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EL 492 AND EL 893

DARKE PEAKE

PROGRESS REPORTS FOR THE PERIOD 15/6/79 TO 27/9/82

Submitted by
Pancontinental Mining Ltd
1982

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TENEMENT HOLDER: Pancontinental Mining Limited And Power Reactor And Nuclear Fuel Development Corporation.

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QUARTERLY REPORT FOR THE PERIOD

15 JULY TO 15 SEPTEMBER, 1979

E.L. 492, EYRE PENINSULA, SOUTH AUSTRALIA

FOR THE

PANCONTINENTAL MINING LIMITED/
POWER REACTOR & NUCLEAR FUEL
DEVELOPMENT CORPORATION
JOINT VENTURE

BY

PANCONTINENTAL MINING LIMITED
(OPERATOR)

15 OCTOBER, 1979.

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AND ENERGY
SECURITY
3551

INTRODUCTION

This report summarises work completed for the period 15 June to 15 September, 1979 on E.L. 492, Eyre Peninsula, South Australia.

GENERAL

Approximately 80% of the Exploration Licence has been covered by semi-detailed geological and radiometric mapping. Geoex completed the airborne geophysical survey on 31 July, 1979 and are currently compiling the data for presentation.

WORK COMPLETED

Geological & Ground Radiometric Surveys

Although much of this E.L. is covered by sand and calcrete, Warrow Quartzite and basement gneiss outcrop on some ridges and hills. Sparse outcrops of iron formation and Mangalo Schist indicate that the extrapolation of the stratigraphy, defined in the Cleve area, to the Darke Peak - Carappee Hill area, is valid. Although silicified dolomites and graphite schists of the Pooramookinnie Dolomite were recognized, none were found to be anomalous in uranium. The only significant radiometric anomalism is in the area associated with pegmatitic segregations in the basement gneiss and with Tertiary laterites. Trenching or augering of spot laterite anomalies is the only follow-up work that is recommended in this area of limited potential for uranium mineralization.

Airborne Geophysical Survey

Geoex completed the airborne geophysical survey on 31 July, 1979. Overall, a total of approximately 15,000 line kilometres was flown at a line spacing of 250 metres and an elevation of 300 feet. A number of low-level (150 ft.) runs at 100 metre line spacing were flown over three areas of known mineralization. This was done in order that the character of the radiation could be determined, to enhance the interpretation of the higher level regional coverage.

A magnetic susceptability meter is being used to establish the magnetic response of the various rock types to assist with the interpretation of the airborne magnetics.

PROPOSED WORK

Upon the receipt of the airborne geophysical results, future work will consist predominantly of following-up the airborne anomalies. A more detailed geological mapping programme will be conducted over the areas of interest as delineated by the airborne survey.

EXPENDITURE

Total expenditure for the period 15 June to 15 September, 1979 was $35,568 comprising the following costs:

Salaries & On Costs	$6,332
Travel & Other Costs	78
Assaying & Analytical	390
Geophysical Survey	26,062
Camp & Other Expenses	822
Sydney/Field Expenses	191
SUB-TOTAL	$33,875
5% Overhead	1,693
TOTAL	$35,568

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1-1100-19

QUARTERLY REPORT FOR THE PERIOD 15 SEPTEMBER - 15 DECEMBER, 1979 E.L. 492, EYRE PENINSULA, SOUTH AUSTRALIA

FOR THE

PANCONTINENTAL MINING LIMITED/
POWER REACTOR & NUCLEAR FUEL
DEVELOPMENT CORPORATION
JOINT VENTURE

BY

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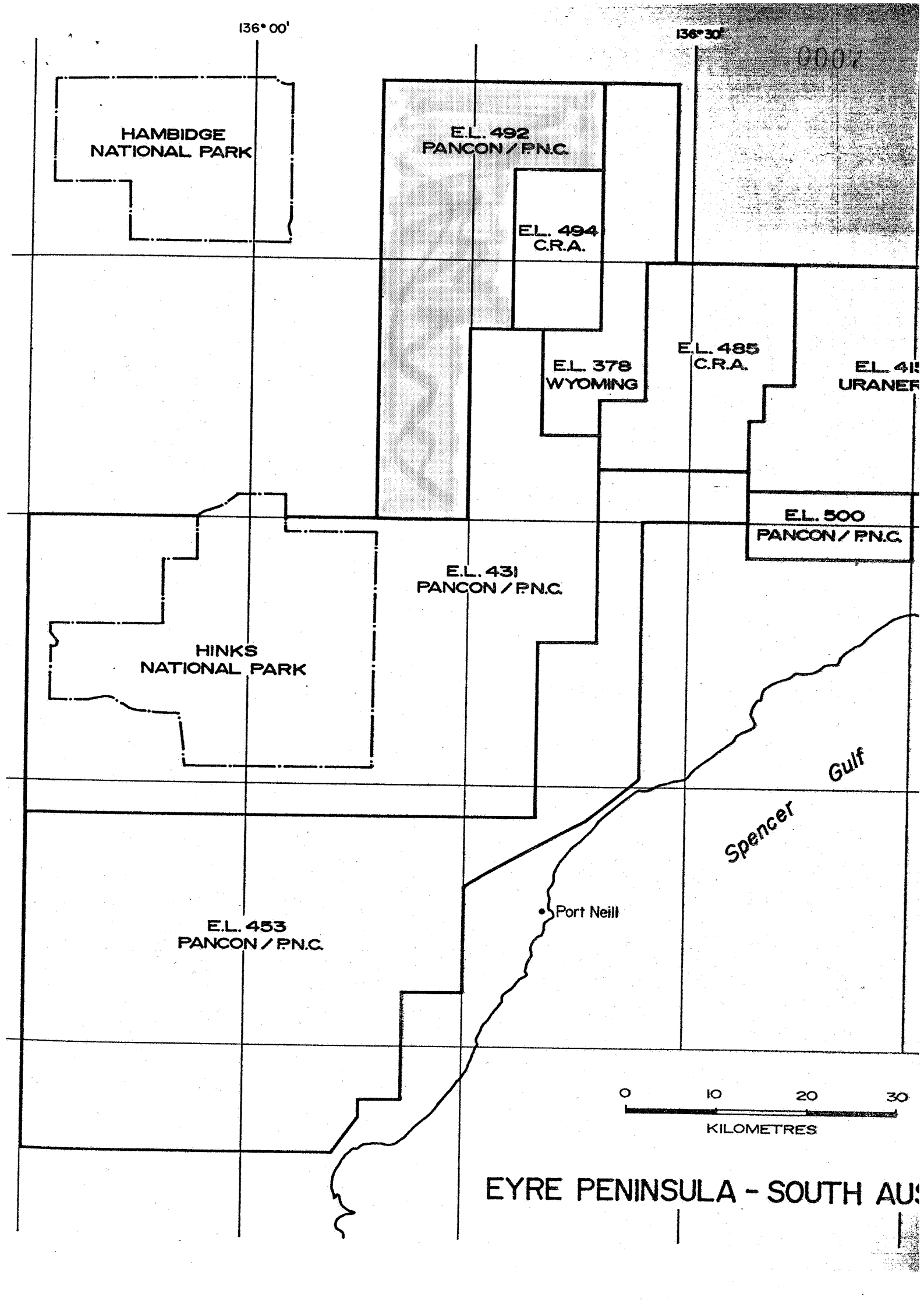
17 JANUARY, 1980
SYDNEY, N.S.W.


136° 00'
136° 30'
0002
HAMBIDGE NATIONAL PARK
E.L. 492 PANCON / P.N.C.
E.L. 494 C.R.A.
E.L. 378 WYOMING
E.L. 485 C.R.A.
E.L. 415 URANER
E.L. 500 PANCON / P.N.C.
E.L. 431 PANCON / P.N.C.
HINKS NATIONAL PARK
Gulf
Spencer
Port Neill
E.L. 453 PANCON / P.N.C.
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KILOMETRES
EYRE PENINSULA - SOUTH AU

1.0 INTRODUCTION

This report summarizes all work completed for the period 15 September to 15 December, 1979 on E.L. 492, Eyre Peninsula, South Australia.

2.0 GENERAL

The majority of work completed during the period was devoted to geophysical follow-up work and more detailed geological mapping in areas delineated to be anomalous in uranium from the airborne geophysical survey.

3.0 WORK COMPLETED

3.1 Geological/Radiometric Mapping

Regional geological and radiometric mapping has been completed over the E.L. No new anomalies were detected during the period.

3.2 Airborne Geophysical Survey

Initial results of the airborne survey have been received from Geoex, and both the magnetic and radiometric data was evaluated at a preliminary level during the Quarter.

Due to a fault in the Geoex computer the airborne data interpretation has fallen behind schedule. Providing there are no more hold-ups, the data will be reviewed by Pancontinental's consulting geophysicist, Dr. D. Pratt, and by the Pancontinental project geologist, Mr. C. R. Williams during the next Quarter.

2/...

4.0 PROPOSED WORK

The main proportion of work during the next quarter will be devoted to interpretation of both the current geological and geophysical data.

5.0 STAFFING

There were nine people employed on the Joint Venture programme during the quarter comprising of:

1	Project Geologist
3	Geologists
4	Field Assistants
1	Cook
1	Consulting Geophysicist (Part-time)

6.0 EXPENDITURES

Total expenditure for the period 15 September to 15 December, 1979 on E.L. 492 Eyre Peninsula, South Australia, was $6,066.00, comprising the following costs:

Salaries & On Cost	$4,111
Travel & Accommodation & Related Costs	392
Contractors Services	
Analytical Cost (Assaying)	313
Airborne Geophysical Survey	126
Computer	
Data Processing	31
Field & Other Expenses	
Expendable Field Supplies	17
Airphotos, maps & reports	8
Geophysical Equipment Repairs	7

Camp Expenses	
Food	315
Expendable Camp Supplies	29
Fuel & Lubricants	217
Camp Equipment repairs & maintenance	-
Field Office expenses	13
Housing Rental	23
Transportation	
Toyota Repairs & Maintenance	14
Registration & Insurance	50
Sydney Field Expenses	111
SUB TOTAL	5,777
FIXED ASSETS & OVERHEAD COSTS	289
TOTAL EXPENSES	$6,066

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1-1100-19

QUARTERLY REPORT FOR THE PERIOD 15 DECEMBER, 1979 - 15 MARCH, 1980 E.L. 492, EYRE PENINSULA, S.A.

FOR THE

PANCONTINENTAL MINING LIMITED/
POWER REACTOR & NUCLEAR FUEL
DEVELOPMENT CORPORATION
JOINT VENTURE

BY

PANCONTINENTAL MINING LIMITED
(OPERATOR)

30 APRIL, 1980
SYDNEY, N.S.W.

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INTRODUCTION

This report summarizes the work completed on Exploration Licence 492, Darke Peake, Eyre Peninsula, during the period 15 December, 1979 - 15 March, 1980.

GENERAL

There was no field work carried out on the property during the period. The major component of work was attributed to the compilation and interpretation of both the geological and geophysical data which was collected during the 1979 field season.

This data will be presented in its final form at the end of the next quarter.

WORK COMPLETED

Geological/Radiometric Mapping

Maps have been compiled of the area and are currently being used to plan the 1980 field season's activities.

Airborne Geophysical Survey

All the data tapes have been processed and are currently being used to assess the area on a line-by-line basis.

Preliminary results of the airborne survey were in the form of contour maps and stack profiles of the area which presented regional patterns and were helpful in initial anomaly selection for further follow-up work.

The next stage was a more detailed line-by-line analysis of the multi-spectral scan data. Although a time-consuming process, initial results are indicating far more subtle information than the contour maps and stack profiles could present in their relatively crude format.

PROPOSED WORK

To continue with the interpretation of the airborne survey, relating where possible to the geology of the areas.

The 1980 field season will commence during the next quarter, with initial days being devoted to re-establishing the camp at Pt. Neill and again familiarising our geologists with the geology of the region.

STAFFING

There were four people employed on the Joint Venture programme during the quarter, comprising of:

1	Project Geologist
3	Geologists

EXPENDITURE

Total expenditure for the period 15 December, 1979 to 15 March, 1980 on E.L. 492, Darke Peake, Eyre Peninsula, was $4,928.00, comprising the following costs:

Salaries & On Cost	3,679
Travel & Accommodation & Related Costs	296
Contractors' Services	
Airborne Geophysical Survey	24
Freight	13
Field & Other Expenses	
Expendable Field Supplies	11
Airphotos, maps and reports	23
Camp Expenses	
Expendable Camp Supplies	27
Field Office Expenses	(27)
Sydney Field Expenses	647
SUB TOTAL:	4,693
FIXED ASSETS & OVERHEAD COSTS	235
TOTAL EXPENSES:	$4,928

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6-200-6

FOURTH QUARTERLY REPORT
FOR THE PERIOD 15 MARCH - 15 JUNE, 1980
E.L. 492, DARKE PEAKE EYRE PENINSULA, S.A.

FOR THE

PANCONTINENTAL MINING LIMITED/
POWER REACTOR & NUCLEAR FUEL
DEVELOPMENT CORPORATION
JOINT VENTURE

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(OPERATOR)

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AND ENERGY
SECURITY
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JULY, 1980
SYDNEY, N.S.W.

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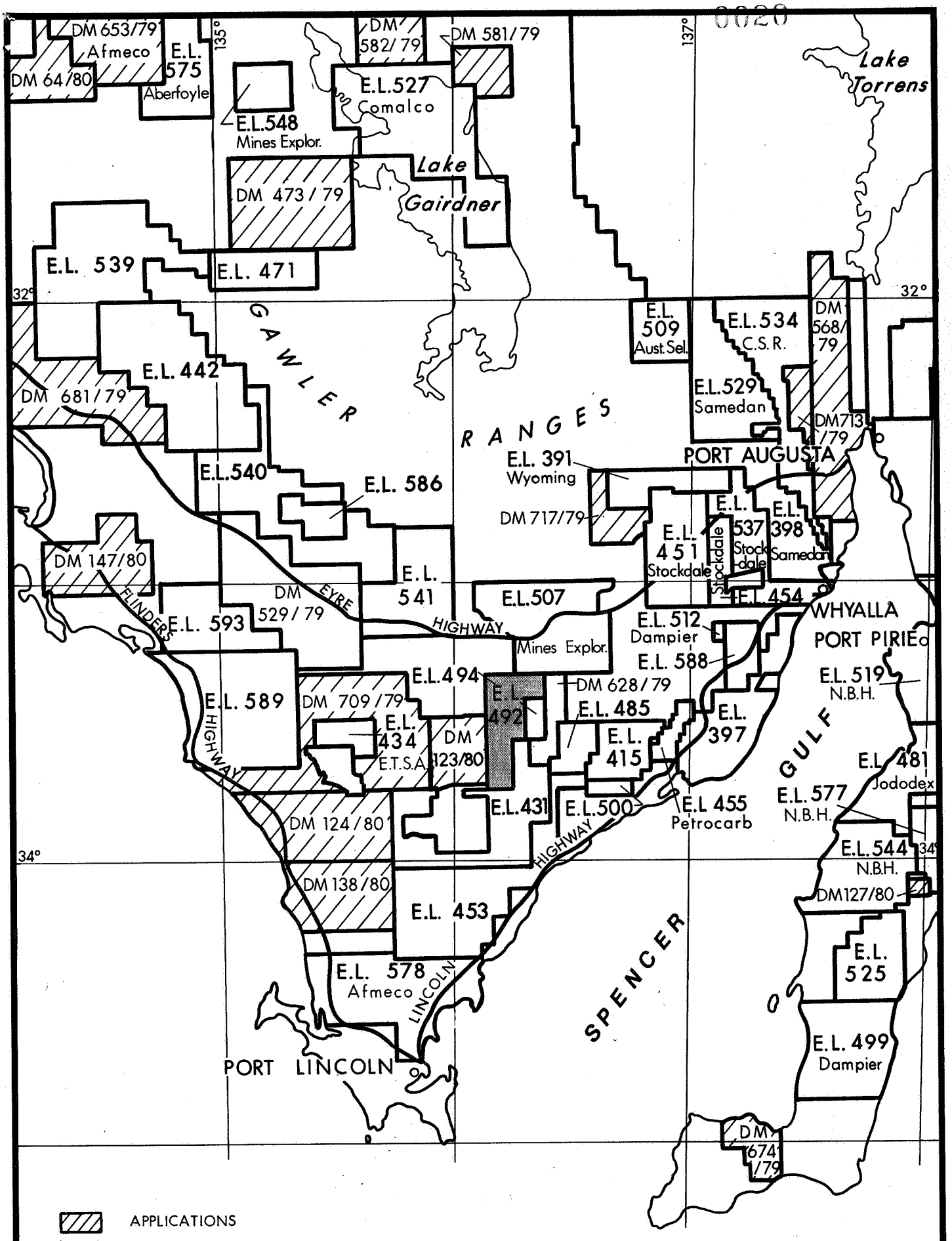
ABSTRACT

The Pancon/PNC Joint Venture acquired E.L. 492 on 14 June, 1979, covering an area of 628 square kilometres with an annual minimum expenditure commitment of $45,000.

An exploration programme designed to evaluate the region for Lower Proterozoic pitchblende mineralization was conducted during the 1979 field season.

An airborne spectrometer/magnetometer survey was conducted over the Licence together with a ground geological and radiometric mapping programme at a scale of 1:25,000.

The only significant radiometric anomalies in the area are those associated with pegmatitic segregations within the basement gneiss and also those associated with Tertiary laterites.


DM 653/79
Afmeco
DM 64/80
E.L. 575
Aberfoyle
135°
DM 582/79
DM 581/79
E.L.527
Comalco
E.L.548
Mines Explor.
Lake Gairdner
DM 473/79
E.L. 539
E.L. 471
32°
GAWLER RANGES
E.L. 442
DM 681/79
E.L.540
E.L. 586
DM 147/80
FLINDERS HIGHWAY
DM EYRE HIGHWAY 529/79
E.L. 593
E.L. 541
E.L.507
Mines Explor.
E.L. 589
E.L.494
DM 709/79
E.L. 434
E.T.S.A.
DM 123/80
E.L. 492
DM 628/79
E.L. 485
E.L. 415
E.L. 397
E.L.431
E.L.500
E.L 455
Petrocarb
DM 124/80
DM 138/80
E.L. 453
E.L. 578
Afmeco
LINCOLN HIGHWAY
PORT LINCOLN
34°
137°
Lake Torrens
E.L. 509
Aust. Sel.
E.L. 534
C.S.R.
DM 568/79
E.L.529
Samedan
DM713/79
PORT AUGUSTA
E.L. 391
Wyoming
DM 717/79
E.L. 537
E.L. 398
Samedan
E.L. 451
Stockdale
E.L. 454
WHYALLA
E.L. 512
Dampier
PORT PIRIE
E.L. 588
E.L. 519
N.B.H.
GULF
E.L 481
Jododex
E.L. 577
N.B.H.
E.L.544
N.B.H.
DM127/80
E.L. 525
E.L. 499
Dampier
SPENCER
DM 674/79
APPLICATIONS
PANCON / P.N.C.
CARPENTARIA
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C.R.A.
March, 1980
EXPLORATION LICENCES
EYRE PENINSULA, S. AUSTRALIA
0 2 4 6 8 10 Kms.
1 : 2 000 000

FIG. 1

1.0 INTRODUCTION

E.L. 492 was granted to the Pancon/PNC Joint Venture on 14 June, 1979 by the Minister for Mines and Energy. The Exploration Licence covers an area of 628 square kilometres on the central portion of the Eyre Peninsula. This report covers all work completed on the Licence during the 1979 field season.

2.0 GENERAL

An exploration programme was conducted between 7 May and 10 November, 1979 on E.L. 492. The purpose of the programme was to evaluate the potential of the tenement for Lower Proterozoic pitchblende mineralization.

The field party consisted of four geologists, four field assistants and a cook. A base camp was established near the small, centrally located, township of Port Neill.

An airborne geophysical survey was conducted over E.L. 492 by Adelaide-based contractors, Geoex Pty. Limited. Unfortunately, due to a number of delays, the geophysical data was not available for detailed assessment during the field programme.

A semi-detailed 1:25,000 scale geological-radiometric mapping programme was conducted over the region. Orthophoto basemaps were compiled at 1:100,000 scale for final map presentation.

All significant radiometric anomalies were samples for geochemical analysis.

2/...

3.0 REGIONAL GEOLOGY

3.1 Introduction

3.1.1 Regional Setting

Archean granites and granite gneisses of the Sleaford Complex outcrop in the south and southwestern Eyre Peninsula, where they are unconformably (?) overlain by the Warrow Quartzite which represents the base of the Hutchison Group. Gneisses and migmatites are mapped east of the Lincoln Mylonite Zone and in anticlinal cores northwest of Cowell. Some of these gneisses and migmatites may represent remobilized Archean basement.

The basal unit of the Lower Proterozoic Hutchison Group is the Warrow Quartzite which is overlain by a sequence of biotite schists and gneisses including two iron formation units with their associated dolomites and graphite schists. Late Lower Proterozoic granites intrude the Hutchison Group metasediments and are unconformably overlain by the Carpentarian sediments and volcanics.

Unconformably overlying the Lower Proterozoic metasediments and granites in the Verran-Cleve area are the Blue Range Beds which are probably a correlative of the Middle Proterozoic Corunna Conglomerate of the northern Eyre Peninsula.

Tertiary and Mesozoic sediments fill broad shallow depressions in the central and southwestern Eyre Peninsula, and deepen rapidly to the west of Rudall forming the Lock Basin.

Extensive Quaternary aeolian sands cover many areas, particularly in the northern and western parts of the Eyre Peninsula.

3.1.2 Previous Definition of Stratigraphy

The stratigraphy of the Eyre Peninsula has been defined many times by different workers and has long been a source of controversy. Recent work by Parker (1978) has substantially clarified the stratigraphy of the region by employing detailed structural mapping.

Tilley (1920) initially proposed a stratigraphy for the southern Eyre Peninsula by defining the Hutchison Series, including all metasediments, and the Flinders Series of granitic gneisses which he believed to be intrusive. On the southwest coast he recognized the Warrow Series for the quartzites and the Dutton Series for the granite gneisses.

Miles (1954) defined the stratigraphy of the Middleback Ranges by proposing the Middleback Group which he considered to be structurally underlain by the younger anatectic granite of the Gneiss Complex.

Johns (1961) redefined the sequence by recognizing the Gneiss Group (Flinders Group) and Schist Group (Hutchison Group). The distinction between the two groups was poorly defined and overlapping. He included the Warrow Series in the Flinders Group and considered it to have formed by in situ granitisation.

Whitten (1964) correllated the Hutchison and Middleback Groups, and the Flinders Group and Gneiss Complex, and suggested that the significant difference between the groups was the grade of regional metamorphism. However Whitten (1966) modified his definition in the southern Eyre Peninsula where he redefined the stratigraphy to the basal Flinders Gneiss, overlain by the Hutchison Metamorphics which were subsequently overlain by the Dutton Metamorphics (including the Warrow Quartzite).

Thomson (1969) included all the metamorphic rocks of the Eyre Peninsula in his definition of the Cleve Metamorphics which consisted of the basal Gneiss Complex, the Warrow Quartzite and the Hutchison Group. The Gneiss Complex included the Middleback Group, and the Warrow Quartzite was considered a facies equivalent of the top of the Gneiss Complex.

Furber & Cook (1976) slightly modified the stratigraphy of Miles (1954) in the Middleback Ranges. Coin (1976) has proposed a sequence which basically agrees with that of Tilley (1920) in that all metasediments are included in the Hutchison Group and all augen and granite gneisses are included in the Flinders Group. Coin considers these gneisses to represent remobilized Archean basement.

The most recent work on the Eyre Peninsula has been conducted by Parker (1978) and (1979) and broadly agrees with the stratigraphic succession outlined in Section 3.1.3.

3.1.3 Revised Stratigraphy

The stratigraphy has been revised for consistency with the Whyalla and Kimba 1:250,000 geological sheets to be published during 1980 by Dr. A. J. Parker of the SADME.

Recent geochronology (Section 3.1.4) has proven the existence of granitic basement of Archean age on the Eyre Peninsula. Granite gneisses of known Archean age outcrop at Cape Carnot and in the Mt. Drummond - Mt. Dutton area and are defined as the Sleaford Complex. Also included in this Complex are the distinctive porphyritic feldspar-quartz-biotite granite gneisses of the Mt. Isabella-Moreenia-Cockaleechie area and Carappee Hill. These gneisses are correlated, by lithological and radiometric similarities, with the Mt. Drummond-Mt. Dutton gneisses.

The remainder of the "basement gneisses" are grouped as the Lincoln-Plug Range Complex. Subsequent isotopic dating studies may prove a correllation between this group and the Sleaford Complex, however, at present this group is defined separately.

The Lower Proterozoic Hutchison Group overlies the Sleaford and Lincoln-Plug Range Complexes. The basal unit of the Hutchison Group is the Warrow Quartzite, which is overlain by the Katunga Dolomite, the Mangalo Schist, the Mt. Shannon Iron Formation and the Yadnarie Schist. This sequence correlates with that defined by BHP in the Middleback Ranges.

The Middle Proterozoic (?) Blue Range Beds unconformably overlie the Archean and Lower Proterozoic sequence. The Blue Range Beds are tentatively correlated with the Corunna Conglomerate, however they are also lithologically similar to the Pandurra Formation near Whyalla.

TABLE I

EYRE PENINSULA AGE DETERMINATIONS

CATION	REF.	ROCK TYPE	Sr^{87}/Sr^{86}	DATE (M.Y.
arnot - S$^{th.}$ Eyre Peninsula	2	augen gneiss	0.7015	2643 ± 134
" " "	2	leucogneiss	0.7026	2837 ± 583
Islands, west coast	3	Whidbey Granite		2337 ± 65
th, S. of Kingoonya	3	Glenloth Granite		2300 ± 33
" "	1	" "		1930
Point, Port Lincoln	2	granite gneiss	0.7034	1855 ± 10
ip of Eyre Peninsula(?)	1	gneissic granulite		1780 ± 120
ange, NW of Cowell	4	granite gneiss (migm)	0.7340	1697 ± 65
y Creek, W of Cowell	4	granite gneiss	0.7240	1643 ± 303
SW of Cowell	4	granite	0.7124	1677 ± 125
camp, W of Cowell	4	granite	0.7108	1635 ± 86
s NW of Cleve	4	Cook Gap Schist	0.7061	1688 ± 76
a, W of Lake Acraman	1	Hiltaba Granite		1740
a, Tarcoola area	1	Wilgena Granite		1600
ron Knob	1	Burkitt Granite		1550 ± 70
Cowell	1	Charleston Granite		1590 ± 30
a Range, N of Iron Knob	1	Corunna Conglomerate		1535
Ranges	1	Gawler Range Volcanics		1535 ± 25
ron Knob	1	Roopena Volcanics		1345 ± 30
Whyalla	1	Cultana Granite		1320

FERENCES:

1) Compston & Arriens (1968)
2) Cooper et. al. (1976)
3) Webb & Thomson (1977) - dates modified by Webb in Parker (1978)
4) Parker (1978)

3.2 Description of Rock Units

3.2.1 Archean

Basement gneisses have been recognised in many areas, generally occupying the anticlinal cores of refolded D_2 anticlines. Lithologies vary from the distinctive porphyritic feldspar-quartz-biotite granite gneiss of the Mt. Isabella - Moreenia area and Carappee Hill, to feldspar-quartz-biotite gneisses, augen gneisses and microgneisses (sometimes migmatitic). As a general rule, the basement gneisses and microgneisses are distinguished from the schists and gneisses of the Mangalo Schist by the presence of feldspar and the relatively high radioactivity (180-350 cps - compared to 100-160 cps for Mangalo Schist).

3.2.2 Lower Proterozoic

3.2.2.1 Lithology

The Lower Proterozoic units are described below in stratigraphic order from oldest to youngest:

1) Warrow Quartzite. The dominant lithology of the Warrow Quartzite varies from a completely recrystallised milky quartz (often in anticlinal cores) to quartz-muscovite (sericite)-tourmaline quartzite and quartz-feldspar-muscovite gneiss. In a number of areas the Warrow Quartzite contains a calcareous component, with mino dolomitic and graphitic interbeds. A basa calc-silicate/dolomite unit is described b Parker (1978) near the Plug Range. This unit varies from a pure recrystallised dolomite to a diopside-feldspar calc-silic and appears to be absent in many areas. Schist and gneiss units are intebedded wit the quartzite in some areas. Thickness of the Warrow Quartzite varies from 10m to more than 500m, although in some areas the apparent thickness is attributed to comple structural repetition.

2) Katunga Dolomite. This unit is characterize by chemically precipitated sediments which exhibit relatively rapid, complex facies changes between the carbonate, silicate and oxide facies. Highly silicified ferruginised and sometimes brecciated, and gossanous dolomite is the dominant litholog All variants, however, from pure dolomite t calc-silicate are observed. Graphitic schists are commonly associated with the dolomite units and hematite chert, quartzit or jaspilite is sometimes present. Biotite schists, some chloritic, sometimes separate the dolomites and jaspilites from the underlying Warrow Quartzite.

3) Mangalo Schist. The Mangalo Schist typical comprise quartz-biotite schist, biotite-quartz schist, quartz-biotite-feldspar microgneiss and minor quartz-biotite-feldsp gneiss. Quartz lenticles up to 5 cm wide and 50 cm long are frequently present and probably represent transposed and boundinag quartz-rich bands and segregations.

Podded sillimanite-quartz-biotite-feldspar schist/microgneiss has been mapped at a nun of localities in the Cleve area. Almandine garnet is relatively common in some schist: and gneisses. Amphibolites, often with fi calc-silicate bands, occur at a number of horizons within the Mangalo Schists and f excellent marker beds at some localities. The lateral extent and bedded nature of th amphibolite-calc silicate supports a derivation from pelitic carbonate sediment

The total thickness of the Mangalo Schist varies from less than 10m in the Middlebac Ranges (Miles, 1954) to greater than 1000m in the Cleve area (Tonkin, 1971). Calcula of thickness are generally complicated by structural repetition.

4) Mount Shannon Iron Formation. Hematite chert, jaspilite, ironstone and chert are the dominant lithologies of this unit. Graphite schist is associated with the hematite cherts in some areas and rare dolomites have been observed. The predominance of hematite chert and jaspilite over the subordinate dolomite distinguish this unit, on a regional scale, from the Katunga Dolomite.

5) Yadnarie Schist. The Yadnarie schist is only recognized northwest of Cleve, where it is represented by fine-grained quartz-muscovite-biotite schists and phyllites. The phyllitic appearance of these rocks is due to their fine grainsize rather than their metamorphic grade.

3.2.2.2 Metamorphism

The Lower Proterozoic metasediments of the Eyre Peninsula have been subjected to upper amphibolite facies regional metamorphism. The development of sillimanite and garnet is common throughout the Mangalo Schist and Parker (1978) describes the metamorphic development of orthoclase, microcline and plagioclase. This defines the sillimanite-almandine-orthoclase subfacies of the Almandine Amphibolite Facies. The development of forsterite and diopside in the calc-silicates and dolomites confirms an upper amphibolite facies grade. Joplin (1968) describes granulite facies gneisses from the Eyre Peninsula, some of which probably belong to the Sleaford Complex.

Parker (1978) distinguishes two high grade metamorphic events followed by two minor retrograde events, which he relates to his four deformational phases (Section 3.2.2.3).

The major period of upper amphibolite facies metamorphism probably occurred at around 1700 m.y. ant it is possible that an earlier event at 1780 - 1800 m.y. is reflected in some of the Lincoln Complex age determinations.

Subsequent upper greenschist facies metamorphism is associated with the D_3 deformation and the formation of the Lincoln Shear Zone. A low grade metamorphic event produced chlorite associated with the D_4 deformation.

3.2.2.3 Structure

The structure of the Lower Proterozoic metasediments of the Eyre Peninsula is extremely complex with as many as four separate deformationa events being recognised by workers such as Parker (1978) and Coin (1976). These structures can only be unravelled by detailed structural mapping.

The four major deformational events recognised are summarized below:-

D_1 - the earliest formed schistosity which parallels the lithological layering and was probably produced by tight isoclinal folding. The major metamorphic event was probably associated with this deformation phase.

D_2 - the major fabric forming event which produced tight isoclinal structures. Post-dates and partly contemporaneous with the major metamorphic event.

D_3 - produced the macroscopic structure observed. Relatively open-style folding with a strong axial plane cleavage. Related to development of Lincoln Shear Zone and regional retrogressive metamorphism.

D_4 - an east-west oriented crenulation deformation which produced gentle warping of the D_3 fold axes.

The Lincoln Shear Zone extends as a sinuous belt, up to 2 kilometres wide, from Sleaford Bay to the Gawler Ranges. South of Cowell the zone trends northeast and sub-parallels the coastline, separating the Lincoln Complex in the east from the Hutchison Group in the west. North of Cowell the zone swings north-north west, to west of the Uno Range. In the Lincoln District the zone is characterized by highly silicified mylonite which exhibit chloritic and epidotic alteration in some localities.

3.2.3 Middle Proterozoic

The Blue Range Beds consist of a basal conglomerate with overlying cross-bedded and ripple marked sandstone and arkose. They have been tentatively correlated with the Corunna Conglomerate (Thomson, 1978), but they are also lithologically similar to the Pandurra Formation. The Blue Range Beds outcrop in the central and northeastern portions of E.L. 431 and the Carpentarian (?) unconformity has been mapped at the southern end of the Blue Range.

3.2.4 Intrusive Rocks

3.2.4.1 Granitic Rocks

Granitic rocks outcrop at a number of localities on the Eyre Peninsula and fall into three main groups:-

1) Archean Granites:

Gneissic granites of this age have been discussed in Section 3.2.1. These included the gneissic granites of the Cape Carnot-Marble Range-Mt. Hope area and Carappee Hil

2) Synorogenic-Late Lower Proterozoic granites

These granites are grouped as the "Younger Granites" on the accompanying maps. Most of the granites of the Eyre Peninsula fall into this group, which intruded the Lower Proterozoic metasediments during the last stages of tectonism, prior to the depositi of Middle Proterozoic sediments and volcanics. These granites mostly give isotopic dates of 1750 - 1650 m.y.

The granites are generally massive, medium grained, granular, quartz-feldspar-biotite adamellites and granodiorites, although coarsely porphyritic types (e.g., Charleston Granite) are known.

Granites included in this group are:- the Moody Granite Series west of Ungarra, the Carpa Granite southwest of Cowell, and the Burkitt Granite west of Iron Knob. The Middle Camp Granite (Parker, 1978) exhibits relict metamorphic banding and pegmatite veining suggesting that it is intimately related to the major metamorphic event.

3) Post-orogenic Granites:-

The Charleston, Cultana, Buckleboo and Hiltaba Granites have been dated on the range 1600 - 1450 m.y. These granites are generally massive and non-foliated.

3.2.4.2 Pegmatites

Pegmatites form two distinct but genetically related groups:-

1) Pegmatites which subparallel the lithologic layering and have formed by metamorphic segregation during the major metamorphic event.

2) Pegmatites which exhibit cross cutting relationships with the lithological layering. These occur as dykes and masses which have probably segregated and mobilise during and subsequent to the main metamorph event. Some may be related to granite intrusions such as the Carpa Granite. Thes pegmatites are particularly prominant where they intrude the Mangalo Schists.

3.2.4.3 Basic Rocks

Metamorphosed dolerite dykes intrude the Lincol Complex at numerous localities. They are genera composed of sericitised plagioclase and pyroxene which is altered to amphibole.

No basic dykes have been observed intruding the Hutchison Group, although some of the numerous amphibolites may represent altered dykes. Some amphibolites associated with the Plug Range and Minbrie complex migmatites exhibit apparently cross-cutting relationships, however these may have been produced during deformation of the migmatites.

Basic dykes are reported to intrude the Hutchis Group in the Middleback Ranges. It is possible that these may be feeder dykes to Upper Proterozoic extrusives and so considerably younger than the Lincoln Complex dykes.

4.0 EXPLORATION ACTIVITY

4.1 Introduction

The exploration programme conducted over E.L. 492 included an airobrne spectrometer/magnetic survey, semi-detailed 1:25,000 scale geological-radiometric mapping and geochemical sampling (see accompanying Plates).

4.2 Airborne Geophysical Survey

Geoex Pty. Limited contracted to conduct an airborne magnetic/spectrometer survey over the majority of the Licence (see Fig. 2).

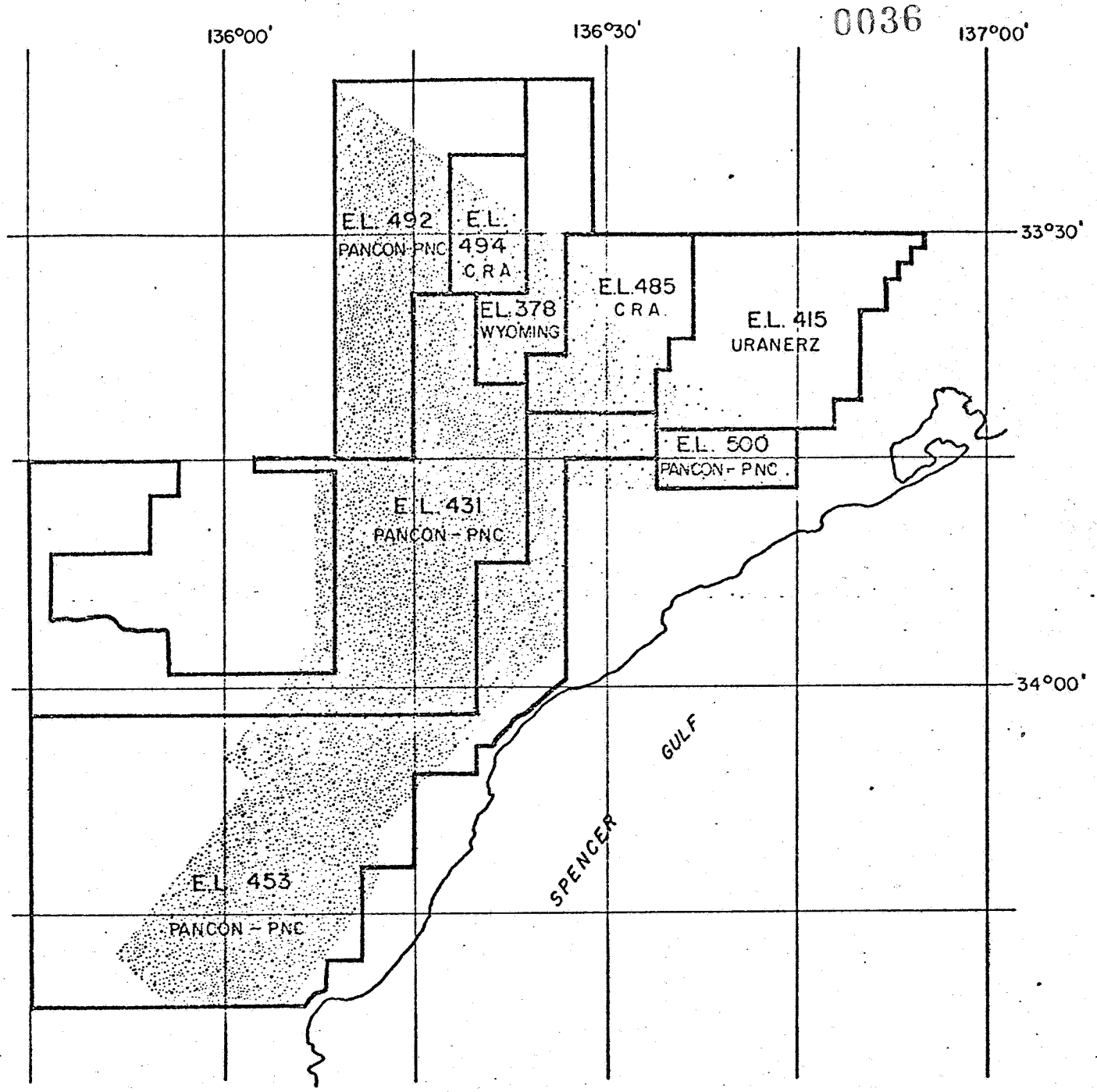
The survey was flown at a height of 115m (magnetic detection height of 90m), a line spacing of 250m and a sample spacing of approximately 40m. Instruments used included a Geometrics G-803 Magnetometer and a McPhar SPECTRA 2 Spectrometer with a McPhar 1024 Channel Analyser (256 channels were recorded) and a 24 litre NaI detector.

An airborne survey commenced on 3 June, 1979 and was completed, behind schedule, on 31 July, 1979. Delays were primarily due to unsatisfactory weather conditions.

The magnetic and radiometric contour sheets were prepared at 1:25,000 and compilation sheets were prepared at 1:100,000 scale. These compilation sheets have been submitted with the report.

4.3 Geological-Radiometric Mapping

Although much of the Licence is covered by sand and calcrete, Warrow Quartzite and basement gneiss outcrop on some ridges and hills. Sparse outcrops or iron formations and Mangalo Schist indicate that the extrapolation of the stratigraphy, defined in the Cleve area, to the Darke Peak-Carappee Hill area, is valid.



EYRE PENINSULA

AIRBORNE GEOPHYSICAL SURVEY

FIG. 2

Although silicified dolomite were recognised, none were found to be anomalous in uranium. The only significant radiometric anomalism is in the area associated with pegmatitic segregations in the basement gneiss and with Tertiary laterites. Trenching or augering of spot laterite anomalies is the only follow-up work that is recommended in this area of limited potential for pitchblende mineralization.

4.4 Geochemistry

A total of 22 samples were collected for geochemical analysis (see Appendix I).

All samples were analysed for uranium and thorium by XRF and for Cu, Ni, Pb, Zn, Co, Mn by AAS.

4.5 Proposed Work

Initial follow-up work in the 1980 field season will consist of detailed prospecting of the Middle/Lower Proterozoic unconformity north of Cockabidnie.

Ground checking of the low order radiometric anomalies detected from the 1979 airborne survey. This will be followed by trenching/augering if these anomalies prove substantial.

5.0 EXPENDITURES

Total expenditure for the period 15 March to 15 June, 1980 on E.L. 492, Darke Peak, S.A., was $9,506.00, comprising the following costs:

Salaries & On Cost	$4,652
Travel & Accommodation & Related Costs	312
Contractors' Services	
Analytical Cost (Assaying)	2
Airborne Geophysical Survey	148
Computer	
Data Processing	51
Field & Other Equipment	
Geophysical Equipment Repairs	38
Expendable Field Supplies	470
Airphotos, maps & reports	2
Geophysical Equipment Rental	89
Camp Expenses	
Food	1,428
Expendable Camp Supplies	147
Fuel & Lubricants	191
Camp Equipment Repairs & Maintenance	31
Field Office Expenses	149
Housing Rental	234
Camp Equipment Rental & Leasing	58
Transportation	
Toyota Repairs & Maintenance	147
Registration & Insurance	14
Sydney Field Expenses	890
SUB-TOTAL	$9,053
Fixed Assets & Overhead Costs	453
TOTAL EXPENSES:	$9,506

N.B. S.A. Fixed assets were not reported and overhead reported to the extent of 5% only.

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APPENDIX I

ASSAY RESULTS

S4 - EYRE PENINSULA ROCK CHIP SAMPLES

0042

E.L. 492

DATE 11-DEC-79

Sample No.	GEOCHEMICAL ANALYSES									
	U	Th	Cu	Pb	Zn	Co	Ni	Mn	Au	Fe
1740	16	150	420	90	280	15	50	150	-1	-1
1741	250	16	1300	65	470	55	150	70	-1	-1
1817	10	240	5	25	55	10	10	65	-1	-1
1818	18	320	10	90	5	10	10	12	-1	-1
1819	6	240	12	40	2	20	10	10	-1	-1
1824	36	28	38	5	20	20	25	60	-1	-1
1825	6	190	22	15	12	30	40	55	-1	-1
1826	8	180	12	20	8	25	35	25	-1	-1
12001	8	10	15	0	10	0	5	60	-1	-1
12002	0	70	12	5	10	5	15	50	-1	-1
12003	14	360	22	50	12	5	10	15	-1	-1
12004	8	32	45	20	30	10	20	55	-1	-1
12005	16	150	100	1600	220	50	110	370	-1	-1
12006	4	95	120	110	190	30	75	270	-1	-1
12007	6	170	42	50	320	35	65	260	-1	-1
12008	4	75	22	50	90	10	25	35	-1	-1
12009	8	260	8	15	15	75	170	130	-1	-1
12010	4	120	8	55	10	10	25	15	-1	-1
12011	6	32	12	5	5	5	10	10	-1	-1
12012	8	160	8	25	8	5	15	30	-1	-1
12013	0	90	5	10	8	10	20	15	-1	-1
12014	34	1350	12	150	2	0	10	5	-1	-1
Detn Limit	4	4	5	5	5	5	5	5	5	0

These analyses were performed by The Australian Mineral Development Laboratories - AMDEL.
All analyses are quoted in ppm unless otherwise stated.

Analyses below the detection limit have been set to zero.

"-1" indicates that no assay value was available.

Au assay values mutiplied by 100.

417

600 000 mE
610 000 mE
620 000 mE
630 000 mE
6 315 000 mN
6 305 000 mN
6 295 000 mN
6 285 000 mN
6 275 000 mN
6 265 000 mN
136°15'
136°30'
33°30'
33°45'

WADDIKEE
CUMMINS
DARKE PEAK
DARKE PEAK RANGE
BUCKLEBOO
KELPA
Pub-Puc
RAILWAY
RUDALL
Gum Creek

1825 • • 1826
• 1824

E.L. 492

Ag
Ap
Plw
Plk
Pls
Plm
Plma
Pub-Puc

LEGEND

MIDDLE PROTEROZOIC
- Pub-Puc — Blue Range Beds (Pub)
  Corunna Conglomerate (Puc)

LOWER PROTEROZOIC
- Pls — Mount Shannon Iron Formation (Pls)
- Plm / Plma — Mangalo Schist (Plm)
  Amphibolite & banded calc.-silicate (Plma)
- Plk — Katunga Dolomite (Plk)
- Plw — Warrow Quartzite (Plw)

ARCHAEAN?
- Ac — Coolanie Gneiss Complex (Ac)
- Ag — Plug Range - Lincoln Complex (Ag)

ARCHAEAN
- Ap — Sleaford Complex (Ap)

Strike & dip of foliation

Strike & dip of bedding

• 1875 Sample location & number

PANCONTINENTAL MINING LIMITED

PANCON - PNC JOINT VENTURE

EYRE PENINSULA, SOUTH AUSTRALIA

E.L. 492

GEOLOGY & SAMPLE LOCATIONS

1000 0 2000 4000 6000 8000 10 000 m

1 : 100 000

JUNE, 1980

PLAN Nº 11/S/D/8

RECEIVED
5 AUG 1980
DEPT. OF MINES AND ENERGY SECURITY
3551

3551(I)-1

600 000 mE
610 000 mE
136°15'
620 000 mE
630 000 mE
136°30'
6 315 000 mN
6 305 000 mN
6 295 000 mN
33°30'
6 285 000 mN
6 275 000 mN
6 265 000 mN
33°45'

WADDIKEE

E.L. 492

CUMMINS

DARKE PEAK

DARKE PEAK RANGE

BUCKLEBOO

OKELPA

RAILWAY

RUDALL

Gum Creek

PANCONTINENTAL MINING LIMITED

PANCON - PNC JOINT VENTURE

EYRE PENINSULA, SOUTH AUSTRALIA

E.L. 492

RADIOMETRICS

JUNE 1980

PLAN Nº 11/S/E/11

RECEIVED
5 AUG 1980
DEPT. OF MINES AND ENERGY SECURITY
3551

3551(I)-2

600 000 mE
610 000 mE
620 000 mE
630 000 mE
6 315 000 mN
6 305 000 mN
6 295 000 mN
6 285 000 mN
6 275 000 mN
6 265 000 mN
136°15'
136°30'
33°30'
33°45'

WADDIKEE

E.L. 492

CUMINS

DARKE PEAK

DARKE PEAK RANGE

BUCKLEBOO

KELPA

RAILWAY

RUDALL

Gum Creek

-2000
-1750
-1500

H
L

PANCONTINENTAL MINING LIMITED

PANCON - PNC JOINT VENTURE

EYRE PENINSULA, SOUTH AUSTRALIA

E.L. 492

MAGNETICS

1000 0 2000 4000 6000 8000 10 000 m

1 : 100 000

JUNE, 1980

RECEIVED
5 AUG 1980
DEPT. OF MINES AND ENERGY SECURITY
3551

PLAN N°. 11/S/E/12

3551(I)-3

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0043

6-200-6

QUARTERLY REPORT FOR THE PERIOD

15 ~~JULY~~ JUNE - 15 SEPTEMBER, 1980

E.L. 492, EYRE PENINSULA, S.A.

