DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT BK NO. 89/48

REVIEW OF SADME DIAMOND DRILLING AND COMPANY EXPLORATION AT PARABARANA COPPER PROSPECT, NORTHERN MOUNT PAINTER BLOCK

GEOLOGICAL SURVEY

by

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DME 73/88

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ABSTRACT

Intensive exploration of Parabarana Copper Prospect was undertaken in the period 1968 - 1975, mainly by North Flinders Mines Ltd (NFM). In 1971 NFM approached the South Australian Department of Mines (SADM) for assistance in proving the deposit.

Two diamond drill holes, PDD8 and PDD11, were drilled by SADM in the period November 1972 - November 1973. To date drilling results have not been made available.

In 1988/89 data from Parabarana Cooper Prospect was reviewed to present all SADME data and to summarise company exploration. Drill hole PDD11 was also resampled.

Although the prospect has been drilled, reserve figures have not been calculated. Inferred resources are quoted as 6.1 million tonnes at 0.9% Cu (Gordon-Smith 1972). Every (1975) quotes a grade of 1.1% in the thickest part of the mineralised zone, which ranges from 10-30m in width.

Mineralisation is considered to be a result of hydrothermal activity associated with the intrusion of the Mount Neill Granite Porphyry and subsequently localised in shear zones.

INTRODUCTION

On 29 November, 1971, North Flinders Mines Ltd approached the South Australian Department of Mines (SADM) for assistance in proving the Parabarana copper prospect.

Information was evaluated by Gordon-Smith (1972) who recommended a two stage drilling programme of six vertical holes, totalling about 2500m.

Two diamond drill holes pre-collared by rotary-percussion holes, PDD8 and PDD11, were completed by SADM and logged by K Every, Assistant Senior Geologist, Metallic Minerals Section.

To date results of these holes have not been made available. This report presents Every's drill hole data and briefly reviews the exploration history at Parabarana.

In December 1988 - January 1989 drill core from PDD11 was inspected, resampled and photographed by E A Dubowski, Senior Geologist, Mineral Resources Branch. Results from this work are also included.

LOCATION, ACCESS AND TOPOGRAPHY

Parabarana copper prospect is situated in the northeast corner of the Mount Painter Block, northern Flinders Ranges. It lies on Moolawatana Station adjacent to the northern end of Arkaroola Station, approximately 550 km north-northeast of Adelaide and 135 km east-northeast of Leigh Creek (Figure 1).

Access from Adelaide is either along the main north road via Leigh Creek and Lyndhurst, along the Strzelecki Track to 'Mount Freeling', then onto 'Mount Fitton' and 'Moolawatana', or alternatively, via Yunta and northwards through 'Curnamona', 'Frome Downs', 'Balcanoona' and 'Moolawatana'.

Parabarana Hill, latitude 29°58.8'S, longitude 139°41.9'E, rises to just under 1,000 metres a.s.l. Topography is rugged, heavily dissected by drainage and drops steeply to the adjacent Frome Plains, which are about 75 metres a.s.l. The prospect area, southeast of Parabarana Hill rises to approximately 150 metres a.s.l.

REGIONAL GEOLOGY

The regional and economic geology of the Mount Painter Province is described by Coats and Blissett (1971). Crystalline basement rocks of the Mount Painter Complex are exposed as two basement inliers - the northern, east-west trending, granitic Mount Babbage Block, and the southern, northeast-southwest trending, essentially metasedimentary Mount Painter Block (Figure 2).

Regional mapping and drilling at Parabarana indicated mineralisation lies in a structurally complex, highly altered metasedimentary and volcanic sequence, correlated to Brindana Schist (Every, 1975), thrust over in the north by Terrapinna Granite. The Mount Neill Granite Porphyry intrudes the metasediments immediately south of the prospect (Figure 3).

Faulting is related to the Paralana Fault system with fault reactivation and thrusting during the Tertiary.

MINING AND EXPLORATION HISTORY

Early accounts of mining are described in Brown (1908), Jones (1909) and Winton (1918). Jones (1911) briefly describes the Windy Creek workings approximately 3 km southwest of Parabarana.

Coats and Blissett (1971) state mining commenced in 1899 with work over the following three years being undertaken by Wortupa Exploration and Mining Co Ltd after which tributors commenced stoping out the working. There was minor activity during 1905-1907 and again in 1917.

Tables 1 and 2 list exploration tenements over Parabarana since 1966. During the course of stream sediment sampling by Anaconda geochemical anomalies were recorded around Parabarana. Follow up work indicated the deposit was of limited size and of little economic interest.

TABLE 1. SMLs COVERING PARABARANA COPPER PROSPECT

SML NO.	LICENCEE	DATE GRANTED	DURATION	SADME OPEN FILE ENV
112	Anaconda Aust. Inc.	16.5.66	6 months	663
193	Billy Spring P/L	19.6.68	1 year	1037
297	North Flinders Mines	19.5.69	2 years	1221
558	North Flinders Mines	25.3.71	2 years	1639
705	North Flinders Mines	18.5.72	2 years	2034,2035

North Flinders Mines consolidated their Mt Painter SMLs, including SML 297, into SML 558 in 1971. Following detailed mapping, sampling, geophysical surveying and rotary-percussion/diamond drilling programmes at Parabarana, NFM aimed to prove the prospect under a separate lease, SML 705, in a joint venture with Dampier Mining.

Dampier withdrew from the joint venture in August 1974 due to limited size and low grade mineralisation (Hall and Johnson, 1974). NFM joint venture partners on subsequent licences have included Aquitaine Australia Minerals N/L (ELs 153, 272) and Marathon Petroleum (subsequently bought out by Pan Australian Mining Ltd) on all licences since 1978.
The current licence, EL 1536 is held jointly by Pan Aust and NFM, and is current to 16 November 1989.

TABLE 2. ELs COVERING PARABARANA COPPER PROSPECT

EL NO	LICENCEE	DURATION	EXPIRY DATE
153	North Flinders Mines	2 years	25.08.76
272	NFM/Marathon	2 years	22.11.78
480	NFM/Marathon	2 years	24.05.81
871	NFM/Marathon	2 years	30.08.83
1191	NFM/Marathon	2 years	16.11.84
1271	NFM/Pan Aust	2 years	10.02.87
1536	NFM/Pan Aust	1 year	16.11.89

GEOLOGICAL INVESTIGATIONS

Company

Considerable exploration has been undertaken at Parabarana and surrounding areas. Data on SMLs are available in SADME's open file envelope system and are briefly reviewed. Data on Exploration Licences are still confidential. Table 3 summarises exploration at Parabarana on SMLs.

Table 4 presents a summary of company interpretations of the geology, mineralisation and alteration. Rotary-percussion and diamond drill hole information is given in Tables 5 and 6.

SADM

H Blissett in Coats and Blissett (1971) reviewed the economic mineral deposits in the Mount Painter Province and described the history, geology, mineralisation and workings at Parabarana. Gordon-Smith (1972) appraised company data to determine the potential of the prospect and to consider the extent of SADM involvement in target drilling. Six drill

TABLE 3: SUMMARY OF EXPLORATION, PARABARANA COPPER PROSPECT

SML No.	112	193	297	558	705
COMPANY	ANACONDA	BILLY SPRING	NORTH FLINDERS	NORTH FLINDERS	NORTH FLINDERS
	Regional stream geochemistry Photogeology Field mapping Chip sampling	Literature search Brief Inspection	Assessment Anaconda work Orientation stream sediment geochemistry Airborne (helicopter) radiometric survey Grid marking/surveying Semi detailed, 1:400 ft geological mapping Grid soil sampling Grid magnetometer traverse IP survey, NS grid lines Access road construction 32 rotary percussion holes Commencement diamond drilling	1:12 000 aerial photography Continuation diamond drilling Petrological investigations PDD 3, 5, 6 and 7 Review geophysical data	Detailed geological sedimentary mapping 1:100 ft Continuation diamond drilling Structural geology re-mapping Parabarana - Gunsight Mapping and geological appraisal, Brindana Gorge - Parabarana Ground magnetics Windy Creek workings - mapping, rock sampling, ground magnetics

