR KAPALGA 24

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
190 60						quartzite, angular quartz minor mica-quartz schist
200						
210 65						
220						mica schist, mica-quartz schist, angular quartz
230 70						
240						
250 75						
260						
270 80						
280						mica-quartz schist, quartzite, angular quartz. minor coarse grained pale pink & clear feldspar (vein)
290						
300 90						
310						
320 95						
330						
340 105						core: banded white quartzite and muscovite-chlorite schist veined by coarse grained quartz & pink feldspar. isoclinally folded dip of axial plane schistosity ~45° 100% recovery

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERLOCATION 19,000 m. westHOLE NO. BMR KAPALGA 25CO-ORDINATES 12° 44' 25"132° 19' 55"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG arbitrary units	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
10	25		25		mottled red, yellow, & off-white sandy clay
5					off-white & dark yellow sandy clay
20					off-white & minor yellow sandy clay
30					off-white & pink sandy clay
40					dark yellow & minor off-white clay
50					
60					
70					
80					
90					
100					
110					
120					
130					
140					
150					
160					
170					
180					
55					unconsolidated sub-towel rounded quartz gravel minor dark yellow & off-white clay
DRILLER <u>L. KEAST</u>		AIR		COMMENCED <u>4/10/76</u>	
TYPE <u>MAYHEW 1000</u>		WATER <u>0' - 24.5'</u>		COMPLETED <u>5/10/76</u>	
				LOGGED BY <u>R.G.S-S</u>	
				DRAWN BY <u>R.G.S-S</u>	

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

CO - ORDINATES

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVERLOCATION 21,000 m westHOLE NO. BMR-KAPALGA-26CO-ORDINATES 12° 44' 25" 132° 18' 45"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG arbitrary units	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
10	60	10	50 7c = 2 sec		laterite: ferricrete, Fe oxide pisolites, brick red clay.
5					
20					off-white + yellow sandy clay
30					medium to coarse grained brownish sand (well rounded grains)
40					off-white sandy clay
50	15				
60					dark yellow, reddish brown + off-white med. grained consolidated sand & sandy clay
20					
70					
80	25				
90					yellow + pink sandy clay
30					
100					coarse grained pinkish yellow sand minor well rounded quartz pebbles
110					off-white + yellow + pink sandy clay
35					dark yellow + brown sandy clay
120					reddish brown sandy clay
130	40				pink coarse grained quartz sand & gravel
140					dark yellow + pale greenish yellow clay, yellow phyllite, angular quartz.
45					
150					dark yellowish brown clay, & phyllite, minor angular quartz.
160	50				
170					
180	55				
DRILLER <u>L. KEAST</u>		AIR		COMMENCED <u>6/10/76</u>	LOGGED BY <u>P.G.S.S.</u>
TYPE <u>MAYHEM 1000</u>		WATER <u>0 - 391' 8"</u>		COMPLETED <u>7/10/76</u>	DRAWN BY <u>P.G.S.S.</u>

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

BMR KAPALGA 26

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
190						
60						
200						
210						
65						
220						
70						brown & pale grey phyllite, yellowish brown clay, angular quartz
240						
75						
250						
260						
80						greenish grey clay, dark grey, chloritic carbonaceous phyllite, angular quartz.
270						
85						
280						
290						
90						
300						
310						
95						
320						dark greenish grey carbonaceous, chloritic phyllite. minor: greenish grey clay, angular milky quartz.
100						
330						
340						
105						
350						
360						
110						
DRILLER		AIR		COMMENCED		LOGGED BY
TYPE		WATER		COMPLETED		DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