FOR THE

PANCONTINENTAL MINING LIMITED/
POWER REACTOR & NUCLEAR FUEL
DEVELOPMENT CORPORATION
JOINT VENTURE

BY

PANCONTINENTAL MINING LIMITED
(OPERATOR)

OCTOBER, 1980
SYDNEY, N.S.W.

1.0 INTRODUCTION

This report summarizes all the work completed during the period 15 July - 15 September, 1980 on E.L. 492, Darke Peak, Eyre Peninsula.

2.0 GENERAL

Field work continued during the period with the emphasis being placed on following up anomalies detected from the previous year's airborne geophysical survey.

3.0 PROPOSED WORK

To continue geological/radiometric mapping of the area in conjunction with the anomaly follow-up programme currently in progress.

4.0 WORK FORCE

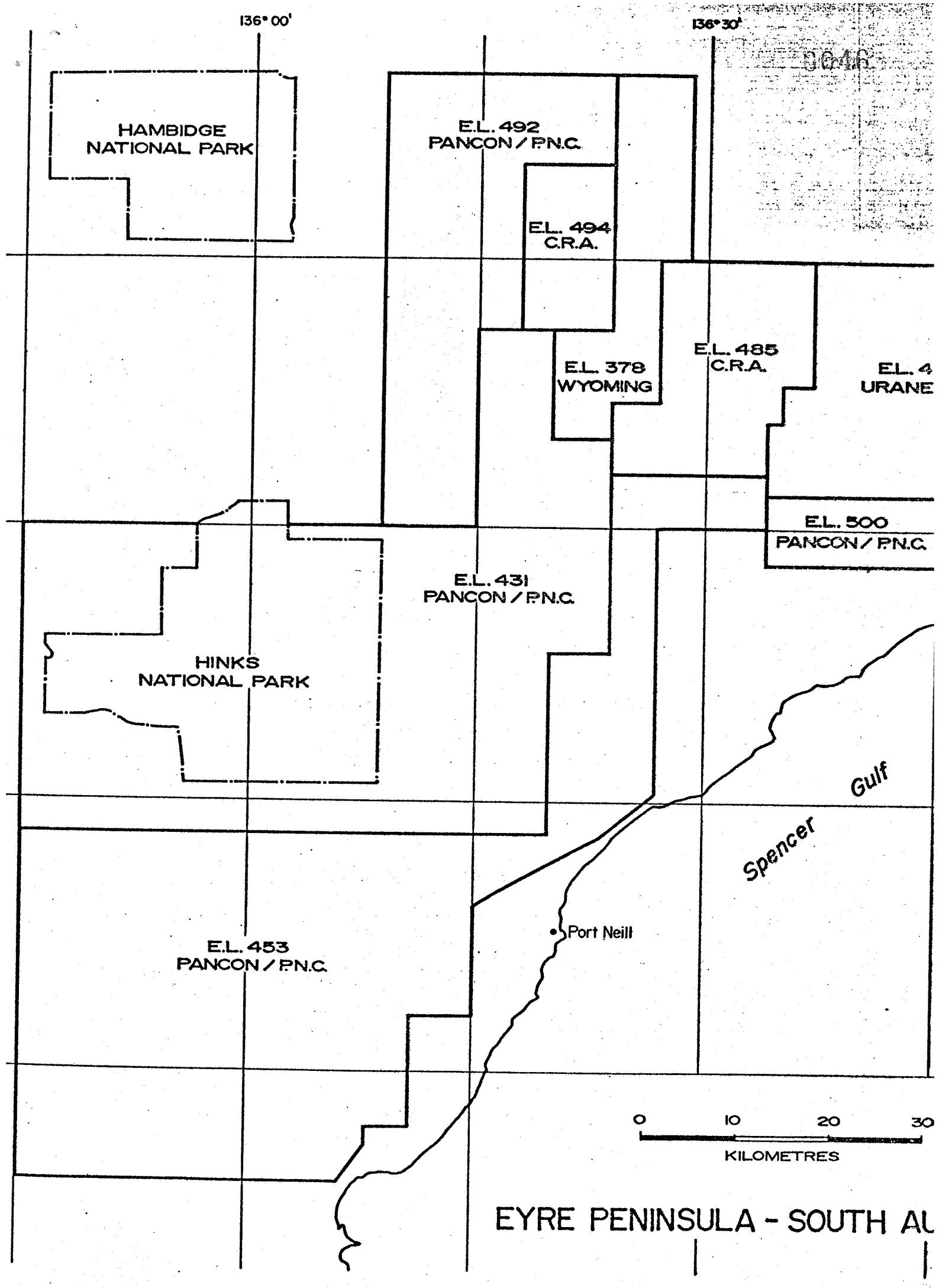
1	Senior Project Geologist
2	Geologists
3	Field Assistants
1	Cook

5.0 EXPENDITURE

Total expenditure for the period on E.L. 492 was $4,922.00, comprising the following costs:

2/...

Salaries & On Cost	2,861
Travel & Accommodation & Related Costs	153
Contractors' Services	
Analytical Cost (Assaying)	544
Computer	
Data Processing	124
Field & Other Expenses	
Expendable Field Supplies	17
Airphotos, maps and reports	8
Camp Expenses	
Food	422
Expendable Camp Supplies	84
Fuel & Lubricants	105
Field Office Expenses	15
Housing Rental	72
Transportation	
Toyota Repairs & Maintenance	27
Road Haulage	49
Sydney Field Expenses	207
SUB TOTAL	4,688
Fixed Assets & Overhead Costs	234
TOTAL EXPENSES:	$4,922


136° 00'
136° 30'
HAMBIDGE NATIONAL PARK
E.L. 492 PANCON / P.N.C.
E.L. 494 C.R.A.
E.L. 378 WYOMING
E.L. 485 C.R.A.
E.L. 4 URANE
E.L. 500 PANCON / P.N.C.
E.L. 431 PANCON / P.N.C.
HINKS NATIONAL PARK
Gulf Spencer
Port Neill
E.L. 453 PANCON / P.N.C.
0 10 20 30
KILOMETRES
EYRE PENINSULA - SOUTH AU

I

0047

49.100.6

E.L. 492, DARKE PEAKE, SOUTH AUSTRALIA

SECOND QUARTERLY REPORT FOR THE PERIOD
16 OCTOBER 1980 - 15 JANUARY 1981

SEP DEC

FOR THE

PANCONTINENTAL MINING LIMITED/POWER
REACTOR AND NUCLEAR FUEL DEVELOPMENT
CORPORATION JOINT VENTURE

BY

PANCONTINENTAL MINING LIMITED
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AND ENERGY
SECURITY
3551

SYDNEY N.S.W.
FEBRUARY 1981

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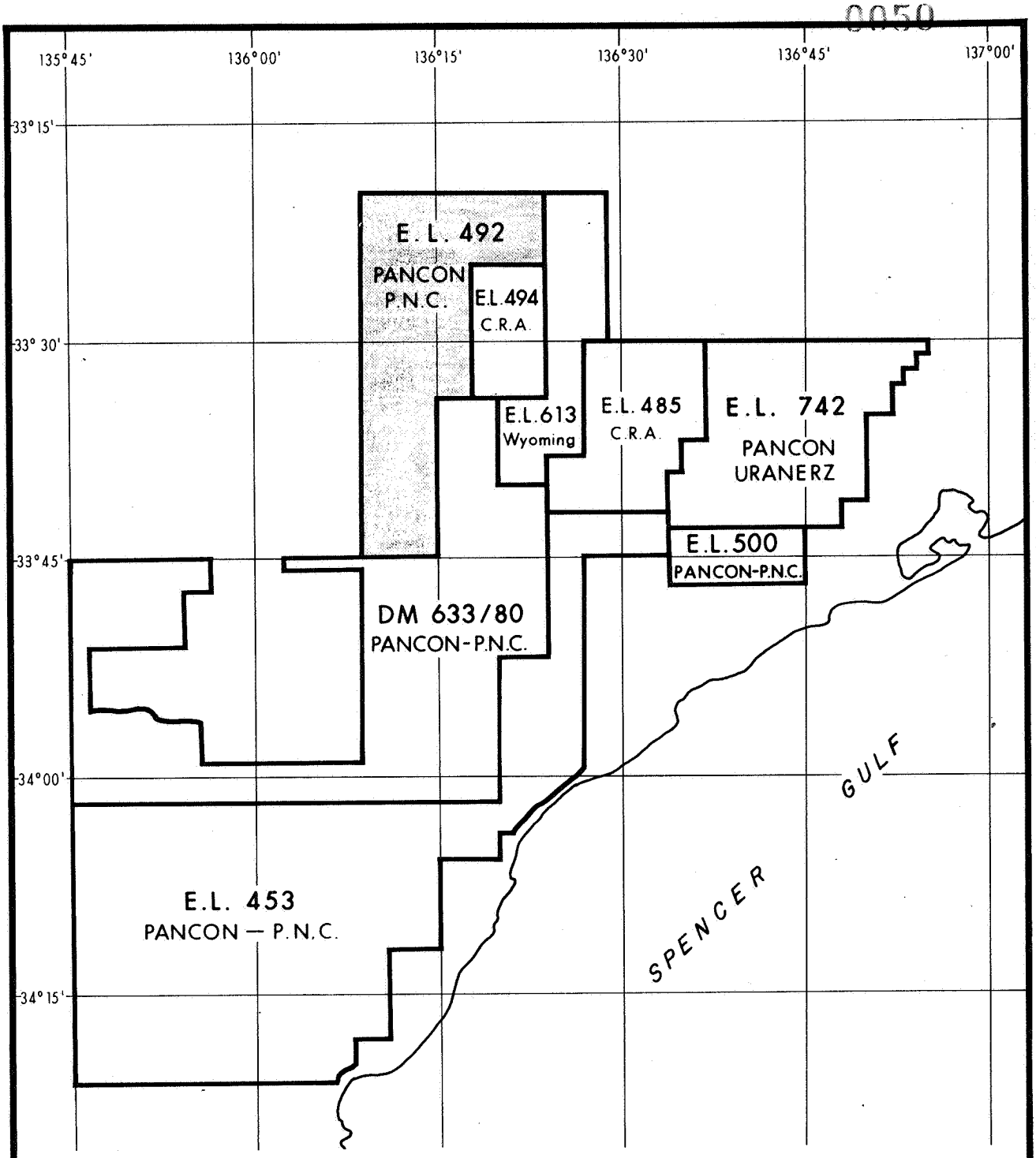
11 Geology, Radiometric Anomalies and Sample Locations Scale 1:2,500

12 Magnetics Scale 1:2,500



PANCONTINENTAL MINING LIMITED

E.L. 492
EYRE PENINSULA, S.AUSTRALIA

0 10 20 30 40 50 60
KILOMETRES

FIG.1

0051

1.0 SUMMARY

An exploration programme was conducted between May and October 1980 in ~~the~~ Eyre Peninsula over E.L. 492.

One main area of interest at Cockabidnie was investigated.

2.0 GENERAL

2.1 Introduction

E.L. 492 was mapped jointly with other E.L.'s held by this joint venture on the Eyre Peninsula.

The objectives of the programme were:

(1) To conduct detailed surveys over areas delineated as 'target zones' during the 1979 field programme

(2) To conduct a follow-up programme on anomalies located during the 1979 airborne geophysical survey

The field party consisted of three geologists, three field assistants and a cook, although all were not engaged on any particular E. L. at the same time.

This report on the 1980 programme is intended to be read in conjunction with the 1979 report. Geologic descriptions and interpretations stated previously are not repeated and this report will emphasise new results and conclusions.

2.2 Tenement Status

E.L. 492 was granted to Pancontinental Mining Limited and Power Reactor and Nuclear Fuel Development Corporation on 15 June 1979 for a period of one year with an annual expenditure of $45,000. An application for an extension of term for an additional one year was granted with an additional expenditure of $45,000.

0052

3.0 REGIONAL GEOLOGY

3.1 Introduction

The regional geology of the Eyre Peninsula has been described in considerable detail in the 1978 and 1979 Final Reports. Detailed descriptions of some recently recognized lithological variants in E.L.'s 415 and 500 are discussed in the following Sections 4.5 and 4.1 respectively.

3.2 Stratigraphy

The stratigraphic nomenclature, revised in the 1979 Final Report, will be used in this report. The stratigraphic sequence is as follows:

Age	Stratigraphic Group	
Middle Proterozoic	Blue Range Beds	
~~ unconformity ~~~~~~~~~~		
Lower Proterozoic	Hutchison Group	Yadnarie Schist
		Mount Shannon Formation
		Mangalo Schist
		Katunga Dolomite
		Warrow Quartzite
~~?~~~~?~~ unconformity ~~?~~~~?~~		
Archean ?		Minbrie Complex
		Lincoln - Plug Range Complex
		Coolanie Complex
Archean		Sleaford Complex

0053

4.0 COCKABIDNIE GRID

4.1.1 Introduction

The Cockabidnie area was selected as a zone of considerable potential for uranium mineralisation following the 1979 regional mapping programme. Although very poor outcrop conditions exist on E.L. 492, the mapping and geochemical sampling of E.L. 494 (CRA) during 1979, delineated three Katunga Dolomite zones exhibiting uranium and base metal anomalism (up to 750 ppm U, 1750 ppm Cu, 750 ppm Pb and 9700 ppm Zn). The airborne geophysical survey detected subtle magnetic peaks associated with these anomalous horizons, enhancing extrapolation into the Cockabidnie area, where the horizons are overlain by the Blue Range Beds and extensive Cainozoic cover.

A total of 52.8 line kilometres of detailed geological mapping, radiometrics and ground magnetics, were conducted on a 10 x 50 metre grid over the Carpentarian unconformity in the Cockabidnie area (Plate 11).

4.1.2 Geological/Radiometric Mapping

Extensive sand and soil cover obscured most of the Lower Proterozoic geology on the Cockabidnie Grid. With the exception of two small outcrops, most of the areas of Mangalo Schist have been mapped on the presence of highly bleached and laterised schist and vein quartz gravel and rubble.

Highly bleached, slightly graphitic, Mangalo Schist is directly overlain by Blue Range Beds conglomerate at AMG 6288550N/619750E. Ferruginous clays at the unconformity exhibit radiometric anomalism up to 250 cps (5 x background), however, geochemical sampling confirms a thorium source for the anomalism.

A zone of lateritised Mangalo Schist and vein quartz rubble, adjacent to the unconformity at AMG 6288300N/620300E, is associated with radiometric anomalism up to 95 cps (2 x background). No spot highs were located in the area and the significance of the anomaly is not known at present.

The sandstones and conglomerates of the Blue Range Beds form low hills over most of the southern portion of the grid. In the central and eastern parts of the grid, conglomerates contain cobbles of vein quartz, Warrow Quartzite and banded iron formation (probably Mt. Shannon Formation). The boulder conglomerates of the southwestern Cockabidnie Grid are composed primarily of highly silicified and ferruginous Katunga Dolomite. This alteration occurred prior to the deposition of the Blue Range Beds and probably during the Carpentarian weathering hiatus.

The sandstones overlying the basal conglomerate range from well-sorted, cross-bedded, quartz sandstone, to poorly sorted micro-conglomerates.

A zone of intense hematisation occurs within the conglomerates and micro-conglomerates, adjacent to the Carpentarian unconformity. The alteration ranges from a pervasive hematisation of the conglomerate matrix, to cross curring hematite breccias and massive ironstones (AMG 628796N/619580E). The age of the hematite alteration is

uncertain. A Tertiary age is unlikely as unaltered sandstone and conglomerate is observed to overlie the hematised zone at a number of localities. The close spatial relationship between the zone of hematisation and the unconformity would suggest a regolithic origin of Carpentarian age for the zone. Hematite breccias, however, are observed to transect sedimentary bedding, which is inconsistent with a Carpentarian age. The slickensided and brecciated structure of the massive hematite is also consistent with an oxidised chlorite origin (refer to Section 4.1.2) during a post-Carpentarian period of alteration.

The radiometric response of the Blue Range Beds typically ranges from 60 - 100 cps for conglomerate and 60 - 80 cps for sandstone outcrops. A radiometrically anomalous zone (80 - 110 cps/bgd. 50 - 70 cps), associated with comglomeratic gravels at AMG 6287890N/619100E, warrants further investigation. A hematite-quartz breccia (?) cobble (sample number 15039) to the south of the zone returned a slightly anomalous copper and insignificant uranium assay. The origin of this breccia, and the quartz-hematite breccia at sample location 15045, is not known.

The zone of hematised conglomerate is associated with radiometric anomalism up to 1.5 x background and ranges from 80 - 150 cps. The radiometric anomalism is due to slightly enhanced uranium and thorium concentrations.

The radiometric anomalism (80 - 95 cps), associated with the brown soils in the southeast corner of the grid, exhibits coincident ground magnetic anomalism. This anomalism may reflect the presence of Katunga Dolomite below the Blue Range Beds and so increases the significance of the radiometric anomaly. As the magnetic anomaly was not recognised in the field, and no outcrop exists in the anomalous area, no geochemical samples were collected. Further investigation of this anomaly is warranted.

4.1.3 Ground Magnetic Survey

A computer contour map of the Cockabidnie ground magnetic survey is presented on Plate 12. The strong regional magnetic gradient, decreasing to the northwest, has necessitated the production of a residual magnetic intensity plot, which is not available for interpretation at present. Two preliminary observations on the ground magnetics are as follows:-

(a) A zone of complex magnetic patterns occurs in the southeast portion of the grid. The presence of coincident magnetic and radiometric anomalies enhances the significance of this area, although no outcrop was located. The northerly extension of the magnetic zone may reflect the Katunga Dolomite trending in from the northeast (Plate 10).

(b) A strong northwest - southeast trend in the southwest corner of the Cockabidnie Grid coincides with a soil-filled valley. The linearity of the trend and its orientation perpendicular to the regional magnetic trend, suggests that it may represent a fault. Sub-parallel trends in the central and southeastern grid may similarly reflect cross-cutting faults.

4.1.4 Geochemical Sampling

A total of 11 geochemical rock chip samples were collected from Cockabidnie Grid. No significant uranium results were obtained.

The radiometric anomalism, associated with the three lateritised Mangalo Schist samples (Sample Numbers 15038, 15047 and 15048), is due to thorium concentrations. Sample 15048 contained a calc-silicate or amphibole mineral which is reflected in the slightly anomalous copper assay (55 ppm Cu). The radiometric anomalism associated with the sericite and clay filled slickenside transecting unaltered sandstone (Sample No. 15040) and with the ferruginous clays at the Carpentarian unconformity near 15046, is also due to thorium concentration.

0057

The samples collected from the zone of ferruginised Blue Range Beds (15041 - 15044) all exhibit slight uranium and thorium anomalism, with uranium and thorium present in approximately equal proportions. The associated anomalous lead values could reflect the presence of radiogenic lead.

The two hematite quartz breccia samples (15039 and 15045) yielded slightly anomalous copper assays with insignificant uranium.

0058

5.0 AIRBORNE GEOPHYSICAL SURVEY

5.1 Introduction

The airborne geophysical survey conducted during 1979 by Geoex Pty. Limited was described in the 1979 Final Report. Problems with the Geoex computer system delayed final data presentation until April, 1980. The 1979 Report stated that Dr. D. Pratt of Geospex Associates would present a regional evaluation of the magnetic data prior to the commencement of the 1980 season. The concept of so large a report was abandoned in favour of detailed evaluations of specific areas when required. Specific areas for detailed interpretation will be delineated during 1981.

5.2 Computer Processing and Evaluation of Data

All the geophysical data was processed through the Pancontinental computer system. Stack profiles of altitude, magnetics, total count radiometrics, uranium, thorium, potassium, U/Th and U/K were plotted for each flight line. An "anomaly rating" profile was generated by Dr. Pratt. This profile weighted those anomalies with high uranium and U/Th values, over total count anomalies which primarily only reflect broad increases in radiometric background. Final data assessment was by detailed manual examination of the stack profile sheets and then plotting of significant radiometric and magnetic anomalies onto 1:25,000 scale orthophoto basemaps.

All anomalies delineated by the computer processing and subjective evaluation were listed on computer compatible data sheets for ground follow-up. Preliminary ground reconnaissance data was entered on the sheets for further computer processing requirements.

0059

5.3 Anomaly Follow-Up

Anomalies located by the airborne survey have been evaluated by ground follow-up. The methods employed include reconnaissance radiometric/ground magnetic traverses to locate the source of the airborne anomaly, followed by detailed mapping and sampling of significant anomalies.

The airborne anomalies located on E.L. 492 were mostly due to exposures of lateritic soils or gravels (50 - 120 cps) in areas of aeolian sand of very low radiometric background (20 - 40 cps). Most of these anomalies proved insignificant with the exception of some coincident radiometric-magnetic anomalies.

0060

6.0 CONCLUSIONS

One priority area of Cockabidnie and one lower priority area southeast of Cockabidnie where a strong magnetic trend, associated with regionally anomalous Katunga Dolomite to the northwest, is overlain by Blue Range Beds, have been delineated by the 1980 E.L. 492, Eyre Peninsula Programme.

The investigation of anomalies located by the airborne geophysical survey is a continuing programme and is anticipated to delineate other anomalous zones warranting detailed follow-up exploration.

0061

7.0 RECOMMENDATIONS

Detailed grid geology, radiometrics, ground magnetics and geophysical sampling is warranted over the area southeast of Cockabidnie.

Trenching and shallow augre drilling and if warranted, deep percussion and core drilling may be required at Cockabidnie.

0062

8.0 EXPENDITURE

Expenditure for the quarter amounted to $9,285 comprising the following costs:

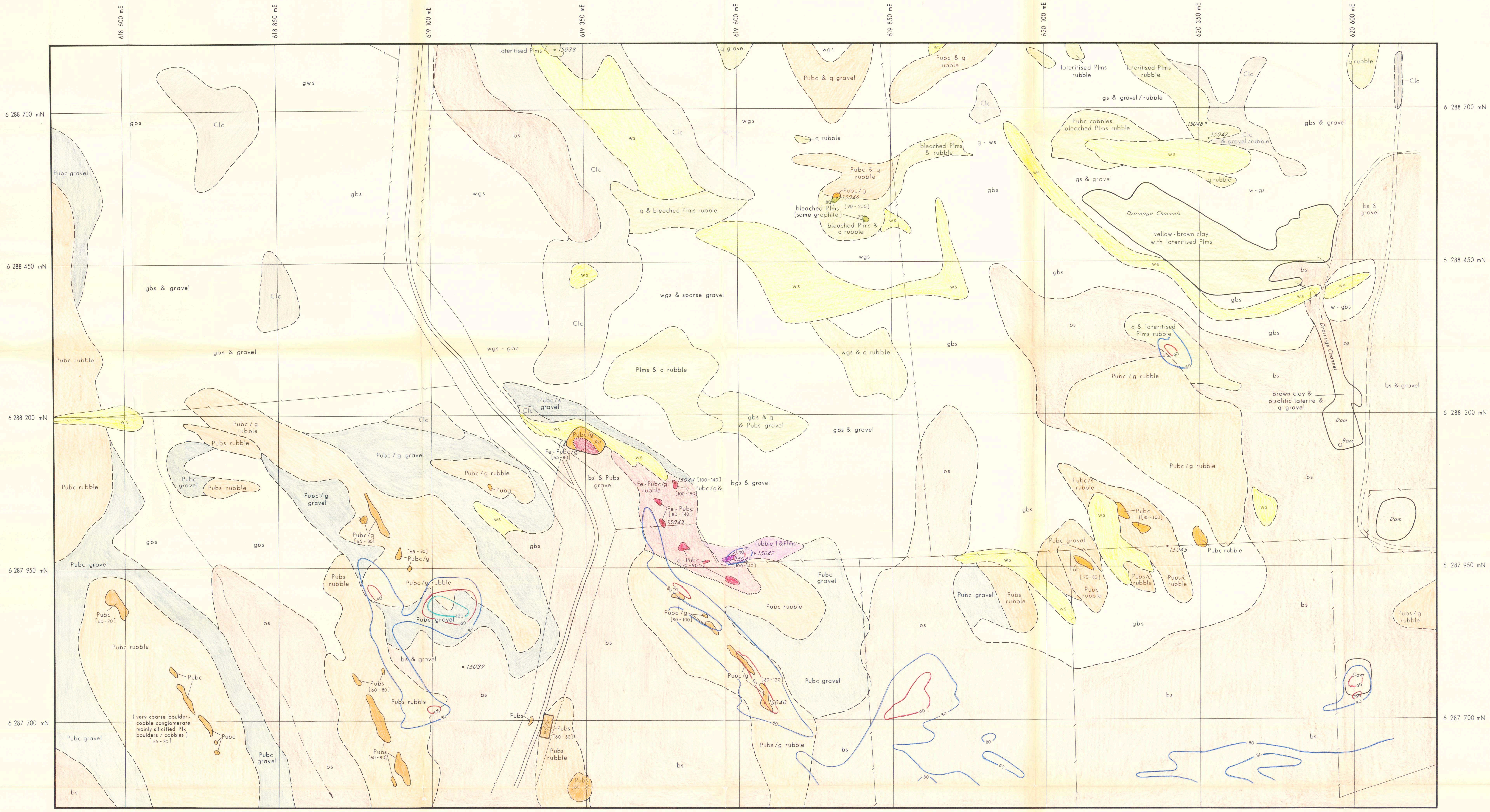
E.L. 492

Cumulative Expenses - 16 October 1980 to 15 January 1981

	$
Salaries and On Costs	6,223
Travel and Accommodation and Related Costs	201
Contractors Services	
Freight	8
Analytical Costs (assaying)	97
Petrographic Studies	
Geophysical Consulstants	22
Computer	
Data Processing	225
Field and Other Expenses	
Expendable Field Supplies, Airphotos Maps and Reports	40
Camp Expenses	
Food	419
Expendable Camp Supplies	99
Fuel and Lubricants	193
Camp Equipment Repairs and Maintenance	11
Camp Equipment Rental/Leasing	
Field Office Supplies	1
Housing Rental	27
Transportation	
Toyota Repairs and Maintenance	101

0063

	$
Sydney Field Expenses	407
Sub-Total	8,074
Fixed Assets and Overheads	1,211
TOTAL EXPENSES	$9,285



LEGEND

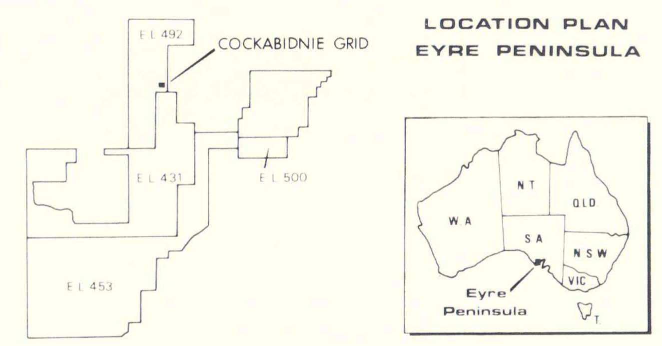
QUATERNARY	ws	White to light grey aeolian sand	Colour code: w. — white, g — grey, b — brown
	wgs	Grey to grey brown sand and silt	
	bs	Brown to red brown silt and sand	
	Clc	Calcrete	
	Pub grav	Gravels derived from the Blue Range Beds	
MIDDLE PROTEROZOIC	Pubs/g	"BLUE RANGE BEDS" - medium to coarse grained quartz sandstone (s) and grit (g). Friable to indurated.	outcrop / rubble
	Pubc/g, Fe	- coarse pebble to boulder conglomerate and grit. Some intensely hematised (Fe) conglomerate / grit near the unconformity.	outcrop / rubble
		Ironstone - massive hematite / limonite / goethite associated with Fe - Pubc	outcrop / rubble
LOWER PROTEROZOIC	Plms, q	"MANGALO SCHIST" - laterised and bleached quartz - biotite schist / microgneiss, some with garnet or sillimanite (?) Pegmatite (o) and vein quartz (q) common	outcrop / rubble

Symbol	Meaning
Pubc	Outcrop boundary
	Soil / rubble boundary
70	Dip and strike of beds
80, 90	Radiometric contours (only readings >80 c.p.s. contoured)
[100 - 140]	Radiometric reading on outcrop (c.p.s.)
• 15041	Geochemical sample location
	Road / track
	Fence
	Pit, dam, drainage channel
	Drainage

ASSAY RESULTS (p.p.m)

SAMPLE Nº	U	Th	Cu	Pb	Zn	Ni	Co	%Fe	Mn
15038	<4	26	12	26	2	<4	<4	24·0	50
15039	6	8	75	6	4	4	<4	17·0	38
15040	<4	48	4	22	4	4	<4	1·55	40
15041	10	10	6	16	2	<4	<4	39·5	34
15042	18	14	4	14	2	<4	<4	33·0	28
15043	14	16	8	24	4	<4	<4	16·5	32
15044	20	30	12	36	4	<4	<4	30·5	16
15045	<4	16	60	10	4	<4	<4	8·50	110
15046	20	65	<2	8	2	<4	<4	2·30	12
15047	<4	48	8	32	2	<4	<4	20·5	28
15048	<4	28	55	24	2	<4	<4	23·5	42

LOCATION PLAN
EYRE PENINSULA



PANCON

Exploration & Production Division

PANCONTINENTAL MINING LIMITED

PANCON-PNC JOINT VENTURE

EYRE PENINSULA, S.AUSTRALIA

E.L. 492 COCKABIDNIE GRID

GEOLOGY, RADIOMETRIC ANOMALIES & SAMPLE LOCATIONS

SCALE 1 : 2 500

0 50 100 150 200 250
METRES

Compiled C.R.W.	Date	Dwg Nº 11/S/D/13	
Drawn L.R.	Date 5-12-1980	PLATE 11	

RECEIVED 17 FEB 1981 DEPT. OF MINES AND ENERGY SECURITY 3551

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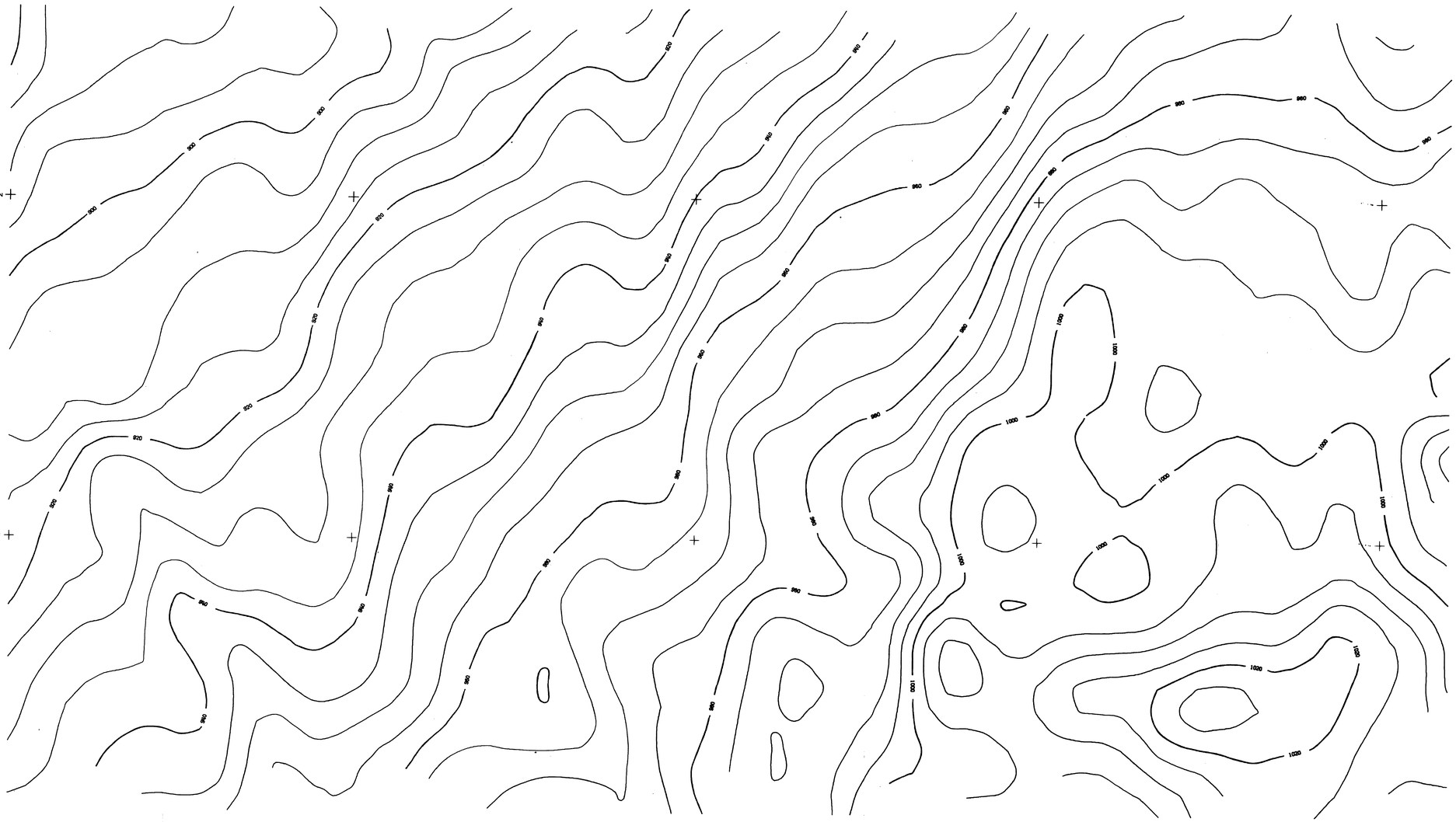
618 500 E | 619 000 E | 619 500 E | 620 000 E | 620 500 E

6 289 000 N

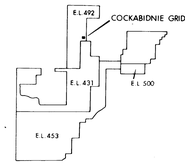
6 288 500 N

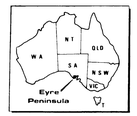
6 288 000 N

6 287 500 N



LOCATION PLAN
EYRE PENINSULA





All contours are relative to a base of 58,000 ϒ
Instrument : Geometrics G 816/826 A Magnetometer .

Exploration & Production Division
PANCON

PANCONTINENTAL MINING LIMITED

PANCON-PNC JOINT VENTURE
EYRE PENINSULA, S.AUSTRALIA
E.L. 492 COCKABIDNIE GRID

MAGNETICS

SCALE 1 : 2 500
0 50 100 150 200 250
METRES

Compiled A.D.	Date	Dwg Nº 11/S/E/22
Drawn	Date 5 12 1980	PLATE 12

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17 FEB 1981
DEPT. OF MINES AND ENERGY SECURITY 3551

3551(I)-5

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49.100.6 0064

E.L. 492, DARKE PEAKE
QUARTERLY REPORT FOR THE PERIOD
16TH JANUARY TO 15TH MARCH 1981

FOR THE

PANCONTINENTAL MINING LIMITED/
POWER REACTOR & NUCLEAR FUEL DEVELOPMENT CORPORATION
JOINT VENTURE

BY

PANCONTINENTAL MINING LIMITED
(OPERATOR)

SYDNEY, N.S.W.
APRIL, 1981

RECEIVED
7 MAY 1981
DEPT. OF MINES AND ENERGY SECURITY
3551

INTRODUCTION

This report summarizes work completed during the period 16th January to 15th March 1981 on E.L. 492, Darke Peake, Eyre Peninsula.

GENERAL

E.L. 492 was granted to the Joint Venture on 15th June 1979 for a period of one year with an annual expenditure of $45,000. An application for an extension of twelve months to 15th June 1981 was granted.

The E.L. is one of five held in the area by the Joint Venture and all areas are mapped jointly.

WORK COMPLETED

Work continued in the office of appraisal of previous field work and the airborne datas. A brief trip to the field was made in February for familiarization.

EXPENDITURE

Total expenditure for the quarter amounted to $4,578 comprising the following costs :-

Salaries & Oncosts	$1,922
Travel & Accommodation & Related Costs	$ 250
Geophysical Consultant	$ 28
Sydney Field Expenses	$ 281
Sub Total	$2,481
Fixed Assets & Overheads	$2,097
TOTAL EXPENSES	$4,578

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0066

E.L. 492, DARKE PEAKE
QUARTERLY REPORT FOR THE PERIOD
16 MARCH TO 14 JUNE 1981

FOR THE

PANCONTINENTAL MINING LIMITED/
POWER REACTOR AND NUCLEAR FUEL
DEVELOPMENT CORPORATION JOINT
VENTURE

BY

PANCONTINENTAL MINING LIMITED
(OPERATOR)

SYDNEY N.S.W.
AUGUST, 1981

RECEIVED
20 AUG 1981
DEPT. OF MINES
AND ENERGY
SECURITY
3551

INTRODUCTION

This report summarises work completed during the quarter 15 March - 14 June 1981 on E.L. 492 Darke Peake, Eyre Peninsula.

GENERAL

E.L. 492 was granted to the Joint Venture on 15 June for a period of twelve months with an annual expenditure of $45,000. A subsequent application for an extension of twelve months was granted and application for renewal for a further twelve months submitted to Mines.

WORK COMPLETED

No work was carried out on E.L. 492 during the quarter.

PROPOSED WORK

A field crew will commence work in August in the area. The main work area will centre on the Cockabidnie prospect where the grid will be extended to the east and southeast, where it will be mapped for geology, magnetics, radiometrics and a sirotem geophysical survey conducted. Percussion drilling is planned dependent on results on the above.

EXPENDITURE

There was no expenditure on the E.L. during the quarter.

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0068

PANCONTINENTAL MINING LIMITED
PNC EXPLORATION (AUSTRALIA) PTY. LIMITED

AFMECO PTY. LIMITED

EXPLORATION LICENCE 893
DARKE PEAKE - EYRE PENINSULA
QUARTERLY REPORT - 28 SEPTEMBER 1981 TO 27 DECEMBER 1981

PANCONTINENTAL MINING LIMITED
EXPLORATION AND PRODUCTION DIVISION

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PLATES

1. Cockabidnie - Regional Geology and Airborne Magnetic Trends 1:25,000

FIGURES

1. Location Diagram

0071

1. SUMMARY

Exploration for unconformity related uranium deposits was conducted between August 1 and December 22 on Eyre Peninsula Exploration Licence 893, held by the Joint Venture (Pancon/PNC/AFMECO). Exploration was also conducted on adjoining E.L's 803, 867 and 901 also held by the Joint Venture.

The 1981 programme has consisted of gridding, ground radiometric and magnetometer surveys, radon surveys, SIROTEM transient electromagnetic (TEM) surveying, trenching and percussion drilling.

A priority area at Cockabidnie was outlined by work conducted in 1979 and 1980. A similar geologic target has been defined as that in other areas, namely Lower Proterozoic Katunga Dolomite or graphitic Mangalo Schist overlain by Middle Proterozoic Blue Range sandstone.

At Cockabidnie, ground geophysics failed to trace the prospective Katunga Dolomite unit across the grid, however, deep pitting has located dolomite in at least one area and appears to confirm the interpreted trend of the unit.

2. CONCLUSIONS & RECOMMENDATIONS

Interpretation of the available data leads to the following conclusions:

1. Cockabidnie:

   Geophysics have failed to trace the prospective Katunga Dolomite across the area to the Blue Range Sandstone. However, this area remains a potential target.

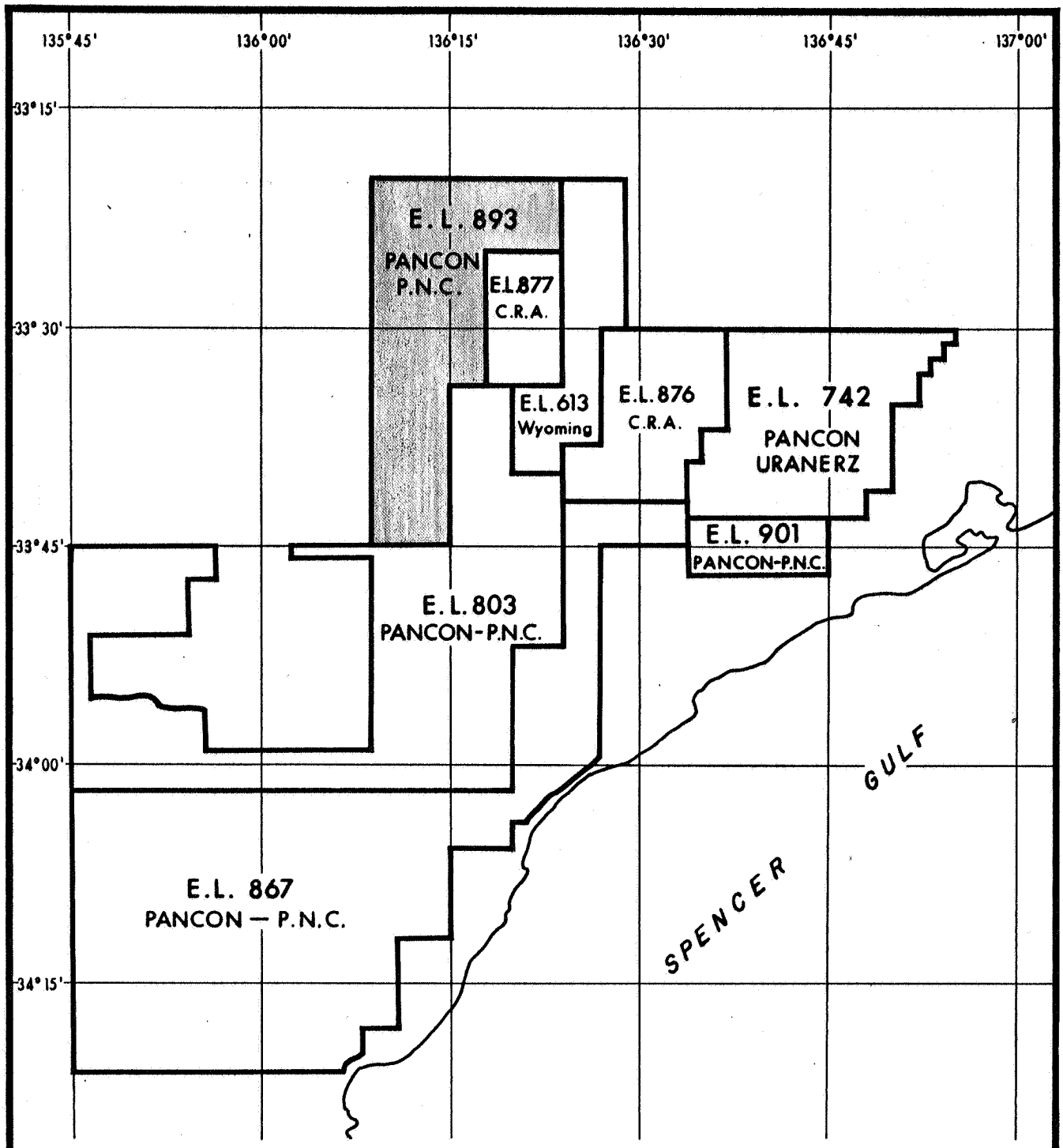
Continued exploration is warranted; the following programme is recommended:

<u>COCKABIDNIE</u>

Extensive shallow auger and percussion drilling is required to define the detailed geology within the area of interest.

Detailed radon surveying is required to follow-up anomalies located in 1981.

Reconnaissance of other areas within the disposition is warranted.



PANCONTINENTAL MINING LIMITED

EYRE PENINSULA, S. AUSTRALIA

0 10 20 30 40 50 60

KILOMETRES

0073

REGIONAL

A re-evaluation of the regional geology and examination of anomalies located by the 1979 airborne survey which have not been field checked is necessary.

3. GENERAL

INTRODUCTION

The 1981 exploration programme on E.L. 893 held by the Afmeco Joint Venture, was conducted between August 1 and December 22, 1981.

The objectives were:

1. To pinpoint drilling targets within those areas previously identified as having significant potential, utilising such geological, geochemical or geophysical techniques deemed necessary.

2. To excavate trenches where prospective areas are covered by overburden.

3. To test, by drilling, anomalous areas and areas where favourable lithologies are present.

The field party consisted of one permanent geologist, one temporary junior geologist, and three field assistants. While most of the planned activities were completed, the drilling program was not. Delays in completion of the Joint Venture Agreement with Afmeco delayed the start of the drill program until November 5. Drilling planned at Cockabidnie, however, was only completed on one other E.L. The proposed 1982 programme includes testing of the area at Cockabidnie.

Reference to previous Annual Joint Venture Reports is essential as known geological descriptions and interpretations are not repeated in this report.

STATUS OF TENEMENT

Exploration Licence 893 was granted on September 9, 1981 for a period of 12 months over an area of 628 square kilometres with an annual expenditure commitment of $45,000.

0074

EXPENDITURE

Accumulated expenditure to 31st January 1982 has amounted to $16,153 comprising the following breakdown of costs:

Salaries, Travel, Accommodation and related costs	3,244
Contractors Services	
Assaying	218
Data processing	507
Geophysical survey	6,072
Geophysical consultant	274
Trenching	519
Field Expenses	1,848
Sydney field expenses	1,303
Fixed assets and overheads	2,168
TOTAL	$16,153

4. REGIONAL GEOLOGY

INTRODUCTION

The regional geology of the Eyre Peninsula has been described in previousreports. Detailed descriptions of lithological units have also been presented in conjunction with discussion of specific targets. No significant variations were noted during work in 1981.

STRATIGRAPHY

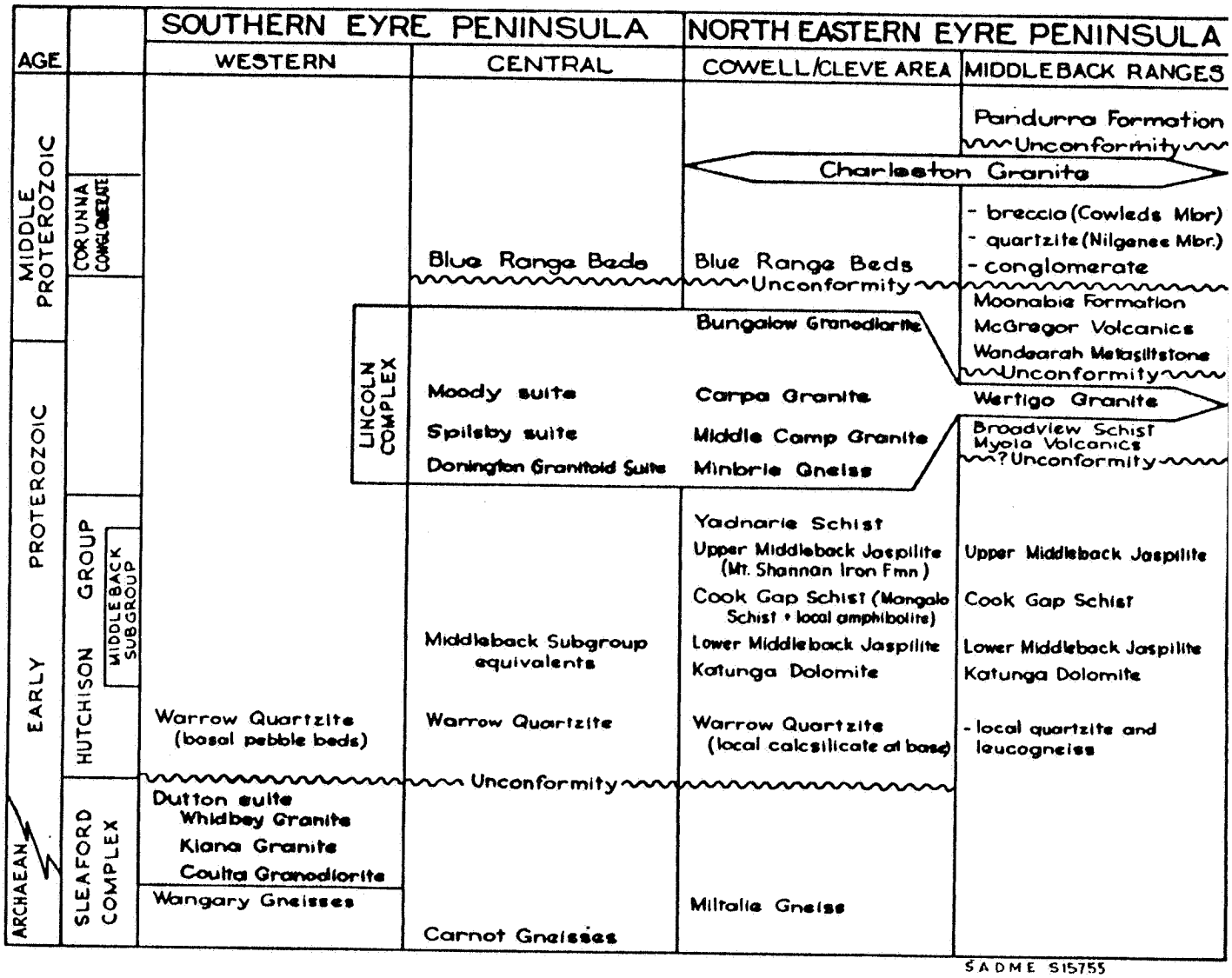
The stratigraphic nomenclature used previously and as shown on the accompanying figures is the same as that used in previous reports.