TABLE 4: SUMMARY OF GEOLOGICAL INTERPRETATIONS

COMPANY	GEOLOGY	MINERALISATION	ALTERATION	COMMENTS
Anaconda	Mineralisation associated with acid volcanics (syenites, andesites and tuffs) intruding older Precambrian sediments (schists and quartzites). Mylonitised granite indicates presence of major west trending fault south of Paranbana Hill.	Malachite concentrated in breccia zones developing in folds within syenitic beds. Chalcocite - malachite in thin quartz veins or small pods in shear zones associated with faults separating acid volcanics from Pepegoona porhry, schists and quartzites. Scattered narrow veins in strong shear zones and in tuffs. Trace copper in carbonate veins.	Sericitisation of breccias, tuff and andestie associated with shear zones, Epidote not confined to mineralised zone often as complete replacement of rock unit or as films along joint and cleavage planes.	
Billy Spring	Metamorphosed clastic sediments, granite gneiss, rapakivi granite porphry amphibolites and Pepegoona Porphry Relationships of units difficult to establish.	Disseminated malachite along east-west shear zone, approximately 6 feet wide, extending to wide, extending to 150 yards west of mine. Traces of chalcopyrite obtained. Traces of chalcopyrite dolomite/limestone bed. Away from mine, copper associated with porphyry, gneiss, metasediments and along shear zones. Dumps have specimens of cuprite, chalcocite, malachite and azurite.		
North Flinders Burnside & Hallof 1971	Associated with a pink to red porphyry and chloritic hornfels. Minor disseminated graphite.	Chalcopyrite and pyrite with minor molybdenite.		Based on IP anomalies and rotary-percussion drilling.
Pontifex 1971, 1972	Upper (hanging wall) granitic facies regionally and dynamically meta-morphosed. Host rock facies, modified brecciated and hydrothermally altered. Lower (footwall) hybrid calc-silicate facies, essentially a skarn and also mineralised Sporadic distribution of plagioclase amphibolite syenite, laumontite rock and possible meta-volcanics.	Pyrite, and minor hematite, chalcopyrite, bornite, bornite, molybdenite and sphalerite widespread in microadamellite extending into calc-silicate; localised in stockwork of fractures associated with hydrothermal alteration products. Copper mineralisation intense in parts of intrusive rich in primary K-feldspar. Sulphides and magnetite associated with calc-silicate.	Dominantly propylitic and potash-silica silicate. Propylitic alteration as veins and pervasive areas of epidote, carbonate, chlorite and minor actinolite. Potash-silica metasomatism as veins of K-feldspar, quartz and chlorite. Pneumatolytic influence shown by disseminated tourmaline, fluorite, apatite and sphene.	Possibly two genetically related spatially different copper mineralised zones.
Freytag 1972	Middle Proterozoic acid igneous rocks; north dipping microadamellite bounded by east-west thrust slices. Undergone varying degrees of metamorphic and hydrothermal alteration. Rock boundaries faulted. Mt Neill Granite intrusive into microdamellite.	molybdenite and uranium introduced with alteration minerals into fractures and fine stockwork. Copper sulphides localised in sheet-like breccia of brittle microadamellite. Molybdenite and uranium localised along secondary shears/faults belonging to main thrust zone.	Hydrothermal activity following brecciation introduced assemblages dominated by calcite, chlorite, green biotite and quartz. Some pervasive sericitisation.	Depth of oxidation 15 - 46 Mineralisation is epigenetic, hydrothermal phase of Mt Neill has a true width of 46 metres.
Dampier Mining	The Paralana Fault separates the Terrapinna Gneiss to the north from the acid volcanics and intrusives Mt Neill Granite to the south.	Disseminated copper mineralisation, associated with intrusion of Mt Neill Granite, was remobilised and is now confined to intensley fractured granite and chloritic shear zones parallel to the Paralana Fault.	High concentrations of epidote, chlorite, pyrite, magnetite and associated molybdenite and fluorite.	

holes were recommended, in two stages, to test up dip and lateral extensions of the deposit. Only two holes, PDD8 and PDD11, were drilled by SADM.

Logging of the holes was completed by K Every who presented his interpretation of the geology and mineralisation at Parabarana at the 1st Australian Geological Convention (Every 1975).

Other

AMDEL undertook an independent study to determine the economic viability of Parabarana cooper prospect (Boyce 1973).

R. Davy (1973) investigated the suitability of the mercury halo prospecting technique. Fifty-six samples were obtained from 2 diamond drill holes and 1 rotary percussion hole and analysed for Hg, Pb, Zn and Cu. Mercury ranged from 25-170 ppb and showed no correlation with other elements.

In 1978 an Adelaide University honours student, Adrian Brewer, investigated drill core from Parabarana; his data have not been included in this review.

SADM DIAMOND DRILLING

Data prepared by K Every for PDD8 and PDD11 are presented as tables and in appendices.

All petrological and analytical data were extracted from Amdel reports listed in Table 7. Compilations in Tables 9 and 11 are in order of sample number.

TABLE 6: SUMMARY OF DIAMOND DRILLHOLES

COMPANY	HOLE No. (PDD)	NFM GRID N/S - E/W	ANGLE (degrees)	PRE COLLAR DEPTH (metres)	CORED INTERVAL DEPTH (metres)
NFM	1	1200N - 400W	70 S	129	129 - 321
	2	750N - 400W	75 S	?38	?38 - 230
	3	950N - 800W	70 S	125	125 - 427
	4	1200N - 00W	70 S	122	122 - 251
	5	300N - 2000W	Vertical		0 - 383
	6	665N - 1200W	Vertical		0 - 412
	7	567N - 1600W	Vertical		0 - 313
SADME	8	500N - 800W	Vertical	196	196 - 265.2
	11	1825N - 1075W	Vertical	182.6	182.6 - 757.2
DAMPIER	12	800N - 800E	Vertical	30	30 - 149
	13	600N - 00E	Vertical	183	Abandoned
	13A	600N - 025E	Vertical	91	91 - 439
	14	1020N - 1150W	Vertical	183	183 - 581
	15	1000N - 100E	Vertical	183	Abandoned

TABLE 5: NORTH FLINDERS MINES ROTARY - PERCUSSION DRILLING PROGRAMME

HOLE No.	NFM GRID N/S - E/W	DATE COMMENCED	DATE COMPLETED	ANGLE (degrees)	DEPTH (metres)	MINERALIZED ZONE (metres)	COPPER average %
NFP 1	72N - 00W	15/2/70	16/2/70	59 S	79	0 - 18	0.63
NFP 2	131N - 003W	17/2/70	17/2/70	70 S	91	21 - 47	0.52
NFP 3	189N - 00W	18/2/70	19/2/70	70 S	94	38 - 61	0.77
NFP 4	195.5N - 00W	20/2/70	22/2/70	vertical	168	52 - 70	0.46
NFP 5	287N - 00W	23/2/70	24/2/70	vertical	113	87 - 101	0.31
NFP 6	247N - 800E	24/2/70	24/2/70	70 S	43	hole collapsed, abandoned	
NFP 7	347N - 809E	25/2/70	25/2/70	70 S	73	high water flow, abandoned	
NFP 8	450N - 806E	26/2/70	26/2/70	70 S	82	73 - 82 metres, Cretaceous sst and slst	
NFP 9	098N - 397W	27/2/70	27/2/70	70 S	26	2 - 14	0.64
NFP 10	096N - 398W	27/2/70	28/2/70	vertical	91	hole collapsed, abandoned 0 - 18	0.63
NFP 11	031N - 399W	1/3/70	1/3/70	vertical	69		
NFP 12	179N - 396W	2/3/70	2/3/70	vertical	73	17 - 40	0.88
NFP 13	271N - 390W	2/3/70	3/3/70	vertical	114	50 - 96	0.94
NFP 14	364N - 395W	5/3/70	9/3/70	vertical	152	96 - 140	1.09
NFP 15	552N - 802E	12/3/70	13/3/70	70 S	98	91 - 98 metres, Cretaceous sst & slst	
NFP 16	1307S - 5197W	14/3/70	16/3/70	70 S	91		
NFP 17	1132.3S - 5198W	16/3/70	18/3/70	60 S	105		
NFP 18	788S - 5100W	20/3/70	5/4/70	60 N	107	6 - 9	0.15
NFP 19	159N - 594W	5/4/70	6/4/70	vertical	76	41 - 64	0.41
NFP 20	001.6S - 800W	6/4/70	7/4/70	vertical	73	15 - 30	0.97
NFP 21	095N - 803W	7/4/70	8/4/70	vertical	85	55 - 70	0.41
NFP 22	249N - 795W	9/4/70	11/4/70	vertical	148	73 or 75 - 146 or 148	0.5 - 0.87
NFP 23	385.5N - 800W	12/4/70	14/4/70	vertical	133		
NFP 24	140S - 1208W	15/4/70	17/4/70	vertical	101		
NFP 25	003N - 1197W	18/4/70	20/4/70	vertical	79	52 - 58	1.02
NFP 26	148N - 1201W	20/4/70	22/4/70	vertical	107	94 - 102	low values

