NORTHERN TERRITORY GEOLOGICAL SURVEY REPORT

G.S. 78/2

SOUTH ALLIGATOR STRATIGRAPHIC DRILLING

by

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CONTENTS

SOUTH ALLIGATOR STRATIGRAPHIC DRILLING

1. INTRODUCTION

At the request of the Bureau of Mineral Resources a 500m continuously cored hole was drilled into the Cahill Formation with a depression of 60° and an azimuth of 60° at a grid reference 1:100 000 5472 - 395020. A previous attempt to drill this hole with a collar 100m East of the above location was abandoned due to difficulties.

2. SUMMARY OF STRATIGRAPHY

AGE	DEPTH (m)	STRATIGRAPHY
MESOZOIC?	0 - 77.05	Siltstones, unconsolidated sands, micaceous sandstone, claystones and sandstones with clay matrix.
		UNCONFORMITY
	77.05 - 102.35	Mottled weathered crumbly micaceous schists.
LOWER PROTEROZOIC	102.35 - 126.00	Silicified carbonates with interbeds of weathered micaceous schist.
	126.00 - 134.70	Carbonates
	134.70 - 151.80	Weathered micaceous schists and clays.
	151.80 - 155.20	Carbonates
	155.20 - 165.35	Quartz mica schist with Amphibolite.
	165.35 - 178.40	Crystalline carbonates, broken carbonates and micaceous schists towards 178.40m.
	178.40 - 182.65	Carbonates with interbeds of micaceous schist.
	182.65 - 466.20	Minor carbonate at 182.65m. A thick sequence of quartz mica schists, quartz amphibolite, amphibolite with minor carbonate throughout.
	466.20 - 501.25	Carbonates with fine bands of silty sediment with banding that varies from 1 to 10cm in width.

3. STRUCTURE

From examination of the core the weathering profile was evident to approximately 120m. Tight isoclinal folds were evident in the mica schists and quartz mica schists, herringbone structures were noted in the amphibolites and much of the core had been subjected to quartz and carbonate veining both concordant with and cutting schistosity.

It is difficult to acertain whether the section represents a continuous section of the Cahill Formation or whether some lighologies have been repeated. However from a cursory examination of the geology exposed in the road cutting some 250m to the south east it would appear that the core does in fact represent a continuous section.

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4. GEOPHYSICS

A gamma log was run to a depth of some 428 metres but nothing of any real significance was outlined.

Within the Mesozoic a poor response was evident from the intersection of unconsolidated sands and micaceous sandstones with higher readings evident from the micaceous sandstones and clays approaching the unconformity between the Mesozoic and Lower Proterozoic. Within the Lower Proterozoic low responses were recorded from the carbonates and amphibolites and higher readings recorded from the schist sequences. A low response, equivalent to that of the carbonates and amphibolites was recorded from a section of near gneissic rock.

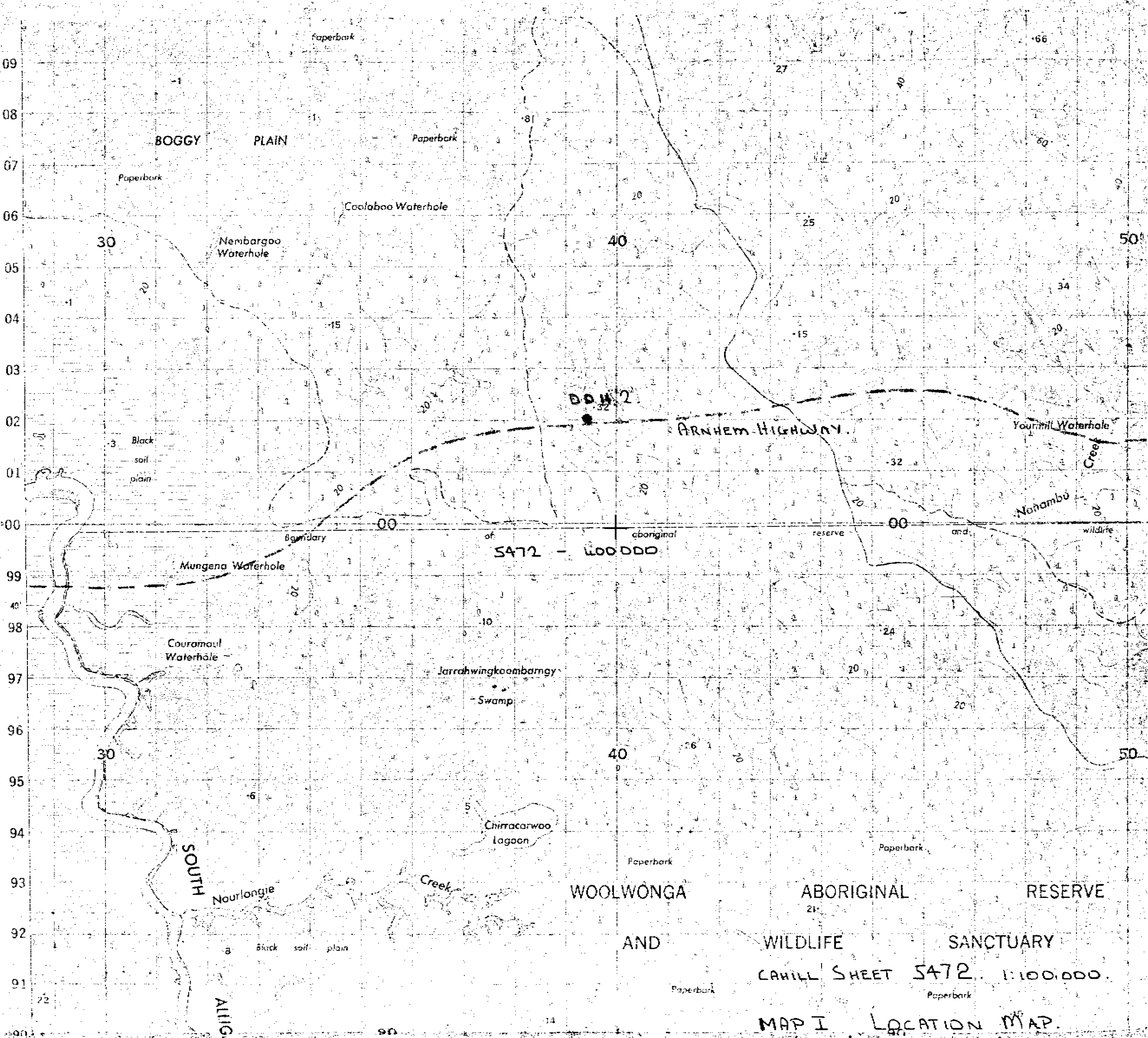
The below Table illustrates generalized readings that were obtained.