Recent published work by Dr John Parker and others however, has suggested several minor modifications. The Precambrian stratigraphy of the Eyre Peninsula is shown on Table 2. Of particular significance is the assignment of the Lincoln-Plug Range-Coolanie Gneiss Complex to the Early Proterozoic.

0075

TABLE 1

PRECAMBRIAN STRATIGRAPHY OF EYRE PENINSULA



5. DETAILED SURVEYS

0076

Activities performed during 1981 are summarised in Table 3. Extensive regridding was necessary in many locations because grids established in previous years had been removed from croplands. In a similar fashion, most of the grids established in the current programme have also had to be removed from the paddocks.

COCKABIDNIE GRID

Introduction

The Cockabidnie area was selected in 1980 as a zone of considerable potential for uranium mineralisation because of the presence of anomalous Lower Proterozoic Katunga Dolomite on adjacent leases which trend under Middle Proterozoic Blue Range sandstone on E.L.893.

The Regional Geology is shown on Plate 8. Detailed geology is described in the report.

The 1981 programme was designed to trace the anomalous Katunga Dolomite from known outcrop on leases to the east to the southwest on to E.L. 893. Ground radiometric, magnetometer, radon and SIROTEM surveys were performed. Limited trenching was also conducted.

Geophysical Surveys

A widely spaced grid, lines 500 m apart, was established for the SIROTEM survey. Ground radiometric and magnetometer surveys were conducted along these lines.

No significant radiometric anomalies were located by the scintillometer survey. Background values obtained over Lower Proterozoic units ranged between 25-55 cps. In the areas of Blue Range sandstone the background ranges from 60-80 cps.

The ground magnetometer survey failed to show any signifciant magnetic features. Magnetic trends interpreted on adjacent leases to represent the Katunga Dolomite and Mt Shannon Iron Formation do not appear to extend on to the Cockabidnie Grid area.

The data does show a strong magnetic gradient, decreasing to the north. A subtle change in slope of the regional gradient is apparent on several lines. No explanation of this feature is readily apparent.

TABLE 2 - TABLE OF ACTIVITIES

	Gridding (kms)	Radiometrics (kms)	Magnetometer (kms)	Radon (kms)	Mapping (kms)	Trenches (T) Pitting (P)	Sirotem (kms)
E.L. 893							
Cockabidnie	13.25	13.25	13.25	4.6		P - 21	110.0

0078

SIROTEM surveying was conducted across widely spaced lines in an attempt to trace the favourable Katunga Dolomite from adjacent properties to the east. There are no apparent trends which would be related to this unit.

Relatively low resistivity values representative of a two-layer pattern were measured. Variations reflect changes in thickness of the conductive upper layer (overburden) and the presence of slightly more resistive Blue Range sandstone. Local variations are interpreted to reflect shallow buried channels or possibly weak conductors.

Radon Survey

Several lines of radon surveying were performed on the eastern side of the grid. The Cockabidnie grid is covered by surficial layers of aeolian sand and has numerous sand hills and ridges. Radon should be an ideal technique to detect anomalous radioactivity below the sand layer.

One area of some significance was located on line 620500E between 6288800N and 6289200N. Readings up to 10 times background were recorded. Corresponding first minute to third minute ratios were generally low, indicating a uranium source.

This anomaly was repeated after a lapse of several days.

No significant increase in background readings were obtained over areas of Blue Range sandstone.

Trenching

Extensive sand and soil cover obscures most of the Lower Proterozoic geology on the Cockabidnie grid. With the exception of two small outcrops, most of the mapping has been done in the presence of highly bleached and laterized gravel and rubble.

Unfortunately, much of the grid is under crop this season, hence to avoid large compensation costs, pitting was confined to fallow paddocks and tracks. Twenty one pits were excavated primarily along line 620500E.

Bedrock was encountered in 75% of the pits at an average depth of 2.5 -3.0 metres. Highly laterised Katunga Dolomite, Mangalo Schist and possibly Mt Shannon Iron Formation were identified.

0079

No significant radioactivity was encountered in any of the pits. Radiometric values up to 260 cps were obtained from the Katunga and 350 cps for the Mangalo. Samples were obtained in each pit. The maximum uranium value measured was 12 ppmU with most of the samples having 4ppmU. No other elements showed significant anomalism.

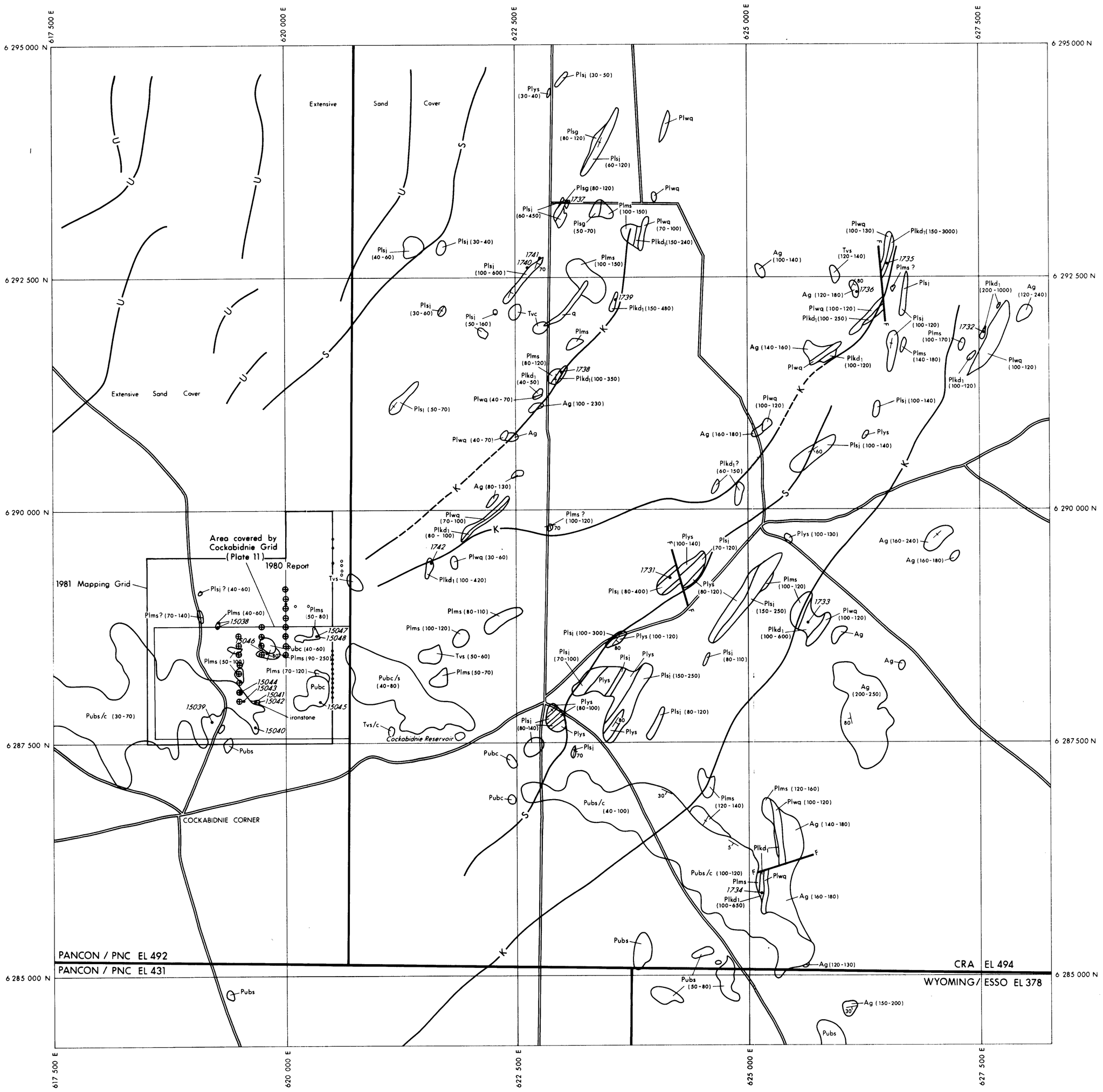
Drilling (Proposed)

The prime target at Cockabidnie is the extension of the Katunga Dolomite below the Blue Range sandstone.

Geological mapping is at best considered interpretative because of the paucity of outcrop. Geophysical techniques have been unsuccessful in tracing the Katunga Dolomite across the grid.

A programme of shallow percussion drilling was planned to provide information about the subsurface geology. Initially, three fences of holes approximately 20 m deep were planned to cross the rend of the prospective Katunga Dolomite and several holes were to test the depth of the Blue Range sandstone.

Unfortunately, for logistical reasons, drilling was postponed until the 1982 season.



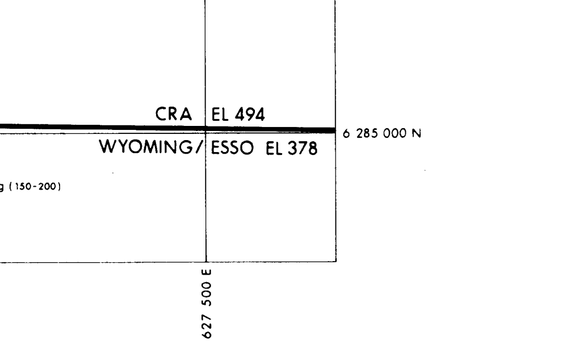
LEGEND

QUATERNARY	Clc	Calcrete
TERTIARY	Tvc/s	Conglomerate and sandstone, hematitic
?	Cg	Conglomerate - uncertain age
MIDDLE PROTEROZOIC	Pubs	'BLUE RANGE BEDS': Sandstone, minor arkose and grit (Pubs) with basal conglomerate (Pubc) and ironstone
	Pubc	
	q	Quartz vein
	p	Pegmatite
	Plg	'YOUNGER GRANITES': Adamellite, granodiorite, pegmatitic granite
LOWER PROTEROZOIC	Plys	'YADNARIE SCHIST': fine grained phyllite and schist
	Plsj, Plsg, Plsd	'MOUNT SHANNON IRON FORMATION': predominantly hematitic jaspilite (Plsj) with minor graphite schist (Plsg) and dolomite (Plsd)
	Plms, Plma	'MANGALO SCHIST': Quartz - biotite - feldspar - muscovite ± garnet ± sillimanite schist (Plms) with amphibolite and banded calc - silicate (Plma)
	Plkg, Plkj, Plkd2, Plkd1, Plks	'KATUNGA DOLOMITE': Silicified and ferruginous dolomite (Plkd1), with minor graphitic schist (Plkg), hematitic jaspilite (Plkj), calc - silicate (Plkd2) and uncommon basal quartz - feldspar - biotite schist (Plks)
	Plwq, Plwd	'WARROW QUARTZITE': predominantly quartzite and conglomeratic quartzite (Plwq) with basal dolomite - calc - silicates (Plwd)
ARCHEAN ?	Ac	'COOLANIE GNEISS COMPLEX': Gneiss, granite gneiss, migmatite and augen gneiss with minor amphibolite
	Ag	'PLUG RANGE - LINCOLN COMPLEX': Gneiss, augen gneiss, granite gneiss, migmatite and minor amphibolite
ARCHEAN	Ap	'SLEAFORD COMPLEX': Granite, diorite, porphyritic granite gneiss

ASSAY RESULTS (ppm)

Sample No.	U	Th	Cu	Pb	Zn
1731	110	< 4	450	30	1250
1732	110	14	18	240	200
1733	220	10	1750	750	1200
1734	750	20	15	45	120
1735	620	6	520	110	440
1736	290	14	570	75	770
1737	95	6	190	20	200
1738	75	8	110	200	9700
1739	600	4	410	250	1800
1740	16	150	420	90	280
1741	250	16	1300	65	470
1742	210	< 4	220	45	170
15038	< 4	26	12	26	2
15039	6	8	75	6	4
15040	< 4	48	4	22	4
15041	10	10	6	16	2
15042	18	14	4	14	2
15043	14	16	8	24	4
15044	20	30	12	36	4
15045	< 4	16	60	10	4
15046	20	65	< 2	8	2
15047	< 4	48	8	32	2
15048	< 4	28	55	24	2

- Geological boundary / outcrop
- 70 — Dip and strike of bedding
- F — F — Fault
- — K — Trend of airborne magnetic highs associated with Katunga Dolomite
- – – K – – Extrapolated airborne magnetic trends associated with Katunga Dolomite
- — S — Trend of airborne magnetic highs associated with Mt Shannon Formation
- — U — Trend of airborne magnetic highs - associated unit unknown
- (80 - 170) Scintillometer reading (cps)
- • 1735 Sample location and number
- Cockabidnie grid (10 x 50m spacing)
- Exploration Licence Boundary
- Road
- ⊕ Proposed drill hole locations
- o Pits
- 1981 Mapping Grid



PANCON — Exploration & Production Division

PANCONTINENTAL MINING LIMITED

PANCON - PNC - AFMECO J.V.

COCKABIDNIE - E.L. 893

EYRE PENINSULA, S. AUSTRALIA

REGIONAL GEOLOGY & AIRBORNE MAGNETIC TRENDS

SCALE 1: 25 000

0 500 1000 1500 2000 2500

METRES

Compiled C.R.W.	Date	Dwg No.	11/S/D/18
Drawn Cartoscope	Date 5.12.1980		PLATE 1

3551 (1) - 6

II

0080

REPORT ON A SIROTEM TRANSIENT EM SURVEY
AT COCKABIDNIE, SOUTH AUSTRALIA,
FOR PANCONTINENTAL MINING LIMITED

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PLATE 2 TEM Voltage Contours for Channel 12

0083

1. INTRODUCTION

Between 9th and 18th November, 1981, a SIROTEM Transient EM survey was carried out at Cockabidnie, South Australia for Pancontinental Mining Limited. The crew leader was Tom Steyn.

2. SURVEY EQUIPMENT

A MKII SIROTEM unit was used for this survey. These units have facilities for recording all information on cassette tape as well as on paper tape, and also an adjustable sferics rejection filter. In common with MKI units, they are flexible regarding the number of channels of data to be recorded and the number of stacks to be averaged to produce each reading.

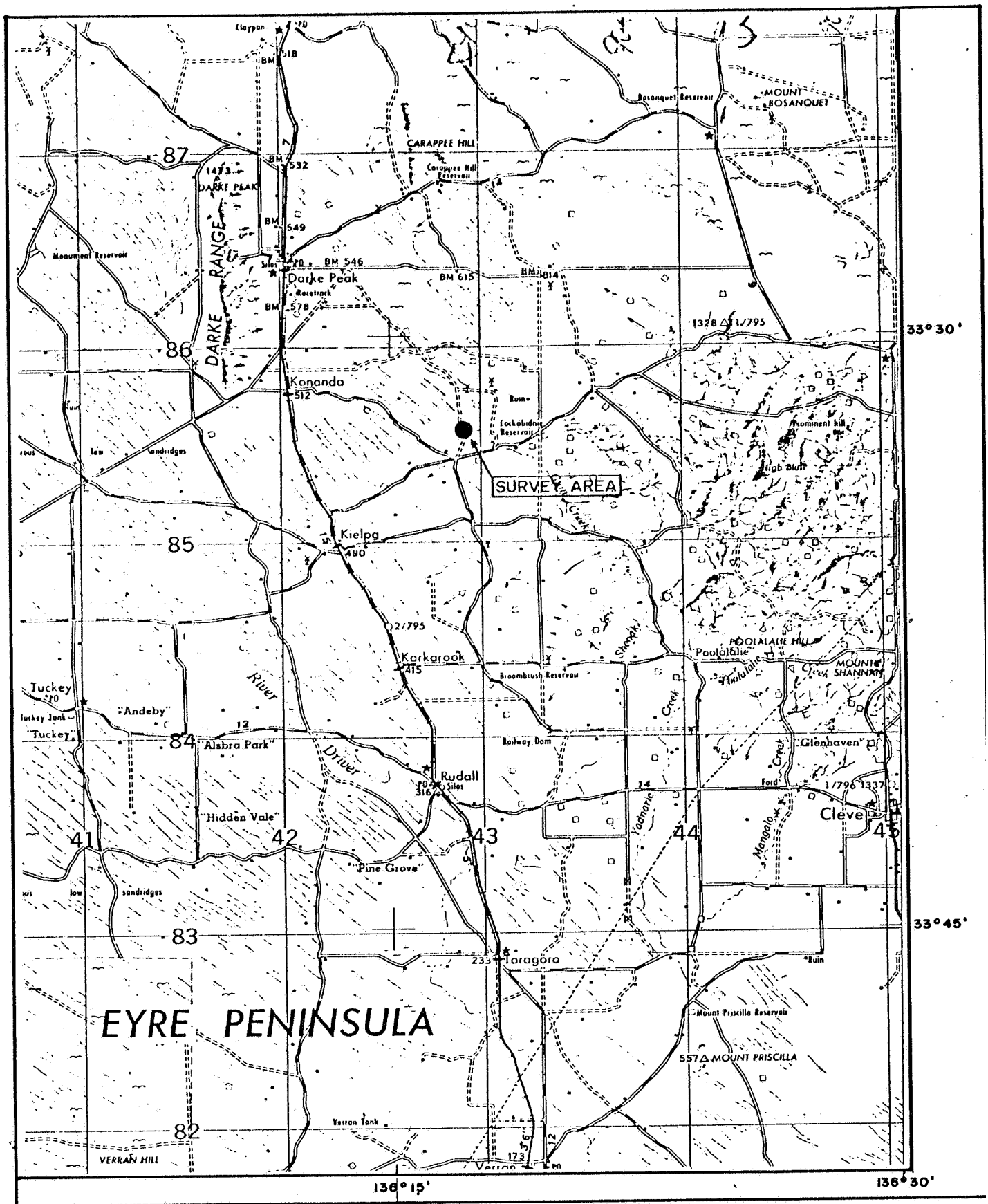
3. SURVEY DETAILS

The survey covered a grid at Cockabidnie, located 26 kilometres north-west of Cleve, South Australia, as shown on the location map (Figure 1). Five lines were surveyed oriented north-south and 500 metres apart. A list of the lines surveyed and their coverage is given in Table 1.

All lines were surveyed using the displaced transmitter receiver loop configuration, with a loop size of 100 metres and a station interval of 50 metres. The transmitter and receiver wires were displaced by 1.5 metres. The loop configuration is described in detail in the appendix to this report.

The operator reports that the grid area is of undulating terrain and mostly cultivated, with only minor areas of scrub. Access is quite good but there is little access along the survey lines because of the presence of crops.

0084



PANCONTINENTAL MINING LIMITED

COCKABIDNIE, S.A.

LOCATION MAP OF SURVEY AREA

SCALE 1: 250,000

FIGURE 1

TABLE 1

TRAVERSE DETAILS

Line	Range	Config-uration	Loop Size (m)	Station Interval (m)	No. of Stations
18500E	7550 - 9500N	Displaced	100	50	40
19000E	7500 - 9400N	Displaced	100	50	39
19500E	7500 - 9500N	Displaced	100	50	41
20000E	7500 -10000N	Displaced	100	50	51
20500E	7500 - 9950N	Displaced	100	50	50

All readings resulted from the stacking and averaging of 512 double pulses, that is effectively 1024 decay curves. Sferics activity was very low throughout the survey and it was usually possible to utilise a tight sferics filter setting of 25%, which resulted in less than 10 readings being rejected from each stack. The signal to noise ratio as indicated by the percentage mean error figure output by the SIROTEM, and by the duplicate reading taken at each station, is good down to a level of about 2 microvolts per amp with only the occasional noisy reading above this level. From 2 microvolts per amp down to 0.5 microvolts per amp, the data are rather noisier but still show the general pattern. The current output to the transmitter loop ranged from 5.5 to 6.5 amps.

4. DATA PRESENTATION

The data are presented in three forms, firstly, voltage profiles, which are the most generally useful for a situation where discrete conductors are being sought. Secondly, apparent resistivity time-distance plots, which are useful for determining where there is overburden and where any variations in regional resistivity occur, and thirdly, plan contours of the TEM voltage for channels 3 and 9. These channels were selected as representative of the early and later responses respectively. All of these data presentations are at a scale of 1:5,000 and are described in full in the appendix to this report.

5. INTERPRETATION

The results of this survey are shown in voltage contour form on Plates 1 and 2, as voltage profiles on Figures 2 to 6 and as apparent resistivity time-distance plots on Figures 7 to 11. The basic picture is shown most clearly in

0087

the apparent resistivity plots, and indicates that the resistivities present a two-layer picture, with a conductive near surface layer overlying more resistive material at depth. All of the resistivities are relatively low, with the upper layer ranging from 4 to 6 ohm-metres, and the lower layer around 20 - 30 ohm-metres. The thickness of the upper layer varies considerably from virtually invisible on some survey lines, while on other sections the lower layer is barely visible. This response pattern accounts for virtually all of the SIROTEM response variations throughout the grid.

The way in which the thickness of the upper layer varies is shown quite clearly on the voltage contours in Plates 1 and 2. So long as the resistivity variations fit an essentially layering model, then channel 3 can be regarded as sampling the shallower layers and channel 12 as looking appreciably deeper. Thus on Plate 2, the extensive area of low response in the centre of the survey area indicates shallower more resistive material, possibly the schist, while the south end of each line and the west side of the survey grid, particularly line 18500E, show much stronger signals indicative of greater conductivities and a greater thickness of the conductive upper layer. This is indicating the variations at a depth of perhaps 50 to 60 metres. Plate 1 on the other hand, which shows the voltage contours for channel 3, is not looking so deep and shows a lot more variation, although the same basic pattern is there. In addition to the areas of a thick conductive upper layer, this plan also shows the zones of higher response where shallower pockets of conductive upper layer material occur. It should be noted that the contouring on Plate 1 in particular is somewhat speculative and the continuity of some of the features in the north-east corner from line to line is by no means defined.

A correlation of this geophysical picture with the geology provided, indicates that the more resistive material is probably the Mangalo Schist, which the more conductive upper layer probably represents the Blue Range beds. Weathered material would also probably yield a resistivity closer to that of the conductive layer than the resistive. On the basis of this supposition, the central and north-eastern part of the survey area is underlain by the schist at relatively shallow depth, while this member gets considerably deeper to the south and west. More local features are shown on Plate 1 and probably indicate zones where the thickness of the upper layer is rather greater than elsewhere. However, it is also possible that these are indicative of more conductive zones within either of the top two layers, and there is a possibility that they are indicating a change in rock type. These are the only features of significance in the survey area apart from the possible stratigraphic information already mentioned.

6. SUMMARY

The SIROTEM survey over this area indicates relatively low resistivities in the range from 4-30 ohm-metres, varying in basically a two-layer pattern. It has been suggested that the variations result primarily from changes in the thickness of the conductive upper layer, which has been associated with the sandstone beds, the resistive lower layer being probably schist. The thickness of the upper layer increases considerably at the extreme south and west edges of the grid. Local variations interpreted as buried channels or possibly weak conductors have been detected and may be worth further follow-up. Such follow-up could be done by trenching or similar methods, since the target has to be very shallow.

Respectfully submitted
GEOEX PTY. LTD.

A.R. DODDS
Senior Geophysicist

No: 82634
18th December, 1981

ARD/pc1

APPENDIX

A. SURVEY EQUIPMENT

The SIROTEM equipment consists of a console, power pack, loop cable and connecting leads. SIROTEM has been designed to measure the transient decay over a larger number of channels than other instruments of this type, and to later time delays than ever previously possible. The particular advantage of later times is the ability to record conductors underlying highly conductive overburden and/or highly conductive surrounding hosts. SIROTEM records the transient over 32 contiguous channels out to a maximum time delay of 165 milliseconds. Table 1 gives the specific delay times for each channel. The instrument is very sensitive and has a low inherent noise. It has a degree of ambient noise rejection capability due to its ability to stack up to 4096 (2^{12}) separate readings to obtain the output average. This is performed simultaneously over all channels so that the background noise is common to all channels at the time of measurement. The readings corrected for output current variation are produced automatically on a printer. As opposed to dial readings, they are thereby objective, operator independent and in ready hard-copy form.

The instrument also has a significant amount of in-built data processing capability due to the incorporation of a microprocessor. Thus apparent resistivities - the resistivity the ground would have, were it homogeneous, to yield the response measured - can optionally be printed out for each channel in addition to the voltages.

B. LOOP CONFIGURATIONS

The standard loop configurations used for SIROTEM surveys are diagrammed in Figure A1.

TABLE A1

CHANNEL DELAY TIMES AND INTEGRATION WIDTHS

Channel No.	Nominal Mean Delay (msecs)	Nominal Width (msecs)	Actual Integration Window (msecs)
1	0.4	0.4	0.25 - 0.6
2	0.8	0.4	0.65 - 1.0
3	1.2	0.4	1.05 - 1.4
4	1.6	0.4	1.45 - 1.8
5	2.0	0.4	1.85 - 2.2
6	2.6	0.8	2.25 - 3.0
7	3.4	0.8	3.05 - 3.8
8	4.2	0.8	3.85 - 4.6
9	5.0	0.8	4.65 - 5.4
10	5.8	0.8	5.45 - 6.2
11	7.0	1.6	6.25 - 7.8
12	8.6	1.6	7.85 - 9.4
13	10.2	1.6	9.45 - 11.0
14	11.8	1.6	11.05 - 12.6
15	13.4	1.6	12.65 - 14.2
16	15.8	3.2	14.25 - 17.4
17	19.0	3.2	17.45 - 20.6
18	22.2	3.2	20.65 - 23.8
19	25.4	3.2	23.85 - 27.0
20	28.6	3.2	27.05 - 30.2
21	33.4	6.4	30.25 - 36.6
22	39.8	6.4	36.65 - 43.0
23	46.2	6.4	43.05 - 49.4
24	52.6	6.4	49.45 - 55.8
25	59.0	6.4	55.85 - 62.2
26	68.6	12.8	62.25 - 75.0
27	81.4	12.8	75.05 - 87.8
28	94.2	12.8	87.85 - 100.6
29	107.0	12.8	100.65 - 113.4
30	119.8	12.8	113.45 - 126.2
31	139.0	25.6	126.25 - 151.8
32	164.6	25.6	151.85 - 177.4

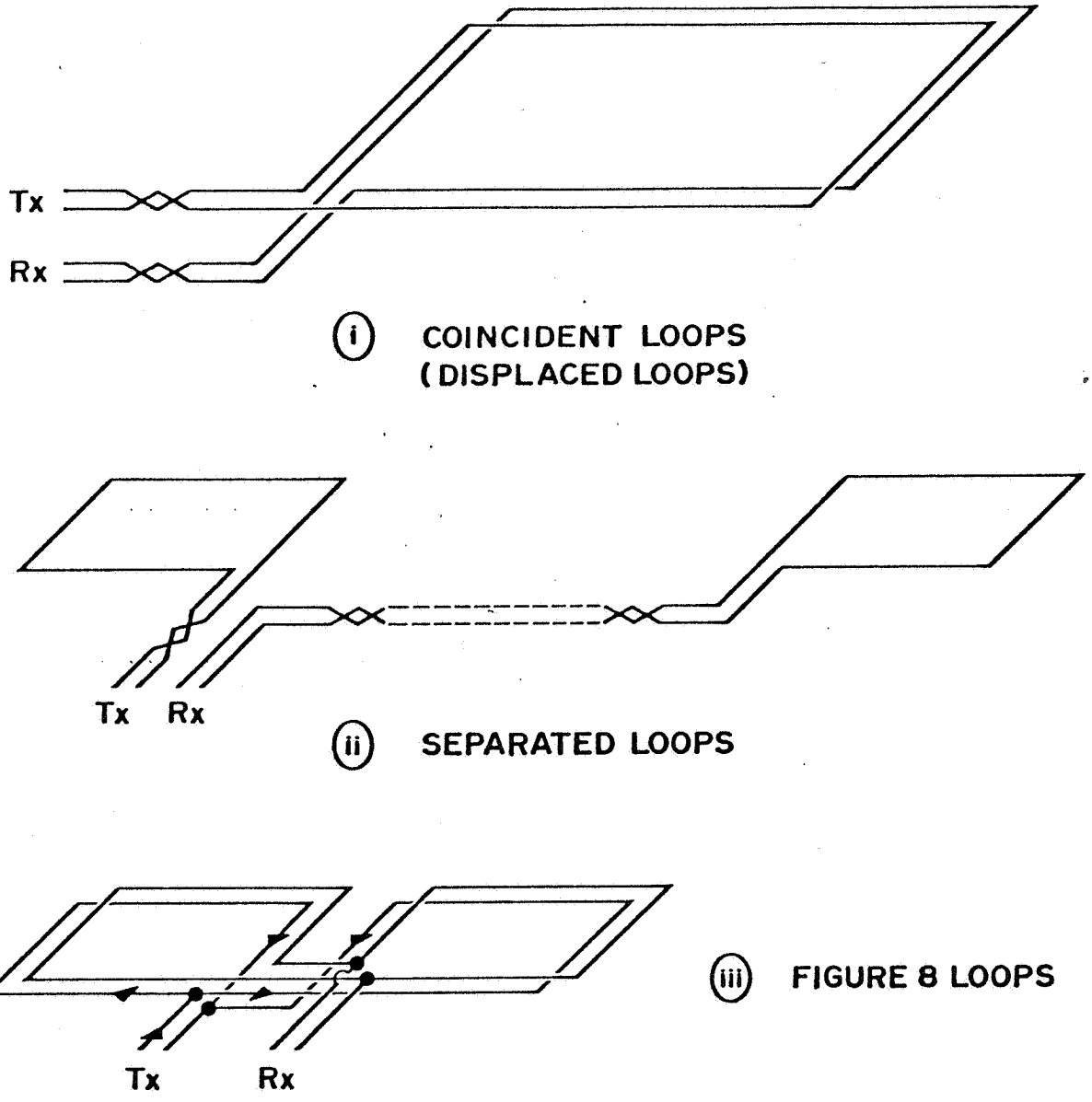


Figure A.1 Loop Configurations.

The most commonly used configuration for reconnaissance work is the coincident transmitter-receiver loop configuration. For this configuration, the transmitter and receiver loops are separated by a negligible distance or may even use the same wire. The loops are normally square with side length ranging from 25 - 200 metres, 100 metres being the most commonly used size. Adequate coverage is normally given by a station spacing of half the loop dimension, that is with a 50% overlap. Results of modelling studies, and experience, indicate that the depth penetration varies with the loop size and is, to an order of magnitude, equal to it. Thus with 100 metre square loops a depth penetration of the order of 100 metres can be expected.

The main advantages of the coincident loop configuration are that the wires are simple to move and thus a satisfactory data production rate can be achieved. Also the resulting data is relatively easy to interpret. The major disadvantage is that the configuration couples well with horizontal conductors, such as conductive overburden, so that the response from steeply dipping bedrock conductors can be swamped in the early channels. However. experience has shown that bedrock conductors usually result in satisfactory anomalies in the later channels, when the response from the overburden has died away. It might also be regarded as a disadvantage that the response for a narrow, steeply dipping conductor can be double-peaked, with a low response when the loops are directly over the conductor and high responses half a loop dimension to either side of the conductor itself. This can make the interpretation less obvious.

A variation of the coincident loop configuration has been devised for situations where the surface resistivities are very high or, more importantly, where strongly magnetic material is present in the immediate vicinity of the surface and close to the wires. This configuration is called the displaced loop configuration and is the same as coincident loops except that the transmitter and receiver loops are

off-set from each other by a distance of approximately 2 metres. Although more cumbersome to use than the coincident loop configuration, this method has the advantage that the results are guaranteed free from the contaminating effects of near-wire materials, and thus encourage more confident and more detailed interpretation.

Another frequently used layout is the separated loop configuration, also shown in Figure A1. For this configuration the transmitter and receiver loops are separated by distance, ranging from 1-3 loop dimensions, the loops themselves being usually 50 or 100 metres square. The station interval varies from a half to one loop dimension.

The separated loop configuration is rather more cumbersome in field use than coincident loops and requires more wire laid out on the ground. However, it has the advantages that it couples less well with conductive over-burden, at least in the early channels, and also produces an anomaly directly over the conductor, which can simplify interpretation considerably. It might be regarded as an advantage also that anomalies with this configuration have a negative polarity and frequently stand out more clearly with standard plotting techniques. A disadvantage of the configuration is that the response from a homogeneous or two-layer half space is more complex, with a change in polarity frequently occurring between early and late channels. Additionally the effect of a vertical or steeply dipping change in sub-surface resistivity can cause a response which looks like the anomaly from a discrete conductor.

The third basic loop configuration, which is less commonly used, is the figure eight configuration, as shown in Figure A1-C. This configuration was designed specifically to maintain the advantages of coincident loops, but also increase the coupling to vertical conductors. The wires are

coincident but have a more complex figure eight pattern. The configuration is, therefore quite cumbersome to use in the field, but has the advantages that vertical conductors couple rather better than with coincident loops and, most significantly, an anomaly is produced directly over the conductor, as well as minor anomalies on either side. This configuration is normally only used in detailing or specific interest situations.

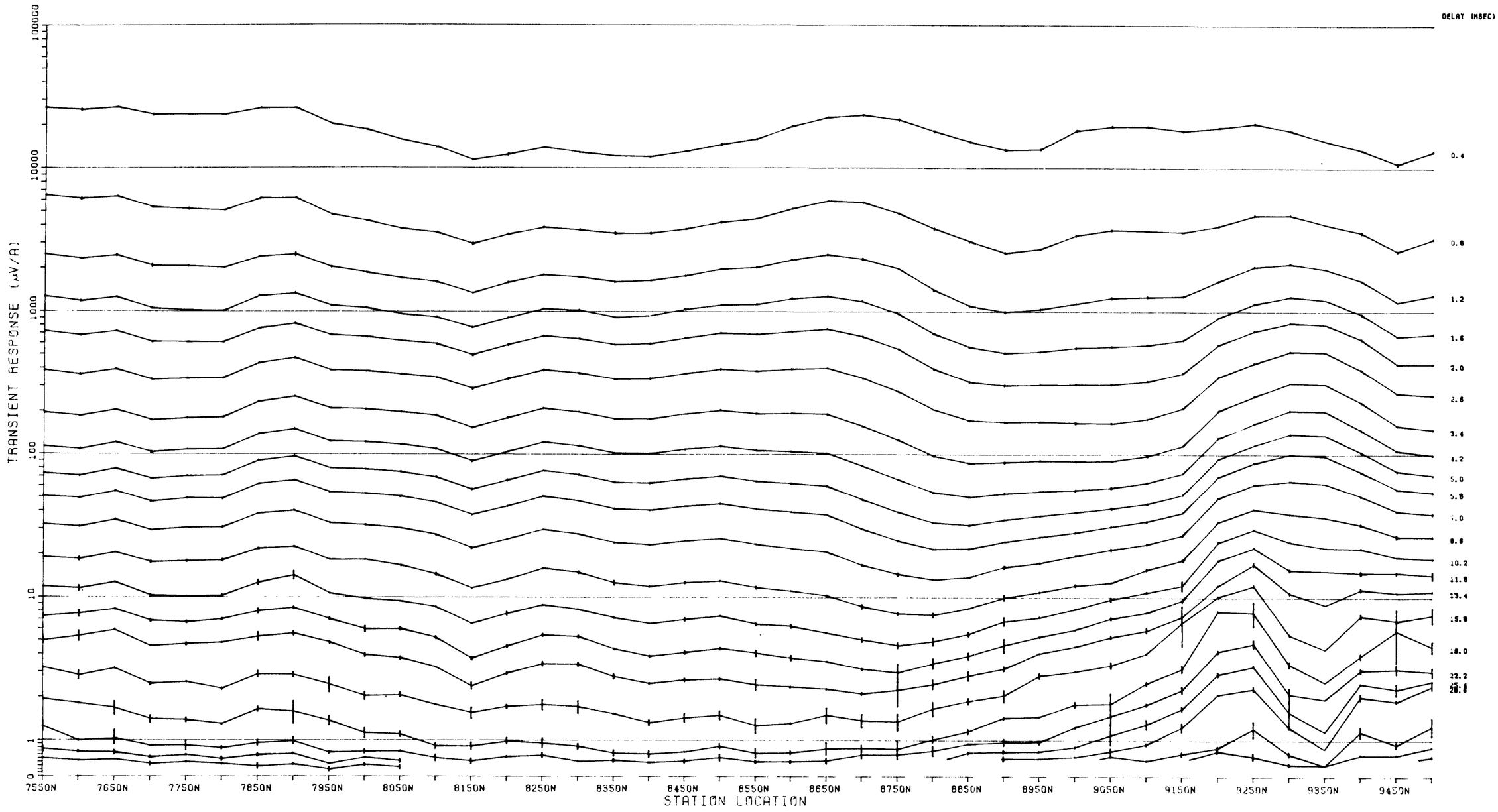
C. DATA PRESENTATION FORMATS

The standard data presentation is of the instrument output of normalised transient voltages, in units of microvolt/amp, plotted as profiles for each line, with a linear horizontal distance scale and a logarithmic vertical voltage scale. This convention allows the full range of voltages to be plotted on a reasonable sized graph and still allows the major features on each decay profile to be easily seen. Error bars are plotted to show the range of recorded values for each station and each delay time and provide an estimate of the accuracy of the reading.

One disadvantage of the above plotting technique is that variations in the voltage level from channel to channel are not evident. This can be overcome by calculating the apparent resistivities and plotting these on a resistivity time-distance plot. The horizontal scale is again a linear distance scale. The vertical scale in this case plots the channel delay times on a logarithmic scale. The value of the apparent resistivity is plotted at the intersection of the station location and the relevant channel number, and the results then contoured. Since there is a relationship between the delay time and the depth penetration for a given reading, the resistivity time-distance plots provide the diagramatic representation of the resistivity layering

in the ground in the absence of finite conductors.

It is also possible to plot the apparent resistivities for a given channel on a plan map, thereby showing the lateral variations over the whole grid of the response at a given time delay. On such plan contours the early channels tend to represent the near-surface or overburden resistivity variations while the later channels show more of the bedrock response and less response from the overburden.



INSTRUMENT :SIROTEM
CONFIGURATION:100M SQUARE DISPLACED LOOPS
READING INTERVAL 50M

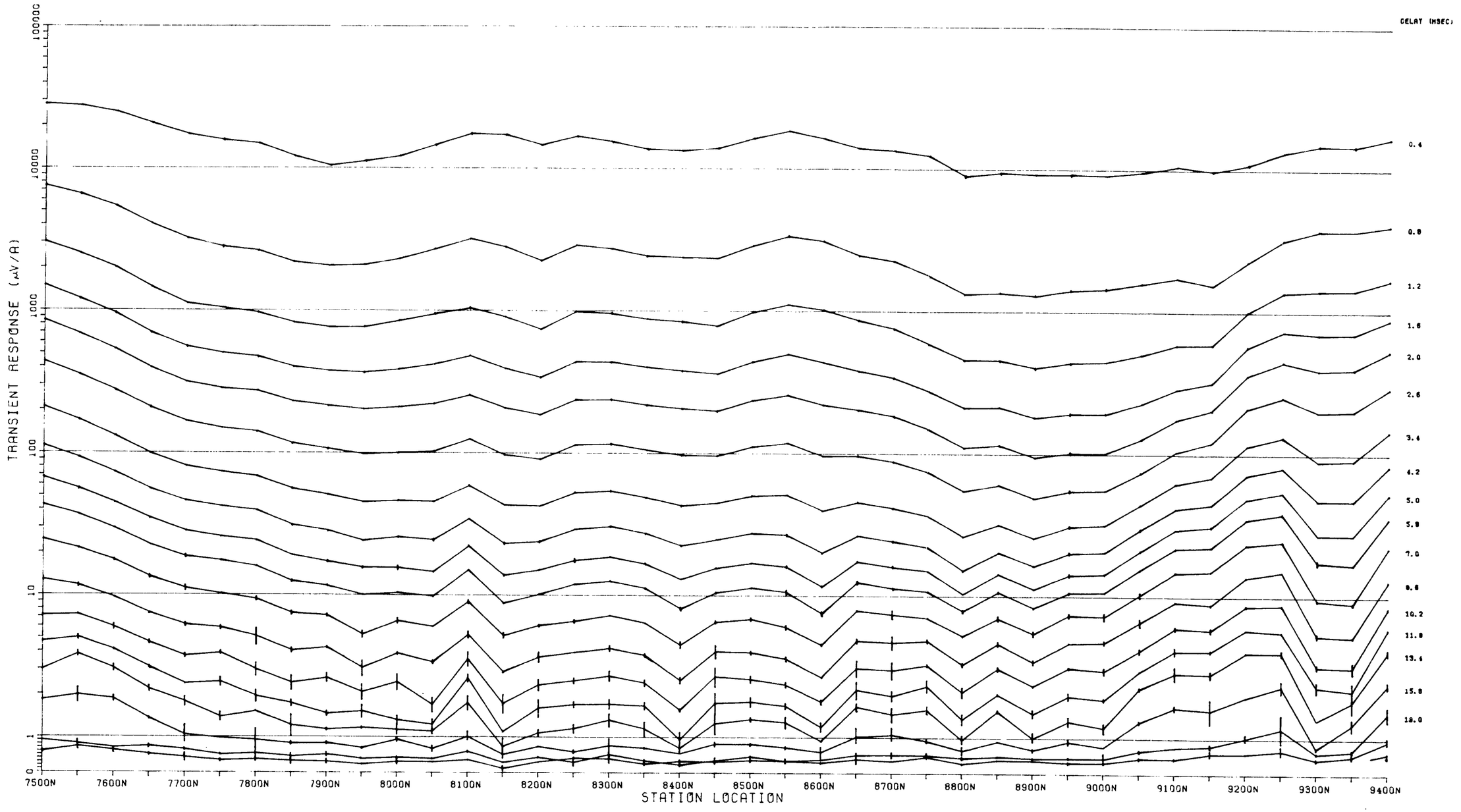
SCALE: 1:5000
DATE : 17/11/81
MAP : CLEVE, S.A.

PANCONTINENTAL MINING LIMITED
TRANSIENT E.M. PROFILE
LINE 18500E, PROSPECT COCKABIONIE

GEOEX PTY LTD

3551(II)-1

FIG.2



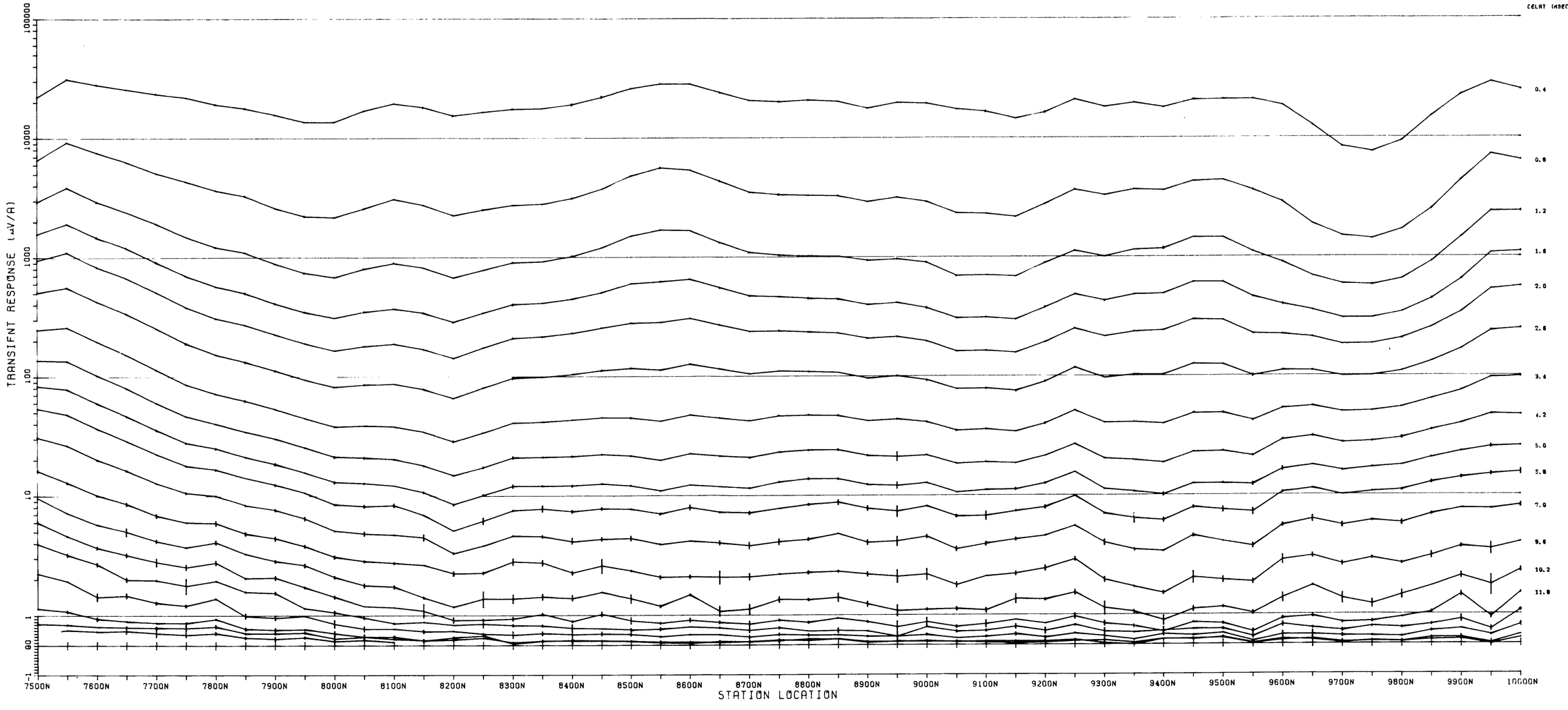
INSTRUMENT :SIROTEM
CONFIGURATION:100M SQUARE DISPLACED LOOPS
READING INTERVAL 50M

SCALE: 1:5000
DATE : 16/11/81
MAP : CLEVE, S.A.

PANCONTINENTAL MINING LIMITED
TRANSIENT E.M. PROFILE
LINE 19000E. PROSPECT COCKABIDNIF

GEOEX PTY LTD

3551(11)-2 FIG. 3



INSTRUMENT :SIROTEM
CONFIGURATION:100M SQUARE DISPLACED LOOPS
READING INTERVAL 50M

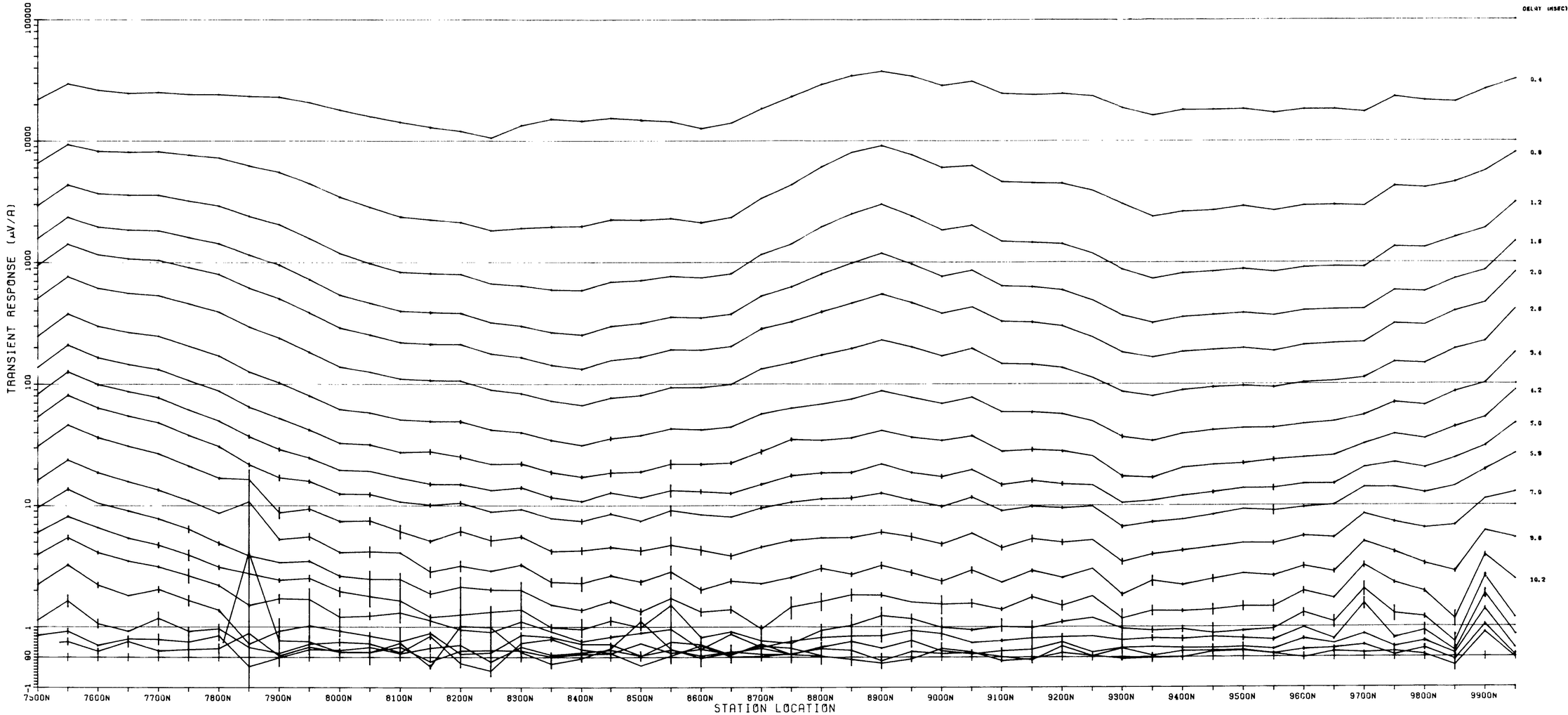
SCALE: 1:5000
DATE : 12/11/81
MAP : CLEVE, S.A.