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HOLE No.	NFM GRID N/S - E/W	DATE COMMENCED	DATE COMPLETED	ANGLE (degrees)	DEPTH (metres)	MINERALIZED ZONE (metres)	COPPER average %
NFP 27	003S - 1597W	23/4/70	26/4/70	vertical	126	87 - 107	low values
NFP 28	205S - 1599W	27/4/70	28/4/70	vertical	99	46 - 56	0.45
NFP 29	210S - 2004W	28/4/70	29/4/70	vertical	130	78 - 130	low values
NFP 30	119S - 2002W	29/4/70	1/5/70	vertical	133	91 - 133	very low values
NFP 31	234S - 2703W	1/5/70	2/5/70	vertical	91		
NFP 32	001N - 2789W	2/5/70	4/5/70	vertical	107	93 - 104	low values

PDD8

This hole was designed to investigate continuity of mineralisation between percussion hole NFP22 and diamond drill hole PDD3. Drilling commenced on 6 November 1972, and was completed to 265.2 m on 24th February 1973. The drill log is given in Appendix A. Tables 8 and 9 present silicate and geochemical analyses. Petrographic descriptions are given in Appendix B.

Major Results

Copper mineralisation was intersected in a zone approximately 30m thick extending from 194 - 223.18m. Generally assays were less than 1%. Localised enrichment was noted at:

205.95 - 206.07m	at	1.75%
207.12 - 207.45m	at	12.0%
210.55 - 211.25m	at	3.5%
213.29 - 213.88m	at	3.8%
219.16 - 219.68m	at	2.1%
219.68 - 220.34m	at	7.0%
220.34 - 221.06m	at	1.25%

Molybdenum was enriched in a 2.84m zone from 220.34 - 223.18 with assays ranging from 240 - 1500 ppm.

TABLE 7: AMDEL ANALYTICAL AND PETROLOGICAL REPORTS, SADME PDD 8 7 11, 1973-75

ANALYTICAL		PETROLOGICAL	
REPORT No.	DATE	REPORT No.	DATE
AN 3724/73	2 March 1973	MP 4064/73	22 May 1973
AN 3740/73	2 March 1973	MP 4491/73	22 May 1973
AN 3788/73	8 March 1973	MP 5053/73	24 July 1973
AN 4110/73	10 April 1973	MP 1745/74	27 February 1974
AN 1646/74	23 October 1973	MP 2099/74	27 February 1974
AN 2152/74	3 December 1973	MP 2461/74	20 December 1973
AN 2315/74	11 December 1973	MP 2462/74	27 February 1974
AN 2315/74	18 December 1973	MP 3860/74	16 August 1974
AN 2153/74	19 December 1973		
AN 2459/74	15 January 1974		
AN 2460/74	10 January 1974		
AN 2461/74	11 January 1974		
AN 3581/74	27 June 1974		
AN 3581/74	17 July 1974		
AN 3590/74	11 April 1975		
AN 4083/75	30 May 1975		
AN 4109/75	6 June 1975		
AN 1019/76	23 October 1975		
AN 1459/76	9 December 1975		

TABLE 8: PDD SILICATE AND GEOCHEMICAL ANALYSES

SAMPLE:	A No. -	727/73	731/73	740/73	741/73	749/73	753/73	755/73	1420/73	1421/73	1422/73	1423/73
DEPTH (m)	from	197	200.6	207.45	208.27	213.88	218.5	219.68	237.14	258.9	208.65	217.5
	to	198	201.35	208.27	208.65	215	219.16	220.34	238.55	260.94	209.2	218.5
SiO2		59.00	60.05	57.28	50.71	59.73	66.27	40.00	47.00	44.00	59.00	63.00
Al2O3		16.80	16.94	13.08	12.57	14.70	15.09	13.50	13.70	12.50	13.50	15.40
Fe2O3		8.10	2.53	2.68	3.80	2.82	0.63	15.00	13.50	14.50	11.40	5.90
FeO		4.27	10.85	14.31	6.83	3.46						
Ca		0.80	0.52	1.59	0.75	1.63	0.99	0.70	13.40	16.70	1.35	1.00
MgO		4.20	2.90	3.95	5.26	2.40	2.06	8.50	2.70	2.30	2.80	1.50
Na2O		2.10	2.43	1.98	1.00	3.58	3.31	<0.10	0.24	0.32	1.90	4.60
K2O		5.70	4.91	3.55	2.54	3.42	5.80	2.20	4.65	4.10	4.00	4.20
TiO2		0.60	0.58	0.52	0.53	0.54	0.61	0.50	0.87	0.92	0.90	1.05
MnO		0.10	0.05	0.10	0.17	0.10	0.10	0.10	0.28	0.66	0.08	0.09
Cr2O3		<0.10		<0.10	<0.10	<0.10	<0.10	<0.10				
V2O5		<0.05		<0.05	<0.05	<0.05	<0.05	<0.05				
P2O5		0.21	0.27	0.20	0.21	0.24	0.20	0.10	0.10	0.10		
LOI		3.00	3.56	2.93	4.76	3.02	1.63	7.00	3.00	3.75	3.25	1.63
H2O+		2.40	3.00	5.19	2.77	1.68						
H2O-		0.20	0.20	0.35	0.15	0.28						
TOTAL		100.40	101.55	101.98	102.14	101.90	102.15	87.50	99.54	99.85	98.28	98.47
Sulphate %		0.05	0.06	0.04	0.10	0.05	0.30					
Sulphide %		1.11	1.69	0.78	1.93	1.83	0.17	7.44				
TRACE ELEMENTS (ppm)												
Cu		5500	9000	5500	17500	7500	1400	70000	20	150	10000	10000
Mo		<3	3	5	5	10	10	1500			5	20
As		280	200	45	45	<10	10	540				
Pb		3	3	10	1	1	40	200	30	20	3	10
Zn		80	20	200	30	50	20					
Sn		1	1	1	1	1	1	10	3	1	1	1
Cd												
Bi								50	1	1	1	
Ag		0.3	0.3	0.1	0.3	0.1	1	15	0.1	0.1	0.1	0.1
Au												

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TABLE 8 (cont.): PDD SILICATE AND GEOCHEMICAL ANALYSES

SAMPLE: A No. –	727/73	731/73	740/73	741/73	749/73	753/73	755/73	1420/73	1421/73	1422/73	1423/73
DEPTH (m) from	197	200.6	207.45	208.27	213.88	218.5	219.68	237.14	258.9	208.65	217.5
to	198	201.35	208.27	208.65	215	219.16	220.34	238.55	260.94	209.2	218.5
Ga								10	10	10	5
Ge											
Sb											
Co	10	100	20	30	30		800	30	20	50	80
Ni	10	10	5	100	50	5	100	30	50	30	30
Cr	100	100	30	20	50	200	50	80	80	100	100
V	80	5	50	100	8	100	80	150	100	150	150
W											
Mn	100	100	200	300	200	200	150	2000	5000	500	500
Ta											
Nb								20	20	20	20
Be	1	1	3	5	5	1	1	10	5	5	3
Th											
Zr	100	100	50	80	100	80	50				