TABLE

AGE	ROCK TYPE	RADIOMETRICS c.p.s.	
MESOZOIC	Siltstone	av	10 - 15
	Unconsolidated sands micaceous sandstones	av	0 - 10
	Micaceous sandstones & clays close to unconformity	av	20
		high	35
		low	15
LOWER PROTEROZOIC	Qtz micaceous schists	av	40
		high	50
		low	30
	Carbonates	av	0 - 10
		high	25
		low	5
	Gneiss	av	15 - 30
		high	25
		low	10
	Amphibolites	av	5 - 15

5. PETROGRAPHY

Selected samples are being thin sectioned and some of the carbonates are being analysed. The results will be added to this report as an appendix.



CAHILL SHEET 5472. 1:100,000.

MAP I. LOCATION MAP.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: South Alligator Stratigraphic No 2 REMARKS: Cahill Formation.
HOLE No: D.D.H. 2 CO-ORDINATES 1:100.000 5472-395020 R.L. GROUND 23 metres
LOCATION 118km E of South Alligator River, 100m N of Arnhem Highway ANGLE FROM HORIZONTAL 60° DIRECTION 60° MAG.

DESCRIPTION OF CORE	LOG	CORE RECOVERY %	SAMPLES + Remarks.
2.40 - 10.80m. Weathered friable crumbly reddish brown yellowish white siltstone - micaceous in part. Comp. Qtz grains clay mica		100%	
10.80 - 11.75m. mottled purplish red yellowish brown ferruginous sandstone ē subrounded medium pebbles of qtz Comp. Qtz pebbles, sand, yellowish clays + mica (10m)		13%	Rock type characteristic of base of Mullaman Beds. Sample 10.80m.
11.75 - 49.15m. Unconsolidated sands; micaceous sandstones + whitish clays. 11.75 - 13.25 Crumbly reddish brown sands. 13.25 - 17.25 As above - unconsolidated, abundant mica, whitish sands at 15.60m. 17.25 - 18.75 No recovery (20m) 18.75 - 19.10 Yellowish brown micaceous sands. 19.10 - 20.95 Ferruginous friable dk brown + yellowish brown sandstone ē colour bands at 40° to C.A. 20.95 - 24.85 Unconsolidated qtz sand 24.85 - 32.45 whitish sands - flaky mica evident. 32.45 - 37.20 Unconsolidated micaceous sands. (30m) 37.20 - 43.15 Gradational sequence of micaceous sandstone to whitish clays to micaceous sandstones. Beds of very coarse sands. 43.15 - 44.65 Coarse unconsolidated sands fragments of magnetite noted. 44.65 - 47.70. Ferruginised crumbly sandst ē a gradational contact to micaceous sandstone - unconsolidated in part (40m) 47.70 - 49.15 Micaceous sandstone ē a gradation to white clay.	Uncon Uncon Uncon Uncon Uncon Uncon	35%	
49.15 - 53.80m. mottled white + purplish crumbly clays ē qtz grains, gradational in part to micaceous sandstones. (50m)		50%	
53.80 - 65.20m. Unconsolidated sands - minor magnetite			
55.20 - 59.95m. Light brownish sands unconsolidated in part grading to a white clay at 56.10m. ē gradations to a whitish micaceous sandstone ē a white clay matrix. (60m)	Uncon.		Sample 60.00m.
59.95 - 60.00m Large pebbles sub ang qtz.			
60.00 - 67.55m. whitish micaceous sandstone ē clay matrix grading to white clay. Small qtz pebbles in part. Broken qtz vein 66.00 - 67.20m.		42%	
67.55 - ~~76.70m~~ 77.05m. Alternating off whitish sandstone ē clay matrix and off whitish clays. Clay becomes more predominate towards 76.70 (70m)			Large pebbles of qtz. The whitish clays are subjected to iron staining in part
77.05 - 97.85m. Mottled weathered crumbly micaceous schists ē abundant clay 79.80 - 80.50m. Qtz pebbles ē schist ē abundant clay (80m) 96.45 - 96.55m Blocky + angular qtz pebbles. (90m)		74%	UNCONFORMITY. Purplish red + bluish black indurated zones Sample 82.00m. Cavities at 88.90m Qtz pebbles exhibiting columnar structure
97.50 - 97.85m. Weathered greenish micaceous ~~97.85~~ schists.			
97.85 - 98.55m. Qtz micaceous schist (muscovite + biotite) Qtz occurs as stringers. (100m)	Cavities	20% 30% 0%	Qtz stringers are subject to reddish orange iron staining.