PANCONTINENTAL MINING LIMITED
TRANSIENT E.M. PROFILE
LINE 20000E, PROSPECT COCKABIDNIE

GEOEX PTY LTD

3551 (11)-4

FIG. 5



INSTRUMENT :SIROTEM
CONFIGURATION:100M SQUARE DISPLACED LOOPS
READING INTERVAL 50M

SCALE: 1:5000
DATE : 10-11/11/81
MAP : CLEVE, S.A.

PANCONTINENTAL MINING LIMITED
TRANSIENT E.M. PROFILE
LINE 20500E, PROSPECT COCKABIONIE

GEOEX PTY LTD

3551(11)-5

FIG. 6

7600N 7700N 7800N 7900N 8000N 8100N 8200N 8300N 8400N 8500N 8600N 8700N 8800N 8900N 9000N 9100N 9200N 9300N 9400N 9500N 9600N 9700N 9800N 9900N

STATION LOCATION

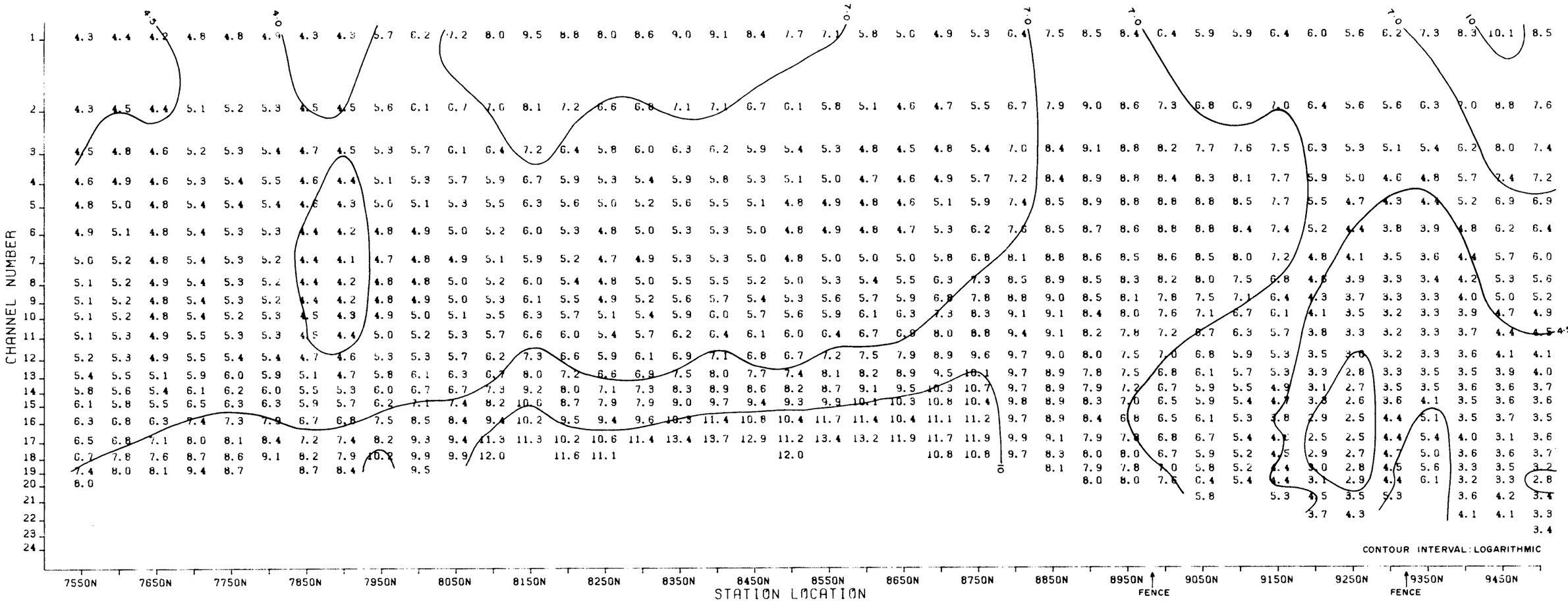
MENT :SIROTEM
URATION:100M SQUARE DISPLACED LOOPS
READING INTERVAL 50M

SCALE: 1:5000
DATE : 10-11/11/81
MAP : CLEVE, S.A.

CONTINENTAL MINING LIMITED
TRANSIENT E.M. PROFILE
20500E, PROSPECT COCKABIDNIE

GEOEX PTY LTD

3551(11)-5



INSTRUMENT :SIROTEM
CONFIGURATION:100M SQUARE DISPLACED LOOPS
READING INTERVAL 50M

SCALE: 1:5000
DATE : 17/11/81
MAP : CLEVE, S.A.

PANCONTINENTAL MINING LIMITED
T.E.M. APPARENT RESISTIVITY TIME-DISTANCE PLOT
LINE 18500E, PROSPECT COCKABIDNIE

GEOEX PTY LTD

FIG. 7

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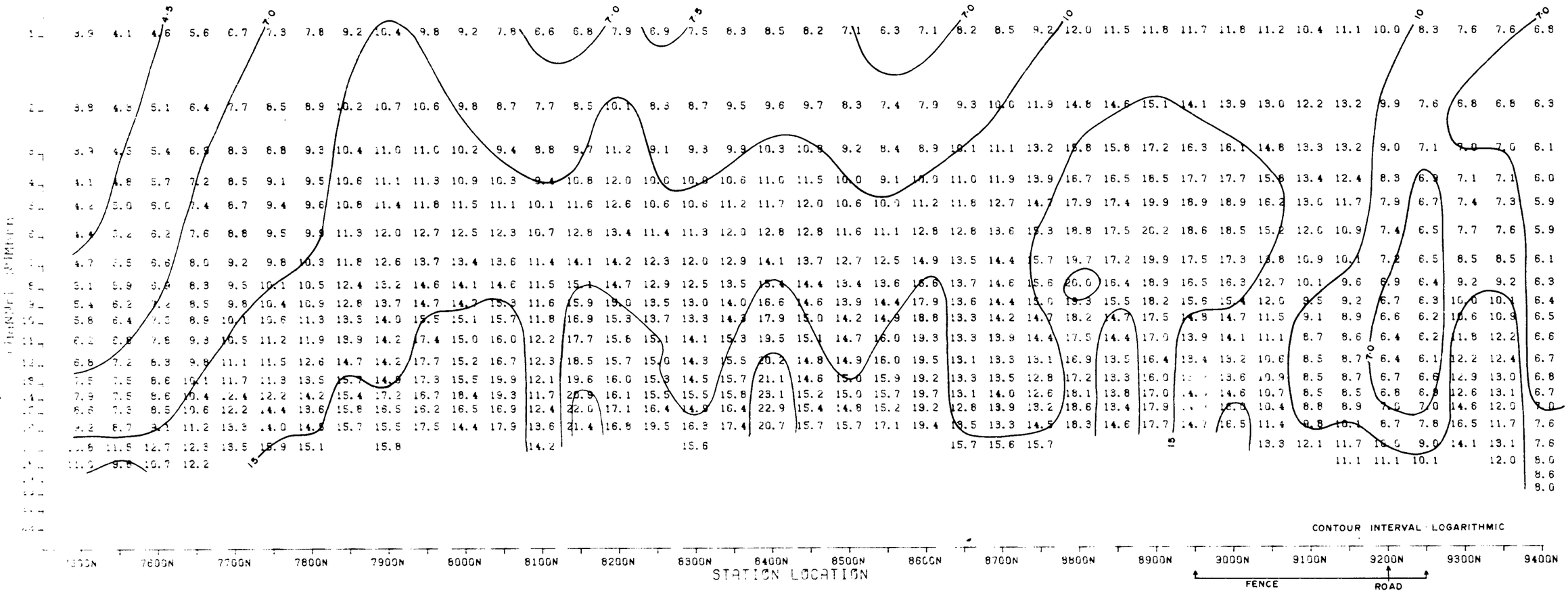

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READING INTERVAL 50M

SCALE: 1:5000
DATE : 16/11/81
MAP : CLEVE, S.A.

PANCONTINENTAL MINING LIMITED
T.E.M. APPARENT RESISTIVITY TIME-DISTANCE PLOT
LINE 19000E, PROSPECT COCKABIDNIE

GEOEX PTY LTD

FIG. 8

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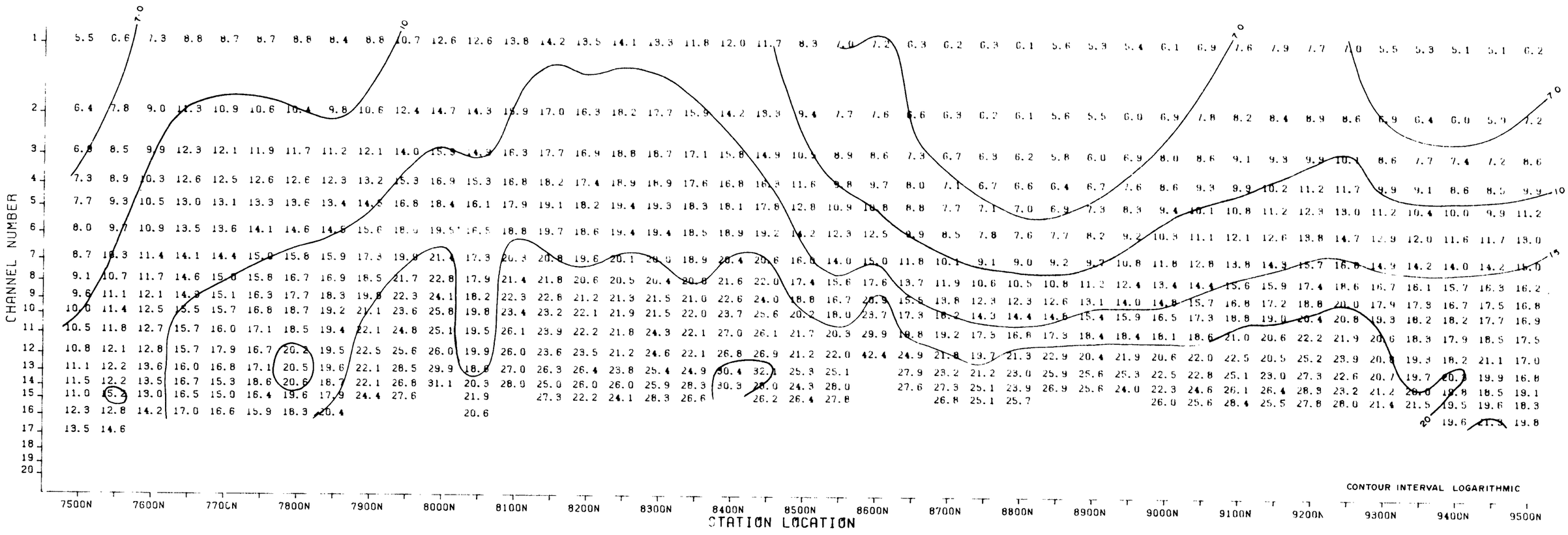

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PANCONTINENTAL MINING LIMITED
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LINE 19500E, PROSPECT COCKABIDNIE

GEOEX PTY LTD

FIG. 9

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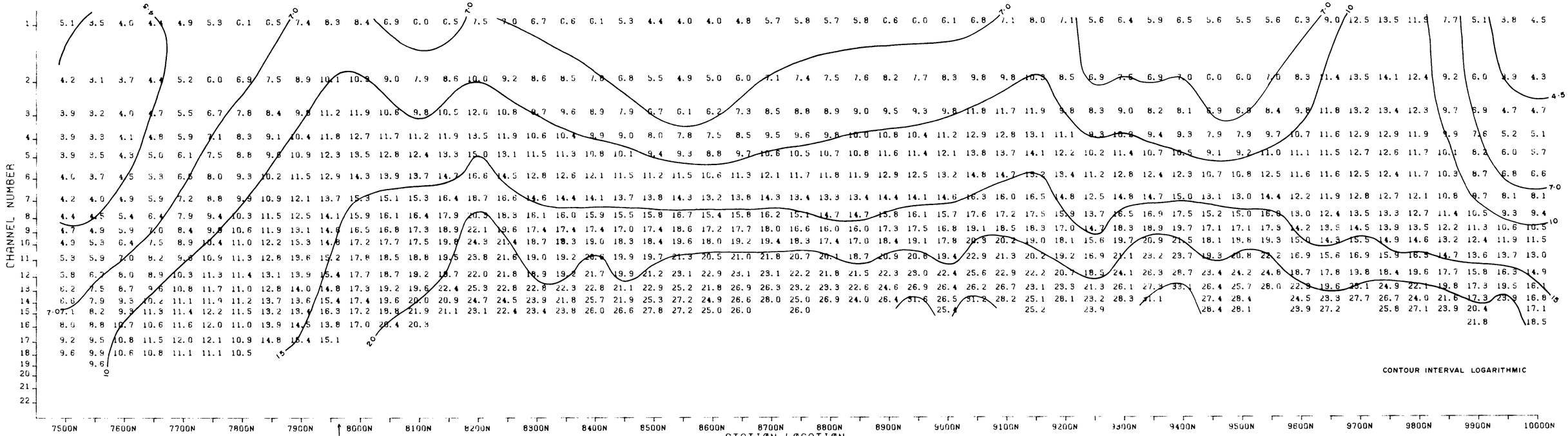

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DATE : 12/11/81
MAP : CLEVE, S.A.

PANCONTINENTAL MINING LIMITED
T.E.M. APPARENT RESISTIVITY TIME-DISTANCE PLOT
LINE 20000E, PROSPECT COCKABIDNIE

GEOEX PTY LTD

FIG. 10

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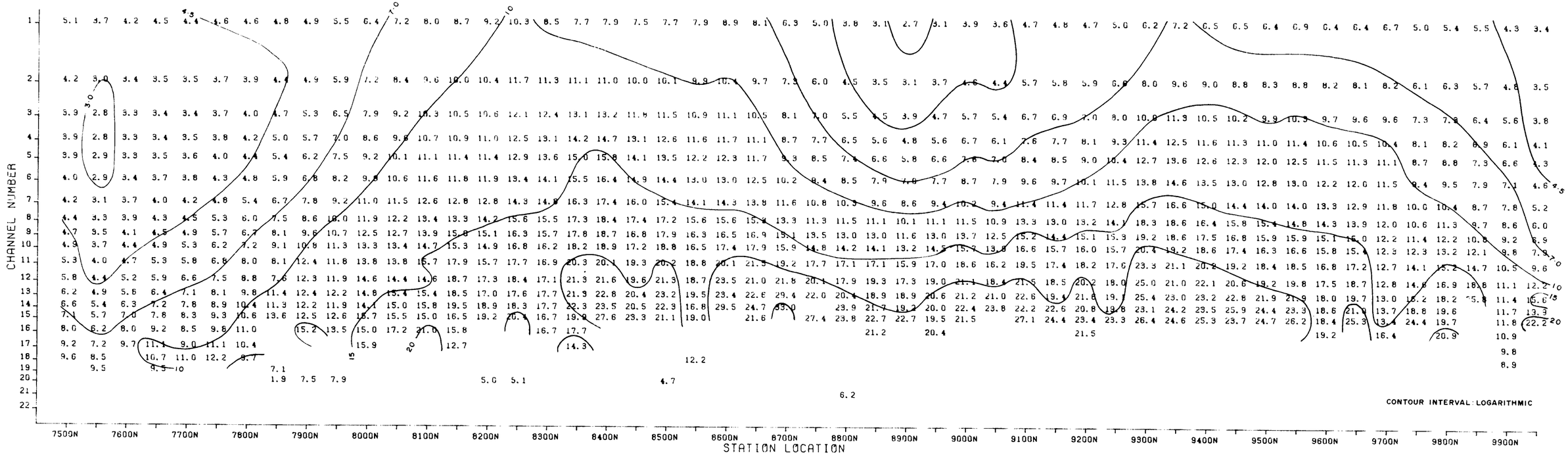

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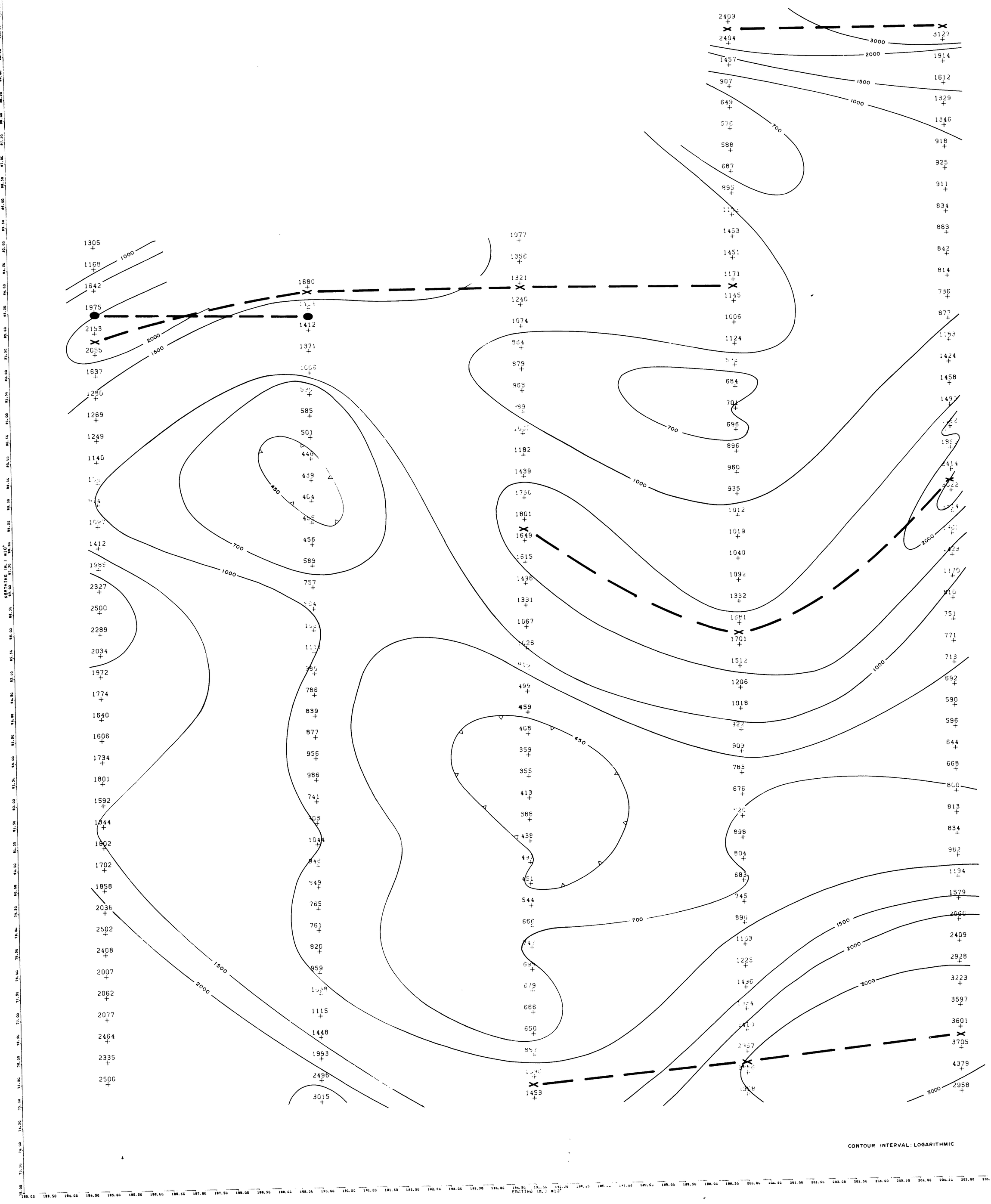
DATE : 10-11/11/81
MAP : CLEVE, S.A.

PANCONTINENTAL MINING LIMITED
T.E.M. APPARENT RESISTIVITY TIME-DISTANCE PLOT
LINE 20500E, PROSPECT COCKABIDNIE

GEOEX PTY LTD

FIG.11

3551(11)-10



CONTOUR INTERVAL: LOGARITHMIC

BURIED CHANNELS OR WEAK, SHALLOW CONDUCTORS

POSSIBLE DEEPER CONDUCTOR

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READING INTERVAL 50M
CHANNEL NUMBER 3

PANCONTINENTAL MINING LIMITED
T.E.M. VOLTAGE PLAN CONTOURS
PROSPECT COCKABIONIE

SCALE: 1:5000
DATE : 12.11/81
MAP : CLEVE, S.A.
UNITS: μV/A

GEOEX PTY LTD

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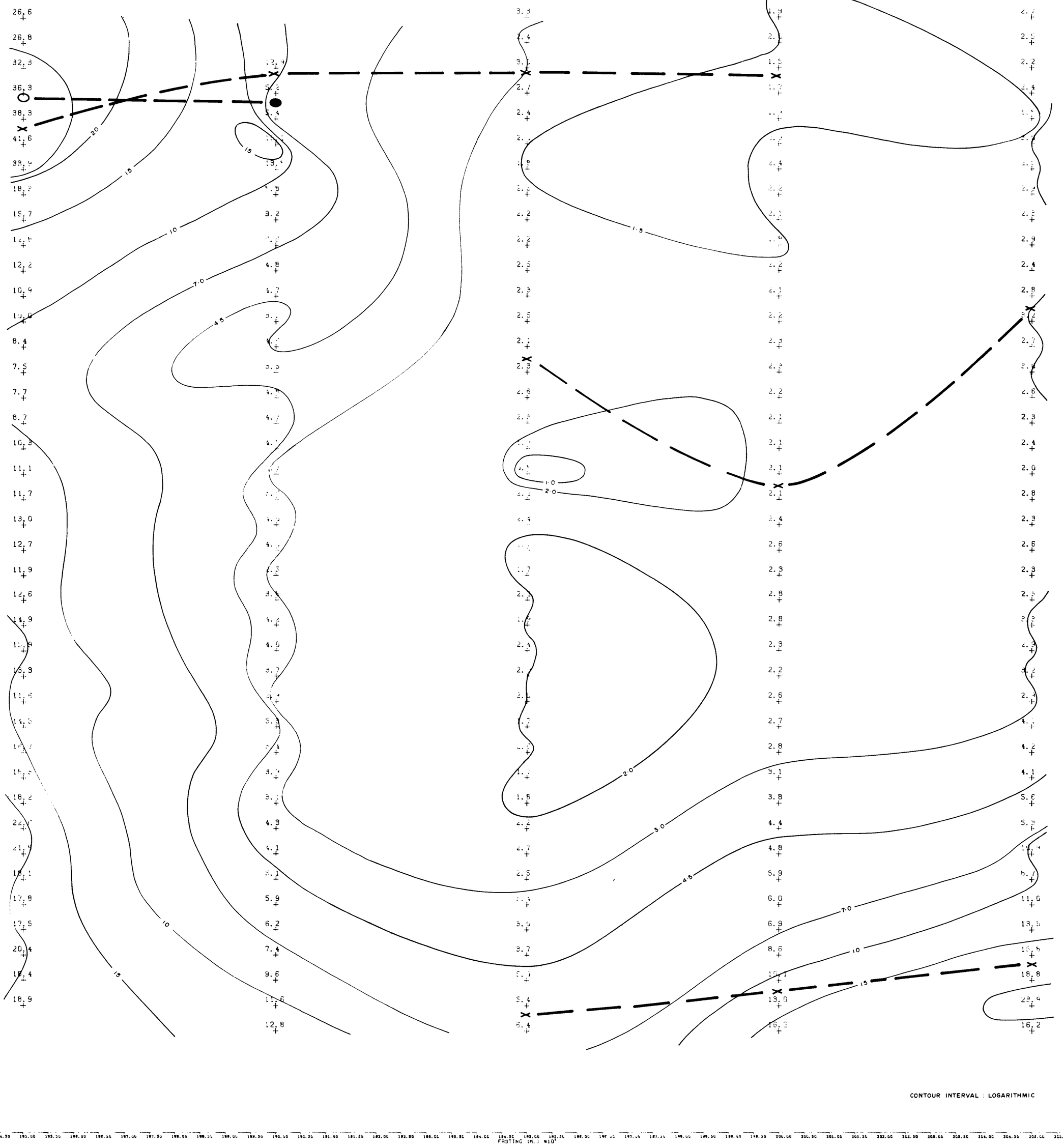
PLATE 1



BURIED CHANNELS OR
WEAK, SHALLOW CONDUCTORS

POSSIBLE DEEPER CONDUCTOR

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LOOP DETAILS: COINCIDENT 100M LOOP
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CHANNEL NUMBER 12

SCALE: 1:5000
DATE : 12/11/81
MAP : CLEVE, S.H.
UNITS: nV/A

PANCONTINENTAL MINING LIMITED
T.E.M. VOLTAGE PLAN CONTOURS
PROSPECT COCKABIDNIE

GEDEX PTY LTD

PLATE 2

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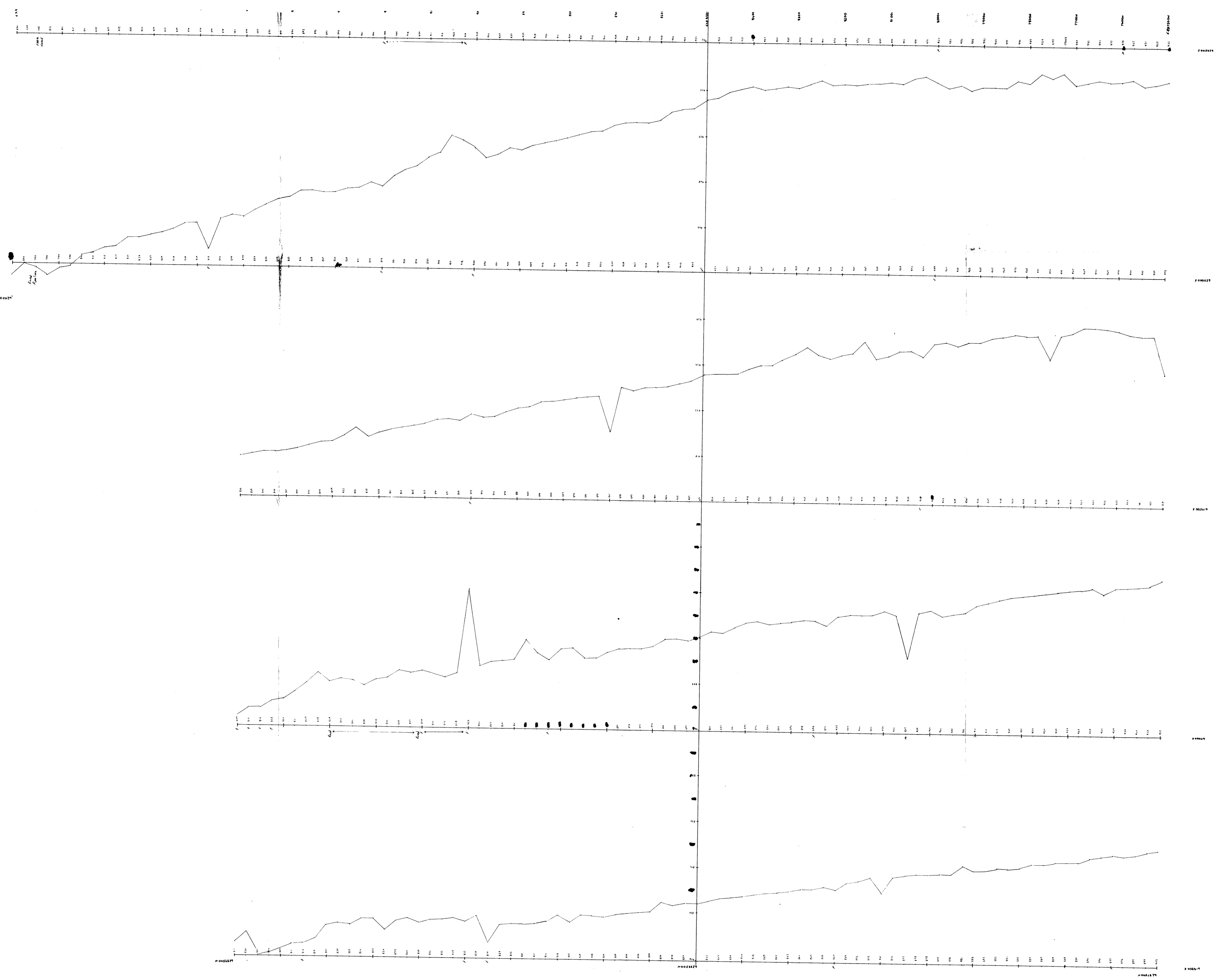
E.L. 893 - COCKABIDNIE
MAGNETOMETER SURVEY (1981)

3551(II)-13



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E.L. 893 - COCKABIONIE
RADON EMANOMETRY (1981)

COCKABIONIE
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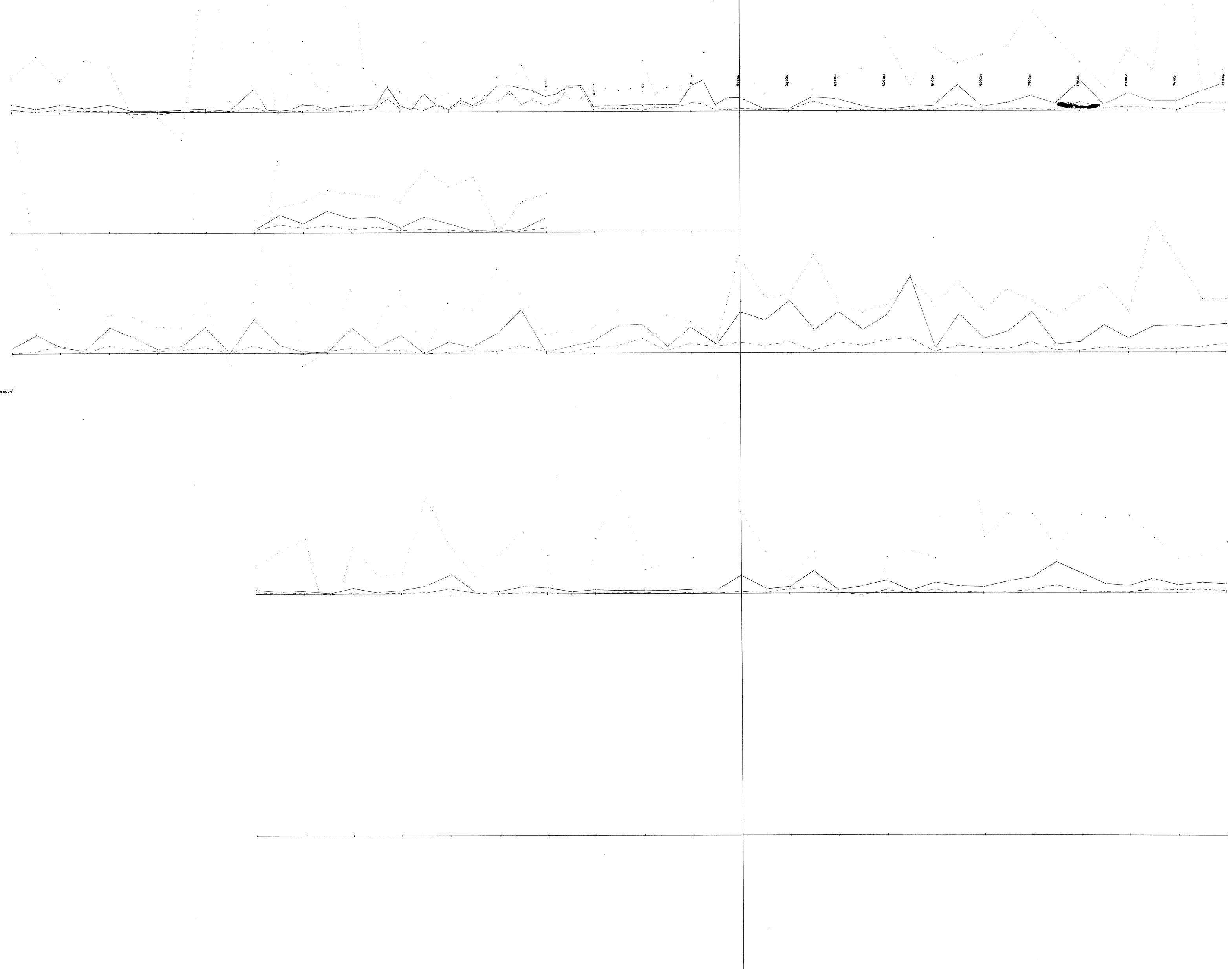

COCKABIONIE
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E.L. 893 - COCKABIDNIE
RADIOMETRIC SURVEY (1981)

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E.L. 893, DARKE PEAKE
QUARTERLY REPORT FOR THE PERIOD
28th DECEMBER - 27th MARCH 1982

for the

PANCONTINENTAL MINING LIMITED/
PNC EXPLORATION (AUSTRALIA) PTY LIMITED/
AFMECO PTY LIMITED
JOINT VENTURE

by

PANCONTINENTAL MINING LIMITED (OPERATOR)

3551

SYDNEY, N.S.W.
MAY, 1982

EXPLORATION LICENCE	:	893
LOCATION	:	DARKE PEAKE, EYRE PENINSULA
OCCUPANTS	:	PANCONTINENTAL MINING LIMITED - PNC EXPLORATION (AUSTRALIA) PTY LIMITED - AFMECO PTY LIMITED
AREA	:	628 SQUARE KILOMETRES
EXPENDITURE COVENANT	:	$45,000
DATE GRANTED	:	28th SEPTEMBER 1982
TERM:	:	12 MONTHS
WORK COMPLETED	:	FINALISATION OF PROGRAMMES AND BUDGETS FOR THE FIELD PROGRAMME TO COMMENCE IN THE FIRST WEEK OF MAY.
PROPOSED WORK	:	THIS YEARS PROGRAMME IS TO CONCENTRATE ON THE MAIN ANOMALY AT COCKABIDNIE WHERE A GRID WILL BE RE-ESTABLISHED, SOIL SAMPLING, RADON SURVEYING, AUGER DRILLING, PITTING AND CORE DRILLING WILL BE PERFORMED.
EXPENDITURE	:	EXPENDITURE DURING THE QUARTER AMOUNTED TO $6,200 COMPRISING THE FOLLOWING COSTS:-

Salaries & Related Costs		$ 1360
Travel & Accommodation		$ 325
Contractors Services		$ 184
Trenching		$ 2759
Field & Other Expenses		$ 510
Sydney/Field Expenses		$ 604
Fixed Assets and Overheads		$ 458
TOTAL	=	$ 6200

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E.L.893 DARKE PEAKE

QUARTERLY REPORT

BY

PANCONTINENTAL MINING LIMITED

SYDNEY, N.S.W.

July, 1982

Exploration Licence:	893
Location:	Darke Peake, Eyre Peninsula
Occupants:	Pancontinental Mining Limited (Operator) PNC Exploration (Australia) Pty. Ltd. Afmeco Pty. Ltd.
Area:	648 sq. kilometres
Expenditure Covenant:	$45,000
Date Granted:	September 28, 1982
Term:	12 months
Work Completed:	At the Cockabidnie anomaly approximately 11 km. of grid was re-established. A total of 172 soil samples was collected at 50 metre intervals along lines 250 metres apart. Several lines of radon emanometer surveying were performed. A total of 592 metres in twenty holes of rotary air blast drilling has been concluded.
Future Work:	Diamond drilling is to be performed in the Cockabidnie area.
Expenditure:	Expenditure during the quarter amounted to $6,072 comprising the following breakdown of costs:

Salaries	$2,384
Travel & accommodation	310
Contractors services	879
Camp expenses	514
Sydney/field expenses	1,179
Fixed assets & overheads	806
	$6,072

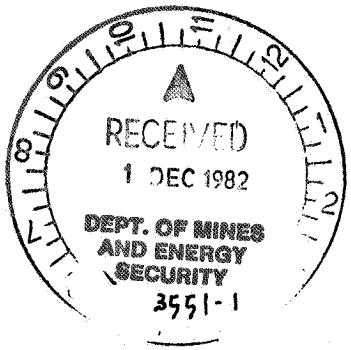
II

0100

PANCONTINENTAL MINING LIMITED
PNC EXPLORATION (AUSTRALIA) PTY. LTD.
AFMECO PTY. LTD.

EXPLORATION LICENCE 893
QUARTERLY REPORT
JUNE 28 - SEPTEMBER 27, 1982

PANCONTINENTAL MINING LIMITED
EXPLORATION & CORPORATE DEVELOPMENT DIVISION



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4C. Petrographic Descriptions, Amdel
4D. Binocular Microscopy, R.A.B. Drilling Samples, Amdel

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2	11/S/J/10	1:5,000	EL 893, Cockabidnie, Geology & 1982 Drill Hole Locations
3	11/S/E/33	1:5,000	EL 893, Cockabidnie, 1982 Radon Profiles
4	11/S/E/34	1:5,000	EL 893, Cockabidnie, 1982 Radon Contours
5	11/S/J/11	1:500	EL 893, Cockabidnie, 1982 Drill Sections

1. SUMMARY

Exploration for unconformity related uranium deposits was conducted between May 7 and October 13 on ~~the~~ Eyre Peninsula of South Australia on Exploration Licence 893 in conjunction with other adjoining EL's 803, 867 and 901 held by the Afmeco Joint Venture (Pancon-PNC-Afmeco)

The 1982 programme consisted of gridding, radon surveys, soil geochemistry, hydrogeochemistry and Rotary Air Blast and Core Drilling.

A significant radon anomaly and anomalous radium, radon and uranium in borehole water have been located at Cockabidnie in an area of graphitic Mangalo Schist and Katunga Dolomite overlain by a thin Middle Proterozoic cover. Increased hematitisation of both Lower and Middle Proterozoic units has been outlined along the same stratigraphic trend.

2. GENERAL

INTRODUCTION

The 1982 exploration programme on E.L.'s 893 held by the Afmeco Joint Venture commenced May 7th. Field activities were completed October 13th.

Objectives of the 1982 programme were:

1. To perform such geophysical and geochemical surveys necessary to better define and evaluate potential targets for drilling.

2. To continue evaluation of priority targets at Cockabidnie by R.A.B. and core drilling.

The field party consisted of one permanent Senior Geologist, one locally hired field assistant and one part-time field assistant. A field office was located at Port Neill. Field supplies, vehicles and core and chip samples are stored in Port Neill.

Reference to previous reports is essential to the complete understanding of each target area.

STATUS OF TENEMENTS

Exploration Licence 893, covering an area of 628 square kilometres was granted to the Joint Venture for a period of twelvemonths expiring on September 27, 1982 with an expenditure covenant of $45,000.

An application (322/82) was submitted to the Department of Mines and Energy for the issue of a new E.L. over portion of E.L. 893 and portion of the adjoining E.L.'s 803 and 867.

3. REGIONAL GEOLOGY

The regional geology of the Eyre Peninsula, described in previous reports, is summarised below. Detailed descriptions of lithological units are presented in conjunction with discussion of specific targets.

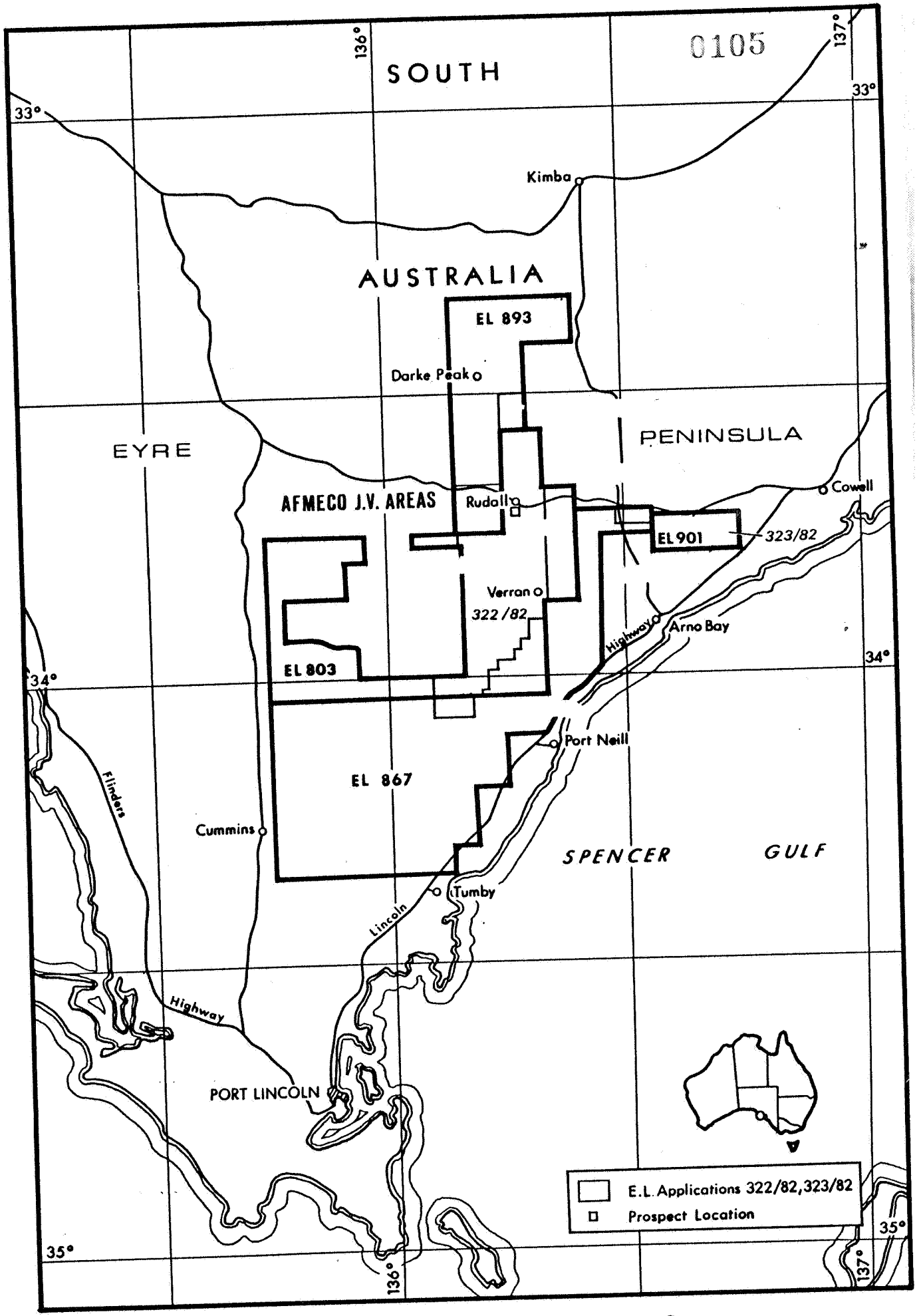
STRATIGRAPHY

The Project Area is situated on the Gawler Craton, a large region of continental crust cratonised ca 1400 Ma and subject to only minor epirogenic movement since. (Figure 2). It consists of a broad variety of Archean to Early Proterozoic gneisses, granites, and metasediments and Middle Proterozoic sediments, volcanics and granites.

The Late Archean to Early Proterozoic basement of the southern Eyre Peninsula consists of older supracrustals and slightly younger, higher level granitoids of the Sleaford Complex. (Figure 3, Figure 4A).

This supracrustal sequence, represented within the Project Area by the Carnot and Miltalie Gneisses, consists dominently of thinly layered garnetiferous quartzofeldspathic gneiss intimately interrelated with thin layers of leucogneiss, biotite - garnet gneiss, hypersthene - bearing felsic gneiss and basic granulite. Banded iron formation and basic extrusive rocks are notably absent from the sequence.

The high level granitoids of the Sleaford Complex, the Dutton Suite, are not recognised within the Project Area although they may have been reworked within the Lincoln Complex.



AFMECO JOINT VENTURE AREAS
Eyre Peninsula, South Australia

Fig.1

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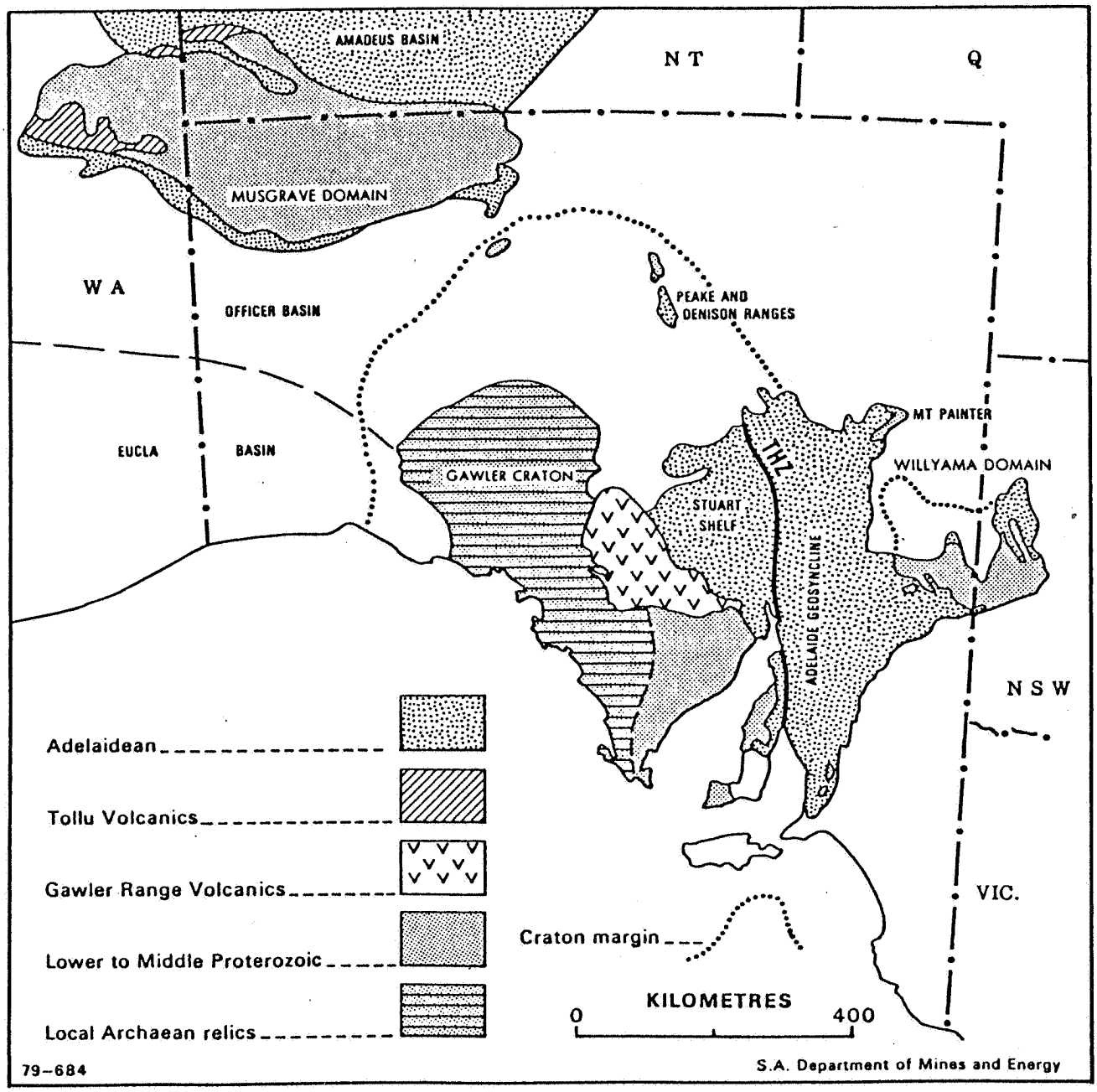

Fig. 2. Precambrian Geology of South Australia.