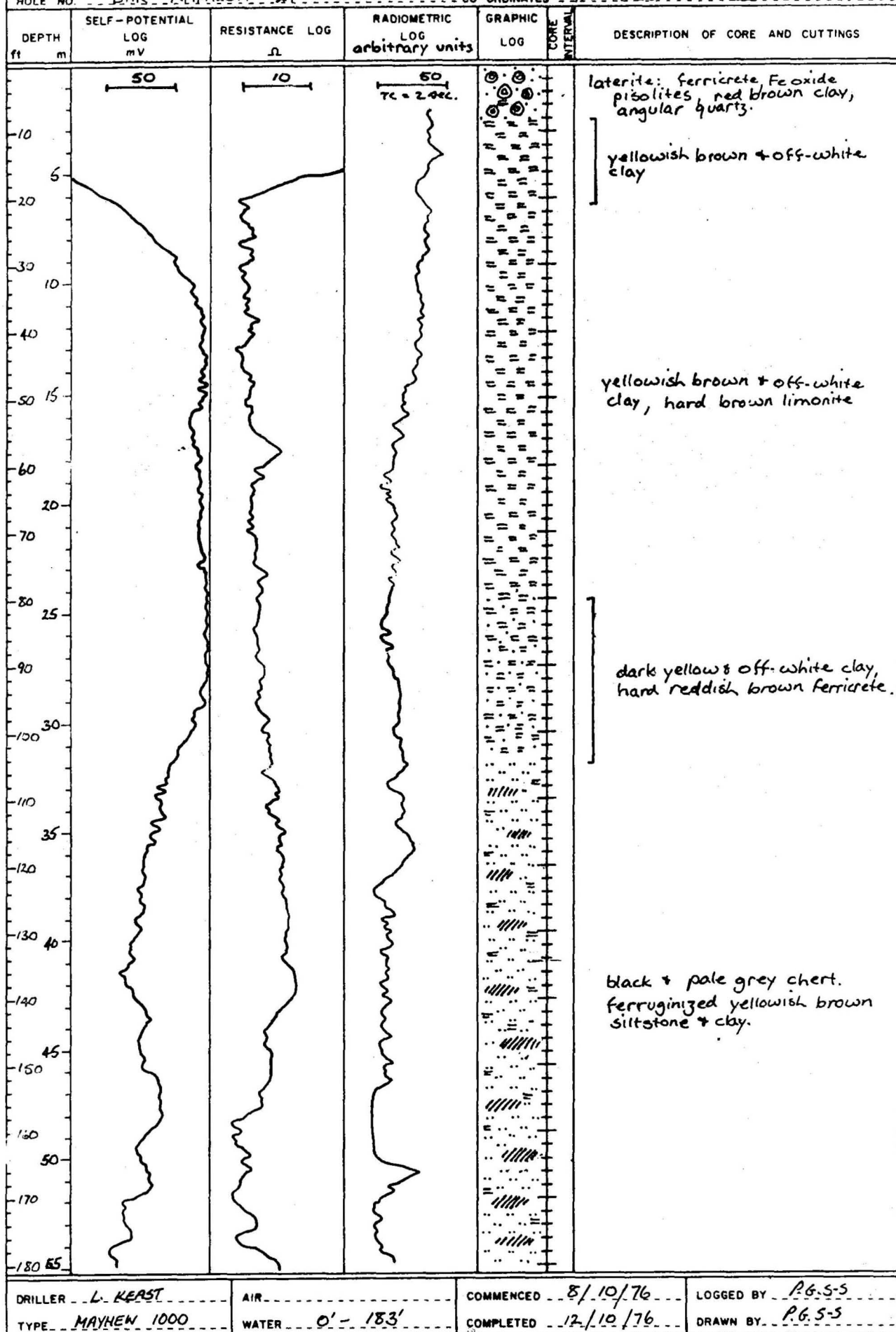
LOCATION

CO-ORDINATES

core: interbedded dark
grey phyllite and pale
grey feldspathic-lithic
arenite
bedding dips $\sim 15^\circ$

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVER LOCATION 1000m east of W. Alligator River
 HOLE NO. BMR KAPALGA 27 CO-ORDINATES 12° 47' 30" 132° 11' 00"