REFERENCES

LOGGED BY Michael Roarty

SHEET 1 OF 5 DRAWING No

GEOLOGICAL LOG OF DRILL HOLE

PROJECT South Alligator Stratigraphic No2 REMARKS Cahill Formation

HOLE N° _____ CO-ORDINATES _____ R.L. GROUND _____

LOCATION _____ ANGLE FROM HORIZONTAL _____ DIRECTION 60° MAG.

DESCRIPTION OF CORE	LOG	CORE RECOVERY %	SAMPLES & REMARKS
100m.			
98.55 - 102.35m. No recovery. Recorded by drillers as cavities.	Cavities		
102.35 - 107.00m. A silicified cavenous recrystallized rock. Numerous cavities exhibiting minute crystalline growth. Secondary qtz is intruded through the rock in veinlets together ± rectangular inclusions		60%	Samples 104.15, 109.65m. Silicified carbonate? Core compact frm 102.35 - 104.35. Broken frm 104.35 - 107.00.
107.00 - 107.50m. Yellowish brn clay. Probably incorrectly placed in tray.			
107.50 - 112.55m. Very broken silicified cavenous rock.	110m.		
112.55 - 112.70m. Brown sand. Magnetite noted.			
112.70 - 115.40m. Weathered micaceous schists completely weathered to clay in most part.			
115.40 - 120.40m. Broken silicified cavenous rock. Cavities at 118.65m. 119.30m.			
120.40 - 126m. A weathered crumbly qtz mica [illegible]. Banding evident at 10° to C.A. clayey sandstone	120m.	97%	Sample 120.40m.
126.00 - 134.70m. White compact rock. A carbonate sequence ± feldspars + mica. Light brown carbonate 70% ± whitish clayey mineral + muscovite. This rock grades to rock type described above.			
134.70 - 135.30 m. Altered rock. Talcy greenish + blackish soapy clays.	130m.		Sample 130.60
135.30 - 136.70m. DK purplish red weathered altered rock affiliated ± above.		50%	
136.70 - 136.90m. Broken banded siliceous rock.			
136.90 - 139.70m. Whitish clays. A qtz vein 8c.m. wide at 137.85m.			
139.70 - 140.05 m. micaceous schist. Abundant biotite, numerous qtz veins	140m.		Cavity 140.05 - 141.00m.
141.00 - 143.90m Whitish clays ± qtz pebbles			
143.90 - 151.80m. Massive qtz ± white clay. In part massive clay ± slickensiding. Grading to predominate qtz towards 151.80m.			The white clay constitutes some 50% of this section and exhibits a wavy pattern in and around the qtz. Pinkish tinges in the clay in part.
	150m.		
151.80 - 155.20m. A carbonate sequence. Greenish grey wavily interbedded carbonate. Broken zone at 154m some 5-8 c.m. in thickness			Sample 154.00m.
155.20 - 156.00m. Qtz muscovite, biotite schist ± qtz predominant. Contact at 20° to C.A.		95%	Sample 155.70m.
156.00m - 165.35m. Amphibolite ± Micaceous schist Abundant mica + minute bands of carbonate both // to schistosity + cutting schistosity	160m.		Samples 157, 161.25m. Very schistose zones 158.50 - 159.20 m. 161.00 - 161.25m. 162.85 - 163.10 m. 163.90 - 165.65m. Minor pyrite, Garnets in amphibolite, Micas rusty red greenish black in colour
165.35 - 172m. White crystalline carbonate sequence			
172 - 175.40m. Unconsolidated sands + chips of carbonate.	170m.		Sample 169 m. The chips are predominantly sugary white carbonate ± limonitic discolouring in part. Reddish brown cubic crystals garnet?
175.40 - 176.40m. Carbonate sequence grading to a schist ± a high carbonate content towards 175.40m. Qtz veins + stringers are evident ± qtz pebbles in part		95%	Sample 177.55m pyrite evident
176.40 - 178.10m. Micaceous chloritic schist - contorted in part	180m.		178.70 - 179.95 Broken core chloritized weathered schist ± qtz veins + stringers. pyrite evident
178.10 - 182.65 m. Carbonate sequence ± int schist.			179.95 - 181.30 Broken brecciated zone ± carbonate + chlorite.
182.65 - 184.80m Micaceous schist ± qtz veining + qtz pebbles chloritized in part. Carbonate veining both concordant and cutting schistosity.			Sample 186.20m. white fibrous mineral
184.80 - 186.65m Qtz mica amphibole schist, ± minor carbonate lenses. Schistosity at 10 to C.A. Diffuse gradation to a carbonate sequence at 185.85m then to a carbonate sequence			
186.65 - 187.05m. Qtz rich zone	190m.		Sample 190.45 193.45
187.05 - 195.25m. A qtz amphibole mica gneiss contact at 10° to C.A. Qtz veining in part			
195.25 - 196.10m. Gradations of above to a highly chloritized schistose banded rock ± qtz veins + blebs. Garnets evident in schistose bands			
200m.			