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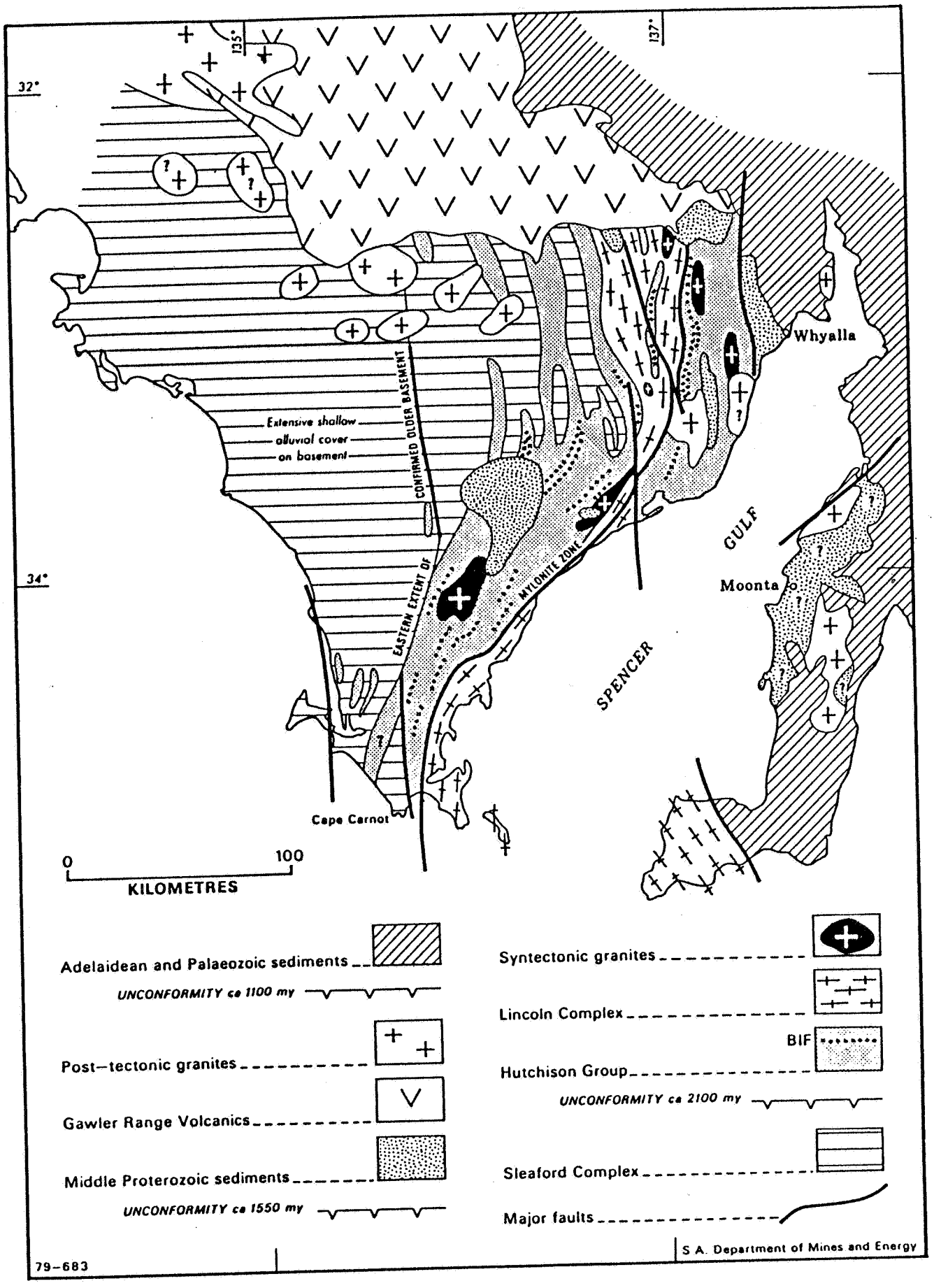

Fig. 3. Regional Precambrian Geology of Eyre Peninsula, from Rutland et al., (1981)

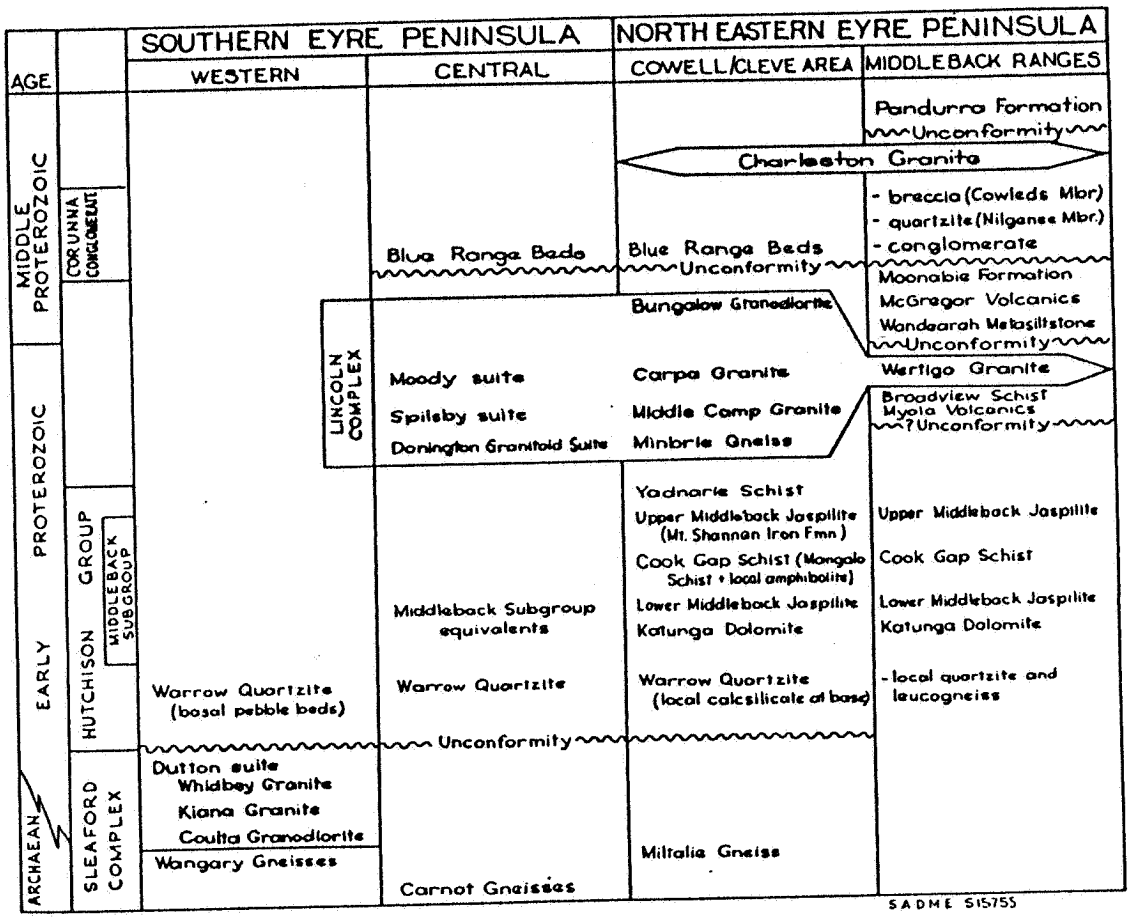

Fig. 4a. Precambrian Stratigraphy of Eyre Peninsula, South Australia.

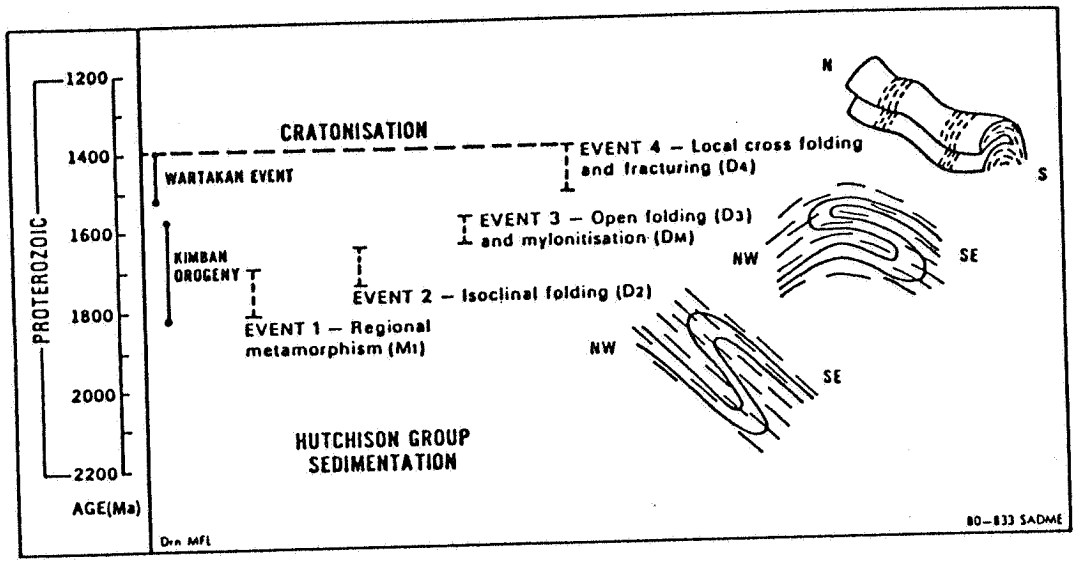

Fig. 4b. "Proterozoic Tectonism" of Eyre Peninsula, South Australia.

Early Proterozoic stratigraphy is comprised of a widespread sequence of mixed chemical and clastic metasediments, the Hutchison Group in the south and the Middleback Group to the north, overlain by volcanic and volcaniclastic units in the far north.

The Hutchison Group consists of a basal quartzite unit, the Warrow Quartzite, a number of mixed chemical/clastic units dominated by various carbonate and iron formation facies, the Katunga Dolomite, Mangalo Schist and Mt. Shannon Iron Formations, and an overlying psammopelitic unit, the Yadnarie Schist.

The Warrow Quartzite represents a fluvial to marginal marine, sandy arkose sequence with fluvial sediments represented in the west and more distal, progradational marine sediments in the east. Facies variations within the Katunga Dolomite represent a number of cyclic transgressions and regressions across a shelf or within a major basin deepening to the east. The Mangalo Schist Fm represents a major influx of clastic sediments associated with regressive sedimentation. The Mt. Shannon Iron Fm. represents a second major transgressive cycle while the overlying Yadnarie Schist represents the return to clastic sedimentation. The proposed source of sediments of the Hutchison Group is the Coulta subdomain of the western Eyre Peninsula.

While no obvious volcanics are present within the Hutchison Group, amphibolites within the Mangalo Schist Fm. probably represent either mafic volcanic extrusions or mafic sills intruded before deformation. Acid volcanics are not known within the Project Area but occur to the north as a prominent sequence of rhyolites and rhyodacites known as the Myola Volcanics.

Granitoids of the Lincoln Complex occur within a band 5-10 kms. wide adjacent to a major structural linear which extends the length of the Eyre Peninsula. The Donington Granitoid Suite evolved through crystal fractionation after emplacement ca 1800 Ma during the first tectonic event of the Kimban Orogeny. Other syn-Kimban orogenic granites, the Middle Camp Granite, the Carpa Granite, the Spilsby Suite and the Moody Suite, were emplaced during later tectonic events of the Kimban Orogeny.

Within the Project Area, the Coolanie Gneiss sequence of mylonitic augen gneisses and the Minbrie Gneiss sequence of migmatitic rocks are thought to have been developed in situ from the reworking of the Sleaford Complex and Hutchison Group

and possibly other granitoids of the Lincoln Complex (e.g. the Carpa Granite and Donington Granitoid respectfully).

A thick sequence of Middle Proterozoic sediments and volcanics occurs on the northern portion of the Eyre Peninsula; however, in the southern portion only a single unit of unmetamorphosed arenite, the Blue Range Beds, is present.

The Blue Range Beds are comprised of fine to coarse grained quartz arenite to orthoquartzitic sandstone, cobble conglomerate and hematitised siltstone. A southeasterly source direction has been postulated from crossbedding measurements.

STRUCTURE

Tectonically the southern Gawler Craton has been subdivided into two main tectonic units:

1) Coulta Subdomain - Western Eyre Peninsula: a cratonic region characterised by scattered, poorly exposed remnants of the older basement.

2) Cleve Subdomain - Eastern Eyre Peninsula: an Early Proterozoic orogenic, belt representing a shelf or basinal depository for the Hutchison Group prior to its deformation during the Kimban orogeny.

Two major periods of complex deformation, metamorphism, and plutonism have been recognised within the southern Gawler Craton. The Sleafordian Orogeny which culminated ca 2300 Ma affected both the Coulta and Cleve Subdomains. It was a high-grade metamorphic gneiss-forming event accompanied by both mafic and acid plutonism.

The Kimban Orogeny ca 1820 - 1580 Ma, locally affected the Coulta Subdomain. It is characterised by four main metamorphic events: (Figure 4B)

Event 1: Regional Metamorphism (Upper Amphibolite - Granulite Facies)

Event 2: Isoclinal folding (associated thrust faulting)

Event 3: Retrogressive; Folding, mylonitisation (Kalinjala Mylonite Zone/Lincoln Shear Zone)

Event 4: Wartaken Event; Local folding, fracturing, also affects Middle Proterozoic.

The major linear feature, the Kalinjala Mylonite Zone (formerly Lincoln Shear Zone), is a zone of intense ductile deformation characterised by mylonitic gneiss to slaty ultramylonite, extending the length of the Eyre Peninsula.

Subsequent tectonism has been restricted to local intracratonic tensional features such as graben development during the onset of the Adelaidean sedimentation, dolerite dyke intrusion ca 1100 Ma and block faulting or graben development during Tertiary to Recent.

METAMORPHISM

Two main periods of complex deformation, plutonism and associated metamorphism have been recognised in the southern Gawler craton; however, it is difficult to ascertain the specific nature of the older Sleafordean Orogeny because similar metamorphic features were induced by the younger Kimban Orogeny.

The Carnot Gneiss has been subjected to prograde granulite facies metamorphism ca 2400 Ma. To the southwest, muscovite-bearing granitoids (Kiana & Whidbey Granites) intruded grey, quartzofeldspathic gneiss (Wangary Gneiss) and may have reached low to middle amphibolite facies.

The metamorphic conditions prevalent in the Project Area during the Sleafordean Orogeny are uncertain because of strong Kimban overprinting. The Miltalie Gneiss has been extensively deformed and partially remobilised during the Kimban; however, similar low to middle amphibolite facies conditions are postulated.

The structural and metamorphic record of the Kimban Orogeny has been better preserved because of the stabilisation of the Gawler Craton soon after the orogeny. The peak prograde metamorphic conditions associated with crystallisation of the Donington Granitoid Suite were probably to the granulite facies; however, upper amphibolite facies conditions prevailed over most of the southern Eyre Peninsula.

0112

4. 1982 PROGRAMME

INTRODUCTION

The 1982 field programme was conducted between May 7th and October 13th. Activities performed are summarised on Table 2. Results of these activities are discussed in detail.

The field programme took approximately two months longer to complete than initially planned because of extensive delays in core drilling on E.L. 901. All other activities were performed on schedule.

Contractors engaged during 1982 are as follows:

(a) Rotary Air Blast Drilling (R.A.B.) - Northbridge Drilling (Southern Drilling), Myrtle Bank, S.A.; Bub Filtness, runner; Investigator Mark 5, 335 CFM, 150 PSI Compressor, blade bit; 1264m, in 5½ days; June 18-24, 1982.

(b) Core Drilling - Pontil Pty. Ltd., Dubbo, N.S.W., Tony Speck, Foreman; Boyles 35, June 10 - October 13, 1982.

All other field activities were performed by Pancontinental personnel.

Radon emanometer surveys performed at Cockabidnie employed the "Amok-style" aluminium tube collectors and a modified E.D.A. RD-200 Emanometer.

Soil geochemistry samples were obtained utilising a Stihl 4308 Versatile two-man gasoline earth auger.

All radiometric logging of R.A.B. and Core Drill holes was performed utilising an S.I.E. T450E Radiometric Logging System with a T75 gamma logging tool (crystal 3/4" x 1 3/4") and T107 manual winch.

Drill sites were prepared utilising tractor mounted backhoes hired from Mr. I.W. Elson, Kielpa. Water supply for core drilling was from water standpipes at Darke Peak.

TABLE 1
TABLE OF ACTIVITIES
1982

0113

Area/Activity	Gridding km.	Soil Geochemistry Samples/km.	Radon km.	R.A.B. Drilling Holes/Metres	Core Drilling Holes/Metres	Water* Samples
EL 893						
Cockabidnie	19.1	172/8.3	11.0	20/592	3/300.8	5

TABLE 2
SOIL GEOCHEMISTRY
SUMMARY OF STATISTICS

		Cockabidnie
No. of Samples		172
Uranium:	Mean Std. Dev.	-
Thorium:	Mean Std. Dev.	-
Copper:	Mean	5.891
	Std. Dev.	±3.366
Lead:	Mean	4.194
	Std. Dev.	±3.344
Zinc	Mean	14.836
	Std. Dev	±5.500
Nickel:	Mean	7.212
	Std. Dev.	±5.909
Iron:	Mean	0.641
%	Std. Dev.	±0.519
Manganese:	Mean	40.461
	Std. Dev,	±24.532
Correlations	0.70	Zn-Ni
Correlations	0.60	Th-Pb-Ni

EL 893

0115

COCKABIDNIE

Introduction

Anomalous Lower Proterozoic Katunga Dolomite and graphitic Mangalo Schist units located on dispositions adjacent to EL 893 have been traced southwest along strike under intensely hematitised Middle Proterozoic Blue Range sandstone and pebble conglomerates at Cockabidnie. Ironstone, perhaps originally Katunga Dolomite, and weakly graphitic Mangalo Schist adjacent to the sandstone contain up to 20 ppm U. In 1981 a radon soil-gas anomaly was located along the anomalous trend although some distance from the sandstone cover.

The 1981 program of soil sampling, radon surveying, R.A.B. drilling and core drilling attempted to better define the Lower Proterozoic stratigraphy, particularly where it is overlain by Middle Proterozoic sandstone, and to locate additional anomalous areas (Table 2, Plate 8).

Soil Geochemistry Survey

The Cockabidnie area is characterised by undulating hills with the area of known Middle Proterozoic sandstone on the western side of the grid generally being of higher relief.

Light grey aeolian sands cover most of the area; several north to northwesterly trending sand ridges are present in the eastern portion of the grid. Soils are primarily red-brown earth, solodised solonetz and mallee soils with some lateritic ironstone gravels in the topsoil. B-horizon soils are generally marked by increased clay content, dark red-brown colour and vary from depths of 0.30 to 1.20 metres below the surface. Wherever possible, B-horizon samples were obtained.

Samples were taken at 50 metre intervals along lines 500 metres apart. Each sample was analised for U, Th, Cu, Pb, Zn, Fe and Mn. Raw data have been contoured and treated statistically.

Geochemical analysis failed to detect any measurable uranium (4ppm) in the samples. All other elements showed a general increase in background values on the western side of the grid where underlain by Blue Range conglomerates and sandstone. Lead and thorium show marked correlation with the known edge of the sandstone outcrop. Statistical treatment of the data suggests an excess of high values in the total population. Log-probability plots indicate multiple populations exist, particularly for nickel and zinc.

Two linear trends outlined by co-incident copper, lead, zinc and nickel values extend across the zone of hematitised sandstone. While not significantly anomalous, there is a coincidence of higher values to the southwest where the trends project onto the Blue Range units.

Continued statistical treatment of the data is possible although is not considered warranted at this time because of the widely spaced nature of the samples.

Radon Survey

Reconnaissance radon surveying in 1981 located an area of anomalous radon in soil-gas with values to ten times background.

Classical emanometer systems such as the EDA-RD-200 system used in 1981 have many inherent technical problems (e.g. contribution of thoron). A technique developed by Amok Ltee., operators of the Cluff Lake uranium property in Saskatchewan, Canada, utilising an aluminium tube collector and a modified gas emanometer eliminates many of these potential problems. The technique is specific to radon-222, a daughter of U-238, and eliminates the contribution of the thorium daughter, radon-220 (thoron).

Utilising this system, a limited program of detailed follow-up and reconnaissance surveying was performed at Cockabidnie. The data are presented both in profile and contoured form (Plates 10, 11).

The 1981 anomaly was successfully relocated on line 620,500E at 6,268,800N and was extended to the east and west. Two other anomalous zones were located to the north. A maximum value of 443 counts was recorded; background is approximately 70 counts.

0117

General background levels on the western side of the grid tend to be much lower; however, there is some possibility that the anomalous zone can be traced at least as far west as 619,500E, a distance of 1,000 m. A comparison of the profile plots for lines 619,500E, 620,000E and 620,500E shows similarities in profiles which can be traced from line to line.

R.A.B.

Scarcity of outcrop has made interpretation of the geology of the Cockabidnie grid area quite difficult. Rotary air blast (R.A.B.) drilling was employed in an attempt to accurately define the extent of the Middle Proterozoic Blue Range sandstone and conglomerate cover and to provide information on the Lower Proterozoic Hutchison Group stratigraphy. A total of 592 metres of R.A.B. drilling was completed in 20 holes along three profiles. (Table 2, Plate 12, Appendix 1A).

All holes were radiometrically logged at the time of drilling. The fine powdered nature of the samples necessitated the use of a binocular microscope for geological logging. Duplicate samples were taken at 1 metre invervals. Geochemical analysis has been performed on representative samples. Identification of clay minerals was performed on several samples (Appendix 4B).

No significant mineralisation was intersected in any of the holes; however, as discussed below, significant uranium-in-water results were obtained.

Nine holes drilled on section 620,000E indicate a shallow sandstone cover is present over the entire length of the drill fence. The sandstone is quartz rich, contains very little feldspar, has variable quantities of find grained clay,green mica and colourless muscovite and scattered detrital toumaline and zircon. The Lower Proterozoic unit, probably a chlorite-biotite schist of the Mangalo Fm, is easily identified in holes RAB 893-1 to 893-7 by the abundance of biotite and dark olive brown mica and general absence of quartz.

At the northern end of the drill fence, distinction of the Lower Proterozoic lithologies in holes RAB 893-8 and 893-9 is difficult because of the abundance of quartz and colourless micas which are considered typical of the overlying sandstone units. However, a tentative interpretation based on radiometric logs, geochemical analyses showing increases in zinc, nickel, iron and

manganese typical of Lower Proterozoic lithologies and the presence of a very few foliated schist chips indicates a sudden thinning of the Middle Proterozoic sandstone cover.

Water samples taken from holes RAB 893-4, 5, 6 and 7 contain significant amounts of radon, radium and uranium (Table 4A). Samples contain up to 600 pCi/l radon, 120 pCi/l radium and 40ppb uranium (RAB 893-7). Chlorite schist in hole RAB 893-7 had a maximum assay of 60 ppm uranium. Increased values of zinc, nickel and manganese were measured in holes RAB 893-5 and 6.

Hole RAB 893-10, drilled to 42.0m, failed to penetrate to the Lower Proterozoic lithologies.

Five holes, RAB 893-11 to 15, drilled along the road crossing the centre of the grid also failed to penetrate the overlying Middle Proterozoic sandstone. Fine grained, arkosic sandstone and small granule to pebble conglomerate was intersected. Pale yellowish green sericitic and white clay altered sandstone in holes 893-12, 15 and 14 surround deeply hematitic sandstone in 893-11 and 13. No significant anomalism was detected in any of the holes.

On section 619,000E five holes, RAB 893-16 to 20, successfully defined the northern edge of the overlying sandstone cover. The Blue Range sandstone is variably a white clay altered to light greenish-yellow sericitic sandstone with minor hematitic patches and, particularly in RAB 893-17, contains abundant granule conglomerate. The Lower Proterozoic encountered in 893-16 and below the sandstone in holes 893-19 and 20 is a highly altered (clay, chlorite, sericite) quartz rich micaceous schist. It could possibly be part of the Yadnarie Schist Fm. In hole 893-19 several metres of large flake muscovite occur at the unconformity, apparently within the sandstone. No significant radioactivity was measured associated with the unconformity.

Core Drilling

To further test the Lower Proterozoic units below the overlying Middle Proterozoic sandstone, three core holes DDH 893-1, 2 and 3, were collared across the projected strike of favoured anomalous Katunga Dolomite and Mangalo Schist units (Plates 9, 12, Table 2, Appendix 1B).

DDH 893-1 on section 619,000E intersected the unconformity with the Lower Proterozoic at a depth of 87.50m. Limonitic and hematitic pebble conglomerate in the upper Blue Range sequence grades to a generally fine grained sandstone with patches of hematitic and sericitic sandstone and minor siltstone. Several large pebbles within a highly hematitic siltstone mark the base of the sequence.

Below the unconformity there is a soft, fine grained phyllitic schist to microgneiss, probably part of the Mangalo Schist Fm. Chlorite and hematite alteration are light throughout. One section has dark chloritic shears coated with trace amounts of graphite.

No significant radioactivity was detected in the hole.

DDH 893-2, located on section 619,350E, cored a sequence of highly hematitic conglomerate and sandstone similar to sandstone outcropping northeast of the road. The unconformity with the underlying Lower Proterozoic units, at 76.30m, is marked by intensely hematitic crushed core with several small Warrow Quartzite cobbles. A very lightly hematitised, greasy, fine grained, chloritic phyllitic schist occurs below the sandstone.

Radiometric background increases are associated with the deeply hematitised sandstone unit between 49.40m and 56.40m with a peak of 975 c/s at 52.8m. A maximum of 18ppm uranium was obtained from core assays.

The third hole, DDH 893-3, was collared at 619,545E near to outcrops of intensely hematitic pebble conglomerate and ironstone. The unconformity was intersected at 30.50m. The Middle Proterozoic sequence consists of argillaceous pebble conglomerate becoming gradationally more hematitic with depth. Soft, mottled, hematitic, chloritic and clay altered conglomerate occur above the unconformity. The Lower Proterozoic sequence consists of a hematitic and chloritic porphyroblastic quartz-feldspar mica schist overlying a chloritic quartz-feldspar microgneiss. Approximately 30 cms of deeply hematitised, kaolinitic and chloritized schist occur below the unconformity.

The upper portion of the lower unit is sheared and brecciated. There are abundant greasy hematitic fracture coatings and possibly fault gouge. Disseminated pyrite occurs within this section. A zone of anomalous radioactivity (1650 c/s) is associated with a fine grained, highly chloritic band

at 66.7m. However, geochemical analysis indicates the sample contains 14ppmU and 190 ppmTh.

5. CONCLUSIONS

Cockabidnie

Soil geochemistry has outlined two linear features, one of which is associated with the hematitised sandstone outcrops. Radon surveying has located a significant anomalous area approximately 500 metres wide open to both the southwest and northeast. R.A.B. drilling indicates that there is a thin cover of sandstone extending further to the east than previously thought. Higher radiometric backgrounds and anomalous water samples were obtained from several of the RAB holes on line 620,000E. Increased hematitisation of both the Middle Proterozoic sandstone and the Lower Proterozoic schist adjacent to the unconformity is present in DDH 893-2 and 893-3

6. RECOMMENDATIONS

To evaluate the Project Area thoroughly, the following activities are recommended:

Cockabidnie

Potential for the discovery of unconformity related uranium mineralisation exists in several locations within the area. Additional radon surveying is required to fully define the extent of the known anomaly. Detailed soil geochemistry is necessary to define and extend the linears interpreted from the widespread 1982 sampling. Shallow R.A.B. drilling, pitting and some percussion drilling is required to adquately test the radon anomaly and the zone of hematitised sandstone.

0121

7. EXPENDITURE

Expenditure on E.L. ~~873~~ 893 during the period June 28 - September 27, 1982 amounted to $52,311 comprising the following breakdown of costs:-

	$
Salaries and oncosts	9,138
Travel and accommodation	708
Data processing	324
Contractors services	(95)
Field expenses	1,111
Drilling	29,436
Transportation	1,765
Analytical costs	3,088
Sydney/Field expenses	1,332
Fixed assets and overheads	5,504
	$52,311

APPENDIX 1A

1982

ROTARY AIR BLAST DRILL HOLES

GEOLOGICAL LOGS

R.A.B. DRILLING

EL 893 - COCKABIDNIE

RAB 893-1	620,000E - 6,288,000N	30m
2	- 6,288,100N	30m
3	- 6,288,200N	15m
4	- 6,288,300N	30m
5	- 6,288,400N	31m
6	- 6,288,500N	30m
7	- 6,288,600N	30m
8	- 6,288,700N	30m
9	- 6,288,800N	39m
10	620,160E - 6,287,960N	42m
11	619,375E - 6,288,000N	18m
12	619,330E - 6,287,910N	24m
13	619,320E - 6,288,100N	30m
14	619,160E - 6,288,260N	9m
15	619,250E - 6,288,175N	21m
16	619,000E - 6,288,250N	36m
17	619,022E - 6,288,020N	36m
18	619,000E - 6,288,100N	27m
19	- 6,288,150N	54m
20	- 6,288,200N	30m
		592m

DRILL HOLE RECORD

Hole: R.A.B. 893-1

Project:	Afmeco J.V. (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	620000E/6288000N
Elevation:	- 14.23 m.
Depth:	30.0 m.
Dip:	-90^{o}
Azimuth:	-
Date Drilled:	23/6/82
Geological Log:	D.A. Currie

Borehole Logging

Gamma: (Open) 0.0 - 24.0 m.; maximum 750 c/s @ 8.4 m.

Geological Log

0.0 - 6.0	Overburden: Light brown to pale reddish brown clay rich weathered soil. Few fragments and rounded grains of quartz.
6.0 - 11.0	Middle Proterozoic: Blue Range Fm - Sandstone (Pubs) Dark reddish brown to moderate reddish brown fine grained sandy rubble (overburden) to sandstone. Minor hematite staining of grains. Dominantly quartz with lesser feldspar and minor muscovite and possibly sericite.
11.0 - 17.0	(?) Lower Proterozoic: Mangalo Schist Fm - Altered Schist (Plms): Fine grained, grayish pink to light grey, clay rich powdery material. Mostly muscovite and powdery clay minerals. Gradationally darker grey near lower contact. No visible quartz, hence probably Yadnarie Schist (Plys) or regolithic alteration of Plms.
17.0 - 30.0	Lower Proterozoic: Mangalo Schist Fm - Biotite Schist (Plms): . Medium grey to dark grey, fine grained quartz-muscovite-biotite schist. Very finely layered. Chloritic.
30.0	End of Hole

Radioactivity Summary

0.5 - 6.5 m.	180 - 280 c/s	Overburden clay
6.5 - 11.0 m.	650 - 750 c/s	Hematised Pubs
11.0 - 15.0 m.	525 - 600 c/s	Clay altered Plys (?) or Regolith
15.0 - 30.0 m.	540 - 640 c/s	Plms

Samples

			Geochemical Results (ppm)							
Sample No.	Interval	Lithology	U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15518	8.0 - 9.0	Pubs	6	16	10	<4	34	26	2.10	200
15519	29.0 - 30.0	Plms	4	22	100	<4	80	42	3.50	900
15632	15.0 - 16.0	Plms	<4	22	6	4	10	<4	0.75	48

DRILL HOLE RECORD

Hole: R.A.B. 893-2

0125

Project:	Afmeco J.V. (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	620,000E/6,288,100 N
Elevation:	-13.37 m.
Depth:	30.0 m.
Dip:	-90°
Azimuth:	-
Date Drilled:	23/6/82
Geological Log:	D.A. Currie

Borehole Logging

Gamma: (Open) 0.0 - 24.9 m.; maximum 785 c/s at 16.0 m.

Geological Log

0.0 - 10.0 Overburden

0.0 - 7.0	Light brown sandy material with up to 50% sandstone grains (quartz).
7.0 - 9.0	Light to moderate brown, up to 40% quartz sand grains up to 0.75 cm., increasingly hematitic.
9.0 - 10.0	Dark brown to greasy olive green structured clay.

10.0 - 12.0 Middle Proterozoic: Blue Range Fm. - Sandstone (Pubs)

Large chips of light to moderate red very fine grained quartz sandstone with lightly hematitic matrix.

12.0 - 20.0 Middle Proterozoic: Blue Range Fm. - Sericitic Sandstone, minor conglomerate (Pubs, Pubc)

Mottled shades of grayish pink to light red. Fine grained quartz sand grains set in greasy hematitic or pale sericitic matrix. Up to 10% sericite, minor muscovite. Large (to 0.5 cm.) quartz granules indicative of pebble conglomerate. Probably overall regolithic alteration.

12.0 - 14.0	Light pinkish gray, sericitic
14.0 - 15.0	Dark hematitic section

20.0 - 30.0 Lower Proterozoic: Mangalo Schist Fm. - Fine grained quartz-biotite schist (Plms)

Variably shades of light pale red to gray to grayish red and minor yellowish green. Generally fine grained, finely banded with thin biotite and muscovite layers with slightly thicker quartz-feldspar bands. Colour varies with the amount of biotite and alteration (hematisation of feldspar, chloritisation of feldspar and mica).

20.0 - 28.0	Grayish black biotite zone.
28.0 - 30.0	Light greenish gray, very fine grained.

30.0 End of Hole

Radioactivity Summary

0.0 - 7.0	100 - 300 c/s	Overburden
7.0 - 12.0	350 - 610 c/s	Overburden to sandstone
12.0 - 20.0	500 - 600, peaks to 790 c/s	Altered, sericitic sandstone, conglomerate
20.0 - 24.9	600 c/s	Schist

Samples:

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15520	10.0 - 11.0	Pubs	6	26	4	<4	6	4	1.30	22
15521	12.0 - 13.0	Pubs	12	20	4	<4	6	<4	0.40	20
15522	14.0 - 15.0	Pubs	12	24	4	<4	16	10	1.30	100
15523	16.0 - 17.0	Pubs	12	20	8	<4	16	6	1.70	65
15524	28.0 - 29.0	Plms	12	24	2	<4	44	10	1.80	150
15633	22.0 - 23.0	Plms	6	22	4	8	75	24	3.10	330

DRILL HOLE SUMMARY

Project:	Afmeco J.V. (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	620,000E/6,288,200N
Elevation:	-12.92 m.
Depth:	15.0 m.
Dip:	-90°
Azimuth:	-
Date Drilled:	23/6/82
Geological Log:	D.A. Currie

Borehole Logging

Gamma: (Open) 0.0 - 10.8 m.; maximum 305 c/s at 10.6 m.

Geological Log

0.0 - 15.0 (?) Middle Proterozoic: Blue Range Fm. - Sandstone (Pubs)

Dark reddish brown, crumbly, compacted quartz grains which could be either Tertiary or Blue Range sandstone bedrock or possibly weathered products of either. Clay is generally absent. Hematite is dominant. One section is slightly bleached (up to 5% clay) and is mottled in appearance. The hole terminated when the rock became too hard for blade bit drilling, hence is considered to be bedrock.

7.0 - 13.0 Bleached section

15.0 End of Hole

Radioactivity Summary

0.0 - 10.8 140 - 305 c/s Overburden, increasing steadily. Possibly sandstone bedrock.

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15525	10.0 - 11.0	Pubs	6	8	4	<4	38	18	1.20	120
15526	12.0 - 13.0	Pubs	4	10	4	<4	18	16	1.00	130
15527	14.0 - 15.0	Pubs	<4	12	4	<4	16	10	1.10	100

DRILL HOLE SUMMARY

0128

Project: Afmeco J.V. (PC 18)
Location: Cockabidnie (EL 893)
Co-ordinates: 620,000E/6,288,300N
Elevation: -11.21 m.
Depth: 30.0 m.
Dip: -90°
Azimuth: -
Date Drilled: 23/6/82
Geological Log: D.A. Currie

Borehole Logging

Gamma: (Open) 0.0 - 24.9 m.; maximum 1025 c/s at 11.25 m.

Geological Log

0.0 - 17.5 m. Middle Proterozoic: Blue Range Fm. - Sandstone (Pubs)

0.0 - 7.5 Overburden: Dark moderate reddish brown fine grained compacted sand. Possibly weathered sandstone outcrop or weathered products.

0.0 - 4.0 Overburden; twigs, grass, sand
4.0 - 5.0 Bleached, clay rich sandstone
5.0 - 7.5 Moderate reddish brown sandstone

7.5 - 17.5 Sandstone: Variably moderate orange pink to pale reddish brown, very fine grained sandstone. Lower section is lighter coloured, sericitic and clay altered.

13.0 - 17.5 Altered, light coloured, sericitic sandstone. Regolith (?)

17.5 - 30.0 m. Lower Proterozoic: Mangalo Schist Fm. - chloritic, biotite schist (Plms)

Soft, powdery; shades of light grays and greenish gray. Chloritic, specks of small (<1 mm.) biotite grains throughout. Few coarse quartz-feldspar grains representing microgneiss bands. Uniform in colour and texture.

30.0 m. End of hole.

Radioactivity Summary

0.0 - 4.0	150 c/s	Overburden
4.0 - 8.5	150-400 c/s	Sandstone, overburden (?)
8.5 - 13.0	700-1000 c/s	Sandstone
13.0 - 17.5	500-700 c/s	Altered sandstone. Regolith (?)
17.5 - 24.4	500-640 c/s	Chloritic, biotite schist

.../2

0129

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15528	10.0 - 11.0	Pubs	10	20	8	<4	34	6	1.20	55
15529	11.0 - 12.0	Pubs	16	22	2	<4	28	6	0.65	26
15530	12.0 - 13.0	Pubs	20	20	6	<4	22	<4	0.80	26
15531	16.0 - 17.0	Pubs	10	20	8	<4	50	10	1.50	155
15532	20.0 - 21.0	Plms	10	24	<2	<4	46	14	2.00	270
15533	28.0 - 29.0	Plms	10	18	<2	<4	42	18	1.30	160

DRILL HOLE RECORD

Hole: R.A.B. 893-5

0130

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	6,288,400N/620,000E
Elevation:	-7.91 m.
Depth:	31.0 m.
Dip:	-90^{o}
Azimuth:	-
Date Drilled:	24/6/82
Geological Log:	D.A. Currie

Borehole Logging

Gamma: (Open) 0.0 - 26.5; maximum 1100 c/s at 15.5 m.

Geological Log

0.0 - 9.5 m. Overburden: Pale yellowish orange crumbly fine grained sand (from sandstone). Only very minor clay. Could be remnant Tertiary sandstone.

9.5 - 21.5 m. Middle Proterozoic: Blue Range Fm. - Sandstone, Pebble Conglomerate (Pubs, Pabs)

Pale red to moderate reddish brown with minor section of greasy hematitic dusky red. Varies from fine grained well compacted sandstone to small pebble conglomerate. Pebbles are rounded and are mostly quartz set in a fine sandy matrix.

14.0 - 16.0 Greasy hematitic section.
18.0 - 20.0 Core - Pebble conglomerate.

21.5 - 31.0 m. Lower Proterozoic: Mangalo Schist Fm: Chloritic Schist (Plms)

Variably yellowish gray to pale olive at the top to dark greenish gray at the bottom. The upper portion consists of fine grained, finely banded schist with a flakey sericitic alteration. The lower portion of the unit is also fine grained and thinly laminated but has a dusted grayish powdery appearance. It is comprised of fine quartz, feldspar and biotite.

21.5 - 25.0 Yellowish gray.
26.0 - 27.0 Greasy moderate red hematitic schist.

31.0 End of Hole.

Radioactivity Summary

0.0 - 4.0	100 c/s	Overburden, loose sand.
4.0 - 9.5	100-375 c/s	Overburden - compacted sand to sandstone.
9.5 - 21.5	500-1000 c/s	Blue Range Sandstone, peak to 1100 associated with hematised sandstone.
21.5 - 26.5	560-680 c/s	Mangalo Schist.

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0131

Samples

Sample	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15627	12.0 - 13.0	Pubs	<4	12	4	<4	30	<4	1.50	44
15628	15.0 - 16.0	Pubs	10	24	4	4	75	26	2.80	470
15629	17.0 - 18.0	Pubs	26	18	4	8	130	55	2.90	1200
15630	22.0 - 23.0	Plms	8	20	6	14	75	30	5.60	290
15631	28.0 - 29.0	Plms	10	16	26	6	75	34	3.40	610

DRILL HOLE RECORD

Hole: R.A.B. 893-6

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	620,000E/6,288,500N
Depth:	30.0 m.
Dip:	-90°
Azimuth:	-
Elevation:	-3.85 m.
Date Drilled:	23/6/82
Geological Log:	D.A. Currie

Borehole Logging

Gamma: (Open) 0.0 - 18.9 m.; maximum 760 c/s at 13.4 m.

Geological Log

0.0 - 6.0 Overburden:

0.0 - 3.0 Light tan brown, sandy
3.0 - 6.0 Darker brown, sandy with up to 25% clay; minor clay structures. Up to 20% quartz pebbles.

6.0 - 24.0 Middle Proterozoic: Blue Range Fm. - Sandstone (Pubs)

Soft, crumbly, variably light grayish pink to moderate red. Generally very fine grained with light hematite and limonite coatings on quartz grains. The upper section appears highly altered and has a slight greenish tint due to the presence of minor amounts of sericite and other clays. Very small specks (<<1 mm.) of a metallic lustre mineral, probably pyrite or iron oxide is present in the upper section (up to 3%).

6.0 - 10.0 Light coloured, clay & sericite rich sandstone.
10.0 - 19.0 Moderate red sandstone.
19.0 - 24.0 Pale red sandstone (?) possibly regolith zone. (Unfortunately radiometric logging was blocked so unconformity cannot be picked on the gamma log.

24.0 - 30.0 Lower Proterozoic: Mangalo Schist Fm. - Hematitic Chloritic Biotite Schist (Plms)

Grayish red to gray, soft, very fine grained lightly hematitic and chloritic finely laminated schist. As noted above, upper contact - the unconformity - is not well marked and may be slightly higher.

30.0 End of Hole.

Radioactivity Summary

0.0 - 5.5 m.	140 - 350 c/s	Overburden
5.5 - 18.9	420 - 760 c/s	Sandstone

.../2

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15534	6.0 - 7.0	Pubs	12	26	4	14	2	<4	0.40	16
15535	12.0 - 13.0	Pubs	4	8	2	<4	<2	<4	0.50	10
15536	21.0 - 22.0	Pubs	8	22	2	<4	<2	<4	0.80	10
15537	29.0 - 30.0	Plms	14	20	4	<4	75	36	1.80	300
15634	13.0 - 14.0	Pubs	4	22	2	6	4	<4	1.10	8
15635	14.0 - 15.0	Pubs	8	18	4	6	<2	<4	1.00	8
15636	24.0 - 25.0	Plms	4	26	8	4	40	10	1.90	185

DRILL HOLE RECORD

Hole: R.A.B. 893-7 0134

Project: Afmeco Joint Venture (PC 18)
Location: Cockabidnie (EL 893)
Co-ordinates: 620,000E/6,288,600N
Elevation: -0.39 m.
Depth: 30.0 m.
Azimuth: -
Dip: -90^{o}
Date Drilled: 23/6/82
Geological Log: D.A. Currie

Borehole Logging

GAMMA: (open) 0.0 - 20.2 m.; maximum 660 c/s at 15.1 m.

Geological Log

0.0 - 4.0 Overburden: Light tan brown to light greenish yellow. Clay rich, hardpan; structured.

4.0 - 26.0 (?) Middle Proterozoic: Blue Range Fm. - Sandstone (Pubs)

Very pale orange to pale greenish yellow to yellowish gray. Soft, clay rich. Very fine grained sand particles comprise 75% with the remainder being fine sericite and clay, with minor hematite staining and a few grains of limonite. Very few chips of easily identifiable sandstone exist; similarly only a very few granule sized quartz grains exist. It is possible that this unit reflects intensely altered quartz-feldspar schist (?). The lower contact is marked by a distinct colour change. Possibly typical of sandstone, there are several minor deeper red hematitic sections. A few grains of grey graphite (?) occur within the upper few metres - this could be due to Mn weathering.

5.0 - 6.0	Graphitic (?) chips
10.0 - 19.0	Light pale red to moderate red
14.0 - 16.0	Dark moderate red
19.0 - 20.0	Limonitic grains.

26.0 - 30.0 Lower Proterozoic: Mangalo Schist Fm. - Schist (Plms)

Soft, grey to light greenish black, lightly chloritized biotite schist. Very fine grained with few grains showing very thin layering defined by white micas and biotite.

30.0 End of hole.

Radioactivity Summary

0.0 - 20.2	400 - 600 c/s	Sandstone (?)

.../2

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15538	5.0 - 6.0	Pubs	6	22	2	44	2	<4	0.40	6
15539	15.0 - 16.0	Pubs	6	22	4	<4	<2	<4	0.60	6
15540	22.0 - 23.0	Pubs	<4	12	4	<4	2	<4	0.60	6
15541	25.0 - 26.0	Pubs	8	22	6	8	4	<4	1.30	10
15542	29.0 - 30.0	Plms	60	30	4	<4	95	14	0.40	20

DRILL HOLE RECORD

Hole: R.A.B. 893-8

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	620,000E/6,288,700N
Elevation:	2.16 m.
Depth:	30.0 m.
Dip:	-90°
Azimuth:	-
Date Drilled:	24/6/82
Geological Log:	D.A. Currie

Borehole Logging:

GAMMA: (open) 0.0 - 20.1 m.; maximum 630 c/s at 18.2 m.

Geological Log:

0.0 - 1.0 Overburden: Dark reddish brown clay.

1.0 - 13.5 (?) Middle Proterozoic: Blue Range Fm - Sandstone (Pubs)

Soft, powdery, creamy white kaolinitic material consisting of extremely fine grained material comprised of up to 25% identifiable quartz grains, 10-20% white mica (muscovite) and minor specks of black metallic iron oxides with the remainder being clay (kaolinite ?). The lower contact is reasonably abrupt. This unit could represent a highly altered Blue Range formation argillaceous sandstone OR could easily be altered Yadnarie Schist or Mangalo Schist.

13.5 - 30.0 Lower Proterozoic: Mangalo Schist Fm - Schist (Plms) to Microgneiss

Shades of light gray becoming brownish gray at depth. Fine to medium grained shards of quartz and feldspar to 70% (to 2 mm.), 20% white mica (muscovite), 10% biotite with minor chlorite and black iron oxides. Lower section is more hematitic and slightly coarser grained, probably reflecting a quartz-feldspar microgneiss band.

13.5 - 19.0 Shades of light gray-chloritic-biotite-muscovite schist.

19.0 - 30.0 Brownish gray, lightly hematitic quartz-feldspar microgneiss.

30.0 End of hole.

Radioactivity Summary:

0.0 - 13.5	380 - 575 c/s	(?) sandstone
13.5 - 20.1	440 - 620 c.s	(?) Mangalo schist

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Samples:

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15543	5.0 - 6.0	(?)Pubs	6	44	2	6	10	<4	0.15	6
15544	9.0 - 10.0	(?) Pubs	6	28	2	28	4	<4	0.15	<4
15545	18.0 - 19.0	Plms	4	20	<2	<4	32	12	1.20	90
15546	22.0 - 23.0	Plm	4	18	2	<4	46	10	1.50	105
15547	28.0 - 29.0	Plm	8	34	2	<4	28	6	1.40	110

Clay Mineral Identification

29401 11.0 - 12.0 m. Pubs

10 ppm U, 42 ppm Th, 300 ppm B

Bulk Mineralogy:

Dominant - Kaolinite
Sub-Dominant - Mica/Illite
Accessory - Quartz

-2 mm. Fraction: (11%)

Dominant - Kaolinite
Accessory - Illite $\pm$ Montmorillonite

DRILL HOLE RECORD — Hole: R.A.B. 893-9

Project: Afmeco Joint Venture (PC 18)
Location: Cockabidnie (EL 893)
Co-ordinates: 620,000E/6,288,800N
Elevation: 0.0 m.
Depth: 39.0 m.
Dip: -90°
Azimuth: -
Date Drilled: 24/6/82
Geological Log: D.A. Currie

Borehole Logging

GAMMA: (Open) 0.0 - 17.7 m. (blocked); maximum 680 c/s at 14.5 m.

Geological Log

0.0 - 4.0 m. Overburden: Reddish brown to yellowish brown clay rich soil, some clay structures. Several large (1 cm.) Warrow quartzite fragments.

4.0 - 39.0 m. (?) Lower Proterozoic: Mangalo Schist (Plms)

Variable from light tan brown and creamy white to dusky yellow to light olive brown to grayish green at the bottom. The upper units could possibly be highly altered argillitic sandstone of the Middle Proterozoic Blue Range Sandstone Fm.