DRILLER L. KEAST

AIR

COMMENCED 8/10/76LOGGED BY P.G. S-5TYPE MAYHEW 1000WATER 0' - 183'COMPLETED 12/10/76DRAWN BY P.G. S-5

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

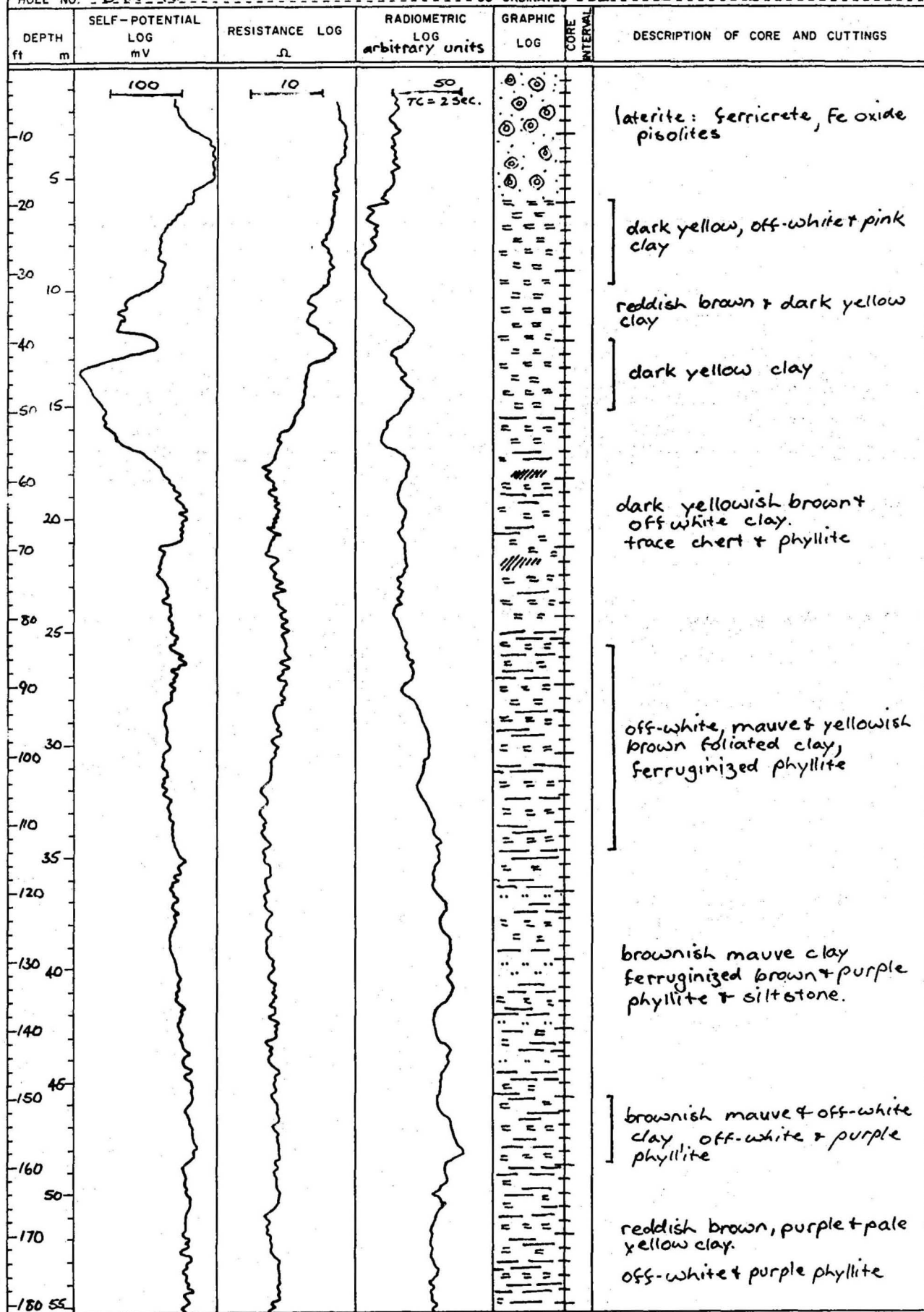
HOLE NO. BMR_KAPALGA_27

CO-ORDINATES

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVER LOCATION 2000m west Walligator River
 HOLE NO. BMR KAPALGA 28 CO-ORDINATES 12° 47' 25" 132° 11' 30"