REFERENCES

LOGGED BY [illegible]

SHEET 2 OF 5

DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT South Alligator Stratigraphic No 2 REMARKS Cahill Formation

HOLE No D.D.H. 2 CO-ORDINATES R.L. GROUND

LOCATION ANGLE FROM HORIZONTAL DIRECTION

DESCRIPTION OF CORE	LOG	CORE RECOVERY %	SAMPLES
200			
196.10 - 222.45m. Qtz mica schist ± qtz veins + blebs. Variations in amount of mica + qtz content but rock type remains similar in mineral constituents ± amphibole. Quite contorted folding in the schists			Sample 202.65m. Garnets, pyrite + reddish pinkish staining abundant Sample 208.45m. Sample 211.45 Sample 216.35
222.45 - 228.75m. Amphibolite ± qtz + carbonate in part. Tight isoclinal folding. Schistosity at 10° to C.A. 222.4 - 225.65 Compact dk greenish 226.35 - 228.75 rock			Sample 222.45 Sample 223.05 pinkish staining evident Sample 228.00
228.75 - 233.60m. Qtz mica schist ± qtz rich zones			Qtz rich zones consist of interlocking clear white qtz grains
233.60 - 235.05m. Amphibolite 235.05 - 236.45m Qtz mica schist. 236.45 - 238.35m Amphibolite. Herringbone structures noted			Rock consists of needle like amphiboles
238.85 - 248.35m. Qtz mica schist Qtz veins + blebs + qtz rich zones Quite contorted in part			Sample 246.15
248.35 - 251.95m. Dark blackish green amphibole Qtz veins + blebs			
251.95 - 273.80m. Qtz mica schist, quite contorted in part, qtz veins + blebs ± minor amphibolite. Variations of content of mica + qtz - extremely qtz rich in part			Sample 252.35 Sample 259.10 Sample 263.90. Qtz vein 264.30 15c.m. in thickness. Broken zones 269.95 - 271.25 272.80 - 273.
273.80 - 274.45m. Amphibolite 274.45 - 292.05m. Qtz mica schist ± qtz veins + blebs. Isoclinal folds in part of qtz stringers			Sample 274.00m Compact zone - similar mineralogy 283.80 - 287.65 Sample 284.00 Amphibolite ± garnets 287.90 - 288.55.
292.05 - 299.75m. Dark greenish amphibolite Carbonate veins evident. Pinkish felspar?			Sample 294.80 Broken qtz 296.65 - 296.75m. Broken core 299.65 - 300.60m.
300			

REFERENCES

LOGGED BY Michael Keary

SHEET 3 OF 5 DRAWING No

GEOLOGICAL LOG OF DRILL HOLE

PROJECT South Alligator Stratigraphic No2 REMARKS Cahill Formation.
HOLE No D.D.H.2 CO-ORDINATES R.L. GROUND
LOCATION ANGLE FROM HORIZONTAL DIRECTION 60° Mag.

DESCRIPTION OF CORE	LOG	CORE RECOVERY %	SAMPLES
299.75 - 322.05m. Banded qtz amphibolite Broken qtz 302.95 - 303 m. 311.35 - 311.55m. 321.00 - 321.10m.	300m. 310m. 320m.		Sample 308.30m.
322.05 - 325.40m. Amphibolite			Sample 323.10m.
325.40 - 331.85m. Qtz mica schists ± qtz veins + stringers + blebs. Highly contorted zones. Very rich qtz rich zone ± interlocking qtz grains + mica fm 327.65 - 328.65m.	330m.		Sample 327.25m.
331.85 - 332.70m. Qtz amphibolite rock			Sample 332.70m.
332.70 - 338.95m. Qtz mica schist - extremely qtz rich ± mica in part. Carbonate evident on fracture planes.			
338.95 - 408.00m. Qtz amphibolite rock ± qtz veins + blebs + carbonate veining in part. Herringbone structure evident Variation in density of qtz stringers	340m. 350m. 360m. 370m. 380m. 390m. 400m.		Sample 344.05m. Sample 361.05m. Sample 369.55m. Sample 385.85m. Apparent schistosity 20° to CA. Sample 398.00m.

REFERENCES

LOGGED BY Michael Kourty

SHEET 4 OF 5 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT South Alligator Statigraphic No 2 REMARKS Cahill Formation

HOLE N° D.D.H. No 2 CO-ORDINATES R.L. GROUND

LOCATION ANGLE FROM HORIZONTAL 60° DIRECTION 60° MAG.