- 4.0 - 13.0 Light coloured, soft, powdery, kaolinitic; similar to top unit in hole 893-8.
- 13.0 - 26.0 Shades of yellowish brown to greenish yellow. Abundant 1 mm. sized grains of quartz throughout.
- 26.0 - 39.0 Gray to grayish green, clay altered quartz-feldspar-biotite schist.

39.0 End of hole.

Radioactivity Summary

0.0 - 4.0	120 - 300 c/s	Overburden
4.0 - 17.7	370 - 500 c/s	Schist

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15548	9.0 - 10.0	Plms(?)	8	34	<2	30	20	<4	0.20	6
15549	14.0 - 15.0	Plms	4	22	<2	10	<2	<4	0.70	6
15550	20.0 - 21.0	Plms	10	28	2	<4	38	12	2.70	100
15551	28.0 - 29.0	Plms	12	20	<2	<4	40	10	1.70	110
15552	38.0 - 39.0	Plms	8	22	4	6	34	6	0.80	44

DRILL HOLE RECORD

Hole: R.A.B.893-10

Project: Afmeco Joint Venture (PC 18)
Location: Cockabidnie (EL 893)
Co-ordinates: 620,160E/6,287,960N
Depth: 42.0 m.
Dip: -90°
Azimuth: -
Elevation: -3.38 m.
Date Drilled: 24/6/82
Geological Log: D.A. Currie

Borehole Logging

GAMMA: (open) 0.0 - 40.4 m.; maximum 940 cps at 37.5 m.

Geological Log

0.0 - 42.0 Middle Proterozoic: Blue Range Formation - Sandstone (Pubs)

Pinkish gray to pale red to moderate red near bottom. Fine to medium grained with minor sections of very small pebbles to 0.5 cm., subrounded. Upper section has few grains with light pale limonitic coating and has up to 10-15% clay coatings. Gradationally becomes hematitic towards the bottom of the hole. Grains are coated with fine grained greasy hematitic coatings; also minor amounts of sericite. Slight radiometric peaks correlate with coarser grained sections and/or with deeply hematized fine grained sections.

42.0 End of hole.

Radioactivity Summary

0.0 - 42.0 Background 400 - 525 c/s, minor peaks: 770 c/s at 5.2 m., 760 c/s at 9.4 m.; 830 c/s at 21.8 m.; 700 c/s at 31.5 m.; 940 c/s at 37.5 m.

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15553	5.0 - 6.0	Pubs	<4	24	2	8	2	<4	0.15	8
15554	9.0 - 10.0	Pubs	4	40	<2	<4	6	<4	0.40	16
15555	21.0 - 22.0	Pubs	<4	22	2	<4	<2	<4	0.60	6
15556	31.0 - 32.0	Pubs	4	14	<2	<4	2	<4	0.35	12
15557	36.0 - 37.0	Pubs	6	34	2	12	14	<4	0.65	32
15558	40.0 - 41.0	Pubs	8	38	<2	<4	12	<4	1.50	60

Clay Mineralogy

29402 13.0 - 14.0 Pubs 4ppm U, 32 ppm Th, 6 ppm B

Bulk Mineralogy

Dominant - Quartz

Accessory-Sub-Dominant - K-feldspar

Accessory - Kaolinite, Illite

-2 mm. Fraction (6%)

Dominant - Mica/Illite

Sub-Dominant - Kaolinite

29403 8.0 - 9.0 Pubs <4 ppm U, 14 ppm Th, 60 ppm B

Bulk Mineralogy

Dominant - Quartz

Sub-Dominant - K-feldspar

Accessory - Kaolinite, Mica/Illite

-2 mm. Fraction (4%)

Dominant - Kaolinite

Sub-Dominant - Mica/Illite

Trace - Quartz

DRILL HOLE RECORD

Hole: R.A.B. 893-11

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	619,375E/6,288,000N
Elevation:	0.65 m.
Depth:	18.0 m.
Azimuth:	-
Dip:	-90°
Date Drilled:	24/6/82
Geological Log:	D.A. Currie

Borehole Logging

GAMMA : (Open) 0.0 - 16.7 m.; maximum 685 c/s at 5.60 m.

Geological Log

0.0 - 3.0 Overburden: Pale red to moderate brown clay soil, minor limonite staining.

3.0 - 18.0 Middle Proterozoic: Blue Range Sandstone Fm.

Grayish pink to pale red to light moderate red; fine to medium grained quartz sandstone. Upper portion has scattered limonite coated grains and up to 5% light green sericite (?) flakes. The lower portion is slightly darker, and more hematitic. No coarse grained conglomerate or pebble layers.

3.0 - 9.0	Light coloured
3.0 - 5.0	Sericite rich section
9.0 - 18.0	Darker moderate red, hematitic sandstone

18.0 End of hole.

Radioactivity Summary

0.0 - 2.5	180 - 300 c/s	Overburden
2.5 - 12.0	460 - 660 c/s	Sericitic sandstone
12.0 - 16.7	400 - 520 c/s	Hematitic sandstone

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15559	5.0 - 6.0	Pubs	4	20	2	<4	8	<4	0.90	40
15560	10.0 - 11.0	Pubs	8	34	4	<4	10	<4	2.50	60
15561	16.0 - 17.0	Pubs	4	18	<2	6	8	<4	1.70	34

DRILL HOLE RECORD

Hole: R.A.B. 893-12

Project: Afmeco Joint Venture (PC 18)
Location: Cockabidnie (EL 893)
Co-ordinates: 619,330E/6,287,910N
Elevation: -2.47 m.
Depth: 24.0 m.
Dip: -90^{o}
Azimuth: -
Date Drilled: 24/6/82
Geological Log: D.A. Currie

Borehole Logging

GAMMA: (open) 0.0 - 22.9 m.; maximum 740 cps at 14.8 m.

Geological Log

0.0 - 4.0 Overburden: Yellowish brown sand.

4.0 - 10.0 Overburden: Brown, clay rich, large 0.5 cm. quartz pebbles.

10.0 - 14.0 Middle Proterozoic: Blue Range Formation - Pebble Conglomerate (Pubc)

Light brown, small pebble (1 - 2.5 cm.) pebble conglomerate. Pebble exclusively gray quartzite (Warrow quartzite) set in fine grained limonitic matrix of fine quartz grains.

14.0 - 24.0 Middle Proterozoic: Blue Range Formation - Sandstone (Pubs)

Pale yellowish orange to very pale orange to light pale red. Fine grained. Comprised dominantly of quartz with minor amounts of limonite, hematite and up to 10% clay minerals (after feldspar).

24.0 End of hole.

Radioactivity Summary

0.0 - 4.0	100 - 140 c/s	Overburden (sand)
4.0 - 10.0	190 - 240 c/s	Overburden (clay, pebbles)
10.0 - 12.0	300 - 510 c/s	Pebble conglomerate
12.0 - 22.9	500 - 740 c/s	Sandstone

Samples

			Geochemical Results (ppm)							
Sample No.	Interval	Lithology	U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15562	10.0 - 11.0	Pubc	<4	14	4	20	12	6	0.65	22
15563	15.0 - 16.0	Pubs	4	26	<2	<4	6	<4	0.25	10
15564	19.0 - 20.0	Pubs	<4	22	2	14	8	<4	0.35	12
15565	23.0 - 24.0	Pubs	<4	32	<2	10	14	8	1.40	80

DRILL HOLE RECORD

Hole: R.A.B. 893-13

Project: Afmeco Joint Venture (PC 18)
Location: Cockabidnie (EL 893)
Co-ordinates: 619,320E/6,288,100N
Elevation: 5.53 m.
Depth: 30.0 m.
Dip: -90°
Azimuth: -
Date Drilled: 24/6/82
Geological Log: D.A. Currie

Borehole Logging

GAMMA : (open) 0.0 - 28.4 m.; maximum 640 c/s at 11.4 m.

Geological Log

0.0 - 1.0 Overburden: Light brown sandy material with quartz pebbles.

1.0 - 5.0 Overburden (?): Whitish gray, clay coated quartzite pebbles up to 1.5 cm. diameter, angular. May be Pubc but most likely quartz rubble on surface.

5.0 - 14.0 Middle Proterozoic: Blue Range Sandstone, Sericitic (Pubs)

Grayish yellow to pale greenish yellow, fine grained sericite rich quartz sandstone. Quartz grains up to 1.5 mm. diameter and quite angular. Minor hematization of some grains.

12.0 - 13.0 Pebble conglomerate

14.0 - 22.0 Middle Proterozoic: Blue Range Sandstone, Hematitic (Pubs)

Moderate to dusky red in colour. Bimodal; chips of blackish red hematized quartz to 0.65 cm. and powder of fine grained quartz and hematite and minor chlorite and sericite.

22.0 - 30.0 Middle Proterozoic: Blue Range Sandstone (Pubs)

Gradationally less hematitic than section above. Mixed light yellow brown to pale red in colour. Scattered coarser grains to 0.35 cm.

30.0 End of hole.

Radioactivity Summary

0.0 - 28.4 m. Background of 320 - 420 c/s Sandstone
Peaks to 640 c/s

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15566	7.0 - 8.0	Pubs	<4	14	4	<4	6	<4	0.65	20
15567	11.0 - 12.0	Pubs	<4	14	2	<4	10	4	0.70	42
15568	15.0 - 16.0	Pubs	6	26	2	38	22	14	4.80	135
15569	20.0 - 21.0	Pubs	6	18	4	6	14	6	4.50	60
15570	29.0 - 30.0	Pubs	8	20	2	<4	4	<4	2.00	18

DRILL HOLE RECORD

Hole: R.A.B. 893-14

0144

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	619,160E/6,288,260N
Elevation:	8.90 m.
Depth:	9.0 m.
Dip:	-90^{o}
Azimuth:	-
Date Drilled:	24/6/82
Geological Log:	D.A. Currie

Borehole Logging

GAMMA: (Open) 0.0 - 8.0 m.; maximum 540 c/s at 7.6 m.

Geological Log

0.0 - 3.0 Overburden

0.0 - 1.0 Sand, light brown
1.0 - 3.0 Clay, structured, grayish orange.

3.0 - 9.0 Middle Proterozoic - Blue Range Formation Sandstone (Pubs)

Pale yellowish orange fine to coarse grained sandstone. Approximately 70% rounded quartz grains to 2 mm. with up to 30% fine quartz and clay matrix, minor white mica flakes and possibly minor sericite. Hole stopped short because of hardness preventing blade bit R.A.B.

9.0 End of Hole.

Radioactivity Summary

0.0 - 9.0 300 - 540 c/s Sandstone

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15571	5.0 - 6.0	Pubs	6	36	<2	<4	4	<4	0.80	14
15572	8.0 - 9.0	Pubs	4	16	<2	<4	6	<4	0.70	16
15637	7.0 - 8.0	Pubs	<4	6	4	<4	<2	<4	0.35	8

DRILL HOLE RECORD

Hole: R.A.B. 893-15

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	619,250E/6,288,175N
Elevation:	9.77 m.
Depth:	21.0
Dip:	-90°
Azimuth:	-
Date Drilled:	24/6/82
Geological Log:	D.A. Currie

Borehole Logging

GAMMA: (open) 0.0 - 17.4 m.; maximum 580 c/s at 11.5 m.

Geological Log

0.0 - 1.5 m. Overburden: Moderate yellowish brown sand.

1.5 - 21.0 m. Middle Proterozoic: Blue Range Formation - Sandstone (Pubs)

Grayish pink, pale yellowish orange, to minor moderate red. Fine to medium grained with up to 10 - 20% larger small pebble sized quartz (0.5 cm.) pebbles. Several sections have deep moderate red hematitic stain with hematite stained micas. Also minor amounts of light yellow stained feldspar grains with lesser amounts of sericite and possibly muscovite.

7.0 - 9.0 Coarse grained, conglomeratic with some hematized grains.
10.0 - 11.0 Moderate red hematized section.
13.0 - 14.0 As above.

21.0 End of hole.

Radioactivity Summary

0.0 - 21.0 300 - 500 c/s Sandstone
Peaks to 580 c/s Hematized sandstone

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15573	3.0 - 4.0	Pubs	<4	8	<2	<4	8	<4	0.40	20
15574	7.0 - 8.0	Pubs	4	10	<2	<4	8	<4	0.65	40
15575	10.0 - 11.0	Pubs	<4	10	4	<4	4	<4	0.70	24
15576	13.0 - 14.0	Pubs	4	14	<2	<4	8	<4	0.60	40
15577	15.0 - 16.0	Pubs	12	14	30	<4	4	<4	1.40	8
15638	11.0 - 12.0	Pubs	<4	8	2	<4	2	<4	1.00	24

Hole: R.A.B. 893-0546

Clay Mineralogy

29404 19.0 - 20.0 Pubs <4 ppm U, 12 ppm Th, 30 ppm B

Bulk Mineralogy

Dominant - Quartz
Sub-Dominant - K-feldspar
Accessory - Kaolinite, Mica/Illite
Trace - Dolomite

-2 mm. Fraction (10%)

Dominant - Kaolinite
Sub-Dominant - Illite ± Montmorillonite
Accessory - Quartz

DRILL HOLE RECORD

Hole: R.A.B. 893-16

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	619,000E/6,288,250N
Elevation:	7.77 m.
Depth:	36.0 m.
Dip:	-90^{o}
Azimuth:	-
Date Drilled:	24/6/82
Geological Log:	D.A. Currie

Borehole Logging

GAMMA: (open) 0.0 - 31.8 m.; maximum 835 c/s at 20.3 m.

Geological Log

0.0 - 3.5 Overburden:

0.0 - 1.0	Sand, light tan brown
1.0 - 2.0	Calcrete
2.0 - 3.5	Clay; greyish brown, structured, weathered Plms grains.

3.5 - 36.0 Lower Proterozoic: Mangalo Schist Formation - Quartz-feldspar-muscovite-biotite schist (Plms)

Various shades of grayish pink, pale red to dominantly brownish gray to brownish black. Comprised of a fine grained mixture of flakes of quartz (20-40%), feldspar (30-50% - largely altered by hematite, chlorite or sericite), muscovite (10% - locally 40%) and biotite (variable 10-30%).

3.5 - 10.0	Light brownish gray
10.0 - 14.0	Light grayish pink, muscovite rich section
14.0 - 16.0	Light brownish gray
16.0 - 27.0	Pale red to brownish gray, increasing biotite content, hematization of feldspar.
27.0 - 36.0	Darker grownish gray to brownish black
33.0 - 34.0	Dark brownish black, possibly graphitic, biotite rich schist

36.0 End of hole

Radioactivity Summary

0.0 - 2.0	200-320 c/s	Overburden
2.0 - 28.0	420 increasing to peak of 835 at 20.3	Schist, hematized
28.0 - 31.8	440-560	Schist, biotite rich

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0148

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15578	10.0 - 11.0	Plms	4	20	<2	<4	18	4	0.90	70
15579	20.0 - 21.0	Plms	8	24	4	14	30	18	2.60	170
15580	25.0 - 26.0	Plms	4	20	8	8	48	18	3.60	240
15581	30.0 - 31.0	Plms	<4	22	4	<4	4	<4	0.60	20
15582	33.0 - 34.0	Plms	6	22	6	<4	16	<4	1.10	50
15583	35.0 - 36.0	Plms	6	22	6	<4	14	<4	1.10	42

DRILL HOLE RECORD

Hole: R.A.B. 893-17

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	619,040E - 6,288,010N
Elevation:	14.08 m.
Depth:	36.0 m.
Dip:	-90^{o}
Azimuth:	-
Date Drilled:	24/6/82
Geological Log:	D.A. Currie

Borehole Logging

GAMMA: (open) 0.0 - 34.7; maximum 825 c/s at 25.0 m.

Geological Log

0.0 - 4.0 Overburden: White, powdery calcrete and conglomerate pebbles.

4.0 - 36.0 Middle Proterozoic: Blue Range Fm. Sandstone (Pubs)

Very light pinkish gray to light grayish white. Fine to medium sand sized quartz grains with abundant sections of 0.75 - 1.0 cm. sized small pebbles of white glossy quartz. Several samples have a light gray to greenish gray colour due to an increased amount of sericite. Composition is approximately 70% quartz, 25% clay and sericite (after feldspar) and up to 5% sericite, muscovite and chlorite.

4.0 - 19.0	Generally up to 40% is pebble conglomerate with up to 10% conglomerate at: 6.0 - 7.0 m., 9.0 - 10.0, 14.0 - 15.0
21.0 - 24.0	Conglomeratic
24.0 - 26.0	Light greenish gray sericitic sandstone
30.0 - 31.0	As above

36.0 End of hole.

Radioactivity Summary

0.0 - 4.0	150 - 250	Overburden
4.0 - 34.7	200 - 450	Sandstone

Peaks of 590 at 21.5, 825 cps at 25.0 m., 580 cps at 30.0 m. correspond to sericitic sandstone intervals.

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0150

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	(Fe)%	Mn
15584	5.0 - 6.0	Pubs	<4	20	<2	<4	10	<4	0.25	10
15585	12.0 - 13.0	Pubs	6	34	6	4	4	<4	0.20	8
15586	21.0 - 22.0	Pubs	4	36	6	8	<2	<4	0.20	8
15587	24.0 - 25.0	Pubs	4	26	8	20	10	4	0.75	32
15588	25.0 - 26.0	Pubs	6	32	6	55	20	8	0.80	50
15589	29.0 - 30.0	Pubs	<4	12	<2	<4	<2	<4	0.20	6
15590	30.0 - 31.0	Pubs	<4	14	<2	<4	4	<4	0.10	6
15591	31.0 - 32.0	Pubs	<4	26	8	4	10	<4	0.45	32
15592	35.0 - 36.0	Pubs	<4	26	8	<4	8	<4	0.50	34

DRILL HOLE RECORD

Hole: R.A.B. 893-18

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	619,000E - 6,288,100N
Elevation:	13.23 m.
Depth:	27.0 m.
Dip:	-90^{o}
Azimuth:	-
Date Drilled:	24/6/82
Geological Log:	D.A. Currie

Borehole Logging

GAMMA: (open) 0.0 - 25.7 m.; maximum 520 cps at 16.7 m.

Geological Log

0.0 - 2.0 m. Overburden: Tan brown sand with minor calcrete and greenish gray silcrete chips.

2.0 - 27.0 m. Middle Proterozoic: Blue Range Sandstone Fm. (Pubs)

Variable from light moderate orange pink to grayish orange pink light pale yellowish orange. With minor light pale greenish yellow. Generally fine to medium sand sized quartz grains with locally up to 20% granule to small pebble sized grains. No major conglomerate zones. The upper portion of the hole has a faint light reddish hematite tint (hematization of feldspars) with a zone of sericite rich sandstone with a light greenish tint below.

0.0	- 5.0	Light brown, lightly hematized zone.
5.0	- 8.0	Light greenish, sericite and clay rich.
8.0	- 10.0	White, clay rich zone.
10.0	- 12.0	Light greenish, sericitic sandstone.
16.0	- 17.0	As above.
22.0	- 24.0	Light tan-brown sandstone.

27.0 End of hole.

Radioactivity Summary

0.0 - 25.7 m. 220 - 340 cps Sandstone
Peaks: 440 cps at 1.0 m.; 415 cps at 4.2 m.; 445 cps at 6.0 m.; 450 cps at 9.3 m.; 475 cps at 15.2 m.; 520 cps at 16.7 m.; 475 cps at 18.7 m.; 400 cps at 21.6 m.; 440 cps at 25.2 m.
Peaks generally associated with light green sericitic tint.

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0152

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15593	6.0 - 7.0	Pubs	<4	20	10	4	8	<4	0.30	18
15594	16.0 - 17.0	Pubs	6	36	6	42	14	<4	0.50	28
15595	17.0 - 18.0	Pubs	6	34	8	34	10	<4	0.35	18
15596	18.0 - 19.0	Pubs	4	24	10	20	8	<4	0.30	22
15597	23.0 - 24.0	Pubs	4	22	12	<4	6	<4	0.50	18
15598	26.0 - 27.0	Pubs	<4	10	10	<4	6	<4	1.10	8

Clay Mineralogy

29406 11.0 - 12.0 Pubs

< 4 ppm U, 30 ppm Th, 80 ppm B

Bulk Mineralogy:

Co-Dominant - Kaolinite, Quartz
Accessory - Mica/Illite

-2 mm. Fraction (21%)

Dominant - Kaolinite
Sub-Dominant - Mica/Illite

29407 19.0 - 20.0 Pubs

< 4 ppm U, 16 ppm Th, 10 ppm B

Bulk Mineralogy:

Dominant - Quartz
Accessory - K-feldspar, Kaolinite, Mica/Illite

-2 mm. Fraction (9%)

Dominant - Kaolinite
Sub-Dominant - Mica/Illite
Trace - Quartz

DRILL HOLE RECORD

Hole: R.A.B. 893-19

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie (EL 893)
Co-ordinates:	619,000E - 6,288,150N
Elevation:	11.48 m.
Depth:	54.0 m.
Dip:	-90°
Azimuth:	-
Geological Log:	D.A. Currie

Borehole Logging

GAMMA: (open) 0.0 - 53.0 m.; maximum 630 cps at 39.6 m.

Geological Log

0.0 - 6.0 Overburden

0.0	-	1.0	White, leached sand, minor calcrete
1.0	-	3.0	Brown clay, structured
3.0	-	4.0	Reddish brown sandstone fragments, minor clay minerals.
4.0	-	6.0	Light pale yellow green clay rich sandstone chips, laterized.

6.0 - 50.0 Middle Proterozoic: Blue Range Fm. Sandstone (Pubs)

Overall pale grayish orange pink to pale greenish yellow with sections of dark yellowish orange, grayish orange and grayish red. The light greenish sections are comprised of possibly up to 20% light flakes and coatings on quartz grains of sericite and other clay minerals and a few flakes of muscovite. The pale pink sections are similar yet contain up to 10% lightly hematized clay minerals. Quartz grains in both varieties are similar: fine to coarse grained sand sized, moderately well rounded quartz grains. There is very little evidence of feldspar - other than the clay alteration.

There are several minor sections of deep hematization or limonitic staining and several small cobble sized layers are also present.

The contact with the unit below (i.e. the "unconformity") is marked by several metres of large (up to 1.5 cm.) muscovite flakes within the sandstone. The contact appears quite sharp.

6.0	-	8.0	Pale greenish coloured
11.0	-	14.0	As above
14.0	-	17.0	Dark reddish brown hematitic layer, some cobbles
17.0	-	19.0	Light yellowish to pale red brown.
19.0	-	24.0	Light pale reddish tint
24.0	-	26.0	Dark yellowish brown limonitic sandstone
26.0	-	27.0	Light greenish tint
27.0	-	38.0	Generally very light, pale grayish pink to greenish yellow; bimodal, granules to 0.4 cm. in fine grained matix.

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0154

38.0 - 44.0 Becoming increasingly more hematitic and micaceous; grades to dark reddish brown in colour.
44.0 - 45.0 Grayish brown muscovite rich
45.0 - 50.0 Light pale pinkish gray in colour with approximately 40% large, up to 1 cm. square, muscovite books and abundant fine grained muscovite throughout. Also up to 5% fine dark greenish flakes to 0.5 mm. which could possibly be chlorite (do not appear soft enough).

50.0 - 54.0 Lower Proterozoic: Mangalo Schist Formation Schist (Plms)

Moderate brown, fine grained, micaceous (up to 40% muscovite, 20% biotite and 10% chlorite, minor sericite).

54.0 End of hole.

Radioactivity Summary

0.0 - 2.2	180 c/s	Overburden
2.2 - 27.0	146 - 360 c/s	Sandstone, with minor peaks to 490 c/s associated with coarser grained sections or sericitic rich sections
27.0 - 50.0	200-500 c/s	Steadily increasing background; sandstone.
50.0 - 53.0	400-480 c/s	Mangalo schist.

Samples

			Geochemical Results (ppm)							
Sample No.	Interval	Lithology	U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15599	7.0 - 8.0	Pubs	6	38	12	75	20	8	1.00	65
15600	10.0 - 11.0	Pubs	<4	14	16	14	16	<4	0.20	6
15601	15.0 - 16.0	Pubs	<4	14	8	30	42	<4	2.70	60
15602	20.0 - 21.0	Pubs	4	24	4	12	10	<4	0.60	20
15603	25.0 - 26.0	Pubs	<4	12	10	14	4	<4	1.70	10
15604	30.0 - 31.0	Pubs	<4	24	6	8	12	<4	0.25	8
15605	34.0 - 35.0	Pubs	4	18	8	<4	8	<4	0.20	10
15606	39.0 - 40.0	Pubs	6	22	6	6	8	<4	0.50	16
15607	42.0 - 43.0	Pubs	4	22	8	6	12	<4	2.00	38
15608	45.0 - 46.0	Pubs	4	8	10	<4	14	<4	0.50	26
15609	46.0 - 47.0	Pubs	4	8	10	<4	6	<4	0.45	18
15610	47.0 - 48.0	Pubs	4	<4	12	<4	8	<4	0.40	20
15611	48.0 - 49.0	Pubs	<4	8	10	<4	28	<4	1.00	70
15612	49.0 - 50.0	Pubs	<4	4	8	<4	4	<4	0.50	20
15613	50.0 - 51.0	Plms	6	22	4	<4	50	20	4.40	270
15614	51.0 - 52.0	Plms	4	20	8	<4	60	26	3.90	260
15615	52.0 - 53.0	Plms	<4	14	6	<4	55	16	4.70	300
15616	53.0 - 54.0	Plms	4	22	4	<4	360	80	2.60	210

DRILL HOLE RECORD

Hole: R.A.B. 893-20

Project: Afmeco Joint Venture (PC 18)
Location: Cockabidnie (EL 893)
Co-ordinates: 619,000E - 6,288,200N
Elevation: 9.66 m.
Depth: 30.0 m.
Dip: -90°
Azimuth: -
Geological Log: D.A. Currie

Borehole Logging

GAMMA: (open) 0.0 - 28.2 m.; maximum 540 cps at 17.8 m.

Geological Log

0.0 - 5.50 Overburden

0.0 - 2.0 Clay, bleached, minor calcrete
2.0 - 5.5 Clay, moderate yellowish brown, textured.

5.50 - 20.60 Middle Proterozoic: Blue Range Sandstone Fm. (Pubs)

Generally pale yellowish orange to dark yellowish orange to very pale orange. Fine to very fine grained sand sized quartz fragments, well rounded. Up to 20% clay coatings, off white to pale greenish yellow. However, not as much identifiable sericite as seen in other holes. Only very random granule sized quartz grains. Contact with unit below is sharp.

5.0 - 11.0 Dark yellowish brown
11.0 - 16.0 Very pale orange to pale yellowish orange
16.0 - 17.0 Dark yellowish brown
17.0 - 20.6 White to very pale orange, clay rich section

20.60 - 30.0 m. Lower Proterozoic: Mangelo Schist Fm. (Plms)

Light olive gray to medium bluish gray, fine grained, highly altered (clays, chlorite, sericite). Few relic feldspars are highly altered; only 15-20% quartz is identified. Minor section of medium bluish gray could possibly have been graphitic (?). Minor amount of foliation/layering is visible on some of larger chips. Layers seem extremely thin (<<1 mm.).

25.0 - 26.0 Bluish gray layer.

30.0 End of hole

Radioactivity Summary

0.0 - 5.50	180 - 280	Overburden
5.50 - 20.60	195 - 300	Sandstone, several minor peaks to 540 cps.
20.60 - 30.0	360 - 440	Schist, low amplitude pattern

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0156

Samples

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
15617	9.0 - 10.0	Pubs	4	14	6	<4	6	<4	0.20	6
15618	14.0 - 15.0	Pubs	<4	18	8	<4	12	<4	0.20	8
15619	17.0 - 18.0	Pubs	4	10	6	<4	4	<4	0.15	4
15620	18.0 - 19.0	Pubs	<4	12	4	<4	8	<4	0.20	14
15621	19.0 - 20.0	Pubs	4	24	<2	12	6	<4	0.50	14
15622	20.0 - 21.0	Plms	<4	18	4	12	10	<4	0.45	28
15623	21.0 - 22.0	Plms	6	24	<2	6	24	<4	0.60	60
15624	22.0 - 23.0	Plms	6	16	<2	8	22	<4	0.60	70
15625	25.0 - 26.0	Plms	8	20	4	10	12	<4	0.35	42
15626	29.0 - 30.0	Plms	6	26	2	6	10	<4	0.30	22

APPENDIX 1B

1982

CORE DRILL HOLES

GEOLOGICAL LOGS

1982

CORE DRILLING

0158

EL 893

Cockabidnie

DDH 893-1	619,026E - 6,288,025N	-90°	126.20m
DDH 893-2	619,320E - 6,288,000N	-90°	100.20m
DDH 893-3	619,545E - 6,287,955N	-90°	74.40m
			300.80m

DRILL HOLE RECORD

Hole: DDH 893-1

0159

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie Grid (E.L.893)
A.M.G. Co-ordinates:	619,026E/6,288,025N
Elevation:	14.08 m.
Depth:	126.20 m.
Dip:	-90^{o}
Azimuth:	-
Date Commenced:	28/7/82
Date Completed:	8/8/82
Geological Log:	D.A. Currie

Borehole Logging

GAMMA:	(Rods)	0.0 - 124.6 m.;	maximum 500 c/s at 100.4 m.
	(Open)	0.0 - 124.6 m.;	maximum 600 c/s at 123.5 m.

Geological Log

0.0 - 87.5 m. Middle Proterozoic: Blue Range Fm. - Sandstone, Pebble Conglomerate (Pubs, Pubc)

0.0 - 38.40	Pebble conglomerate - white to pale yellowish green; clay rich, sericitic.
38.4 - 43.50	Pebble conglomerate - limonitic
43.5 - 54.80	Pebble conglomerate - hematitic
54.8 - 85.75	Sandstone - grey, porous
85.75- 87.50	Regolith

This unit grades from a generally weathered granule to medium pebble conglomerate at surface to a porous, medium grained sandstone at the contact with the underlying units.

The uppermost conglomerate section is white to gray to light pale yellowish and locally pale greenish yellow (clays, sericite). It consists of granule to small pebbles, mostly pitted quartzite (Warrow Quartzite) and minor gneiss and granite in a matrix of medium sand sized quartz grains with an abundance of white clay both as cement and as relic grains (after feldspar). The section contains up to 10% light pink feldspar grains, 10-20% clay minerals, 5-10% sericite, 70% quartz, minor muscovite. There are several minor pale greenish yellow sericitic silstone bands. Bedding is not well defined. This section is gradational to a zone of limonitic conglomerate which is very similar to the clay rich conglomerate.

Below the limonitic conglomerate there is a light to gradationally darker pale red to moderate red pebble conglomerate. It contains up to 25% greasy hematitic coatings within the matrix. There are several minor bleached clay altered silstone sections within the unit. Both the upper and lower contacts are gradational.

The lower sandstone unit varies from pale pink at the upper contact to a pale gray. It is extremely soft, crumbly, poro looking. It is well bedded; bimodal, comprised of large san sized grains in a fine grained matrix. Creamy white clay minerals after feldspar comprise up to 15% of the core. In places the core has a pitted appearance.

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The lowermost section is gradationally finer grained, and more hematitic and sericitic. It is moderate red in colour, consisting of generally a fine grained sandstone to siltstone with random small pebble sized quartz pebbles set in a dark greasy hematitic matrix. Pale yellowish green to light olive green sericitic flakes are also present (up to 10%). The lowermost contact - the unconformity - is marked by 4-6 cm. of pale olive clay altered material.

Core: Soft and crumbly at surface; blade drilled to 30 m.

Radioactivity: Average background: (probe - through rods) 150-250 c/s in pebble conglomerate, 180-375 in sandstone. No marked anomaly at unconformity although background increases twofold.

Composition: 70% quartz; 10% feldspar; 5-15% clay, minor hematite, sericite.

0.00 - 38.40	White clay altered pebble conglomerate.
0.00 - 3.00	Rubble; overburden.
3.00 - 8.00	Core recovered.
8.00 - 30.00	Blade drilling, chips recovered.
32.70	Bedding at 65° to core axis.
38.40 - 43.50	Limonitic pebble conglomerate.
43.50 - 54.80	Hematitic pebble conglomerate.
44.80	Bedding at 50° to core axis.
48.30 - 49.70	Very coarse pebble to small cobble conglomerate.
49.30 - 49.50	Crushed core.
52.80 - 54.80	Deeply hematitized section.
54.80 - 85.75	Pale gray, medium grained, porous sandstone.
54.80 - 62.50	Gradationally less pale pink with depth.
61.0	Bedding at 70° to the core axis.
62.50 - 65.20	Dark gray, very porous, hard, flinty.
64.00	Bedding at 70° to core axis.
65.20 - 70.00	Soft, crumbly clay rich porous sandstone.
70.00 - 70.90	Pale red sandstone.
71.80 - 78.50	Very porous, crumbly sandstone.
76.00	Bedding at 70° to core axis.
81.00	Bedding at 70° to core axis.
85.75 - 87.50	Fine grained, moderate red, hematitic; sandstone to siltstone; few small pebbles.
87.45	Few larger pebbles up to 3 cm. diameter.

87.50 — Unconformity.

87.50 - 126.20 — Lower Proterozoic: Mangalo Schist Fm. - Schist to Microgneiss (Plms)

Pale to moderate to grayish red to gradationally blackish-red near the bottom of the hole. Uniform texture; generally a soft, fine grained phyllitic schist with up to 15% microgneiss. Gneissic bands comprised of thin (1-3 mm. avg; max. 1-1.15 cm.) white to creamy pink quartz/feldspar bands. Schistosity/gneissosity is well developed throughout at 10-30° to core axis. Although there is minor contorted beds, foliation is fairly uniform. A few of the felsic bands exhibit minor augen structures. Overall the unit has a faint hematitic and chloritic overprint. There is no significant alteration throughout the unit. Within the lower section, there are numerous strong fractures parallel to schistosity

which have thin coatings of graphite and/or chlorite.

Core: Very blocky, many short drilling runs; no major core loss or fault zones.

Radioactivity: (probe: with rods) average background 300-400 c/s increasing slightly to 350-420 in lower graphitic section. No significant peaks.

87.50 - 107.20	Generally lighter coloured (pale to moderate red) phyllitic schist.
89.20	Schistosity at 38° to core axis.
92.00	Schistosity at 20° to core axis.
100.00	Schistosity at 30° to core axis.
107.20 - 113.90	Gradational to darker graphitic schist; several fractures coated with rusty yellowish orange brown coating.
108.70	Schistosity at 35° to core axis.
109.70 - 109.95	Quartz vein.
110.30 - 110.50	Soft hematitic, chloritic, greasy material - possible shear.
111.70 - 111.90	Quartz vein.
113.40 - 133.90	Crushed zone; greasy hematite and chlorite, large (to 1 cm.) white mica flakes; fractures at 20° to the core axis. Possible fault zone.
113.90 - 126.20	Generally darker coloured schist/microgneiss. Graphitic and chloritic shears: 15° to core axis at 115.30 35° to core axis at 118.75 25° to core axis at 124.30
116.50	Schistosity at 40° to core axis.
124.80	Schistosity at 28° to core axis.

126.20 End of Hole.

SAMPLES

			Geochemical Results (ppm)						
Sample No.	Interval	Lithology	U	Th	Cu	Pb	Zn	Ni	Fe(%)	Mn
16545	32.90 - 33.00	Pubc	<4	24	22	22	36	<4	0.90	55
16546	39.00 - 39.10	Pubc	<4	18	8	8	8	<4	0.40	16
16547	51.80 - 51.95	Pubc	<4	30	6	14	18	<4	2.90	75
16548	58.40 - 58.50	Pubs	<4	6	6	10	4	<4	0.20	8
16549	63.25 - 63.35	Pubs	<4	12	8	16	4	<4	0.25	8
16550	74.90 - 75.00	Pubs	<4	16	6	12	2	<4	0.25	8
16551	86.60 - 86.70	Pubs-Reg	<4	26	4	14	22	<4	3.40	70
16552	88.10 - 88.20	Plms	<4	24	4	14	55	24	2.90	280
16553	94.60 - 94.70	Plms	<4	24	6	12	44	16	4.50	250
16554	106.00 - 106.20	Plms	4	32	12	10	42	10	5.30	290
16555	113.60 - 113.70	Plms	<4	14	8	10	16	10	1.60	120
16556	115.80 - 115.90	gr Plms	8	38	8	8	42	14	3.20	430
16557	124.30 - 124.40	Plms	<4	26	10	16	75	28	5.20	520

DRILL HOLE RECORD

Hole: DDH 893-2

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie Grid (EL 893)
AMG Co-ordinates:	619,320E/6,288,000N
Elevation:	0.65 m.
Depth:	100.20 m.
Dip:	-90°
Azimuth:	-
Date Commenced:	August 9, 1982
Date Completed:	August 14, 1982
Geological Log:	D.A. Currie

Borehole Logging

GAMMA: (Rods) 0.0 - 98.9 m.; maximum 630 cps at 52.55 m.
(Open) 0.0 - 96.9 m.; maximum 975 cps at 52.8 m.

Geological Log

0.0 - 31.35 Middle Proterozoic: Blue Range Fm. - Pebble Conglomerate (Pubc)

Variable from light yellowish orange to brilliant yellowish orange to black limonitic and iron stained, to brilliant, moderate red, hematitized, to creamy to pale yellowish green to greenish gray sericitic pebble conglomerate. Several soft crumbly-crushed zones.

Dominantly a small pebble to locally small cobble conglomerate with minor sections of dense, fine grained clay (dominantly sericite).

Pebbles are primarily subrounded, ranging in size from 0.5 - 3.5 cm. in long dimension. They are mostly of Warrow Quartzite with minor Mangalo Schist and granite. The pebbles are set in a highly altered matrix comprised dominantly of greasy yellowish brown clays and pale greenish gray sericite. Hematite and/or limonite alteration strongly overprints the matrix material.

The contact with the lower unit is gradational; the lower conglomerate section becomes consistently hematitic and gradationally less conglomeratic.

Composition: 70% pebbles (Plw, Plms)
30% matrix (clay, sericite, hematite, limonite, quartz)

Core: Several minor soft, crumbly sections.

Radioactivity Summary: (Rods)

0.0	-	5.00	50-150 c/s	Overburden
5.0	-	12.00	150-300 c/s	Bleached, sericitic conglomerate
12.0	-	30.00	150-225 c/s	Hematitic and limonitic conglom.

0.0 - 6.00 Blade drilling.
6.0 - 10.40 Generally pale greenish gray, clay rich, sericitic conglomerate with limonitic coatings on fractures.

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10.4	- 11.40	Crushed, deeply hematitized.
11.4	- 13.70	Mottled hematitic and sericitic.
13.7	- 17.40	Intermixed hematitic and limonitic zone.
17.3		Strong fracture at 20° to core axis, limonitic.
17.4	- 21.70	Lightly limonitic zone.
19.7	- 20.40	Several strong fractures subparallel to 20° to the core.
21.7	- 26.90	Pale greenish gray sericitic conglomerate.
26.9	- 31.35	Mottled limonitic and hematitic conglomerate.
28.5	- 28.80	Strong fracture at 15° to the core, limonitic.
30.7	- 31.20	Strong fracture subparallel to core with 0.5 cm. of mushy hematitic gouge, slickensided.
31.2	- 31.35	Soft, plastic fine grained hematite.

31.35 - 76.30 Middle Proterozoic: Blue Range Fm.: Sandstone, Granule to Pebble Conglomerate (Pubs, Pubc)

31.35 - 41.60 Hematitic pebble conglomerate.
41.60 - 76.30 Hematitic sandstone.

The upper portion of this hole is similar to the overlying conglomerate except that it appears to have a greater density of smaller pebbles and is set in a uniform moderate red hematitic matrix. There are no limonitic or sericitic sections. The contact with the sandstone unit below is reasonably sharp; the lower 1.5 metres comprises larger small cobble sized clasts.

The sandstone unit is pale red to moderate red in colour. It consists of well bedded, medium grained sandstone with abundant sections of granule sized quartz and feldspar grains. The matrix is obscured by hematite but appears to be comprised of fine sericite. Several minor sections are deeply hematitized bright moderate red in colour, soft and crumbly and lacking any bedding.

The lower contact is marked by a minor basal conglomerate unit approximately 2.0 m. thick. The lower contact is crushed and not observed. Several small cobble sized quartzite clasts occur within the crushed zone.

Composition: 60-70% quartz, 20% feldspar, 15% hematite, 5% sericite.

Core: Little crushed core; very competent.

Radioactivity: (Rods)

31.00	- 56.00	200-450 c/s, several spiky peaks to 450 c/s, peak to 630 c/s at 52.55 m. Associated with deeply hematitized zone. (Open) Peak of 675 c/s at 48.5 m. and 975 c/s at 52.8 m.	
56.00	- 74.80	150-250 c/s	Sandstone
74.80	- 76.30	350-400 c/s	Conglomerate; unconformity.

31.35	- 41.60	Hematitic pebble conglomerate.
34.10	- 35.10	Plastic, hematitic zone - no pebbles.
39.95	- 40.80	Deeply hematitized zone.
40.80	- 41.60	Coarser grained cobble conglomerate.
41.60	- 76.30	Sandstone.
41.60	- 43.35	Deeply hematitic sandstone.
43.70		Bedding at 65° to the core.
47.80		Bedding at 55° to the core.

49.40	- 56.40		Deeply hematitic zone with minor crushed, crumbly core; several minor fractures subparallel to 15° to the core axis.
58.40			Bedding at 80° to the core.
65.10			Bedding at 85° to the core.
66.20	- 76.30		Increased hematite.
68.70			Crushed zone; fracture at 70° to core axis.
70.40			Bedding at 60° to the core axis.
70.80	- 71.20		Hematitic, crushed zone. Strong fracture, minor chlorite coating, at 55° to the core axis.
73.40	- 74.40		Hematitic zone; strong fractures at 55° to core axis.
74.40	- 76.30		Hematitized cobble conglomerate zone.
76.20	- 76.30		Crushed hematitic sandstone.

76.30 - 100.20 m. Lower Proterozoic: Mangalo Schist Fm. - Chloritic Schist (Plms)

Very lightly hematitized, pale red to overall greasy pale greenish grey with minor pale yellowish green to pale olive grey. Has shiny, phyllitic lustre. Very finely banded; alternating layers of 0.5 mm. of light coloured material and darker "granule like" chlorite (possibly after garnet). Schistosity is very well defined throughout at steep angles to the core. Schistosity is locally crenulated. Randomly located conformable bands of quartz and feldspar layers (micro-gneiss) are scattered throughout.

Moderate hematitization at the unconformity decreases rapidly to depth. Consistent moderate chloritization throughout. The core is well fractured parallel to schistosity. However, there is no significant alteration associated with these fractures.

Core: Reasonably competent; short blocky runs.

Composition: 20% quartz, 40% feldspar, 30% chlorite, 10% sericite, minor hematite, biotite and muscovite.

Radioactivity : (Rods)

76.30	- 79.50 m.	350-400 c/s	Hematitized schist.
79.50	- 98.90 m.	300-375 c/s	Chlorite schist.

76.30	- 82.00	Lightly hematitized zone.
76.30	- 76.70	Hematitized schist.
78.20		Schistosity at 30° to core axis.
81.00	- 81.25	Fractured zone; several fractures at 25° to core axis.
84.50		Schistosity at 30° to core axis.
86.80		Shear at 35° to core axis.
91.00		Schistosity at 65° to core axis.
92.40	- 92.80	Fractured zone; abundant large flakes (1 cm.) of muscovite.
95.60		Schistosity at 35° to core axis.
98.30	- 98.70	Crumbly quartz-feldspar biotite gneiss, chloritized.
99.80	- 100.20	Biotite rich schist.

100.20 End of Hole.

0165

SAMPLES

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	%Fe	Mn
16558	10.00 - 10.20	Pubc	<4	30	8	16	24	<4	0.45	16
16559	14.50 - 14.70	Pubc	<4	12	8	6	<2	<4	1.90	8
16560	25.50 - 25.70	Pubc	<4	22	6	6	<2	<4	0.30	12
16561	32.30 - 32.50	Pubc	<4	10	6	8	4	<4	1.60	28
16562	37.50 - 37.80	Pubc	12	28	8	12	20	10	4.50	100
16563	49.40 - 49.60	Pubs	18	34	8	10	24	12	3.20	75
16564	52.00 - 52.40	Pubs	<4	4	12	<4	<2	<4	0.95	12
16565	52.40 - 52.60	Pubs	4	10	6	4	<2	<4	0.70	12
16566	52.60 - 52.80	Pubs	6	12	10	6	4	<4	1.20	20
16567	52.80 - 53.20	Pubs	14	8	38	<4	2	<4	0.80	12
16568	64.20 - 64.40	Pubs	<4	16	8	4	<2	<4	0.95	16
16569	72.30 - 72.50	Pubs	<4	8	8	<4	2	<4	1.30	16
16570	75.50 - 76.30	Pubs/c	<4	18	8	6	16	<4	4.10	55
16571	76.50 - 76.70	Plms	4	24	6	10	55	22	4.00	370
16572	80.10 - 80.30	Plms	4	18	16	6	36	16	3.80	270
16573	89.00 - 89.20	Plms	<4	20	16	8	44	26	3.40	320
16574	97.50 - 97.70	Plms	<4	18	6	6	50	26	3.30	420

DRILL HOLE RECORD

Hole: DDH 893-3

Project:	Afmeco Joint Venture (PC 18)
Location:	Cockabidnie Grid (EL 893)
AMG Co-ordinates:	619,545E/6,287,955N
Elevation:	6.02 m.
Depth:	74.40 m.
Dip:	-90°
Azimuth:	-
Date Commenced:	August 16, 1982
Date Completed:	August 19, 1982
Geological Log:	D.A. Currie

Borehole Logging

GAMMA: (Rods) 0.0 - 74.5 m.; maximum 1425 c/s at 66.6 m.
(Open) 0.0 - 73.1 m.; maximum 1650 c/s at 66.7 m.

Geological Log

0.0 - 30.50 m. Middle Proterozoic: Blue Range Fm. - Argillaceous Pebble Conglomerate (Pubc)

Mottled shades of grayish pink to light red to very pale orange to pale yellowish orange becoming moderate red in the lower portion. Overall unit is very soft and crumbly, particularly in grit to conglomerate sections. Sections of large granule to medium pebble gritty conglomerate interlayered with soft, pliable very pale grayish green sericitic clay and siltstone. Conglomeratic sections contain up to 70% rounded clasts to 0.75 cm. of frosted quartzite. A few larger clasts to 3.0 - 4.0 cm. are scattered throughout. Bedding is crudely defined within conglomerate at 70° to the core axis. Mottled colour banding overprints the central argillaceous section masking any bedding evidence. Core is broken at steep angles to the core axis; fracturing is minimal.

The lowermost section of the unit comprises several sections of pebbly conglomerate within a zone of soft mottled hematitized, sericitized and possibly chloritized clay matrix.

Composition: 40-70% clasts, dominantly quartz, minor feldspa
30-60% matrix, silty to clay, sericite, hematite.

Radioactivity Summary:

0.0 - 9.5 m.	Average 120 c/s (open, probe), 60-80 (rods, probe), 60 c/s on core.
9.5 - 30.50	Range 200-380 (open, probe), 150-300 (rods, probe), 60-80 c/s on core

0.0 - 6.00	Open hole drilling; pebble conglomerate
6.0 - 11.35	Light coloured, coroded pebble conglomerate, well bedded, crumbly, slightly porous.
11.35 - 13.15	Pale red to moderate red grit to pebbly conglomerate.
13.15 - 14.55	Pale yellowish orange; limonite coated

.../2

	fracture sub-parallel to core axis. Several large (3.5 cm.) quartz pebbles at the base of this section.
14.55 - 18.25	Solid colours, gritty pebble conglomerate.
18.25 - 23.75	Mottled colours, argillaceous section.
23.75 - 25.95	Pale red, tightly packed granule conglomerate, hematitic matrix.
25.95 - 27.60	Light colour argillaceous siltstone.
27.60 - 30.50	Moderate red hematitized, sericitized and possibly chloritized siltstone with several 10 cm. sections of grit to pebble conglomerate
30.40 - 30.50	Basal conglomerate; large white quartz pebbles.

30.50 - 49.10 Lower Proterozoic: Mangalo Schist Fm. - Porphyroblastic Chloritized Quartz-feldspar-mica Schist (Plms)

Overall pale yellowish brown to light greenish gray with moderate red hematitic fracture coatings. Fine grained with thinly laminated micaceous bands alternating with 1-2 mm bands of white quartz and feldspar. Schistosity regular at 60° to the core axis. White to lightly pink tinted rounded to slightly elongated feldspar porphyroblasts up to 3-4 mm., generally in most deeply chloritized zones; schistosity not as well developed yet porphyroblasts aligned.