DRILLER L. KEAST

AIR

COMMENCED 13/10/76LOGGED BY P. G. S-STYPE MAYHEN 1000WATER 0 - 462'COMPLETED 15/10/76DRAWN BY P. G. S-S

GEOLOGICAL LOG OF DRILL HOLE

PROJECT		LOCATION		CO-ORDINATES	
HOLE NO. <u>BMR KAPALGA 28</u>					
DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
190					foliated pale yellow + brown clay, purple phyllite.
200					mauve + yellowish brown clay, mauve phyllite + siltstone. minor quartz + chert.
210					mauve foliated clay
220					
230					mauve + off-white clay
240					
250					mauve + off-white clay, mauve + brown siltstone + phyllite, angular quartz
260					
270					
280					
290					
300					
310					mauve + brown siltstone + phyllite, mauve, brown + yellow clay
320					
330					
340					
350					
360					

DRILLER	AIR	COMMENCED	LOGGED BY
TYPE	WATER	COMPLETED	DRAWN BY

GEOLOGICAL LOG OF DRILL HOLE

LOCATION

BMR KAPALGA 28

CO-ORDINATES

DEPTH		SELF-POTENTIAL LOG	RESISTANCE LOG	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERVAL	DESCRIPTION OF CORE AND CUTTINGS
ft	m	mV	Ω				
370							
115							
380							black carbonaceous clay, minor carbonaceous phyllite.
390							
120							
400							
410							
125							
420							black carbonaceous phyllite, minor graphite, trace pyrite, + fine grained grey quartzite, angular quartz + black clay
130							
430							
440							
135							
450							
460							core: pyritic carbonaceous phyllite with small (<2cm) grey quartzite bands. minor graphite slickensides cleavage + bedding dip ~ 65° 100% recovery
140							
470							
145							

DRILLER _____
 TYPE _____

AIR _____
 WATER _____

COMMENCED _____
 COMPLETED _____

LOGGED BY _____
 DRAWN BY _____

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVER LOCATION 3500 m east of W. Alligator River
 HOLE NO. BMR KAPALGA 29 CO-ORDINATES 12° 47' 15" 132° 12' 20"

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG arbitrary units	GRAPHIC LOG	DESCRIPTION OF CORE AND CUTTINGS
10					laterite: ferricrete, Fe oxide pisolites, angular quartz.
5					hard white sandy clay, ferruginized phyllite.
20					dark yellow & off white clay
30					laterite: ferricrete, Fe oxide pisolites, dark reddish brown & off white clay
40					dark yellowish brown clay, limonite, trace phyllite.
50					pale greenish white & dark yellow clay
60					dark yellow, reddish brown & off white sandy clay, ferruginized siltstone?
70					reddish brown clay (minor yellow & pale green)
80					yellowish brown & pale green clay, minor pale green phyllite
90					reddish brown & dark yellow clay, pale green & brown phyllite
100					
110					
120					
130					
140					
150					
160					
170					
180					
55					
DRILLER <u>L. KEAST</u>		AIR		COMMENCED <u>18/10/76</u>	
TYPE <u>MAYHEW 1000</u>		WATER <u>0' - 250'</u>		COMPLETED <u>19/10/76</u>	
				LOGGED BY <u>P.G. S-S.</u>	
				DRAWN BY <u>P.G. S-S.</u>	