TABLE 9: PDD 8 ADDITIONAL GEOCHEMICAL ANALYSES

DEPTH (m)	SAMPLE A No.	Cu	Mo	As	Pb	Zn	Sn	Bi	Ag	Co	Ni	Cr	V	Mn	Be	S%
180 - 182	205/73	500	<3													
182 - 184	206/73	800	<3													
184 - 186	207/73	4900	4													
186 - 188	208/73	800	<3													
188 - 190	209/73	400	<3													
190 - 192	210/73	900	12													
192 - 194	211/73	800	5													
194 - 196	212/73	3600	4													
196 - 197	726/73	5500	<3	140												1.05
198 - 199	728/73	6000	3	140												1.15
199 - 200	729/73	4400	<3	380												1.05
200 - 200.6	730/73	4500	<3	220												0.78
201.35 - 202.13	732/73	3000	<3	240												0.36
202.13 - 203.1	733/73	8500	3	1750												1.55
203.1 - 204.55	734/73	4900	3	1950												0.79
204.55 - 205.95	735/73	3700	5	860												0.48
205.95 - 206.07	736/73	17500	25	200												2.75
206.08 - 206.77	737/73	43	25	170												0.4
206.77 - 207.12	738/73	5500	10	350												0.55
207.12 - 207.45	739/73	120000	3	65	10	500	10	20	10	300	400	30	50	200	3	17.2
208.65 - 209.2	742/73	3800	5	40												0.38
209.2 - 209.56	743/73	5500	18	45												0.67
209.56 - 210.55	744/73	7500	5	10												1.15
210.55 - 211.25	745/73	36000	10	25												2.35
211.25 - 212.29	746/73	5500	5	20												0.7
212.29 - 213.29	747/73	4000	15	<10												0.55
13.29 - 213.88	748/73	30000	5	90												7.1
215.0 - 216.5	750/73	5500	5	<10												0.69
216.5 - 217.5	751/73	2900	25	<10												0.27
217.5 - 218.5	752/73	6500	25	50												0.66
219.16 - 219.68	754/73	21000	22	55												1.65
220.34 - 221.06	756/73	12500	240	100												1.35
221.06 - 221.95	757/73	4000	950	20												0.56
221.95 - 223.18	758/73	1500	240	60												0.16
223.18 - 223.98	759/73	400	5	<10												0.02
223.98 - 224.86	760/73	600	5	15												0.01

PDD11

Although Gordon-Smith (1972) recommended PDD8, 9 and 10 as holes SADM should initially drill, encouraging results from PDD8 justified a wider step out for the second hole. PDD11 was selected and aimed to intersect mineralisation 365 metres down dip from PDD3 (Figure 3).

Drilling commenced on 26 March 1973 and was completed to 757.2 m on 7 November 1973. The drill log is presented in Appendix C. Tables 10 - 11 present silicate and geochemical data with petrographic descriptions given in Appendix D.

Major Results

Copper mineralisation was intersected in a zone from 727.68 -753.0m with assays generally below 1%. Significant intersections were:

745-15 - 745.5m at 8700ppm
746.52 - 747.45m at 1.5%

Arsenic also showed significant concentrations in the same zone as copper. Petrography indicated the presence of arsenopyrite.

Molybendum assays were generally low with only two significant anomalies recorded:

627.4 - 627.7m at 900ppm
752.37 - 753.0m at 130ppm

TABLE 10: PDD 11 SILICATE AND GEOCHEMICAL ANALYSES

SAMPLE A	No.	1401/73	1424/73	1425/73	1426/73	1427/73	1428/73	1429/73	1430/73	1431/73	1432/73
DEPTH (m)	from	648	185.52	249.92	287.37	364.55	581	593.32	614	649.9	661.65
	to	649	185.54	249.94	287.39	364.57	582	594.35	615.2	650.35	662.65
	SiO2	35.43	73.00	64.00	75.50	72.00	41.50	61.50	45.00	36.50	56.00
	Al2O3	15.25	12.60	15.50	9.70	12.80	20.80	15.80	14.00	23.70	19.20
	Fe2O3	4.39	3.50	5.20	6.30	3.90	11.00	8.00	17.50	12.50	7.00
	FeO	18.21									
	CaO	9.85	0.45	0.15	0.10	0.25	0.40	1.30	5.50	16.70	0.50
	MgO	4.71	0.41	0.85	0.40	0.55	14.00	0.85	6.20	0.95	1.05
	Na2O	0.23	2.40	0.20	0.13	0.21	0.12	3.60	0.25	0.10	0.22
	K2O	1.25	5.60	10.50	5.40	5.90	3.50	4.90	2.30	2.90	11.40
	TiO2	2.44	0.50	1.30	0.52	0.13	1.10	1.45	1.45	1.45	1.45
	MnO	0.96	0	0.27	0.38	0.05	0.18	0.40	0.90	0.67	0.16
	P2O5	0.49	<0.10	0.10	<0.10	<0.10	0.10	0.20	0.40	0.20	0.10
	Cr2O3		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	V2O5		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	LOI		1.21	2.15	1.13	4.05	6.90	1.52	4.65	3.20	1.65
	H2O+	5.57									
	H2O-	0.21									
	TOTAL										
TRACE ELEMENTS (ppm)											
	Cu	15	10	10	5	10	10	5	80	50	10
	As	20									
	Pb	10	100	120	150	20	30	20	150	50	30
	Zn	200		80	800	20	200	50	800	200	50
	Sn	10	1	1	1	1	1	1	3	3	
	Bi									3	
	Ag	0.1	0.1	0.1	0.3	0.1	0.1	0.1	2	2	0.3
	Ga		20	15	10	5	10	20	10	30	5
	Co	5	10	10	10	5	30	50	80	80	30
	Ni						20	5	10	20	30
	Cr	20	100	50	100	50	20	100	50	50	50
	V	100	30	30	30	10	80	80	200	150	100
	Mo	3	3	3	3	5	10				10
	Mn	3000	500	2000	3000	300	1000	3000	8000	8000	1000
	Nb	30	30	30			20	50	20	50	30
	Be	3	5	5	1	5	10	3	5	5	1
	Th	100	100	100							
	Zr	100									

TABLE 10(cont.): PDD 11 SILICATE AND GEOCHEMICAL ANALYSES

SAMPLE A	No.	535/74	536/74	537/74	538/74	539/745	540/74
DEPTH (m)	from	183	243.37	281.27	299.59	300.12	346.62
	to	197.65	258	285.63	299.96	300.79	359
	SiO2	72.85	59.69	72.30	60.33	73.76	73.49
	Al2O3	12.46	16.75	12.06	17.46	11.20	12.25
	Fe2O3	0.75	1.50	0.83	2.00	2.27	0.87
	FeO	2.67	3.71	3.92	3.73	3.18	2.55
	CaO	0.56	0.28	0.09	0.22	0.13	0.72
	MgO	0.46	0.87	0.39	0.76	0.53	0.37
	Na2O	2.17	0.21	0.15	0.17	0.10	1.77
	K2O	5.90	12.50	7.79	11.71	6.17	5.99
	TiO2	0.40	0.49	0.33	0.37	0.32	0.34
	MnO	0.10	0.50	0.20	0.33	0.22	0.11
	P2O5	0.06	0.08	0.05	0.07	0.05	0.07
	Cr2O3						
	V2O5						
	LOI						
	H2O+	0.94	1.44	1.32	1.93	1.76	1.17
	H2O-	0.22	0.22	0.08	0.23	0.10	0.11
	TOTAL						
TRACE ELEMENTS (ppm)							
	Cu						
	As						
	Pb	50	1000	200	250	50	10
	Zn	100	200	250	400	300	30
	Sn	1	1	1	1	1	1
	Bi						
	Ag	1	0.3	0.1	0.3	0.3	0.1
	Ga						
	Co						
	Ni			5			

TABLE 10 (cont.): PDD 11 SILICATE AND GEOCHEMICAL ANALYSES

SAMPLE A	No.	535/74	536/74	537/74	538/74	539/745	540/74
DEPTH (m)	from	183	243.37	281.27	299.59	300.12	346.62
	to	197.65	258	285.63	299.96	300.79	359
	Cr	50	30	100	30	80	80
	V	10	2	10	10	10	10
	Mo						
	Mn	300	1500	500	500	1000	300
	Nb	20	20	20	20	20	20
	Be	3	3	3	5	3	3
	Th						
	Zr	100	250	150	200	250	200