The core is fairly competent although it is cut by numerous wispy fractures generally subparallel to 30° to the core axis. Fracture surfaces are coated with a greasy moderate red hematite coating. Hematitization and intensity of fracturing increasing towards bottom of unit.

The upper contact is marked by several cm.'s of deeply hematitized schist and chloritized and kaolinitic schist followed by a zone of very weak hematitization.

Composition: 40% quartz and feldspar
60% chlorite and mica
Minor hematite.

Radioactivity Summary: (Open)

30.50 - 49.10	Average background 420-460 c/s.
30.50 - 32.50	Slight increase below unconformity to 580 c/s
45.00 - 47.50	Slight increase to 590 c/s associated with increased hematitization.
47.50 - 49.50	Radiometric low 310-360 c/s with peak of 505 c/s at 48.5 m.
30.50 - 30.80	Regolith. Deeply hematitized, kaolinitic and chloritized.
30.80 - 33.40	Lightly hematitized zone.
34.20	Schistosity at 60° to core axis.
36.60	" " 55° " " "
36.60 - 44.20	Moderately hematitized chloritized schist; few porphyroblastic sections.
44.20 - 49.10	Porphyroblastic chloritized schist. Abundan fracturing at 0.30° to core axis; extremely hematitized.

0168

49.10 - 74.40 Lower Proterozoic: Mangalo Schist Fm. - Hematitized chloritic quartz-feldspar microgneiss, minor porphyroblastic schist (Plms)

Moderate red, moderate reddish brown, dark reddish brown to locally grayish red. Extremely badly broken core, possibly brecciated yet individual pieces are hard. Several sections appear brecciated and have associated crushed greasy hematitic smears indicative of shearing. Individual blocks show a well developed regular schistosity/gneissosity, such as in unit above; at about 60° to core axis

This unit appears more felsic than the schist above, containing mostly a fine grained quartz-feldspar microgneiss comprised of alternating bands of chlorite and micas 3-4 mm. thick with quartz-feldspar bands 2-4 mm. There are several sections where vein quartz appears to cut the core; the broken nature of the core disguises the contact with the unit above. Several minor porphyroblastic sections, similar to the unit above, exist.

Sulphide mineralisation (pyrite) is present both as disseminations and as fracture fillings within the upper portion of this unit. A zone of weak radioactivity (as detected by the downhole radiometric logger, appears to be associated with a grayish yellow to pale greenish yellow highly altered fine grained rock, possibly an intrusive unit. This is bounded by very silicaceous material which is vuggy and vertically fractured.

Composition: 60% quartz and feldspar
40% chlorite, mica
Minor hematite, pyrite

Radioactivity Summary: (Open hole)

49.10 - 53.50	Slightly higher background of 600 c/s with peak of 770 c/s at 52.0 associated with greasy dusky red hematitization and approximately 0.75 m. of core loss.
53.50 - 59.50	Average background 500 c/s associated with hematitic zone; slight rise 58.0-59.2 associated with pyritic zone.
59.50 - 62.00	Background 400-500 c/s; less hematitized.
62.00 - 73.10	Gradually increasing background to 500-650 c/s with peaks of 940 c/s at 64.4 m. and 1650 c/s at 66.7 m.

49.10 - 49.40	White quartzite, possibly vein quartz.
49.40 - 60.20	Moderate red hematitized microgneiss.
51.30 - 53.50	Greasy hematitic zone, core loss, broken and crushed core; possible fault zone.
53.60 - 54.10	Brecciated quartz vein sub-parallel to core axis; greasy hematitic fracture coated with pyrite.
59.00 - 59.40	Disseminated and fracture filled pyrite.
60.20 - 63.00	Less well broken, chloritized schist.
60.20 - 60.85	Crushed and sheared, chloritic schist with pyrite.

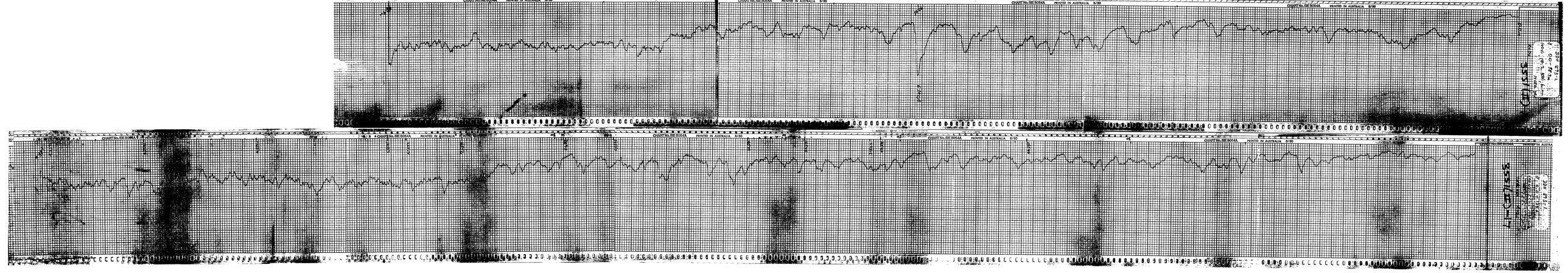
.../4

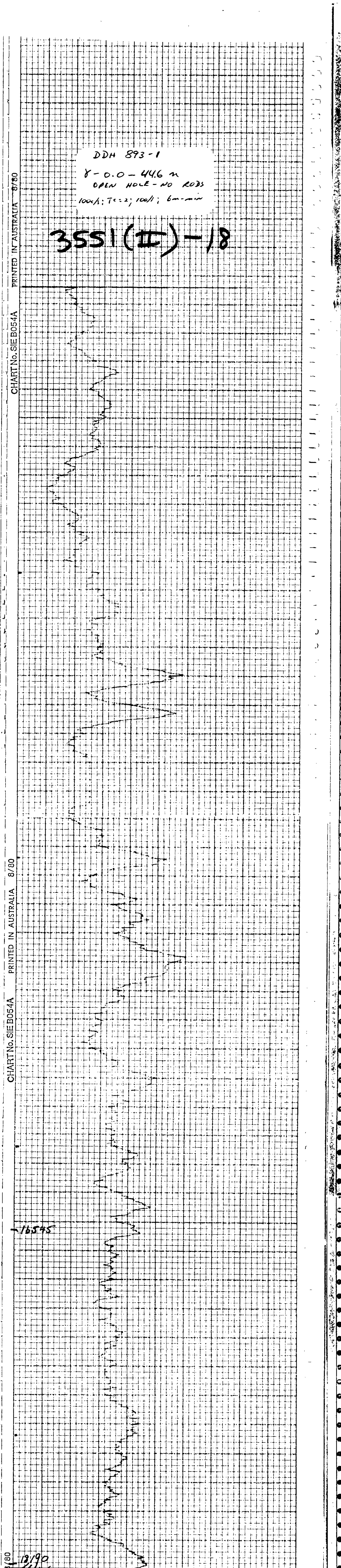
63.00 - 64.60	Hematitized microgneiss.
64.60 - 67.10	Mylonitic quartz-feldspar gneiss, pyritic.
66.15 - 66.25	Clay rich, crushed and brecciated shear zone.
67.10 - 67.50	Pale greenish yellow highly altered fine grained rock; possibly intrusive.
67.50 - 71.50	Broken, quartz-feldspar microgneiss.
71.50 - 74.40	Slightly more competent core; porphyroblastic schist becoming slightly hematitic towards bottom of hole.

74.40 End of Hole.

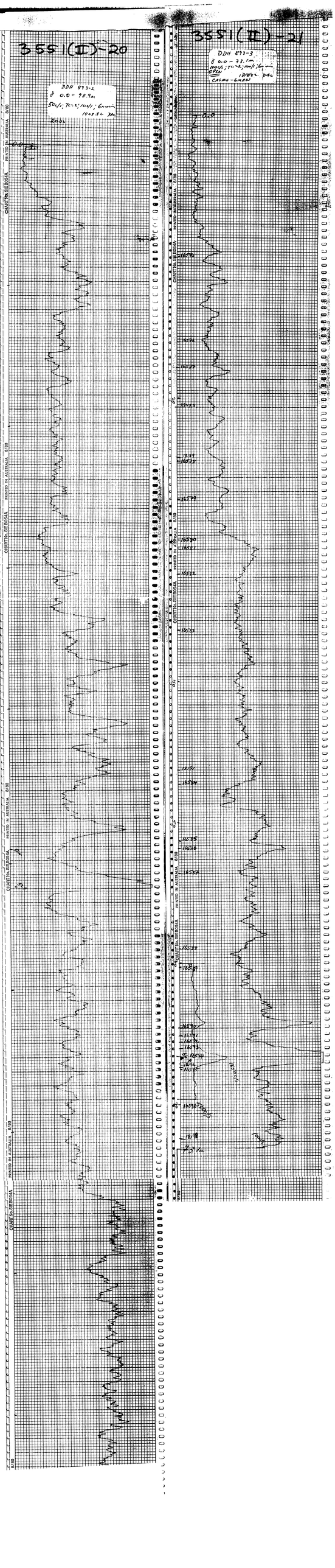
SAMPLES

Sample No.	Interval	Lithology	Geochemical Results (ppm) U	Th	Cu	Pb	Zn	Ni	Fe (%)	Mn
16575	10.15 - 10.25	Pubc	<4	8	10	26	6	<4	0.30	12
16576	16.15 - 16.25	Pubc	<4	4	10	12	2	<4	0.30	12
16577	18.00 - 18.25	Pubc	<4	4	8	10	2	<4	1.00	14
16578	24.50 - 24.60	Pubc	<4	10	6	4	<2	<4	1.10	10
16579	27.10 - 27.20	Pubs	4	20	14	44	12	8	1.20	34
16580	30.00 - 30.10	Pubs	4	14	12	18	16	10	3.70	44
16581	30.50 - 30.80	Reg	4	22	26	30	60	26	7.80	280
16582	32.40 - 32.50	Plms	6	18	22	16	40	20	3.20	270
16583	36.40 - 36.50	Plms	4	20	18	8	32	18	2.00	195
16584	47.20 - 47.40	Plms	6	18	6	12	48	24	5.60	240
16585	51.30 - 51.80	Plms	10	16	6	14	30	18	6.20	150
16586	51.80 - 53.50	Plms	8	16	8	14	6	10	5.50	26
16587	53.60 - 54.10	QV	4	16	8	4	6	6	2.10	26
16588	59.00 - 59.40	Plms	<4	16	24	6	4	6	1.60	12
16589	60.20 - 60.85	Plms	4	26	220	14	4	14	3.50	16
16590	64.60 - 65.10	Plms	<4	12	22	<4	4	10	0.50	16
16591	65.10 - 65.60	Plms	<4	14	32	<4	4	8	0.40	12
16592	65.60 - 66.10	Plms	6	16	36	<4	8	4	0.50	14
16593	66.10 - 66.60	Plms	8	18	24	<4	4	6	0.50	14
16594	66.60 - 67.10	Plms	6	22	12	8	6	8	0.30	24
16595	67.10 - 67.50	Plms (?)	14	190	8	8	6	14	1.20	12
16596	67.50 - 68.10	Plms	8	20	6	6	4	16	0.65	26
16597	70.00 - 70.15	Plms	8	18	6	8	16	14	1.50	130




DDH 893-1
γ-0.0-44.6 m
OPEN HOLE - NO RODS
3551(II)-18
CHART No. SIE B054A
PRINTED IN AUSTRALIA 8/80
16545

DDH 893-2
γ 0.0- 96.9m
3551(II)-19
0.0
16558
16559
16560
16561
16562
16563
16568
16569
16570
16571
16572
CHART No. SIE B054A
PRINTED IN AUSTRALIA 8/80


3551(II)-20
DDH 893-2
@ 0.0 - 98.9m
SPol; TX-2; Coil; Gamma
1981.84 Jul
3551(II)-21
DDH 893-3
@ 0.0 - 93.1m
Mag; TX-2; Coil; Gamma
Open
Calma-Emag
1984 Dec
QUANTITY SURVEYORS
PRINTED IN AUSTRALIA 8/80

3551(II)-23

DDH 893-3
γ 0.0-74.5m
TRU RODS
100c/s; TC=2; 100/1/6min
18/8/82 DAC

3551(II)-22

0.0

CHART No. SIE B054A PRINTED IN AUSTRALIA 8/80

DDH 893-3
γ 0.0-70.0m
100c/s; TC=2; 100/1; 6m-min
18/08/82 DAC
THRU RODS

0.0

CHART No. SIE B054A PRINTED IN AUSTRALIA 8/80

CHART No. SIE B054A PRINTED IN AUSTRALIA 8/80

CHART No. SIE B054A PRINTED IN AUSTRALIA 8/80

500c/s

CHART No. SIE B054A PRINTED IN AUSTRALIA 8/80

3551(II)-24

RAB 893-1
γ - 0.0 - 24.0
100c/s; TC: 2; 100/
17/7/82 DAC

CHART No. SIE B054 A — PRINTED IN AUSTRALIA 6/81

0.0

15572

15803

15632

24.0

3551(II)-25

RAB 893-2
γ - 0.0 - 24.9m
100c/s; TC: 2; 100/
17/7/82 DAC

CHART No. SIE B054 A — PRINTED IN AUSTRALIA 6/81

0.0

15580

15591

15582

15583

15605

15633

15806

24.9m

3551(II)-26

KAE 293-3

d - Dia 10.2

100 t/c 7C

CHART NO. SIEB0547

3551(II)-28

RAB 893-5
δ 0.0 - 26.3m
500c/s; TC=2; 100/1; 6m/m
17/7/82 DAE

CHART No. SIE B054A PRINTED IN AUSTRALIA 6/81

0.0

15501

15502

15503

15504

15505

RAB 893-5
δ 0.0 - 26.5m
100 c/s; TC=2; 100/1;
17/7/82 DAE

0.0

3551(II)-27

RAB 893-4
δ 0.0 - 24.9
100c/s; TC=2; 100/1
δ 4.8 - 14.8
500c/s; TC=2; 100/1
17/7/82 DAE

0.0

15529

15530

15531

15532

15533

15534

CHART No. SIE B054A PRINTED IN AUSTRALIA 6/81

RAB 893-6
δ 0.0 - 18.9m
100 c/s; TC=2; 100/1; 6m/m
14/7/82 DAE

0.0

3551(II)-29

15624

15625

15626

15627

15628

15629

15630

15631

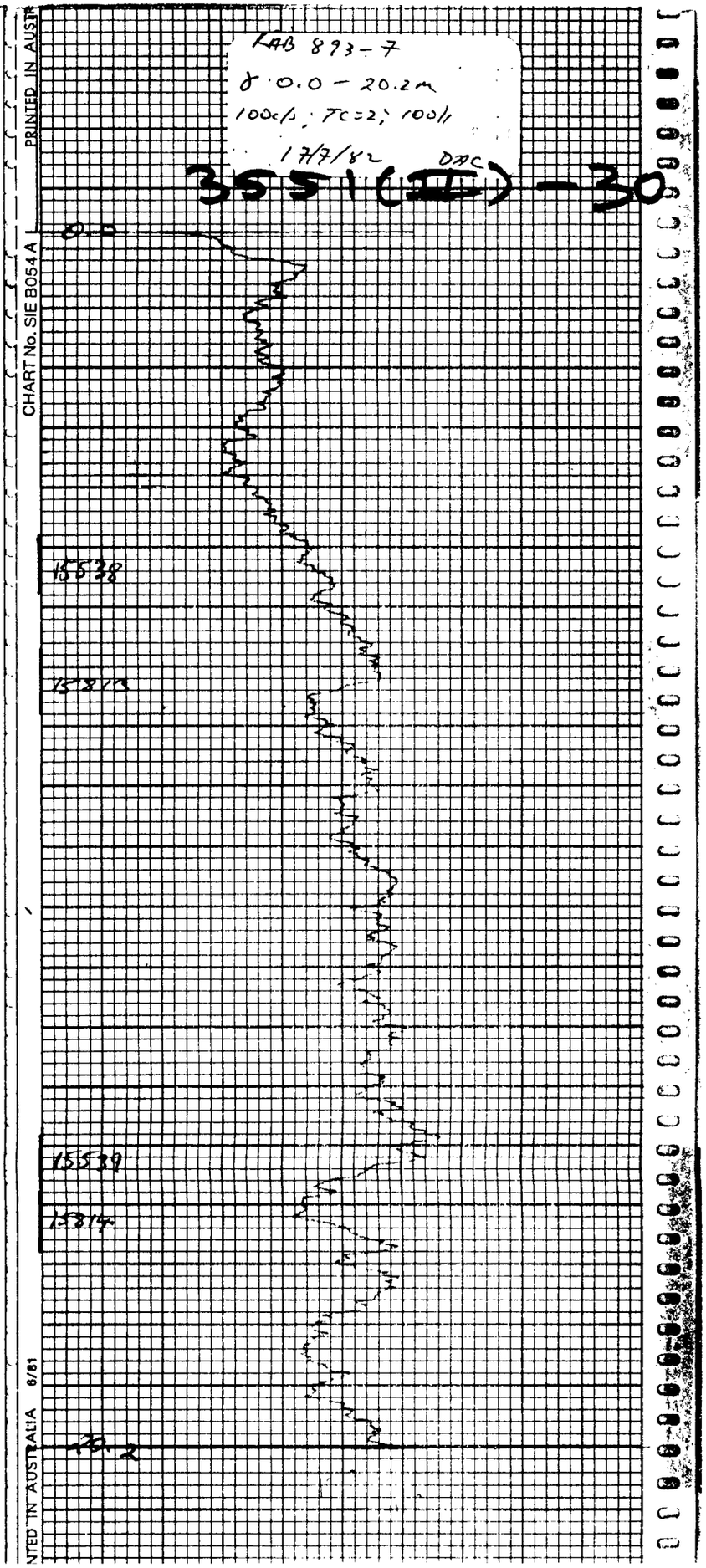
15632

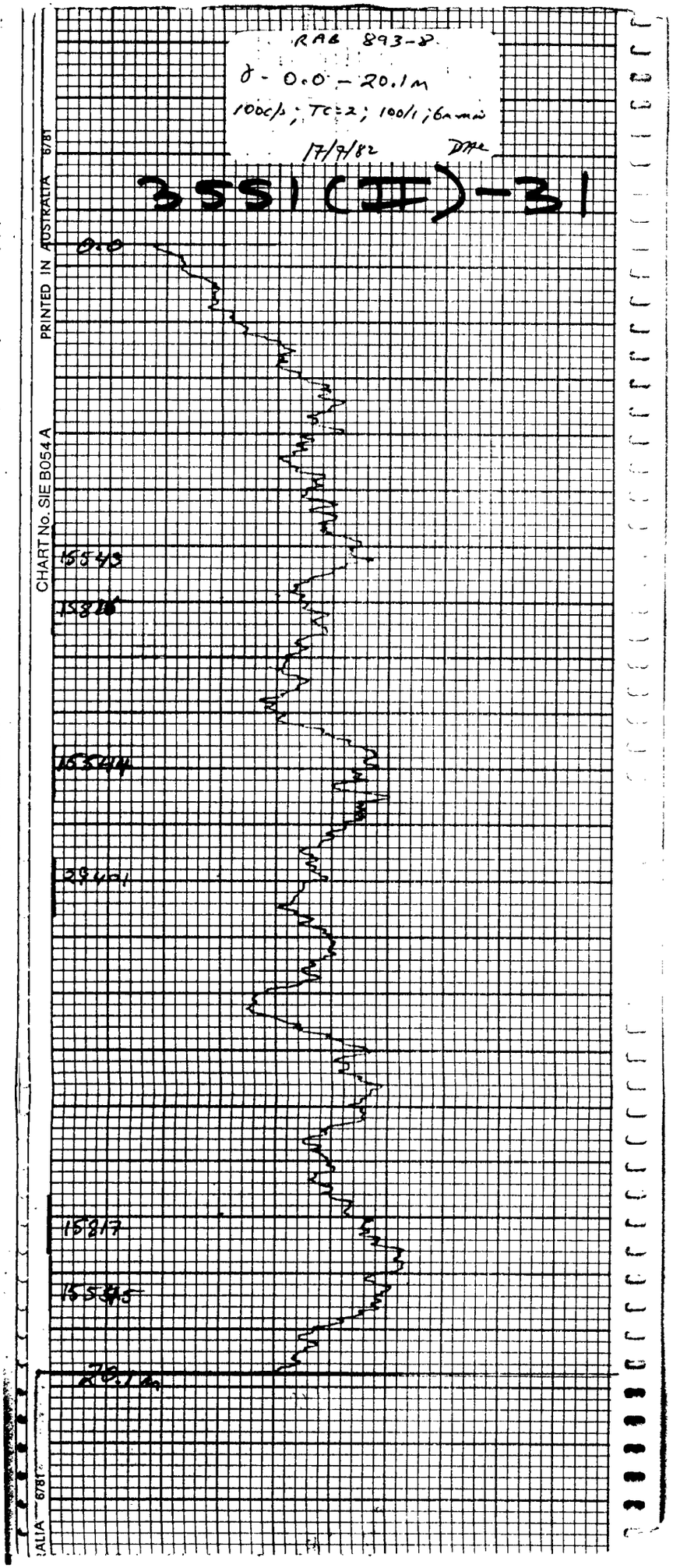
15633

15634

15635

CHART No. SIE B054A PRINTED IN AUSTRALIA 6/81


RAB 893-7
δ 0.0 – 20.2m
100c/s ; TC=2; 100/1
17/7/82 DMC
3551 (II) – 30
0.0
15538
15813
15539
15814
20.2
CHART No. SIE B054 A
PRINTED IN AUSTRALIA 6/81


RAB 893-8
δ - 0.0 – 20.1m
100c/s ; TC=2; 100/1 ; Gamma
17/7/82 DMC
3551 (II) – 31
0.0
15543
15818
15544
15819
15817
20.1
CHART No. SIE B054 A
PRINTED IN AUSTRALIA 6/81

RAB 893-11
0.0 – 16.7m
100c/s; TC=2; 10m/min
17/7/82 DAC

3551(II)-34

0.0

15559

15824

16.7

RAB 893-10
0.0 – 20.4
100c/s; TC=2; 10m/min
17/7/82 DAC

3551(II)-33

0.0

15553

15940

15534

15822

29402

RAB 893-9
0.0 – 17.7
100c/s; TC=2; 6m/min; 100/1
17/7/82 DAC

3551(II)-32

0.0

15819

15548

15519

17.7

15556

15823

15557

15558

20.4

PRINTED IN AUSTRALIA 6/81
CHART No. SIE B054-A

RAB 893-13
γ: 0.0 – 28.4
100 c/s; TC = 2; 10 v/i
13/3/82 DAC

ASSIC(HE)-38

CHART No. SIE B054 A PRINTED IN AUSTRALIA 6/81

RAB 893-12
γ: 0.0 – 22.90
100 c/s; TC = 2; 10 v/i
13/3/82 DAC

ASSIC(HE)-35

CHART No. SIE B054 A PRINTED IN AUSTRALIA 6/81

RAB 893-16
γ 0.0 – 31.8 m
100 c/s; TC: 2; 100 l/s
17/7/82 Date

3551(II)-39

0.0
15828
15578
15829
15830
15679
15580
31.8

RAB 893-15
γ - 0.0 - 17.4 m
100 c/s; TC: 2; 100 l/s
17/7/82 Date

3551(II)-38

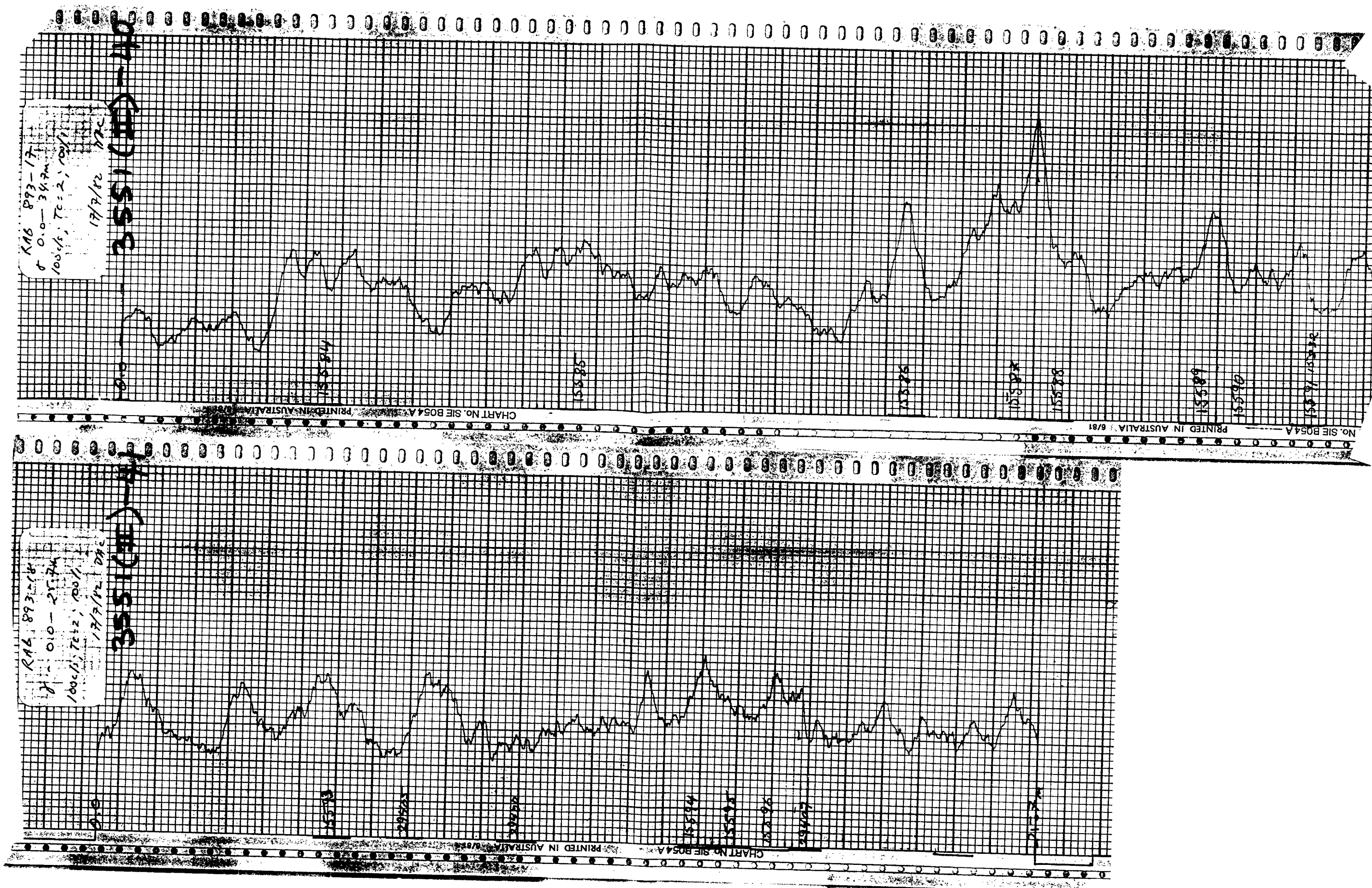
0.0
15573
15574
15575
15638
15576
17.4

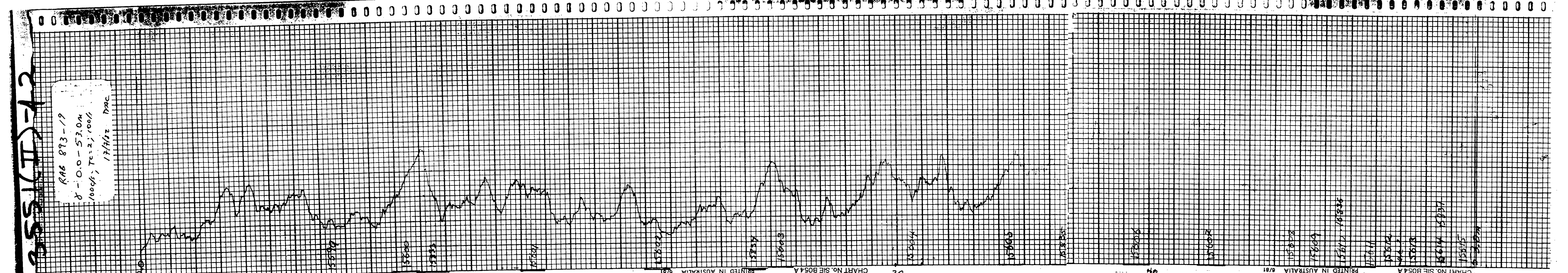
3551(II)-37

RAB 893-14
γ 0.0 - 8.0
100 c/s; TC: 2; 100 l/s
19/7/82 Date

0.0
15574
15637
8.0

CHART No. SIE B054 A PRINTED IN AUSTRALIA 6/81


355.1(HE)-1H
RAB 893-17
0.0 — 341.7m
100c/s; TC=2, 100/1
17/2/82
0.0
355.2
355.3
355.4
355.5
355.6
355.7
355.8
355.9
356.0
356.1
CHART No. SIE B054A
PRINTED IN AUSTRALIA 6/81
355.1(HE)-1H
RAB 893-17
0.0 — 341.7m
100c/s; TC=2, 100/1
17/2/82
0.0
355.2
355.3
355.4
355.5
355.6
355.7
355.8
355.9
356.0
356.1
CHART No. SIE B054A
PRINTED IN AUSTRALIA 6/81


RAB 893-19
δ - 0.0 - 53.0m
100%; Te=2; 100%
13/9/82
DRAC
CHART No. SIE 8054 A
PRINTED IN AUSTRALIA 6/81
30
40

RAB 893-20
0.0 - 28.2m
1000c/s ; TC=2 ; 100/1
17/7/82 DMc

3551 (II) - 4

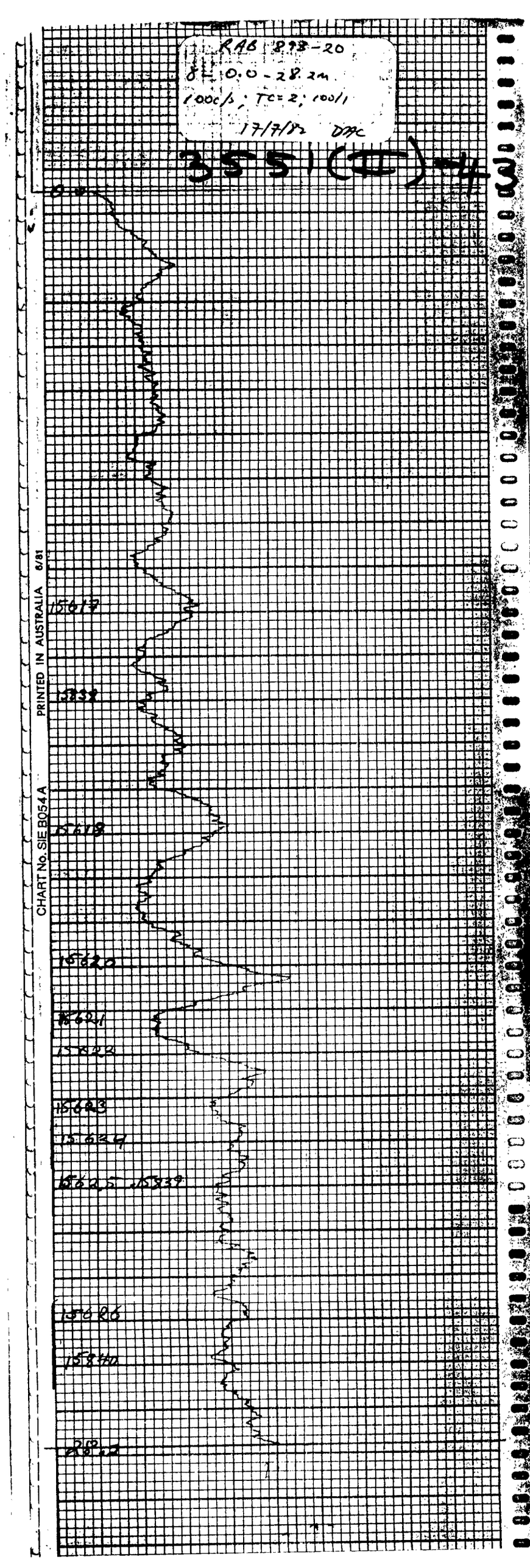


CHART No. SIE B054A PRINTED IN AUSTRALIA 6/81

APPENDIX 4B

CLAY MINERALOGY

AMDEL

CLAY MINERALOGY

Sample No.	Hole	Depth	Lithology	%-2u	Dominant Clay
29401	RAB 893-8	11.0m	Pubs (kaolinitic)	11	Kaolinitic
402	RAB 893-10	13.0m	Pubs (sericitic)	6	Mica/Illite
403	RAB 893-10	8.0m	Pubs (sericitic)	4	Kaolinite
404	RAB 893-15	19.0m	Pubs (sericitic)	10	Kaolinite
405	RAB 893-18	8.0m	Pubs (white clay)	17	Kaolinite
406	RAB 893-18	11.0m	Pubs (seritic)	21	Kaolinite
407	RAB 893-18	19.0m	Pubs (sericitic)	9	Kaolinite
421	DDH 893-1	87.0m	Pubs - Regolith (clay)	25	Mica
422	DDH 893-2	43.4m	Pubs (hematitic)	6	Kaolinite/mica
423	DDH 893-3	20.65m	Pubs (clay)	14	Kaolinite/mica

ne Australian
Development
Laboratories

treet, Frewville,
Australia 5063
delaide 79 1662
Telex AA 82520

ease address all
respondence to
114 Eastwood
SA 5063
In reply quote

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amdel

25 August, 1982

GS3/698/0

Pancontinental Mining Ltd.,
C/- Post Office,
PORT NEILL, SA 5604

Attention: Mr D. Currie

REPORT GS 647/83

YOUR REFERENCE:	Order 10757 dated 26/7/82
MATERIAL:	20 rock samples
LOCALITY:	Pt. Neill, S.A.
IDENTIFICATION:	29401-20
DATE RECEIVED:	28/7/82
WORK REQUIRED:	Clay mineralogy (MC2). Analysis for U, Th & B

Investigation and Report by: Dr Roger Brown

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

Acting Chief
Geological Services Section
for Norton Jackson
Managing Director

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Perth, W A
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Townsville
Queensland 4814
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CLAY MINERALOGY & CHEMICAL ANALYSIS

1. INTRODUCTION

A set of 20 rock samples received from Mr D. Currie of Pancontinental Mining Ltd., Pt. Neill, SA, was to be examined by XRD for the determination of bulk and -2 μm (clay) mineralogy. Three samples in particular were urgent (29412-3, 29415) and the preliminary results for these were telephoned to Mr Currie on 2/8/82.

In addition to the clay work, analyses for U & Th (XRF) and B (spectro) were required.

2. PROCEDURE

Subsamples were briefly milled to aid in dispersion in water for the clay sedimentations. Portion of each was powdered finely and used to prepare an X-ray diffractometer trace which was interpreted by standard procedures.

Weighed subsamples were taken and dispersed in water with the aid of deflocculants and an electric blender, and allowed to sediment to produce -2 μm e.s.d. size fractions by the pipette method. The resulting dispersions were examined by plummet balance to determine their solids contents, and were then used to produce oriented clay preparations on ceramic plates. Two plates were prepared per sample, both being saturated with Mg^{++} ions, and one in addition being treated with glycerol. When air-dry, these were examined in the X-ray diffractometer. Various additional diagnostic examinations were carried out as required, including examination of the glycerol-free plate hot ($\sim 130^{o}$) and after heating for one hour at $550^{o}C$.

The chemical analyses were carried out as requested by XRD and spetrographi methods.

3. RESULTS

3.1 Mineralogy by XRD

The results are given in Table 1, which lists the following:

(a) The mineralogy of the total sample, as derived from examination of the bulk material, with supporting evidence as available. The minerals found are listed in approximate order of decreasing abundance, using the semiquantitative abbreviations given. Coverage of clays may be incomplete, and for full clay mineralogy Section (c) should be consulted. This section (a) is for information on non-clay minerals and to give a general idea of the makeup and proportions.

(b) The proportion of the sample found to separate into the -2 μm size fraction, as determined by the plummet balance. The figure obtained applies only to the pre-treatment and dispersion conditions used.

(c) The mineralogy of the -2 μm fraction, given as in Section (a).

3.2 Chemical analyses

The results are listed in Table 2.

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TABLE 2: ANALYSES FOR U, Th & B

Results in ppm

Sample	U	Th	B
29401	10	42	300
2	4	32	6
3	<4	14	60
4	<4	12	30
5	<4	12	30
6	4	30	80
7	<4	16	10
Detection limit	(4)	(4)	(3)

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28 October 1982

GS 3/698/0

Pancontinental Mining Limited,
AMP Centre,
50 Bridge Street,
SYDNEY, NSW 2000.

Attention: Mr D.A. Currie

REPORT GS 1974/83

YOUR REFERENCE:	Order 10789 dated 25 September 1982. Additional hand-written request from D. Currie
MATERIAL:	11 samples of rock cores
IDENTIFICATION:	24921-29431
DATE RECEIVED:	27 September 1982
WORK REQUIRED:	Clay mineralogy (MC2). Determinations of Kübler index and peak ratio for illite

Investigation and Report by: Dr Roger Brown

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

Keith Henley

for Norton Jackson
Managing Director

jd/3:2

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CLAY MINERALOGY AND X-RAY STUDIES OF ILLITE

1. INTRODUCTION

A set of 11 rocks from Pancontinental Mining Limited (Mr D. Currie) was submitted for mineralogical examination by XRD (including clay mineralogy, MC2).

An additional note inserted with the samples referred to the use of certain clay mineralogical techniques in uranium metallogenic work in Canada. Measurements of illite crystallinity (Kübler index) and illite I(002)/I(001) ratio had been made and used in an Esquevin plot (Kübler (1968), Esquevin (1969)) indicative of degree of low-grade metamorphism. Mr Currie requested that Kübler indices of illite crystallinity and illite I(002)/I(001) ratios be measured on these current samples in addition to the standard MC2 work.

2. MC2 PROCEDURE

The drill cores were crushed, subsampled and then pulverised in a swing mill. Portion of each was used to prepare an X-ray diffractometer trace which was interpreted by standard procedures.

Further, weighed subsamples were taken and dispersed in water with the aid of deflocculants and an electric blender, and allowed to sediment to produce -2 μm e.s.d. size fractions by the pipette method. The resulting dispersions were examined by plummet balance to determine their solids contents, and were then used to produce oriented clay preparations on ceramic plates. Two plates were prepared per sample, both being saturated with Mg^{++} ions, and one in addition being treated with glycerol. When air-dry, these were examined in the X-ray diffractometer.

3. MC2 RESULTS

The results are given in Table 1, which lists the following:

(a) The mineralogy of the total sample, as derived from examination of the bulk material, with supporting evidence as available. The minerals found are listed in approximate order of decreasing abundance, using the semiquantitative abbreviations given. Coverage of clays may be incomplete, and for full clay mineralogy Section (c) should be consulted. This section (a) is for information on non-clay minerals and to give a general idea of the makeup and proportions.

(b) The proportion of the sample found to separate into the -2 μm size fraction, as determined by the plummet balance. The figure obtained applies only to the pre-treatment and dispersion conditions used.

(c) The mineralogy of the -2 μm fraction, given as in Section (a).

4. KÜBLER INDEX MEASUREMENTS - REMARKS AND PROCEDURE

0178

Copies were obtained of the papers by Kübler and Esquevin and these were studied. They show a notable lack of simple but important information on particulars of experimental procedure to be used.

A single good definition of Kübler's crystallinity index is lacking. This index is essentially a measurement of the width at half height of the illite (001) basal peak using copper radiation. This would most simply be given in decimals of a degree, but Kübler uses two sets of "private" units, which he calls "unités Philips 1600 mm/h, 2°/min" and "unités X-Y 8°/min". The former units are apparently in millimetres where 13.33 mm represents 1°, whereas the origin of the latter is obscure. Kübler uses both units himself at different times, but fortunately gives a conversion graph in his paper. His "X-Y 8°/min" units are evidently those generally used (e.g., in the Canadian papers forwarded) and our measurements were converted correspondingly. In these units the métamorphique/anchimétamorphique boundary is at 2.5 units and the anchimétamorphique/diagénétique boundary is at 4.0 units. Dunoyer de Segnozac (1970), another well-known worker in this field, uses yet another set of breadth measurement units in which the above transitions occur at 3.6 and 5.5 units (p. 320 of his article).

Fortunately we had obtained on loan some years ago a set of three Kübler crystallinity standards and had used these to calibrate our equipment. Kübler's accompanying laboratory notes were also helpful. Illite standard peak breadths were at that time measured using both copper radiation (commonly used in many laboratories including Kübler's) and cobalt radiation (used by us and many geological laboratories). The agreement with Kübler's copper figures was close and regarded as satisfactory. A small conversion factor applied to convert cobalt peak widths to copper peak widths and this was determined. Kübler's scanning rate of 2°/mm was used for purposes of comparison with his figures, but is regarded as undesirably fast experimentally, and a slower rate is now used here for better results.

The scanning conditions used by us are summarized as follows:

Philips PW1050 goniometer with oriented clay sample 48 mm long, 1° divergence and scatter slits, 0.2 mm receiving slit, scan rate ½°/min, time constant 4 seconds. The chart speed is not significant but 1 cm/min is convenient. Cobalt radiation is used and the width of (001) peak measured at half height, a small correction factor being applied to give the width for copper radiation. This width (in degrees) is converted to millimetres (unités Philips 1600 mm/hr, 2°/min) by multiplying by 13.33 and then converted to Kübler's "X-Y 8°/min" units using his conversion graph.

Kübler does not give details of any pre-treatment of the clay, and there is no mention of glycolation, although this could serve a purpose in some cases. Our procedure has been to saturate the oriented clay sample with Mg" and wash, followed by thorough air-drying before carrying out the above measurement.

5. ILLITE PEAK RATIO

A proper definition of I(002)/I(001) is not given by Esquevin. In the absence of information to the contrary, it has been taken as the ratio of peak heights of the (002) and (001) illite peaks on oriented non-glycolated samples. The use of the 1° divergence and scatter slots has been maintained and other scanning details were as above. Again we have used Mg^{++}-saturated air-dry oriented material.

This measurement is straightforward for non-interstratified illites in the absence of significant montmorillonite. There is no doubt that for significantly-interstratified illites the relative intensity of the (002) reflection is affected. More importantly, when significant amounts of montmorillonite are present as a separate clay mineral, the third order basal montomorillonite peak (for untreated or non-glycolated material) falls on the (002) illite peak and renders its proper separate measurement impossible. Treatment of the sample with glycerol moves the montmorillonite peak away, but the glycerol affects the observed I(002)/I(001) ratio by a somewhat variable amount. It may be possible, however, by using glycerol and applying an average correction factor, to obtain an approximate estimate of what the (002)/(001) ratio would be in the absence of the interfering montmorillonite. This approach has been adopted for two samples, 29426 and 29431.

6. ILLITE RESULTS

The results are given in Table 2.

7. REFERENCES

DUNOYER de SEGNOZAC, G. (1970). *Sedimentology*. 15, 281-346.

ESQUEVIN, J. (1969). *Bull. Centre Rech. Pau-SNPA*. 3, 147-153.

KÜBLER, B. (1968). *Bull. Centre Rech. Pau-SNPA*. 2, 385-397.

TABLE 1: BULK AND -2 μm MINERALOGY

	29401		29402		29403		29404		29405	
ieralogy:	K M Q	D SD A-SD	Q F' M K	D A-SD A A	Q F' M K	D SD A A	Q F' M K Dol?	D SD A A Tr	Q K M	CD CD A
act. %:	11		6		4		10		17	
gy:	K M+	D A-SD	M K	D SD	K M Q	D SD Tr-A	K M+ Q	D SD Tr-A	K M	D A

	29406		29407		29421		29422		29423	
ieralogy:	Q K M	CD CD A	Q K M F'	D A A A	Q K F' M+	D SD SD SD	Q F' M+ K H Dol?	D SD A A Tr Tr	Q F' M+ K Dol? H?	D SD A A Tr Tr
act. %:	21		9		25		6		14	
gy:	K M	D SD	K M Q	D SD Tr	M+ K Q	D SD Tr	K M+ Q F'	CD CD A Tr	M+ K Q F'	D A A Tr

l Key:

Anatase
Chlorite
Dolomite
K feldspar
K feldspar plus plagioclase, former more abundant.
Hematite
Kaolinite
Mica/illite
M with some minor montmorillonite interstratification
Montmorillonite (smectite)
Quartz

Semiquantitative Abbreviations:

D = Dominant. Used for the component apparently most abundant, regardless of its probable percentage level.

CD = Co-dominant. Used for two (or more) predomin components, both or all of which are judged to present in roughly equal amounts.

SD = Sub-dominant. The next most abundant compone providing its percentage level is judged above about 20.

A = Accessory. Components judged to be present between the levels of roughly 5 and 20%.

Tr = Trace. Components judged to be below about 5

TABLE 2: KÜBLER INDICES AND I(002)/I(001) RATIOS

Sample	Kübler Index	(002)/(001) Ratio
29421*	4.1	0.31
22*	5.1	0.38
23*	6.7	0.47

* Illite with some montmorillonite interstratification. Peak breadths and relative intensities can be affected. See text.

APPENDIX 4C

PETROGRAPHIC DESCRIPTIONS

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PETROGRAPHIC DESCRIPTION

imple	Hole No.	Depth	Description
3189	DDH 893-3	24.2m	
3190	DDH 893-1	44.50m	
3191	DDH 893-3	46.3m	(To Follow)
3192	DDH 893-3	67.4m	
3193	DDH 893-3	72.4m	
2912	DDH 893-1	52.60m	
2913	DDH 893-1	79.30m	
2914	DDH 893-1	93.0m	
2915	DDH 893-1	125.30m	
2916	DDH 893-1	38.90m	
2917	DDH 893-2	67.50m	
2918	DDH 893-2	83.50m	
2919	DDH 893-2	98.9m	

APPENDIX 4D

BINOCULAR MICROSCOPY

RAB DRILLING SAMPLES

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BINOCULAR MICROSCOPY

R.A.B. DRILLING SAMPLES

Sample No.	R.A.B. Hole No	Depth (m)	Lithology
15801	893-5	14.0-15.0	Pubs
802		24.0-25.0	Plms (chlorite schist)
803	893-1	13.0-14.0	Pubs (micaceous)
804		20.0-21.0	Plms (biotite schist)
805	893-2	17.0-18.0	Pubs
806		24.0-25.0	Plms
807	893-3	8.0-9.0	Pubs
808	893-4	13.0-14.0	Pubs (muscovite)
809		21.0-22.0	Plms (biotite schist)
810	893-6	8.0-9.0	Pubs (feldspathic)
811		16.0-17.0	Pubs
812		26.0-27.0	Plms (biotite schist)
813	893-7	7.0-8.0	Pubs (clay rich)
814		16.0-17.0	Pubs (feldspathic)
815		28.0-29.0	?? Plms
816	893-8	[illegible]	Pubs
817		17.0-18.0	?? Pubs ? Plms (chloritic schist)
818		[illegible]-27.0	?? Pubs ? Plms (chloritic schist)
819	893-9	7.0-8.0	-
820		19.0-20.0	?? Pubs ? Plms (biotite schist)
821		33.0-34.0	?? Pubs ? Plms (biotite schist)
822	893-10	10.0-11.0	Pubs/Pubc
823		25.0-26.0	Pubs
824	893-11	9.0-10.0	Pubs (arkosic)
825	893-12	22.0-23.0	Pubs (hematitic)
826	893-13	6.0-7.0	Pubs (arkosic)
827		19.0-20.0	-
828	893-16	5.90-6.0	?? Pubs ?? Plms (qtz-muscovite schist)
829		12.0-13.0	?? Pubs?? Plms (qtz-muscorvte schist)
830		19.0-20.0	?? Pubs?? Plms (qtz-muscorvte schist)
831		32.0-33.0	?? Pubs?? Plms (qtz-muscorvte schist)

832	893-17	32.0-33.0	Pubc
833	893-19	11.0-12.0	Pubs
834	893-19	24.0-25.0	Pubs
[illegible]		[illegible].0-37.0	Pubs
		47.0- [illegible]	Pubs
837		51.0-52.0	?Pubs?Plms (mica schist)
838	893-20	11.0-12.0	Pubs
839		23.0-24.0	? Pubs? Plms (mica schist)
840		26.0-27.0	? Pubs? Plms (mica schist)

MINERALOGY OF ROTARY AIR BLAST SAMPLES FROM PROTEROZOIC SEQUENCE IN EYRE PENINSULA, S.A.

Pancontinental Mining Limited
South Australia

3/698/0-GS1176/83 September 1982

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22 September 1982

CS 3/698/0

Pancontinental Mining Limited,
GPO PORT NEILL, SA 5604.