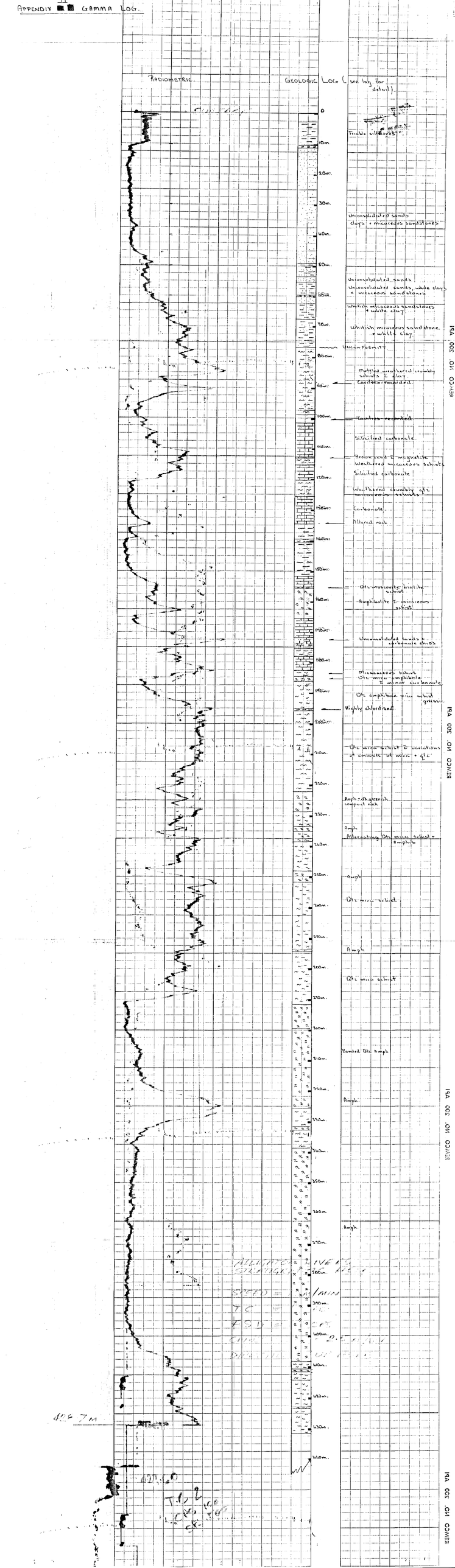
DESCRIPTION OF CORE	LOG	CORE RECOVERY %	SAMPLES
400m			
408 - 410.70m. Qtz mica schist ± qtz veins & blebs. Grain size variations. Greenish siliceous veins 409.05 (7c.m) 409.45 (5c.m.)	410m		Sample 410.10m.
410.70 - 411.75m. Siliceous rock ± small bands of amphibolite + garnet ± small lenses of siliceous rock.			Qtz vein 411.75 - 412 m.
411.75 - 414.05m. Finely laminated qtz mica schistose rock.			Sample 417.46m.
414.05 - 422.80m Qtz mica schist ± qtz veining & blebs. abundant mica content in part. Finer varieties 418.15 - 418.55 / 418.95 - 419.15 / 420.05 - 420.45 } Samples dom. inantly qtz although micas still retain alignment exhibiting schistosity	420m		Sample 420.45m. Qtz vein at 420.20 15 c.m. in thickness. Wholly siliceous vein ± mica 422.90 - 423.
422.80 - 422.90m. Thinly laminated amphibolite ± pyrite - bands @ 10° to C.A.			Banded amphibolite 423.00 - 423.05m
422.90 - 431.60m. Qtz mica schists ± garnets wavy pattern of qtz veins + blebs. Quite contorted in part & brecciated & chloritized. More qtz rich sections 425.70 - 426.05m 427.95 - 428.30m.	430m		reddish pinkish crystals. Sample 430.95m.
431.60 - 432.35 m. Thinly laminated amphibolite			
432.635 - 432.65 m. Qtz mica schists			
432.65 - 442.25m. Banded amphibolite & micaceous schist. Upper contact at 55° to C.A. Micaceous schist 438.15 - 438.95m. Garnets evident at 442.25m.	440m		
442.25 - 446.70m. Qtz micaceous schist - tight folding evident. Amphibolite vein 446.30m. some 5c.m. in thickness. Qtz & mica content varying			
446.70 - 446.90m. Banded amphibolite rock			Sample 447.35m.
446.90 - 447.65m. Qtz mica schist.			Sample 449.30m.
447.65 - 447.85m. Banded amphibolite rock	450m		
447.85 - 447.95m. Qtz mica schist - qtz veined			
447.95 - 448.15m. Banded amphibole rock.			
448.15 - 448.20m Qtz mica schist			Intense dislocation at 454.25m.
448.20 - 448.50m. Banded amphibole rock.			
448.50 - 450.45m. Dense chloritized amphibole rock			
450.45 - 451.40m. Qtz mica schist, extremely qtz rich.			Sample 458.75m.
451.40 - 451.63 m. Banded amphibole & rock	460m		
451.63 - 454.25m. Qtz mica schist ± amphibolite fm 453.60 - 453.65			Qtz rich zone 459.55 (5c.m. in thickness).
454.25 - 455.90m. Banded amphibole rock			
455.90 - 456.45m. Chloritized rock - abundant qtz inclusions & veining			
457.25 - 457.70m. Banded amphibole rock ± bands at 10° to c.A. & qtz inclusions			Sample 468.20m.
457.70 - 458.10m. Banded amphibole rock - tight isoclinal folding in qtz veinlets	470m		Sample 469.35m.
458.10 - 458.90m Qtz mica schist.			
458.90 - 462.50m Banded amphibole rock.			Rich graphite section 470.15 - 470.50.
462.50 - 466.20m Qtz mica schist ± qtz veining & blebs. Qtz rich zones.			
466.20 - 501.25m. Carbonate sequance. Bands of carbonate			Sample 467.90m.
480m			
Carbonate ± chloritized talc mineral 469.10 - 469.45.			
Throughout the carbonate sequence are fine bands of silty sediment ± banding that varies fm 10 to 45° to the C.A. Vary fm 1 to 10c.m in width.			Sample 485.85m.
490m			
Banded sediment ± carbonate ± syngenetic pyrite (See Sample 499.40.)	500m		Sample 499.40
END OF HOLE 501.25m.			