TABLE 11: PDD 11 ADDITIONAL GEOCHEMICAL ANALYSES

DEPTH (m)	SAMPLE: A No.	Cu	Mo	As	Au	Pb	S (%)
707.0 - 708.0	400/73	<100	6	4			
708.5 - 709.15	401/73	<100	3	<4			
709.15 - 709.4	402/73	<100	3	<4			
709.4 - 710.0	403/73	<100	22	7			
710.0 - 711.5	404/73	300	20	50			
711.5 - 711.7	405/73	600	8	105			
711.7 - 712.0	406/73	<100	8	60			
712.3 - 713.7	407/73	300	15	55			
713.7 - 715.55	408/73	<100	5	<4			
715.55 - 717.55	409/73	<100	5	<4			
727.68 - 728.26	968/73	1300	5	1550	<0.05		
728.26 - 729.42	969/73	2500	8	900	<0.05		
729.42 - 731.11	970/73	600	10	25000	<0.05		1.06
731.11 - 731.75	971/73	2300	7	2400	<0.05		1.45
731.75 - 733.48	972/73	4600	4	6300	<0.05		0.92
733.48 - 733.8	973/73	4400	18	7500	<0.05		0.63
733.8 - 734.0	974/73	5900	8	13000	<0.05		1.24
734.0 - 734.5	975/73	2800	22	1750	<0.05		1.12
734.5 - 735.5	976/73	2300	10	6500	<0.05		0.81
735.5 - 736.77	977/73	1800	10	5200	<0.05		0.7
736.77 - 737.7	978/73	500	15	8500	<0.05		0.53
737.7 - 739.0	979/73	2200	15	8000	<0.05		1.74
739.0 - 739.35	980/73	1800	25	2300	<0.05		4.9
739.35 - 740.35	981/73	4100	10	1100	<0.05		0.87
740.5 - 742.0	982/73	300	6	3500	<0.05		0.32
742.0 - 742.2	983/73	1000	5	3100	<0.05		0.24
742.2 - 743.4	984/73	700	5	5000	<0.05		0.32

TABLE 11(cont.): PDD 11 ADDITIONAL GEOCHEMICAL ANALYSES

DEPTH (m)	SAMPLE: A No.	Cu	Mo	As	Au	Pb	S (%)
743.4 - 745.15	985/73	1100	3	3800	<0.05		0.29
745.15 - 745.5	986/73	8700	5	3900	<0.05		1.29
	(1416/73)	(8800)	(18)	(5250)			
745.5 - 746.52	987/73	500	7	3900	<0.05		0.17
	(1417/73)	(600)	(22)	(6800)			
746.52 - 747.45	988/73	15000	7	8100	0.1		1.57
	(1418/73)	(10000)	(15)	(9350)			
747.45 - 749.6	989/73	100	25	4400	<0.05		0.18
	(1419/73)	(100)	(35)	(4700)			
749.6 - 750.3	990/73	<100	15	600	<0.05		0.09
750.3 - 752.37	991/73	2800	25	4200	0.05	300	
752.37 - 753.0	992/73	1200	130	1400	<0.05	800	
753.0 - 755.0	993/73	<100	8	600	<0.05	<100	
501.0 - 502.7	994/73	2	5	10			
510.0 - 511.0	995/73	8	5	5			
513.0 - 514.0	996/73	2	5	5			
519.0 - 520.0	997/73	5	3	<5			
522.38 - 523.38	998/73	8	5	10			
529.0 - 530.0	999/73	5	3	5			
533.9 - 534.9	1000/73	5	3	<5			
537.0 - 358.0	1380/73	8	3	10			
543.4 - 544.4	1381/73	5	4	5			
548.0 - 549.0	1382/73	5	3	5			
555.0 - 556.0	1383/73	360	5	10			
557.23 - 558.45	1384/73	150	5	5			
561.0 - 562.0	1385/73	120	22	30			
566.35 - 567.35	1386/73	12	12	10			
573.57 - 574.57	1387/73	45	12	185			
578.0 - 579.0	1388/73	50	12	35			

TABLE 11(cont.): PDD 11 ADDITIONAL GEOCHEMICAL ANALYSES

DEPTH (m)	SAMPLE: A No.	Cu	Mo	As	Au	Pb	S (%)
581.0 - 582.0	1389/73	10	7	20			
588.0 - 589.0	1390/73	160	18	90			
593.32 - 594.35	1391/73	8	5	15			
596.65 - 597.65	1392/73	40	5	20			
603.8 - 604.8	1393/73	15	3	5			
605.9 - 606.9	1394/73	10	5	<5			
614.0 - 615.2	1395/73	110	3	<5			
617.0 - 618.0	1396/73	320	15	<5			
624.45 - 625.5	1397/73	28	4	40			
626.35 - 627.4	1398/73	70	15	40			
631.0 - 632.0	1399/73	110	18	640			
637.0 - 638.0	1400/73	310	25	2300			
649.9 - 650.35	1402/73	40	3	20			
652.55 - 653.55	1403/73	2	3	45			
660.0 - 661.0	1404/73	15	10	350			
661.65 - 662.65	1405/73	8	10	70			
665.7 - 666.7	1406/73	130	8	135			
674.0 - 675.0	1407/73	220	8	35			
677.4 - 678.8	1408/73	18	5	75			
684.2 - 685.2	1409/73	460	18	500			
688.0 - 689.0	1410/73	90	4	10			
692.0 - 693.0	1411/73	48	3	85			
698.0 - 699.0	1412/73	700	3	5			
702.0 - 703.0	1413/73	70	3	30			
721.88 - 722.88	1414/73	5	6	<5			
726.68 - 727.68	1415/73	150	4	365			
627.4 - 627.7	1434/73	900					

1988/1989 SAMPLING PROGRAMME

Initially a bibliography search on Parabarana copper prospect was undertaken on SADME's STATUS database with references compiled into the Reference section of this report.

Following compilation of SADM drill hole data, core from drill hole PDD11 was re-examined. An association of mineralisation with both brecciation and alteration was recognised, and possible epithermal veins were identified in the gneiss. A detailed sampling programme was subsequently undertaken. A summary drill log developed in the course of re-sampling is presented as Table 12.

Table 13 lists elements analysed and the techniques and detection limits used. It was discovered that neutron activation analysis was unsuitable for Mo detection in all samples and for Au detection in a few samples, due to interference by radioactive elements.

Petrographic descriptions are given in Appendix E and silicate and trace element data are presented as Tables 14 and 15 respectively.

Anomolous rare earth element concentrations were recorded at Parabarana and Table 16 compares the average rare earth element crustal abundance with those in PDD11 rock units. Values for crustal abundances are extracted from Henderson (1984) and Hofmann (1988). Henderson (1984) used figures from Taylor (1964) who estimated rare earth element crustal abundances using a 1:1 mix of mafic to siliceous igneous rock. Hofmann's (1988) figures are represented by mid ocean ridge basalts normalised to primitive mantle values. Average values for Parabarana are an arithmetic mean. For samples less than detection limit, half the value was used. Values for the volcanogenic-metasedimentary sequence are bulked.