Attention: Doug Currie
Senior Geologist

REPORT CS 1176/83

YOUR REFERENCE: Purchase Order 10770 of 16 August 1982

MATERIAL: Rotary drill blast samples

LOCALITY: Eyre Peninsula

IDENTIFICATION: 15801-15840

DATE RECEIVED: 17 August 1982

WORK REQUIRED: Brief petrographic description

Investigation and Report by: Dr Michael Farrand

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William C. Spencer

Keith Henley

for Norton Jackson
Managing Director

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MINERALOGY OF ROTARY AIR BLAST SAMPLES FROM PROTEROZOIC SEQUENCE IN EYRE PENINSULA, S.A.

1. INTRODUCTION

Thirty-nine samples recovered by rotary air blast from holes drilled in a sequence in Eyre Peninsula were received from Pancontinental Mining Limited. The sequence included the Lower Proterozoic Hutchinson Formation, represented by the Mangala Schist and the Cook Gap Schist, and the Middle Proterozoic Blue Range Formation, represented by sandstones and pebble conglomerates.

The investigation requested was an estimation of the relative proportions of quartz and feldspar in the samples, with the aim of locating the contact between the Lower and Middle Proterozoic formations.

Sample numbers are between 15801 and 15840. Sample 15827 is missing.

2. PROCEDURE

The samples were quartered and one quarter was deslimed at 300 mesh. They were then examined in transmitted light in a medium of refractive index 1.54.

3. RESULTS

Sample: 15801: (893 - 5 14.0 - 15.0)

Quartz:feldspar about 10:1

Comment:

Many grains composed of clay minerals may be altered feldspar but the high quartz content suggests that this is Blue Range Formation.

Sample: 15802 (893 - 5 24.0 - 25.0)

Quartz:feldspar about 3:1

Comment:

A sharp increase in the mica content of the sample, as well as the diminished quartz content suggest that this is Hutchinson Formation.

Sample: 15803 (893 - 1 13.0 - 14.0)

Quartz:feldspar about 50:1

Comment:

This sample represents an undoubted return to a siliceous lithology. With the quartz is relatively abundant clear muscovite. The mica in the other two samples described is a dark, possibly phlogopitic, type. The sample possibly marks a quartz-muscovite lens in the schist, if in drill hole 2, or in the Blue Range Sandstone, if in drill hole 1.

Sample: 15804 (893 - 1 20.0 - 21.0)

Quartz:feldspar about 2:1

Comment:

This is certainly schist and contains abundant mica which in this case is biotite.

Sample: 15805 (893 - 2 17.0 - 18.0)

Quartz:feldspar about 5:1

Comment:

The feldspar content may be greater than is evident optically. Many grains are composed of fine-grained clay and may be altered feldspar. The mica content of the sample is low. On balance the sample appears to be of Blue Range Formation.

Sample: 15806 (893 - 2 24.0 - 25.0)

Quartz:feldspar about 1:1

Comment:

Plagioclase and olive-brown mica are abundant in this specimen and identify it as probable Lower Proterozoic schist. However, a significant proportion of potash feldspar makes the diagnosis somewhat tentative.

Sample: 15807 (893 - 3 8.0 - 9.0)

Quartz:feldspar about 100:1

Comment:

The sample is undoubtedly Blue Range Formation. The pinkish-brown colour may be diagnostic and, if so, provides a simple field test. The schist samples tend to be an olive colour.

Sample: 15808 (893 - 4 13.0 - 14.0)

Quartz:feldspar about 50:1

Comment:

The sample contains little recognisable feldspar but much material which is possibly altered feldspar. The abundant clear muscovite suggests a similarity to sample 15805. Both samples are probably Blue Range Formation.

Sample: 15809 (893 - 4 21.0 - 22.0)

Quartz:feldspar about 1:2

Comment:

The high proportion of feldspar and abundant brown mica, much of which is biotite, identify this as Hutchinson Formation.

Sample: 15810 (893 - 6 8.0 - 9.0)

Quartz:feldspar about 2:1

Comment:

The proportion of feldspar may be even higher if the abundant fragments consisting of fine-grained clays are altered feldspars. There is a little mica in the sample and a few grains of detrital tourmaline. Despite the high proportion of feldspar, this sample is more likely to be Blue Range Formation than Hutchinson Formation.

Sample: 15811 (893 - 6 16.0 - 17.0)

Quartz:feldspar about 5:1

Comment:

The proportion of feldspar is possibly again understated due to alteration. The colour of the sample and a high abundance of colourless mica suggests that the sample is of Blue Range Formation. Detrital tourmaline is relatively abundant as an accessory mineral and may be a further diagnostic feature of the Formation.

Sample: 15812 (893 - 6 26.0 - 27.0)

Quartz:feldspar about 1:1

Comment:

Neither quartz nor feldspar are very abundant in this specimen. Biotite is the most abundant constituent and the rock is undoubtedly schist from the Hutchinson Formation.

0192

Sample: 15813 (893 - 7 7.0 - 8.0)

Quartz:feldspar about 100:1

Comment:

There is very little feldspar which can be identified optically with confidence. There is a great deal of fine-grained clay which may be an alteration product of feldspar. The few grains of detrital tourmaline and of poorly-crystalline mica suggest that the rock is Blue Range Formation. Translucent red and yellow-brown iron oxide may also be diagnostic of the sandstones.

Sample: 15814 (893 - 7 16.0 - 17.0)

Quartz:feldspar about 1:2

Comment:

Both microcline and plagioclase are readily identifiable in this sample and there is abundant colourless mica.

Despite the high feldspar content, the rock appears to be more akin to the facies of the Blue Range Formation close to the contact which has been encountered in holes previously described than to the underlying schist. There appears to be a muscovite-rich, possibly arkosic, facies at or near the base. There is an element of uncertainty in this diagnosis but on balance the rock is assigned to the Blue Range Formation.

Sample: 15815 (893 - 7 28.0 - 29.0)

Quartz:feldspar about 1:1

Comment:

The proportion of feldspar may be understated due to alteration. There is a pale brown, rather fibrous mica and the rock is probably from the Hutchinson Formation. The evidence is not as strong as for many other samples, however.

Sample: 15816 (893 - 8 6.0 - 7.0)

Quartz:feldspar about 100:1

Comment:

There is virtually no feldspar which can be identified conclusively. There is a colourless muscovite and quite abundant detrital tourmaline. The rock is confidently identified as Blue Range Formation.

0193

Sample: 15817 (893 - 8 17.0 - 18.0)

Quartz:feldspar about 1:1

Comment:

Again, the proportion of feldspar is uncertain, owing to alteration. There are four kinds of mica, a colourless muscovite, a biotite, a pale olive, non-pleochroic mica and a poorly-crystalline, rather fibrous type. There is also detrital tourmaline and the rock is identified tentatively as Blue Range Formation.

Sample: 15818 (893 - 8 26.0 - 27.0)

Quartz:feldspar about 50:1

Comment:

There is very little identifiable feldspar but a good deal of clay in the sample. Muscovite and tourmaline are present and the sample is identified with confidence as Blue Range Formation.

Sample: 15820 (893 - 9 19.0 - 20.0)

Quartz:feldspar about 10:1

Comment:

Both microcline and plagioclase are identifiable among the feldspar grains. Both colourless and pale olive micas are present, as is a rusty brown iron oxide. The rock is identified as Blue Range Formation.

Sample: 15821 (893 - 9 33.0 - 34.0)

Quartz:feldspar about 50:1

Comment:

The micas in this sample are almost identical to those of sample 15820 and, together with the low feldspar content and rare tourmaline, suggest that the rock is Blue Range Formation. This increases the evidence for a hollow in the unconformity surface.

Sample: 15822 (893 - 10 10.0 - 11.0)

Quartz:feldspar about 1:5

Comment:

The sample is full of fresh plagioclase and microcline but is identified as Blue Range Formation on its mica content. The micas are colourless and pale olive-green and appear to be typical of the sandstones rather than the schists. There are a few grains of tourmaline and zircon. Feldspars alone are apparently not a reliable diagnostic feature of the sediments.

0194

Sample: 15823 (893.10 25.0 - 26.0)

Quartz:feldspar about 1:3

Comment:

The feldspars are mainly microcline in this specimen, which is identified as Blue Range Formation on its colourless and green micas and on its content of red-brown iron oxide.

Sample: 15824 (893.11 9.0 - 10.0)

Quartz:feldspar about 2:1

Comment:

Microcline is the most abundant feldspar, with minor plagioclase. The reddish colour of the sample is due to iron oxide staining. The rock is an arkose of the Blue Range Formation.

Sample: 15825 (893.12 22.0 - 23.0)

Quartz:feldspar about 2:1

Comment:

The rock is another arkose of the Blue Range Formation. Microcline is the dominant feldspar and muscovite, tourmaline and zircon are present. The colour is due to iron oxide staining.

Sample: 15826 (893.13 6.0 - 7.0)

Quartz:feldspar about 1:2

Comment:

The feldspar includes plagioclase and a green mica is present as well muscovite. The specimen is less iron stained than the two just described but is still a Blue Range arkose. Tourmaline is present.

Sample: 15828 (893.16 5.0 - 6.0)

Quartz:feldspar about 100:1

Comment:

The cleaned sample appears to be Hutchinson Formation schist at first sight. Under the microscope it appears on balance to be Blue Range Formation but the evidence is somewhat uncertain. The apparent scarcity of feldspars may be due to the abundant clay alteration but the micas are colourless to green, which is characteristic of the sandstones on the evidence of other samples examined. Iron oxide staining is prevalent.

Sample: 15829 (893.16 12.0 - 13.0)

Quartz:feldspar about 100:1

Comment:

The sample is almost certainly Blue Range Formation. It contains almost no recognisable feldspar and the micas are colourless to very pale green. Rare grains of tourmaline are present.

Sample: 15830 (893.16 19.0 - 20.0)

Quartz:feldspar about 100:1

Comment:

Using the criteria established from the examination of other samples; that is the rarity of feldspar, the colourless or green micas, the presence of tourmaline and iron oxide staining, this sample is Blue Range Formation, despite its appearance without magnification.

Sample: 15831 (893.16 32.0 - 33.0)

Quartz:feldspar about 100:1

Comment:

This sample is an even more extreme example of material that at first sight appears to be Hutchinson Formation schist but which on microscopic examination has the diagnostic characteristics of Blue Range Formation. The dark colour is due to opaque oxides which are neither limonite nor translucent hematite.

Sample: 15832 (893.17 32.0 - 33.0)

Quartz:feldspar about 1:3

Comment:

This is a return to the typical Blue Range Formation arkose which characterised sample traverse B. Microcline is abundant, as is colourless muscovite. Green mica is less abundant and tourmaline is rare.

Sample: 15833 (893.19 11.0 - 12.0)

Quartz:feldspar about 10:1

Comment:

The specimen is from the Blue Range Formation and represents a facies between the feldspar-rich and the quartz-mica rich types. Both microcline and plagioclase are present and the micas are about half green and half colourless. Tourmaline is present but not abundant.

Sample: 15834 (893 - 19 24.0 - 25.0)

Quartz:feldspar about 100:1

Comment:

The sample is a quartz-rich member of the Blue Range Formation, stained red by iron oxide. It contains a little mica, mainly green coloured.

Sample: 15835 (893 - 19 36.0 - 37.0)

Quartz:feldspar about 20:1

Comment:

The sample contains fresh feldspar, both microcline and plagioclase, colourless mica and rare tourmaline. It is a member of the Blue Range Formation.

Sample: 15836 (893 - 19 47.0 - 48.0)

Quartz:feldspar about 50:1

Comment:

The specimen is from the Blue Range Formation. The proportion of feldspars may be understated as many grains consist of fine-grained clay which may be an alteration product of feldspar. Detrital tourmaline is quite abundant. Mica is a major component and is partly colourless, partly green.

Sample: 15837 (893 - 19 51.0 - 52.0)

Quartz:feldspar about 50:1

Comment:

The specimen is richer in mica, mainly colourless, than it is in quartz and feldspar is very rare. Iron oxide forms an abundant coating to the grains. A little green mica and very rare tourmaline and zircon are present. The specimen is probably part of the Blue Range Formation.

Sample: 15838 (893 - 20 11.0 - 12.0)

Quartz:feldspar about 100:1

Comment:

The specimen is a quartz-rich member of the Blue Range Formation. Feldspar is very rare, although some clay may represent original feldspar. Mica is also rare and what there is is greenish. Iron oxide, both opaque and translucent, is common.

Sample: 15839 (893 - 20 23.0 - 24.0) 0197

Quartz:feldspar about 100:1

Comment:

The specimen is quartz and mica-rich with quite abundant tourmaline. A little of the mica is green, most is colourless. Feldspar is virtually absent. The rock is a facies of the Blue Range Formation, similar to mica-rich members near the base of adjacent drill holes.

Sample: 15840 (893 - 20 26.0 - 27.0)

Quartz:feldspar about 100:1

Comment:

The rock is almost identical to sample 15831 at the base of the adjacent hole number 16. The quartz sediment is dark coloured due to opaque iron oxide. There is a little mica present with relatively abundant tourmaline. By the criteria developed during this investigation the rock is part of the Blue Range Formation.

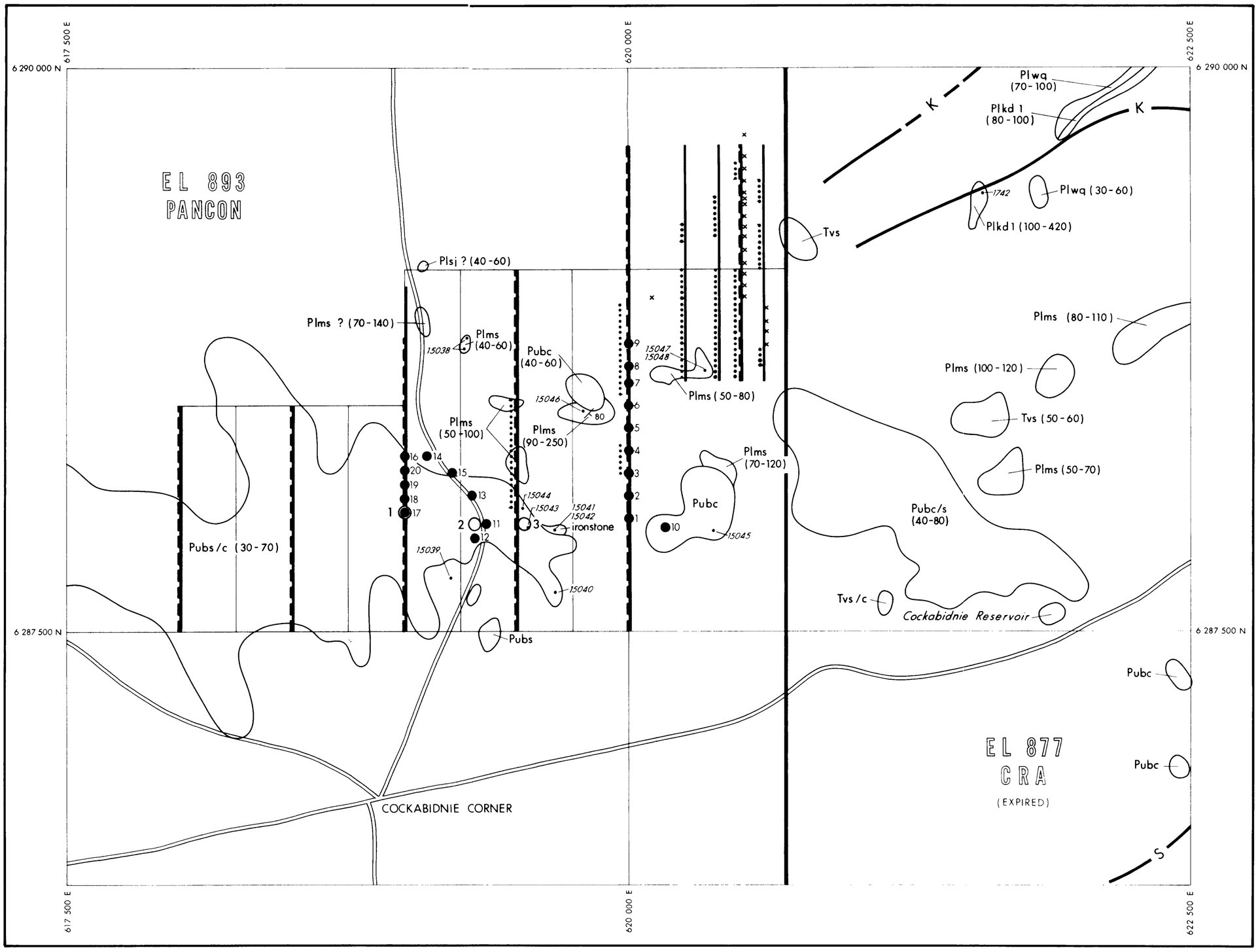
4. DISCUSSION

Diagnosis of the provenance of the samples examined has been based partly on the ratios of quartz to feldspar and partly on other criteria developed as the investigation proceeded. The development of a coherent succession has controlled the investigation to a large extent.

Use of the ratios of quartz to feldspar by itself is not effective as some samples which on stratigraphic and other grounds, must be Blue Range Formation, have more feldspar than quartz. The nature of the feldspar may be more critical. The microcline-rich arkoses of the Blue Range Formation probably do not have equivalents in the more basic schists of the Hutchinson Formation.

The nature of the micas also appears to be significant in arriving at a consistent stratigraphy. The colourless and green muscovites of the Blue Range Formation are distinct from the biotites of the schists of the Hutchinson Formation, on the evidence of the samples examined. The almost ubiquitous tourmaline, usually a greenish colour, seems to distinguish the Blue Range Formation with reasonable reliability. The significance of iron oxides is uncertain at this stage.

Using the criteria developed, the shape of the unconformity appears to be that of a buried landscape rather than a peneplaned surface. A relatively gentle slope to the north is combined with a slope to the west which is so steep that neither the drills on traverse B or traverse C have reached the unconformity.



LEGEND

QUATERNARY — Clc — Calcrete

TERTIARY — Tvc/s — Conglomerate and sandstone, hematitic

? — Cg — Conglomerate - uncertain age

MIDDLE PROTEROZOIC

- Pubs / Pubc — 'BLUE RANGE BEDS' Sandstone, minor arkose and grit (Pubs) with basal conglomerate (Pubc) and ironstone
- q — Quartz vein
- p — Pegmatite
- Plg — 'YOUNGER GRANITES' Adamellite, granodiorite, pegmatitic granite

LOWER PROTEROZOIC

- Plys — 'YADNARIE SCHIST' fine grained phyllite and schist
- Plsj / Plsg / Plsd — 'MOUNT SHANNON IRON FORMATION' predominantly hematitic jaspilite (Plsj) with minor graphite schist (Plsg) and dolomite (Plsd)
- Plms / Plma — 'MANGALO SCHIST' Quartz - biotite - feldspar - muscovite ± garnet ± sillimanite schist (Plms) with amphibolite and banded calc - silicate (Plma)
- Plkg / Plkj / Plkd2 / Plkd1 / Plks — 'KATUNGA DOLOMITE' Silicified and terruginous dolomite (Plkd1), with minor graphitic schist (Plkg), hematitic jaspilite (Plkj), calc - silicate (Plkd2) and uncommon basal quartz - feldspar - biotite schist (Plks)
- Plwq / Plwd — 'WARROW QUARTZITE': predominantly quartzite and conglomeratic quartzite (Plwq) with basal dolomite - calc - silicates (Plwd)

ARCHEAN ?

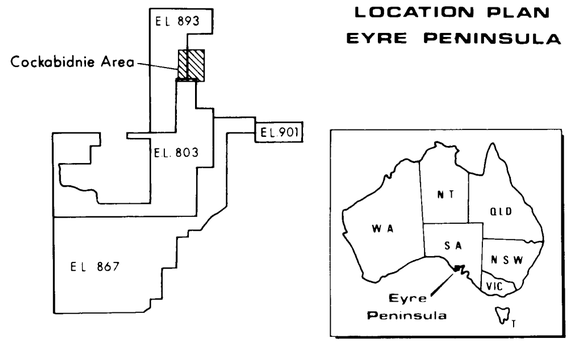
- Ac — 'COOLANIE GNEISS COMPLEX' Gneiss granite gneiss, migmatite and augen gneiss with minor amphibolite
- Ag — 'PLUG RANGE - LINCOLN COMPLEX' Gneiss, augen gneiss, granite gneiss, migmatite and minor amphibolite

ARCHEAN — Ap — 'SLEAFORD COMPLEX' Granite, diorite porphyritic granite gneiss

ASSAY RESULTS (ppm)

Sample No.	U	Th	Cu	Pb	Zn
1742	210	< 4	220	45	170
15038	< 4	26	12	26	2
15039	6	8	75	6	4
15040	< 4	48	4	22	4
15041	10	10	6	16	2
15042	18	14	4	14	2
15043	14	16	8	24	4
15044	20	30	12	36	4
15045	< 4	16	60	10	4
15046	20	65	< 2	8	2
15047	< 4	48	8	32	2
15048	< 4	28	55	24	2

- 1982 Grid Area
- Soil Geochemistry (50m. spacing), 1982
- Radon Surveying (50m. and 25m. spacing), 1982
- Radon Anomaly, 1982
- K — Trend of airborne magnetic highs associated with Katunga Dolomite
- K — Extrapolated airborne magnetic trends associated with Katunga Dolomite
- S — Trend of airborne magnetic highs associated with Mt Shannon Formation
- (80-170) — Scintillometer reading (cps)
- *1735* — Sample location and number
- 10 — Rotary Air Blast Drilling (R.A.B.), 1982
- 3 — Core Drill Hole, 1982
- Geological boundary, outcrop
- 80 — Dip and strike of bedding
- × — Pits (1981)



LOCATION PLAN
EYRE PENINSULA

Exploration & Production Division
PANCON

PANCONTINENTAL MINING LIMITED

PANCON - PNC - AFMECO J.V.
COCKABIDNIE - E.L.893
EYRE PENINSULA, S.AUSTRALIA

1982 PROGRAMME

SCALE 1:12500
0 500 1000 1500 2000 2500
METRES

Compiled D Currie	Date October '82	Dwg Nº 11/S/D/41
Drawn J. B.		PLATE 1

3551(II)-44

EL 893
PANCON / PNC

EL 877
CRA
(EXPIRED)

LEGEND

QUATERNARY	Clc	Calcrete
TERTIARY	Tvc/s	Conglomerate and sandstone, hematitic
?	Cg	Conglomerate - uncertain age
MIDDLE PROTEROZOIC	Pubs	'BLUE RANGE BEDS': Sandstone, minor arkose and grit (Pubs) with basal conglomerate (Pubc)
	q	Quartz vein
	p	Pegmatite
	Plg	'YOUNGER GRANITES': Adamellite, granodiorite, pegmatitic granite
LOWER PROTEROZOIC	Plys	'YADNARIE SCHIST': fine grained phyllite and schist
	Plc	'MOUNT SHANNON IRON FORMATION': predominantly hematite - jaspilite (Plsj) with minor graphite schist (Plsg) and dolomite (Plsd)
	Plms	'MANGALO SCHIST': Quartz - biotite - feldspar - muscovite ± garnet ± sillimanite schist (Plms) with amphibolite and banded calc - silicate (Plma)
	Plkg / Plk1 / Plkd2 / Plkd1	'KATUNGA DOLOMITE': Silicified and ferruginous dolomite (Plkd1), with minor graphitic schist (Plkg), hematitic jaspilite (Plkj), calc - silicate (Plkd2) and uncommon basal quartz - feldspar - biotite schist (Plks), ferruginous dolomite (hachured)
	Plwa / Plwt	'WARROW QUARTZITE': predominantly quartzite and conglomeratic quartzite (Plwa) with basal dolomite - calc - silicates (Plwd), ferruginous dolomite (hachured)
ARCHEAN ?	Ac	'COOLANIE GNEISS COMPLEX': Gneiss, granite gneiss, migmatite and augen gneiss with minor amphibolite
	Ag	'PLUG RANGE - LINCOLN COMPLEX': Gneiss, augen gneiss, granite gneiss, migmatite and minor amphibolite
ARCHEAN	Ap	'SLEAFORD COMPLEX': Granite, diorite, porphyritic granite gneiss

- Geological boundary, outcrop
- Dip and Strike of bedding
- K — Trend of Airborne Magnetics
- 1980 Detailed Mapping (Plate 11, 1980 Report)

1982 DRILLING
- RAB 893-1 — Rotary Air Blast Drilling - 1982
- DDH 893-1 — Core Drill Hole - 1982
- Backhoe Pits - 1981
- 15039 — Geochemical Samples

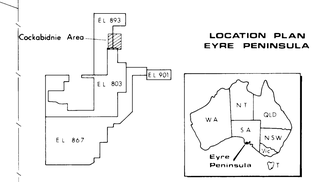
N.B GEOLOGY & TOPOGRAPHY FROM PLATE 10 (1 25,000) AND PLATE 11 (1 25,000), 1980 REPORT

ASSAY RESULTS (ppm)

Sample No	U	Th	Cu	Pb	Zn
1742	210	4	220	45	170
15038	4	26	12	26	2
15039	6	8	75	6	4
15040	4	48	4	22	4
15041	10	10	6	16	2
15042	18	14	4	14	2
15043	14	16	8	24	4
15044	20	30	12	36	4
15045	4	16	60	10	4
15046	20	65	2	8	2
15047	4	48	8	32	2
15048	4	28	55	24	2

— Soil Geochemistry Linears (1982)
✱ Borehole Water Samples

LOCATION PLAN
EYRE PENINSULA



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COCKABIDNIE - E.L. 893
EYRE PENINSULA, S. AUSTRALIA

GEOLOGY AND
1982 DRILL HOLE LOCATIONS

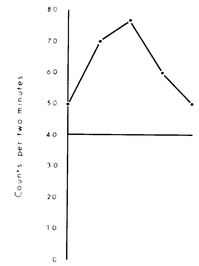
SCALE : 1:5000
0 100 200 300 400 500 metres
METRES

Compiled	D Currie	Date	September 82
Drawn	J B	Date	

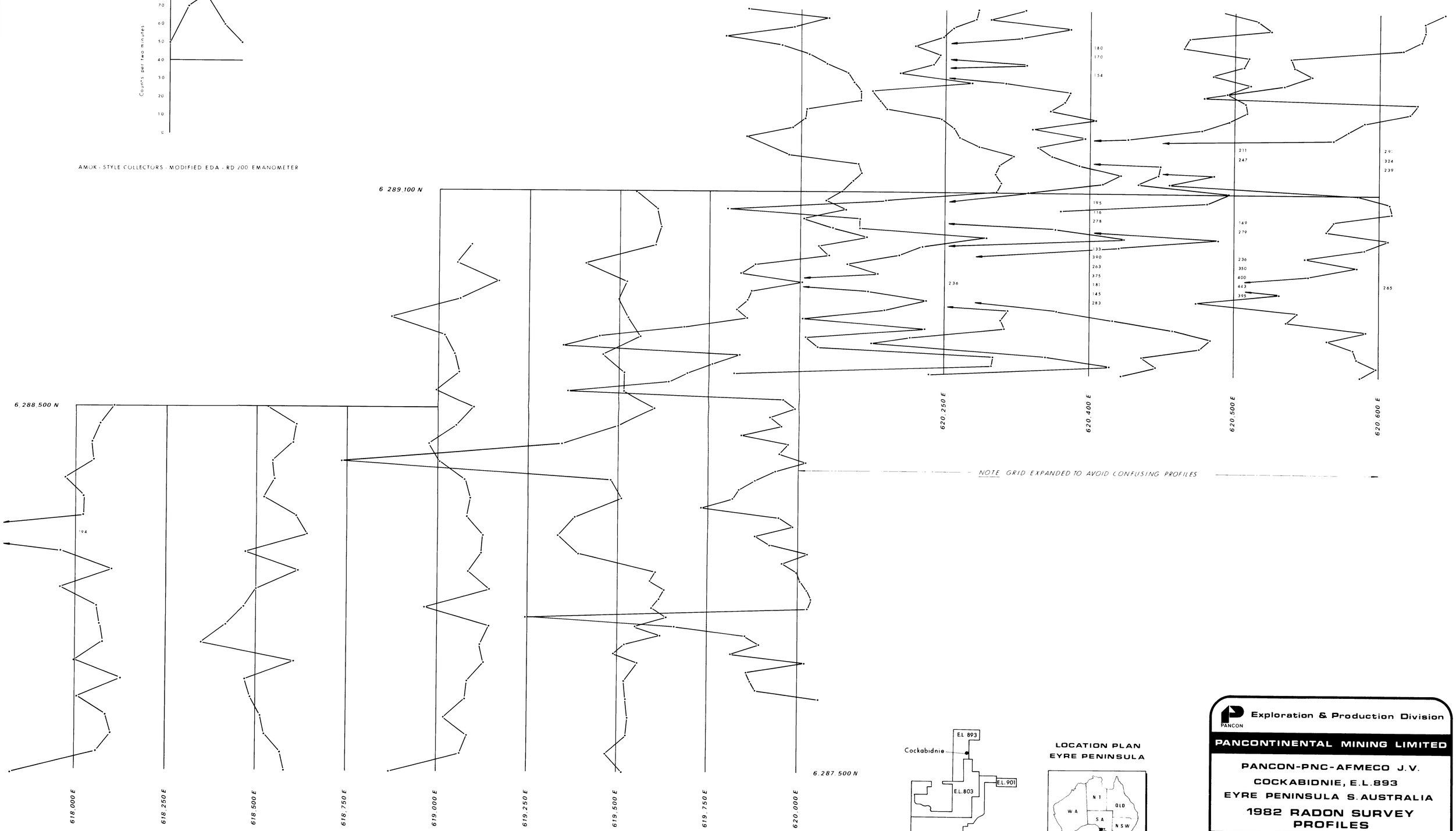
Dwg No 11/S/J/10

PLATE 2

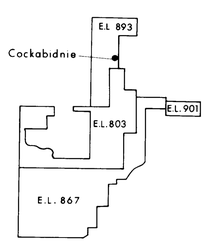
3351(IE)-45



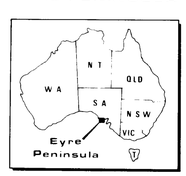
AMOK - STYLE COLLECTORS - MODIFIED EDA - RD 200 EMANOMETER



NOTE GRID EXPANDED TO AVOID CONFUSING PROFILES



LOCATION PLAN
EYRE PENINSULA



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COCKABIDNIE, E.L.893
EYRE PENINSULA S.AUSTRALIA
1982 RADON SURVEY PROFILES

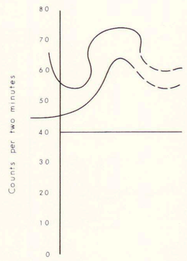
SCALE 1:5000

0 100 200 300 400 500

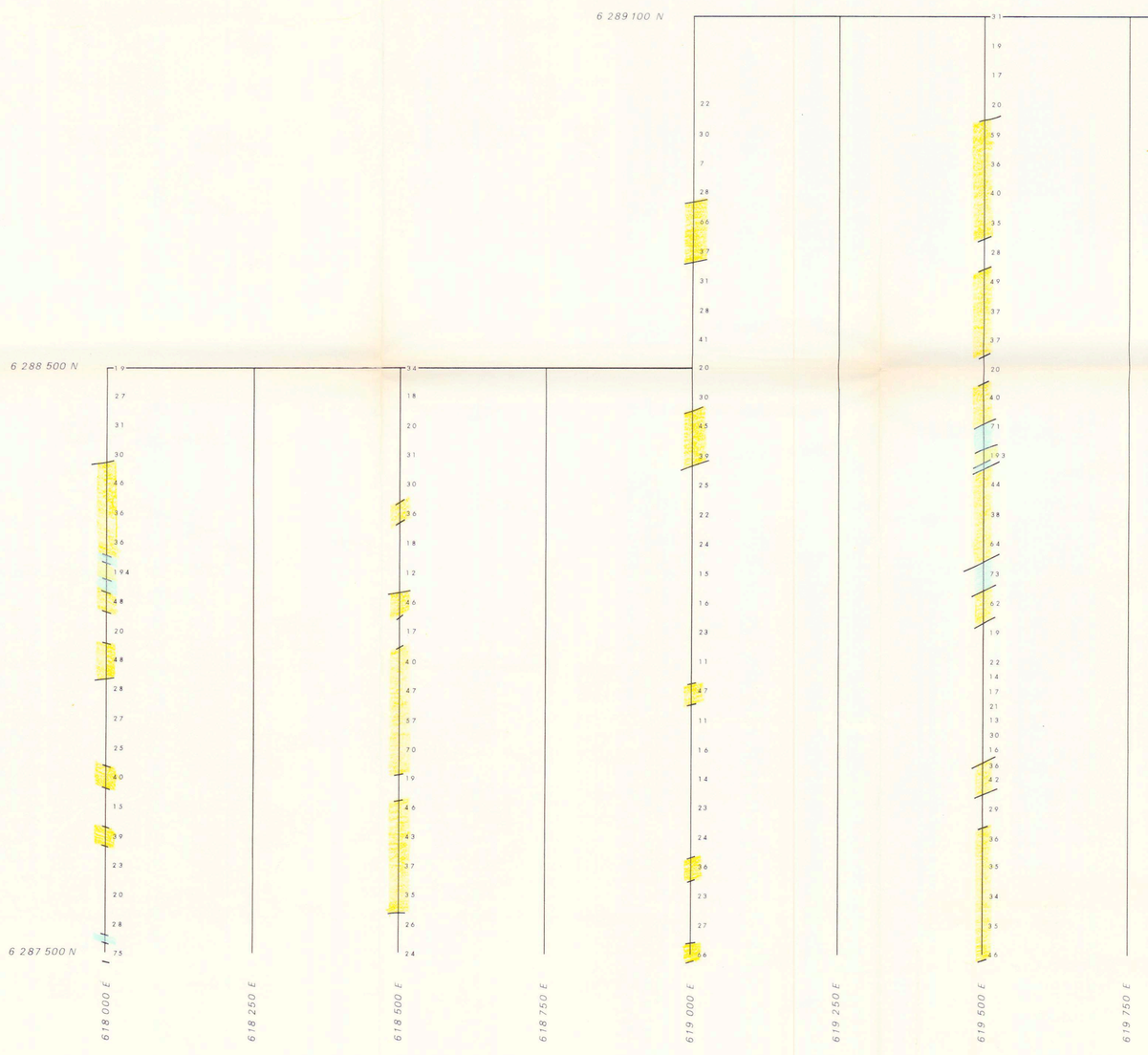
METRES

Compiled D.Currie	Date August, 1982	Dwg Nº 11/S/E/33	
Drawn V.Binder	Date August, 1982	PLATE 3	

3551(II)-46



AMOK - STYLE COLLECTORS - MODIFIED EDA - RD 200 EMANOMETER



CONTOUR INTERVALS

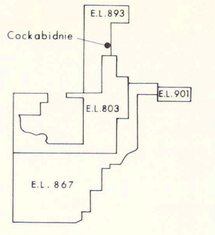
- <35
- 35 - 70
- 70 - 140
- 140 - 210
- 210 - 280
- >280

STATISTICS

POPULATION ..... 349 STATIONS

MEAN ($\bar{x}$) ..... 67·7

STANDARD DEVIATION ..... 69·99
(S.D.)



LOCATION PLAN
EYRE PENINSULA

Exploration & Production Division
PANCON

PANCONTINENTAL MINING LIMITED

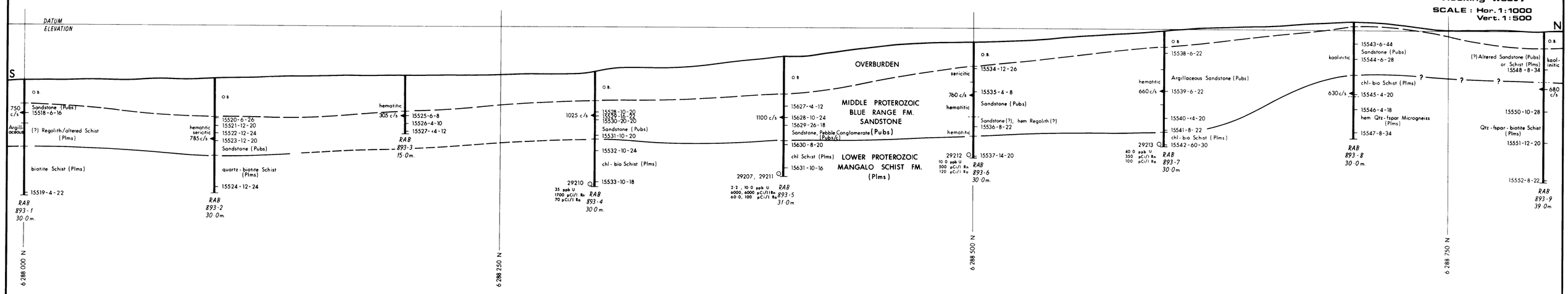
PANCON-PNC-AFMECO J.V.
COCKABIDNIE, E.L.893
EYRE PENINSULA S.AUSTRALIA
1982 RADON SURVEY
CONTOURS

SCALE 1:5000
0 100 200 300 400 500
METRES

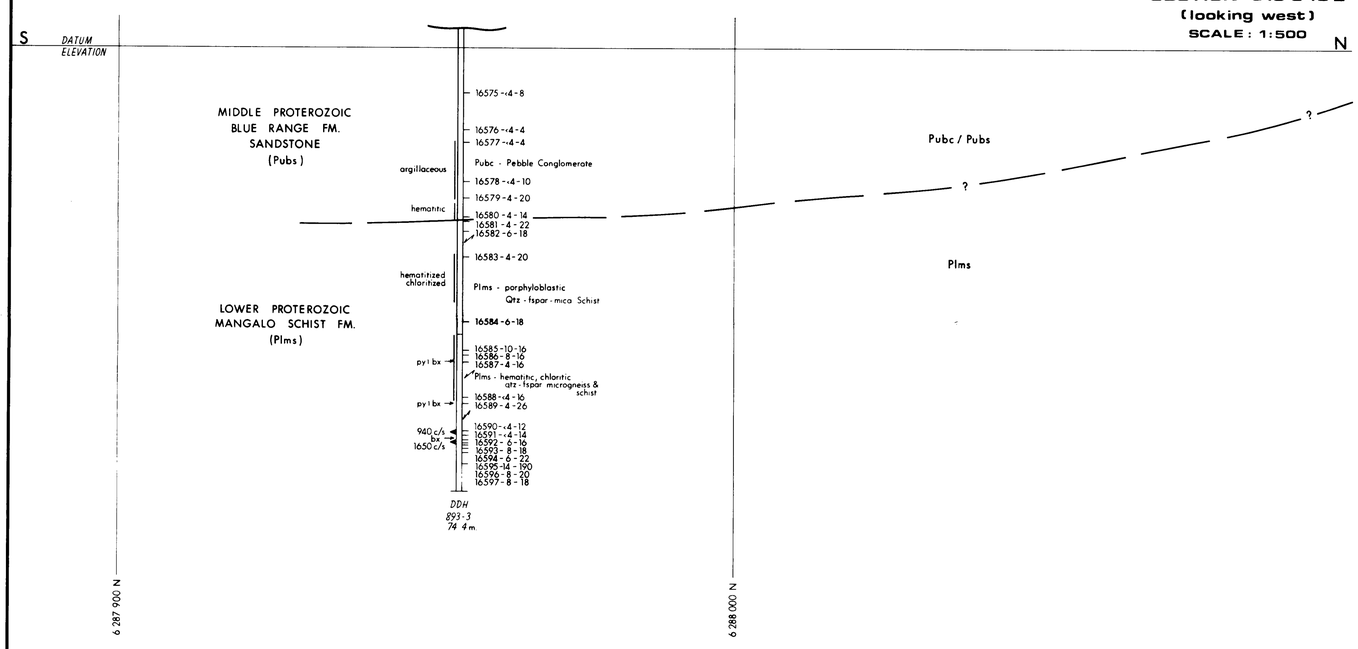
Compiled D. Currie	Date August, 1982	Dwg No 11/S/E/34
Drawn V. Binder	Date August, 1982	PLATE 4

3551(11)-47

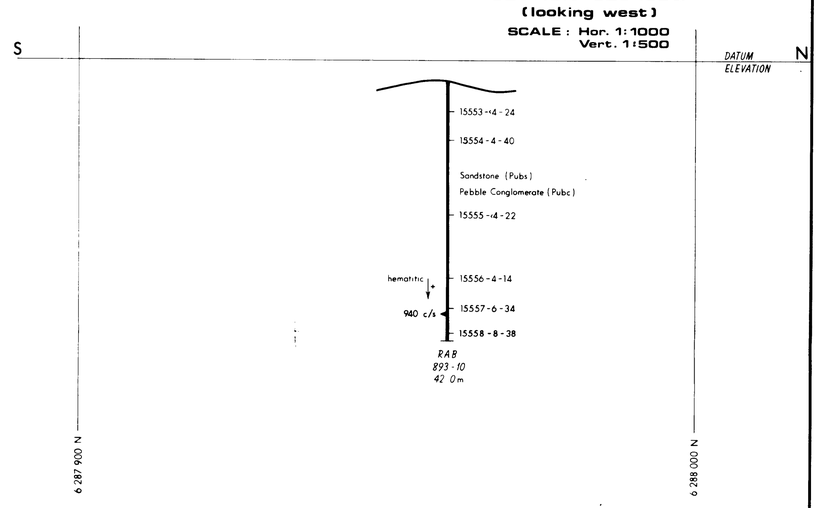
SECTION 620 000 E
(looking west)
SCALE : Hor. 1:1000
Vert. 1:500



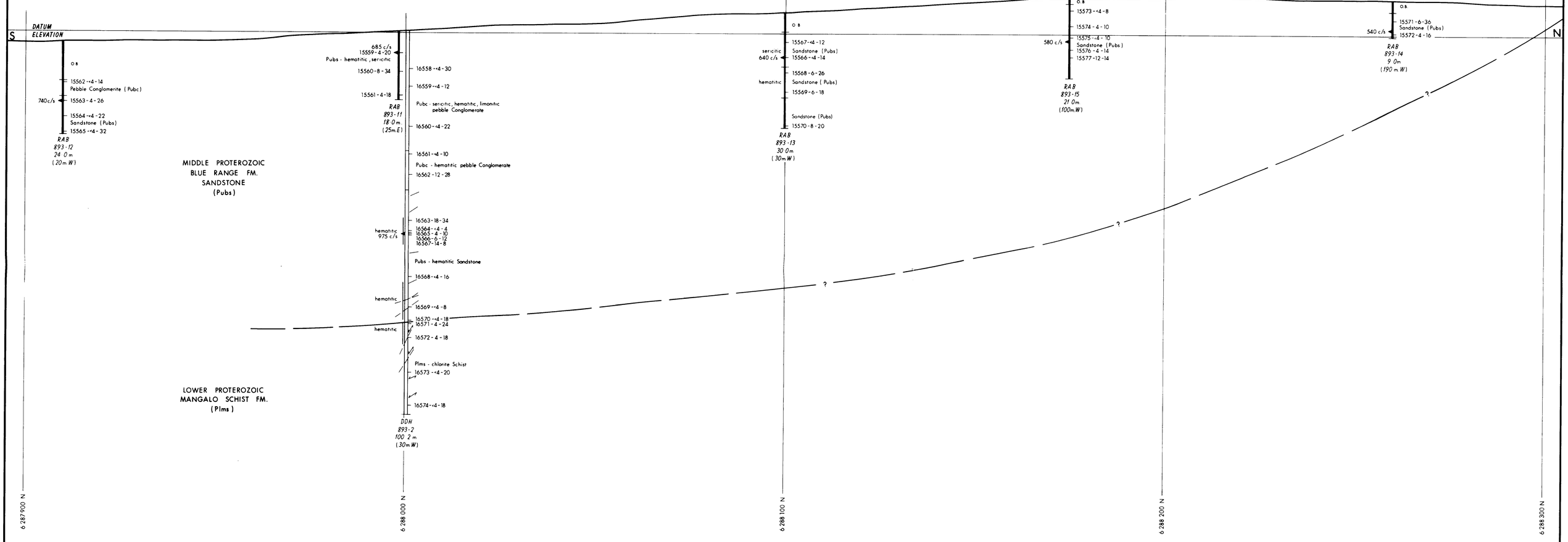
SECTION 619 545 E
(looking west)
SCALE : 1:500



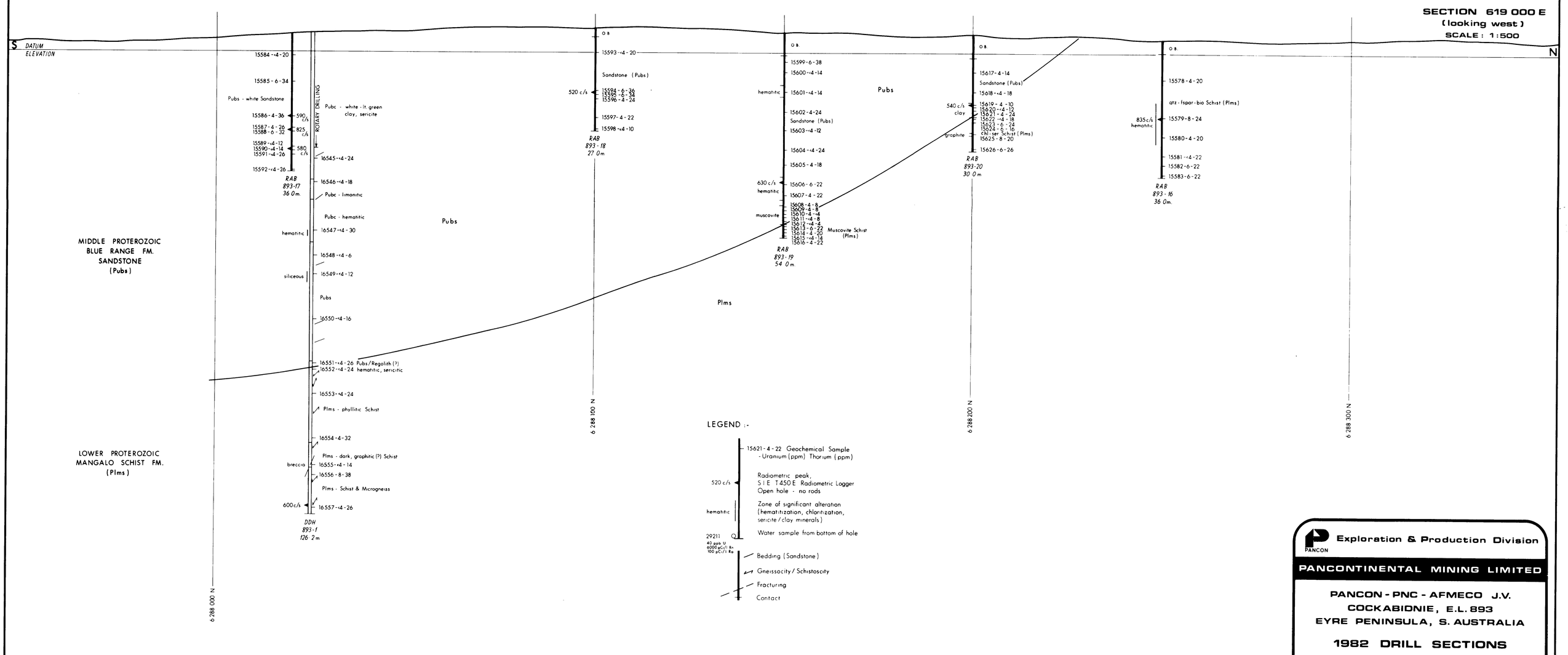
SECTION 620 160 E
(looking west)
SCALE : Hor. 1:1000
Vert. 1:500



SECTION 619 350 E
(looking west)
SCALE : 1:500



SECTION 619 000 E
(looking west)
SCALE : 1:500



LEGEND :-

- 15621-4-22 Geochemical Sample - Uranium (ppm) Thorium (ppm)
- 520 c/s — Radiometric peak, S I E T 450 E Radiometric Logger Open hole - no rods
- hematitic — Zone of significant alteration (hematitization, chloritization, sericite / clay minerals)
- 29211 — 40 ppb U, 6000 pCi/l Ra, 100 pCi/l Ra — Water sample from bottom of hole
- Bedding (Sandstone)
- Gneissocity / Schistosity
- Fracturing
- Contact

FOR DRILL HOLE LOCATIONS - SEE PLATE 9

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1982 DRILL SECTIONS

VERTICAL SCALE 1 : 500
0 10 20 30 40 50
METRES

Compiled D Currie	Date September '82	Dwg N° 11/S/J/11
Drawn J B	Date	PLATE 5

3551(II)-48