REFERENCES

LOGGED BY Whitehead & Gourlay

SHEET 5 OF 5 DRAWING N°

APPENDIX GAMMA LOG.



APPENDIX III

Nine samples were forwarded to Amdel Adelaide for sectioning and petrographic descriptions. The petrographic descriptions give a detailed description of the mineralogy and confirm the rock types as described in the geological log. It is interesting to note that the lenses of banded sediment contained within the carbonate sequence from 466.20 - 501.25m. is quartz mica silliamanite schist and has been determined to be a metamorphosed fine grained detrital sediment of probably low amphibole facies grade which contains both silliamanite and andalusite. The compositional banding is considered to have been inherited from the original sediment with the mica and silliamanite rich bands representing clay rich lamellae in a fine grained quartz rich sandstone.

Samples 169.60 still awaiting
428.20 assay results for Ca & Mg & loss of ignition

NINE

PETROGRAPHY OF ~~TWELVE~~ ROCKS

Sample: SA 155.70; TSC19143

Rock Name:
Mica-quartz schist

Hand Specimen:
A well foliated, micaceous rock with a pale grey colour.

Thin Section:
This is a well foliated rock consisting mainly of muscovite and biotite flakes intergrown with granular quartz and altered feldspar. The foliation is defined mainly by parallel orientation of mica flakes but the granular quartz tends to form lenticular bodies which are also oriented parallel to this foliation direction. Finely divided sericite-clay intergrowths occur interstitially between the mica flakes and appear to represent completely altered feldspar grains. Locally remnants of feldspar were noted in some of these patches but in most cases the feldspar has been completely replaced by secondary phyllosilicates.

Locally garnet porphyroblasts up to 3 mm in diameter are present and exhibit anhedral shapes. Most of the porphryoblasts have a vague helicitic texture defined mainly small opaque inclusions although in some cases granular quartz inclusions are also present. Traces of pleochroic green tourmaline, zircon and apatite form small disseminated crystals most likely of detrital origin.

This sample represents a detrital sediment which has undergone upper greenschist to lower amphibolite facies grade metamorphism to produce a schist.

Sample: SA 157.00; TSC19144

Rock Name:
Schistose amphibolite

Hand Specimen:
A medium grey coloured rock with a well developed foliation and a finely banded character. The rock contains finely disseminated sulphide (probably pyrite) crystals generally below 0.5 mm in size.

Thin Section:
This sample consists mainly of hornblende and plagiocalse feldspar which forms a mosaic with a typical grain size between 0.1 and 0.3 mm. The hornblende has a pleochroic green colour and tends to form somewhat prismatic-shaped crystals which define a nematoblastic foliation. Plagioclase forms xenoblastic grains which contain a small proportion of intergrown granular quartz. Some granular quartz is concentrated in lenticular-shaped bodies or bands oriented parallel to the general foliation direction which causes the finely banded character noted in hand specimen.

Most of the plagioclase shows moderate to extensive replacement by finely divided sericite-clay. The amphibole shows minor marginal alteration to a pleochroic reddish-brown biotite. Some well developed biotite flakes up to 0.1 mm in length are also present and generally intergrown with the amphibole.

One xenoblastic garnet crystal approximately 0.5 mm in size was noted in the sample. The rock also contains disseminated opaque grains which tend to be concentrated in discontinuous bands generally about 0.1 mm wide which are oriented parallel to the foliation direction. Traces of zircon are also disseminated through the rock as small crystals below 0.05 mm in size. Much of the zircon forms small inclusions in amphibole crystals which exhibit a reddish-brown halo similar in appearance to pleochroic haloes in biotite.

The rock is cut by several narrow veins which are filled with prehnite intergrown with minor calcite. The calcite was positively identified by staining with alizarin red-S solution.

This is amphibolite which could represent either a metamorphosed basic igneous rock or possibly a metamorphosed calcareous sediment with the former possibility considered more likely. The alteration of the plagioclase, formation of biotite and the prehnite-filled veins are all considered to be retrograde features.

Sample: SA 177.55; TSC19145

Rock Name:
Andalusite-muscovite-quartz schist

Hand Specimen:
A medium to pale grey micaceous rock with a well developed schistose foliation and a vague banding oriented parallel to the foliation.