TABLE 12: PDD 11 DRILL LOG, 1988/89 SAMPLING PROGRAMME

DEPTH (metres)	LITHOLOGICAL DESCRIPTION	PETROLOGY SAMPLES DEPTH(m) : 6838RS No.	ANALYTICAL SAMPLES DEPTH(m) : 6838RS No.
0 - 182.6	Rotary percussion; Samples not logged. Sequence of augen (mylonitic) gneiss, schistose and amphibolitic rocks.		
182.6 - 550.64	GNEISS, mylonitic, augen, reddish-pink to dark red colour, locally fractured, brecciated and chloritised. Fine, approximately 1 - 2 mm thick quartz, chlorite, calcite and feldspar veins. Minor pegmatite intrusives. Feldspar augen locally altered to bright red ?hematitic clay. Chlorite, calc-silicate and feldspar alteration associated with intense fracturing and brecciation. Sulphide (pyrite) mineralisation associated with zones of chloritisation and also with ?epithermal type, vuggy, chalcedonic quartz veins. Trace ?galena and magnetite visible.		183.5 - 184.0 : RS 152 214.6 - 214.89 : RS 153
	222.6 - 305.5 m: brecciated post mylonitic. Some zones intensely chloritised, others with feldspar alteration to red clay and calc-silicate.		226.14 - 302.54: RS 154 - 165
	323.2 - 323.6 m: brecciated, post mylonitic Chloritised, mylonitic gneiss fragments within white to pale cream carbonate matrix.		309.22 - 309.34 : RS 166 323.16 - 323.44: RS 167
	360.5 - 366.5 m: brecciated, post mylonitic. Chloritic alteration. Feldspars altering to red clay. White carbonate and purplish quartz (amethyst) veins.	361.0 : RS 227	336.48 - 336.7: RS 168 361.0 - 364.52: RS 169 - 171
	373.2 - 376.0 m: Pegmatite, pink, unfoliated, feldspars to 1 cm, veined by deep red ?hematitic/feldspathic clay.		374.55 - 374.78: RS 172
	381 - 407.55 m: finer mylonitic fabric. At 407.55 m quartz to 5 cm thick with "box" type feldspar veins. Later extension evident with chlorite invading centre of veins.		

TABLE 12(cont.): PDD 11 DRILL LOG, 1988/89 SAMPLING PROGRAMME

DEPTH (metres)	LITHOLOGICAL DESCRIPTION	PETROLOGY SAMPLES DEPTH(m) : 6838RS No.	ANALYTICAL SAMPLES DEPTH(m) : 6838RS No.
	418.2 - 429.2 m: extensive core loss. Roller bit used. Highly brecciated vuggy gneiss with fragments supported in a brown silica matrix and veined by ?epithermal type, white, chalcedonic quartz veins. Sulphide (pyrite) mineralisation associated with vugs and veins of brown silica.	412.4 : RS 228 418.75 : RS 229 426.15 : RS 230 428.6 : RS 231	412.42 - 413.39:RS 173-174 426.15 - 426.31 : RS 175 428.57 - 428.79 : RS 176
	511.45 m: narrow zone of calc-silicate alteration. Later, fine veins, <1 mm thick show zone of chlorite alteration.		435.23 - 509.58:RS 177 - 185 511.35 - 511.56 : RS 186
	540.6 - 541.6 m: brecciated, post mylonitic. Clasts supported in white to cream coloured carbonate matrix.	531.2 : RS 232	515.21 - 538.9 : RS 187 - 191 540.5 - 540.65 : RS 192 541.0 - 541.49 : RS 193 549.47 - 549.62 : RS 194
550.64 - 551.55	BRECCIA, extensively chloritised. Sulphide (pyrite) mineralisation associated with chlorite matrix. Zone is possibly a chloritised tectonic contact between the gneiss and the lower volcanogenic - metasedimentary unit.	551.1 : RS 233	551.31 - 551.51 : RS 195
551.55 - 755.0	VOLCANOGENIC - METASEDIMENTARY SEQUENCE Brecciated and chloritised unit of porphyry, schists, ?calc-silicates and amphibolites. Locally sheared and mylonitised. Extensively altered and veined by chlorite, calc-silicate, k-feldspar pegmatite and ?hematitic feldspar. Possible extensive potash metasomatism. Pyrite associated with most altered phases. Arsenopyrite aligned along fracture systems and is seen to be cut by carbonate veins carrying chalcopyrite. Possibly ?pyrite is also replacing arsenopyrite.		554.4 - 554.85 : RS 196

TABLE 12(cont.): PDD 11 DRILL LOG, 1988/89 SAMPLING PROGRAMME

DEPTH (metres)	LITHOLOGICAL DESCRIPTION	PETROLOGY SAMPLES DEPTH(m) : 6838RS No.	ANALYTICAL SAMPLES DEPTH(m) : 6838RS No.
	559.27 - 559.59 m: PEGMATITE, pink, chloritic. K-feldspar altered to pale whitish-grey along fractures.		559.25 - 559.57 : RS 197
	567.7 - 568.52 m: three zones of strong brecciation	564.28 : RS 234	560.57 - 567.0 : RS 198 -200
	571.4 - 573.9 m: and chloritisation.		
	583.27 - 586.4 m: ?PORPHYRY, grey, extremely brecciated and chloritised. Green calc-silicate veins at 585.9 m.	585.96 : RS 235	574.25 - 580.88:RS 201 - 202
	586.4 - 605.49 m: PORPHYRY, pink porphyritic feldspar grains to 3 mm in a chloritised feldspar groundmass. Relatively unfoliated but localised shearing/mylonitisation with calc-silicate alteration. Veins <1 mm thick of calcite, chlorite and k-feldspar.	589.3 : RS 236	587.05 - 587.43 : RS 203 591.27 - 591.59 : RS 204
	605.49 - 612.91 m: ?FELSIC VOLCANIC, grey, feldspathic, brecciated and chloritised rock. Fine fractures infilled with chlorite. Pink k-feldspar veins often as ?halo around white carbonate veins.	605.5 : RS 237	605.62 - 605.81 : RS 205 610.52 - 610.79 : RS 206
	612.91 - 620.17 m: AMPHIBOLITE, grey to green-grey, hornblende-rich.	616.85 : RS 238	615.55 - 615.86 : RS 207
	620.17 - 627.43 m: SCHIST, mica andalusite, grey, with dark grey to black clots to 1 cm.	625.65 : RS 239 626.3 - 626.7 : RS 240	626.05 - 626.21 : RS 208
	?639.3 - 646.65 m: ?FELSIC VOLCANIC, grey, feldspathic, highly fractured and chloritised, veined with red ?hematitic feldspar and white carbonate.	642.35 : RS 241	636.70 - 636.93 : RS 209 642.3 - 642.4 : RS 210 644.75 - 644.91 : RS 211

TABLE 12(cont.): PDD 11 DRILL LOG, 1988/89 SAMPLING PROGRAMME

DEPTH (metres)	LITHOLOGICAL DESCRIPTION	PETROLOGY SAMPLES DEPTH(m) : 6838RS No.	ANALYTICAL SAMPLES DEPTH(m) : 6838RS No.
			649.14 - 655.91:RS 212 - 214
	657.79 - 657.96 m: PEGMATITE, similar to that at 559.27 - 559.59 m.		
		658.4 : RS 242	
	658.43 - 659.5 m: PORPHYRY, chloritised, similar to that at 586.4 - 605.49 m.		
	659.9 - 755.0 m: alternating sequence of variable thickness, 0.5 - 15 m, of granitic, amphibolitic, schistose and volcanic rocks, variably brecciated and chloritised, potash metasomatised, veined by chlorite, red ?hematitic feldspar, quartz and calcite. From 727.68 m arsenopyrite and chalcopyrite mineralisation. Arsenopyrite along fractures cut by carbonate veins carrying chalcopyrite.	688.15 - 753 : RS 243 - 250	663.6 - 745.0 : RS 215 - 225
755.0 - 757.2	?GRANITE, extensively chloritised and with possible calc-silicate assemblage. END OF HOLE 757.2 METRES		756.0 - 757.0 : RS 226

RESULTS

Silicate Analysis

Twenty-three samples were selected for silicate analysis. Within the gneiss SiO_2 ranged from 45.5 - 76.3%. Some samples, e.g. RS 157, RS 188 and RS190 showed high K_2O, and Fe_2O_3 concentrations, possibly an indication of K - metasomatism and Fe-alteration. SiO_2 within the Volcanogenic-Metasedimentary sequence ranges from 39.4-66.5%. This sequence also appears to be affected more by Fe-alteration than K-metasomatism. Al_2O_3 is higher than in the gneiss.

Geochemistry

Geochemical analysis confirms earlier investigations that copper mineralisation is hosted in the Volcanogenic - Metasedimentary sequence. Copper assays were all low with values ranging from 2000 - 3400 ppm intersected in the zone 729.5 - 745.0m.

Assays for Sc, Th, U, Y and Zr as well as the rare earths recorded high values (Tables 15 and 16). Co also showed anomalies in a number of intersections.