GEOLOGICAL LOG OF DRILL HOLE

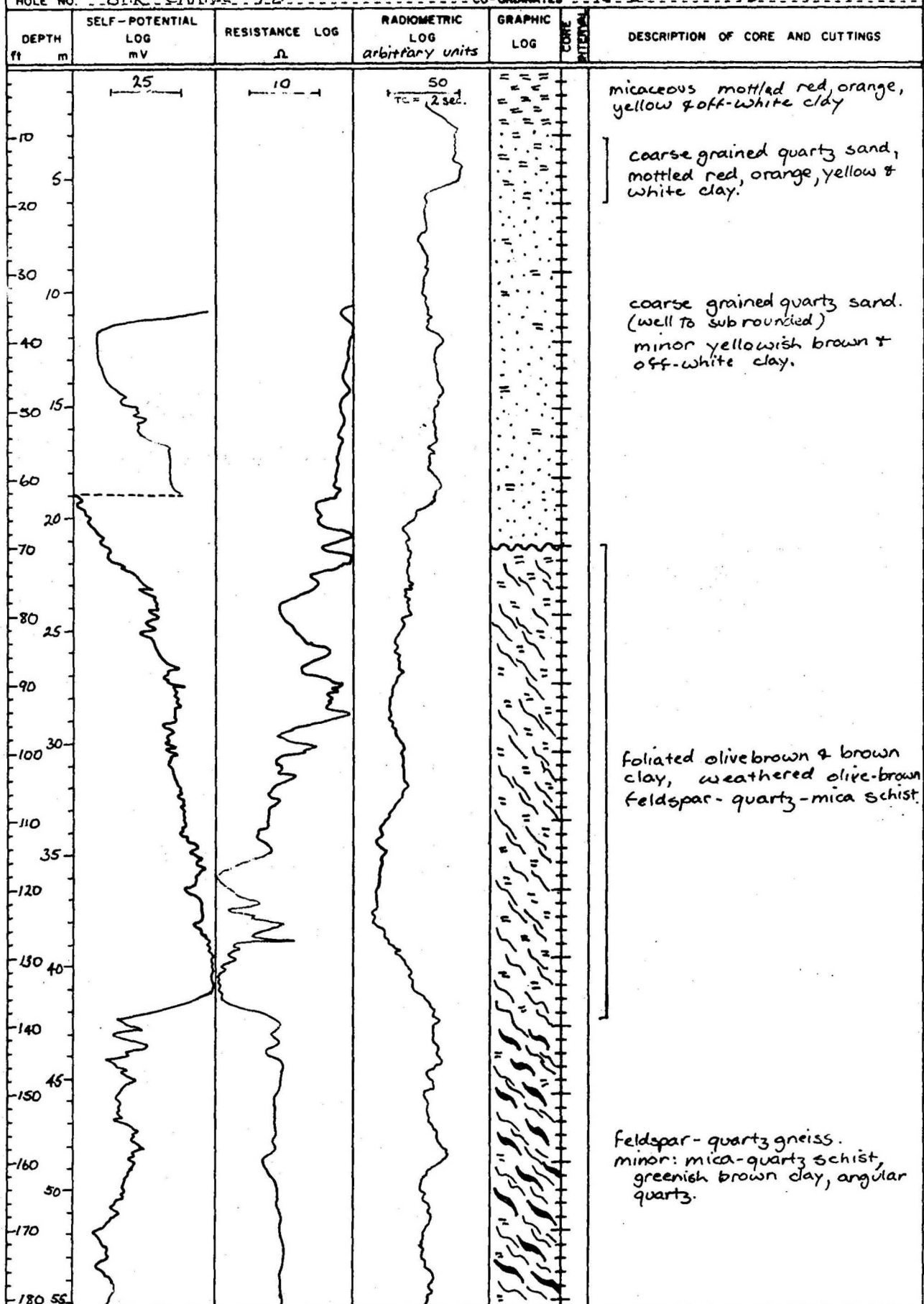
LOCATION

CO-ORDINATES

M(Pf)122

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ALLIGATOR RIVER LOCATION 13600 m east
 HOLE NO. BMR SAMILL 78 CO-ORDINATES 12° 38' 132° 36'

DRILLER L. KEAST

AIR

COMMENCED 1/10/76LOGGED BY P.G.S.S.TYPE MAYHEM 1000WATER 0 - 300'COMPLETED 1/10/76DRAWN BY P.G.S.S.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT

LOCATION

HOLE NO.

BMR CAHILL 78

CO-ORDINATES

DEPTH ft m	SELF-POTENTIAL LOG mV	RESISTANCE LOG Ω	RADIOMETRIC LOG	GRAPHIC LOG	CORE INTERNAL	DESCRIPTION OF CORE AND CUTTINGS
190 60						
200						
210 65						
220						
230 70						
240						
250 75						
260 80						
270						
280 85						quartz feldspar gneiss quartz- Biotite schist.
290 90						
300						No. core taken.
310 95						