Thin Section:
This is a well foliated rock consisting mainly of andalusite intergrown with muscovite flakes and granular quartz. The foliation is defined mainly by a weakly developed mineralogical banding and a lepidoblastic foliation defined by the muscovite flakes. The quartz in particular tends to be concentrated in lenticular bodies with a granular texture. The andalusite forms larger crystals (generally about 1 mm in size) which typically contain abundant intergrown muscovite flakes as inclusions and marginal intergrowths. Although most of the muscovite flakes are oriented parallel to the foliation direction, some tabular muscovite flakes transect the foliation and most likely represent a second stage of muscovite crystallization in a late metamorphorphic or post metamorphic environment.

Chlorite forms well developed flakes which are generally intergrown with muscovite flakes and exhibit a weakly pleochroic brown colour and anomalous brown interference colours. This chlorite forms very well developed flakes, most with concentrations of opaque material along cleavage traces and most likely represent completely chloritized biotite flakes.

The andalusite crystals contain abundant finely divided opaque material as inclusions but opaques are also disseminated through the rock as anhedral grains and granular aggregates which generally have an elongate, lenticular character oriented parallel to the foliation direction.

This rock is a schist produced by lower amphibolite facies grade metamorphism of a pelitic sediment. The chlorite flakes probably represent a retrograde alteration product of biotite.

Sample: SA 223.05; TSC19146

Rock Name:
Schistose amphibolite

Hand Specimen:
A fine-grained, greenish-grey coloured rock with a well developed foliation.

Thin Section:
This sample consists essentially of hornblende intergrown with granular plagioclase and quartz to produce a mosaic with a typical grain size between 0.2 and 0.8 mm. The amphibole tends to form prismatic crystals which exhibit a well developed nematoblastic foliation. The plagioclase is untwinned making it difficult to distinguish from the quartz where it lacks alteration to finely divided sericite-clay.

Most of the plagioclase does show at least some alteration to finely divided sericite-clay which imparts a turbid character to the plagioclase crystals. The amphibole shows minor marginal alteration to pleochroic brown biotite. Some of these biotite flakes also contain lamellar intergrowths of muscovite.

Both sphene and opaques are disseminated through the rock as anhedral grains and granular aggregates which have elongate shapes oriented parallel to the foliation direction. Traces of zircon are also disseminated through the rock as small crystals below 0.05 mm in size. Where the zircon forms inclusions in amphibole it generally exhibits a brown halo similar to a pleochroic halo in biotite.

This sample is very similar to sample SA 157.00 (TSC19144) in mineralogy, texture and origin although this sample has a slightly coarser grain size and hornblende with a slightly darker green, more pleochroic colour suggesting a slightly higher metamorphic grade.

Sample: SA 252.35; TSC19147

Rock Name:
Muscovite-quartz schist

Hand Specimen:
A micaceous, grey to greenish-grey rock with a well developed schistose foliation.

Thin Section:
This sample consists essentially of alternating bands rich in muscovite or granular quartz. The muscovite forms very well developed, tabular-shaped flakes which exhibit a well developed lepidoblastic folation oriented parallel to the banding. Pleochroic green chlorite flakes with anomalous blue interference colours are intergrown with the muscovite flakes and to a lesser extent with the granular quartz.

Plagioclase crystals are also intergrown with the granular quartz and generally exhibit polysynthetic twinning and turbid character produced by incipient alteration to finely divided sericite-clay.

Garnet crystals are disseminated through the rock but in particular tend to be concentrated in the muscovite-rich bands. Traces of pleochroic green tourmaline and apatite also form disseminated crystals approximately 0.3 mm in size.

This sample is a schist produced by upper greenschist to lower amphibolite facies grade metamorphism of a detrital sediment. The chlorite in this rock forms very well developed flakes and is believed to represent a retrograde alteration product of biotite.

Sample: SA 263.90; TSC19148

Rock Name:
Quartz-feldspar-muscovite schist

Hand Specimen:
A pale grey rock containing intergrown reddish-brown to pink feldspar. The rock exhibits a well developed schistose foliation which has a contorted, folded character.

Thin Section:
This sample consists essentially of a granular quartz and feldspar intergrowth with contorted phyllosilicate-rich bands which produces the foliation noted in hand specimen. The feldspar appears to consist mainly of untwinned potash feldspar although some polysynthetically twinned plagioclase is also present. The feldspar exhibits a turbid reddish-brown colour due mainly to finely divided, micron-sized inclusions of iron oxide but also shows incipient alteration to finely divided sericite-clay.

The phyllosilicate-rich bands consist mainly of muscovite intergrown with pleochroic green chlorite with anomalous blue interference colours. The muscovite forms well developed flakes which often exhibit deformed, kinked and fractured shapes. For the most part the chlorite is intimately intergrown with the muscovite as lamellar or marginal intergrowths.

A few discontinuous bands of andalusite are also intergrown with some phyllosilicate areas. The andalusite shows some retrograde alteration to finely divided, birefringent phyllosilicates. Minor apatite is disseminated through the rock as crystals up to 0.5 mm in size.

This is a schist produced by lower amphibolite facies grade metamorphism of an aluminous, detrital sediment.

Sample: SA 308.30; TSC19149

Rock Name:
Schistose amphibolite

Hand Specimen:
A vaguely banded grey to green coloured rock with a well developed foliation.