MINERALISATION

The following summarises K Every's conclusions on mineralisation at Parabarana:

DEPOSIT TYPE: stratabound

GEOLOGY: Hanging wall - andalusite, graphite and retrograded chlorite schists and minor amphibolites.

Mineralised Zone - banded and massive hornfels and felsic volcanics.

Footwall - hornfelsed calc-silicates.

The metasediments dip 53°NNW, are correlated with Brindana Schist and overly an augen basement (Terrapinna Granite) in an overturned sequence. The Mount Neill Granite Porphyry intrudes the metasediments.

MINERALISATION: chalcopyrite, pyrite and arsenopyrite in minor fractures and shears.

ORIGIN: Volcanogenic - Sedimentary.

Sulphides formed in a restricted basin in which biogenic sulphur, precipitated in fine-grained sediments, combined with metal ions deposited in the basin by fumarolic activity.

RESERVES

No statement of proven or probable reserves has yet been given for Parabarana even though an extensive drilling programme has been undertaken. Gordon-Smith (1972) quoted inferred reserves of 6.1 million tonnes at 0.9% Cu.

Every (1975) records dimensions of the minerlised zone as:

- 10-30 metres thick
- 500 metres maximum strike length
- 900 metres proven down dip extent

TABLE 13: PDD 11 ELEMENT ANALYSIS, METHOD AND DETECTION LIMIT - 1988/89 SAMPLING PROGRAMME

METHOD	ELEMENTS (detection limits in brackets)			
Neutron Activation Analysis	Ag (5 ppm)	Cr (5 ppm)	Lu (0.5 ppm)	Sm (0.2 ppm)
	Au (5 ppb)	Cs (1 ppm)	Mo (5 ppm)	Ta (0.5 ppm)
	As (2 ppm)	Eu (0.5 ppm)	Rb (20 ppm)	Th (0.5 ppm)
	Br (2 ppm)	Hf (1 ppm)	Sb (0.2 ppm)	W (5 ppm)
	Ce (2 ppm)	Ir (20 ppb)	Sc (0.1 ppm)	U (2 ppm)
	Co (1 ppm)	La (0.5 ppm)	Se (5 ppm)	Yb (2 ppm)
Inductively Coupled Plasma Spectroscopy	Ba (5 ppm)	Mn (15 ppm)	P (100 ppm)	Zr (5 ppm)
	Ca (50 ppm)	Na (50 ppm)	Sr (1 ppm)	
	Fe (100 ppm)	Nb (10 ppm)	Ti (10 ppm)	
	Mg (15 ppm)	Ni (10 ppm)	Y (1 ppm)	
X-Ray Fluorescence Spectroscopy	S (30 ppm)	K (30 ppm)	Sn (3 ppm)	
Atomic Absorption	Cu (5 ppm)	Pb (5 ppm)	Zn (5 ppm)	

TABLE 14: PDD 11 SILICATE ANALYSES, 1988/89 SAMPLING PROGRAMME

6838RS No.	DEPTH (metres)	SiO2	TiO2	Al2O3	CaO	K2O	Na2O	Fe2O3	MgO	MnO	P2O5	LOI	TOTAL
RS 152	183.5 - 184.0	73.60	0.38	11.80	0.72	6.13	2.01	3.62	0.42	0.11	0.05	0.95	99.79
RS 155	227.17 - 227.35	67.10	0.34	11.50	0.09	6.17	7.14	5.78	0.60	0.22	0.04	1.57	100.55
RS 157	255.3 - 255.54	53.40	0.64	18.80	0.29	10.80	0.16	9.12	1.69	0.63	0.08	4.24	99.84
RS 159	266.52 - 266.69	76.30	0.26	10.20	0.14	6.72	0.11	3.99	0.44	0.14	0.03	1.34	99.66
RS 160	271.4 - 271.83	74.50	0.32	10.60	0.10	6.90	0.07	5.30	0.34	0.28	0.03	1.08	99.53
RS 168	336.48 - 336.7	75.70	0.34	10.50	0.31	7.23	0.15	3.89	0.45	0.14	0.04	1.06	99.81
RS 171	364.17 - 364.52	77.50	0.11	10.00	0.80	7.74	0.11	1.64	0.35	0.08	0.04	1.14	99.51
RS 172	374.55 - 374.78	71.20	0.06	13.90	1.06	9.36	1.83	1.29	0.14	0.04	<0.02	0.66	99.53
RS 174	413.1 - 413.39	73.40	0.13	6.92	7.53	5.97	0.10	2.66	0.20	0.03	<0.02	2.95	99.90
RS 179	452.6 - 452.87	74.20	0.24	10.80	0.10	8.21	0.14	4.26	0.34	0.10	0.03	1.16	99.59
RS 182	499.24 - 499.82	75.30	0.27	10.60	0.29	6.65	1.23	3.76	0.45	0.09	0.03	0.09	98.76
RS 188	523.36 - 523.56	45.50	2.30	13.60	1.20	3.44	0.01	26.00	4.11	0.60	0.62	3.45	100.83
RS 190	538.2 - 538.46	60.00	0.95	11.60	0.33	2.14	0.03	14.40	5.90	0.54	0.20	3.93	100.02
RS 196	554.4 - 554.85	49.90	2.44	14.10	2.45	2.99	0.03	16.90	5.05	1.28	0.53	4.76	100.43
RS 197	559.25 - 559.57	66.50	0.72	15.40	2.85	3.89	5.88	1.51	0.47	0.13	0.11	2.56	100.03
RS 205	605.62 - 605.81	39.40	3.20	16.00	2.81	6.61	0.73	23.90	4.86	0.25	0.63	2.01	100.40
RS 207	615.55 - 615.86	50.50	2.80	13.30	4.93	2.83	0.36	15.70	6.26	0.76	0.61	2.91	100.96
RS 215	663.6 - 663.96	60.10	0.69	17.20	0.63	13.30	0.15	5.03	0.97	0.12	0.08	1.31	99.58
RS 221	707.29 - 707.57	69.60	0.42	13.60	0.25	8.08	0.10	5.02	1.18	0.08	0.06	1.54	99.94
RS 223	729.5 - 730.0	59.20	0.52	12.60	0.77	4.00	0.32	14.20	3.86	0.21	0.16	4.13	99.97
RS 224	735.0 - 735.4	61.40	0.44	13.60	2.22	8.24	0.59	7.96	1.60	0.14	0.17	3.81	100.18
RS 225	744.5 - 745.0	60.20	0.56	16.50	0.80	6.90	2.68	7.00	2.67	0.12	0.21	2.22	99.86
RS 226	756.0 - 757.0	71.60	0.35	12.80	1.80	5.27	0.06	3.23	1.48	0.13	0.12	3.22	100.06