Thin Section:
This sample consists essentially of an amphibole-plagioclase feldspar mosaic with a typical grain size between 0.3 and 1 mm. The amphibole tends to form somewhat prismatic-shaped crystals which exhibit a well developed nematoblastic foliation and a pleochroic green colour. Some of the amphibole crystals contain porphyroblastic quartz inclusions.

The plagioclase feldspar generally shows polysynthetic twinning although a significant proportion is untwinned. Most of the plagioclase exhibits at least localized alteration to finely divided sericite-clay which imparts a turbid character to it.

A few muscovite flakes are disseminated through the rock and generally exhibit somewhat degraded, fibrous characters. Most of the muscovite flakes are oriented transverse to the foliation direction suggesting they are of late-metamorphic or post-metamorphic origin and have subsequently suffered retrograde alteration. Accessory apatite, sphene and opaques are disseminated through the rock as anhedral grains and granular aggregates. The sphene in particular tends to form elongate granular aggregates oriented parallel to the foliation direction. In a few places the elongate sphene aggregates occur within muscovite flakes.

This sample is similar to the two previously described schistose amphibolites (SA 157.00, SA 223.05; TSC19144, 6) in mineralogy, texture and origin.

Sample: SA 327.25; TSC19150

Rock Name:
Quartz-biotite-garnet-feldspar schist

Hand Specimen:
A pale grey coloured rock with a weakly developed schistose foliation best seen on a fractured surface.

Thin Section:
This sample consists essentially of a granular quartz mosaic through which biotite flakes and garnet crystals are disseminated. The quartz has a typical grain size of about 0.2 to 0.3 mm and is intergrown with a much smaller proportion of feldspar. At least some of the feldspar exhibits polysynthetic twinning of plagioclase although a significant proportion of untwinned feldspar is also present. The feldspar generally shows incipient alteration to finely divided sericite-clay which imparts a turbid character to the feldspar crystals making them easy to distinguish from quartz.

The biotite flakes have a subparallel orientation defining a lepidoblastic foliation. The biotite has a weakly pleochroic brown colour and generally exhibits a somewhat fibrous, degraded character showing alteration to pleochroic green chlorite. Locally the biotite flakes have been completely replaced by chlorite.

The garnet crystals are evenly disseminated through the rock and tend to exhibit xenoblastic to subidioblastic shapes with a grain size between 0.1 and 0.3 mm.

This rock would represent a quartz-rich and possibly arkosic detrital sediment which has suffered regional metamorphism of probable lower amphibolite facies grade. Retrograde alteration has affected both the biotite and feldspar.

Sample: SA 499.40; TSC19151

Rock Name:
Quartz-mica-sillimanite schist

Hand Specimen:
A lamellar banded rock consisting of pale grey to dark grey bands up to about 2 mm wide.

Thin Section:
This rock consists essentially of a granular quartz mosaic (typical grain size about 0.1 mm) with narrow bands containing mica and andalusite which are generally below 0.3 mm wide which account for the fine lamellar banded texture noted in hand specimen. Both the phyllosilicate and sillimanite exhibit a well developed foliation oriented parallel to the banding.

The major phyllosilicate is bioite which forms pleochroic brown to reddish brown flakes up to 3 mm long. Minor muscovite is also present as small flakes which are locally intergrown with the biotite.

The sillimanite forms elongate, prismatic to acicular crystals and is by far the dominant aluminosilicate although minor andalusite was also noted as somewhat stubbier, prismatic crystals.

A vein approximately 0.2 mm wide oriented perpendicular to the foliation direction is filled with secondary mafic phyllosilicates. The vein is zoned with the two outer margins containing a pale green weakly pleochroic chlorite with anomalous blue interference colours and the core containing a fibrous, non-pleochroic phyllosilicate with low birefringence which could represent either a different type of chlorite or a serpentine mineral.

Minor opaques are disseminated through the rock as anhedral crystals below 0.1 mm in size.

This rock is a metamorphosed fine-grained detrital sediment of probable low amphibolite facies grade which contains both sillimanite and andalusite. The fine compositional banding of this rock is considered to have been inherited from the original sediment with the mica and sillimanite-rich bands representing clay-rich lamellae in a fine-grained quartz-rich sandstone.

APPENDIX IV

Brief Binocular Microscopic Descriptions

Sample 186.20

Name: An impure carbonate.
Est. constituents: The rock consists dominantly of a white fibrous flaky mineral and a glass clear needle like mineral which both appear to be tremolite.

Sample 202.65

Name: Qtz feldspar mica schist.
Est. constituents: Quartz (veining) 5% felspar (K) veining 10%
Mica 85%.

Sample 294.80

Name: Amphibolite with carbonate veining.
Est. constituents: Monoclinic amphibole 100%. The mineral could be either hornblende or actinolite. The following features were observed with a grain mount

$\gamma/z \approx 20^{\circ}$
Birefringence 0.020
Cleavage $\approx 60^{\circ}$
$2V > 40^{\circ}$ Biaxial -ve

Sample 323.10

As above without carbonate veining

Sample 430.95

Name: Qtz garnitiferous mica schist.
Est. constituents quartz 30% , garnet 30% mica 40%
The garnets were found to have an R.I. < 1.76 and > 1.75 and probably represent a transition between Pyrope and Almandine.

Sample 499.30

Name: Dense chloritized amphibolite
Est. constituents - dominantly chlorite.