TABLE 15: PDD 11 TRACE ELEMENT GEOCHEMISTRY-1988/89 PROGRAMME

6838RS No.	DEPTH (metres)	Ag ppm	As ppm	Au ppb	Ba ppm	Ca ppm	Cu ppm	F ppm	Fe %	K %	Mg ppm	Mn ppm	Mo ppm	Na ppm	Pb ppm	S %	Sb ppm	Sn ppm	Ti ppm	W ppm	Zn ppm
RS 152	183.5 - 184.0	<5	<2	<5	419		10		2.00	4.45			<56		25	0.01	<0.2	3		<2	35
RS 153	214.6 - 214.89	<5	62	66	305	6501	200		2.54	4.40	2112	350	<51	1.49%	1120	0.01	0.3	6	2145	<2	40
RS 154	226.14 - 226.34	<5	7	<5	914	976	230		3.28	5.60	2584	1365	<110	1460	510	0.08	4.9	5	1877	4	270
RS 155	227.17 - 227.35	<5	9	<5	339		5		3.40	4.65			<34		600	0.01	0.8	15		<5	2550
RS 156	236.72 - 236.95	<5	4	<5	536	1778	35		3.41	5.30	4289	557	<40	3330	45	<0.005	1.0	25	2389	3	30
RS 157	255.3 - 255.54	<5	5	<5	506		10		5.40	7.75			<140		1580	0.04	1.7	9		<5	2000
RS 158	263.32 - 263.45	<5	19	<5	507	1020	50		3.68	8.30	4066	1009	<110	1300	65	0.23	6.2	<3	1918	<2	230
RS 159	266.52 - 266.69	<5	14	<5	430		5		520	4.85			<66		135	0.22	2.3	4		<5	195
RS 160	271.4 - 271.83	<5	6	<5	401		5		3.00	5.10			<62		200	0.05	1.0	15		<2	850
RS 161	272.4 - 272.58	<5	39	<5	860	666	20		4.84	6.60	2394	2383	<93	612	70	0.43	3.3	10	2680	6	670
RS 162	275.58 - 275.9	<5	5	<5	452	1037	25		5.57	6.60	4885	3808	<130	955	520	0.01	4.3	8	2274	<2	2400
RS 163	276.15 - 276.35	<5	4	<5	544	1140	15		5.25	8.10	3895	2409	<100	1180	200	<0.005	3.2	4	2034	3	820
RS 164	295.12 - 295.46	<5	6	<5	454	451	10		4.52	7.70	2897	2272	<81	1010	300	0.03	2.6	<3	2214	<2	530
RS 165	302.28 - 302.54	<5	3	<5	516	1086	15		5.07	6.10	4088	2035	<77	1120	175	0.01	1.1	5	2035	<2	540
RS 166	309.22 - 309.34	<5	3	<5	645	697	10		3.44	5.50	1285	328	<91	1280	220	0.01	2.3	8	2037	6	115
RS 167	323.16 - 323.44	<5	5	<5	297	14.8%	15		1.01	4.30	2873	1.61%	<94	539	1100	0.01	1.8	<3	1165	<2	300
RS 168	336.48 - 336.7	<5	3	<5	510		10		2.20	5.00			<78		25	0.03	0.7	<3		<2	50
RS 169	361.0 - 361.13	<5	6	<5	470	3971	15		2.62	6.00	2814	1515	<72	1110	25	0.04	2.1	9	1595	3	45
RS 170	363.17 - 363.45	<5	10	<5	454	1.65%	15		2.39	4.60	3953	1839	<150	1820	35	0.13	2.4	<3	2060	<2	90
RS 171	364.17 - 364.52	<5	5	<5	624		10		1.00	5.10			<250		30	0.03	1.2	<3		<2	60
RS 172	374.55 - 374.78	<5	<2	<5	588		5		0.81	7.05			<18		195	0.01	0.6	20		<2	200
RS 173	412.42 - 412.53	<5	33	<5	412	471	20		2.03	3.70	921	286	<71	497	55	0.73	2.1	<3	641	4	110
RS 174	413.1 - 413.39	<5	20	<5	474		15		1.60	4.35			<83		15	0.44	1.9	<3		<5	80
RS 175	426.15 - 426.31	<5	9	<5	332	716	15		2.14	2.10	3750	675	<110	662	680	0.13	3.1	7	838	5	110
RS 176	428.57 - 428.79	<5	16	<5	429	560	15		3.37	5.30	1846	1157	<110	769	450	0.43	3.1	<3	1480	4	700
RS 177	435.23 - 435.36	<5	19	<5	523	1.18%	20		3.23	5.40	2440	1365	<110	800	84	0.53	2.6	10	1621	3	120
RS 178	437.5 - 437.6	<5	12	<5	403	2.65%	10		1.46	4.10	1377	2186	<97	540	40	0.19	2.3	20	1060		80
RS 179	452.6 - 452.87	<5	19	<5	876		5		2.30	6.05			<100		45	0.47	2.9	15		<2	135
RS 180	86.5 - 486.79	<5	<2	<5	373	3020	10		1.96	5.20	1499	696	<71	1.59%	5	<0.005	1.5	<3	1600	<2	40
RS 181	489.07 - 489.3	<5	<2	<5	446	2739	10		2.48	5.80	1609	725	<64	958	5	0.01	0.4	3	933	<2	65
RS 182	499.24 - 499.82	<5	10	<5	594		5	430	2.20	4.95			<83		10	0.18	0.6	3		<2	30
RS 183	502.51 - 502.64	<5	10	<5	642	1.36%	25		2.20	5.70	1924	983	<76	893	<5	0.28	3.2	20	1266	<2	30
RS 184	505.81 - 505.98	<5	<2	<5	525	1626	5		4.41	4.50	4152	632	<5	581	<5	0.01	0.6	40	1583	<2	30
RS 185	509.29 - 509.58	<5	<2	<5	383	1394	10		4.55	5.20	5269	934	<77	597	<5	0.01	1.2	20	1153	3	60
RS 186	511.35 - 511.56	<5	<2	<5	1862	3196	10		2.32	5.20	3879	1093	<110	3437	5	0.01	0.8	6	950	7	40
RS 187	515.21 - 515.55	<5	4	<5	1369	5815	187		2.73	4.90	4436	4436	<110	1250	<5	0.03	1.4	8	1217	<2	45
RS 188	523.36 - 523.56	<5	6	<5	625		5		15.90	2.79			<5		30	0.20	0.6	35	17		310
RS 189	532.06 - 532.34	<5	<2	<5	413	1132	15		4.53	50	5370	1264	<54	758	10	0.01	0.5	30	1450	5	260
RS 190	538.2 - 538.46	<5	<2	<5	1060		5		8.90	1.91			<110		10	0.01	0.6	20		18	270
RS 191	538.66 - 538.9	<5	2	<5	1773	872	10		5.37	4.00	9725	1490	<100	621	<5	0.01	1.1	15	1300	3	100
RS 192	540.5 - 540.65	<5	5	<5	2791	1.95%	10		3.93	6.60	4876	1936	<87	965	<5	0.01	0.8	20	1005	4	70
RS 193	541.0 - 541.49	<5	3	<5	845	8.77%	10		4.31	3.75	6238	1.09%	<62	595	<5	0.01	0.9	20	1040	4	35
RS 194	549.47 - 549.62	<5	7	<5	568	2838	10		5.36	4.00	4340	873	<170	617	15	0.25	0.8	30	1445	<2	70
RS 195	551.31 - 551.51	<5	19	<5	485	5540	5		14.24	2.04	4.31%	4984	<5	452	30	1.45	1.5	10	7805	6	230

TABLE 15(cont.): PDD 11 TRACE ELEMENT GEOCHEMISTRY-1988/89 PROGRAMME

6838RS No.	DEPTH (metres)	Ag ppm	As ppm	Au ppb	Ba ppm	Ca ppm	Cu ppm	F ppm	Fe %	K %	Mg ppm	Mn ppm	Mo ppm	Na ppm	Pb ppm	S %	Sb ppm	Sn ppm	Ti ppm	W ppm	Zn ppm
RS 196	554.4 - 554.85	<12	3	<5	1480		490		10.30	2.56			<5		10	0.12	0.6	9		16	200
RS 197	559.25 - 559.57	<5	8	<5	821		120		0.91	4.75			<61		220	0.07	1.6	<3		<2	650
RS 198	560.57 - 561.0	<5	17	<5	1813	2997	25		3.92	5.40	8991	1896	<14	1871	1080	0.25	1.2	<3	4585	<2	2750
RS 199	564.28 - 564.55	<5	2320	<5	2378	1432	250		3.31	4.00	6945	1516	<14	1358	1100	0.90	5.9	<3	1815	<2	>1.0%
RS 200	566.35 - 567.0	<5	16	<5	1142	5628	15		7.85	4.00	5.23%	1841	<14	646	95	0.07	1.3	<3	5497	4	1480
RS 201	574.25 - 575.0	<5	90	<5	775	4663	30		2.93	3.07	2.17%	910	<23	3.64%	650	0.22	1.9	<3	2640	<2	3100
RS 202	580.4 - 580.88	<5	14	<5	501	2671	10		11.04	2.77	11.41%	1593	<19	440	<5	0.01	1.4	5	4052	<2	75
RS 203	587.05 - 587.43	<5	8	<5	3278	6896	70		5.10	5.70	8051	3305	<5	9581	35	0.04	0.5	9	6330	4	85
RS 204	591.27 - 591.59	<5	21	<5	3001	5520	25		3.70	6.80	5422	3020	<5	1.34%	65	0.10	0.6	<3	5361	<2	170
RS 205	605.62 - 605.81	<10	<2	<5	981		10		15.10	5.00			<5		<5	0.01	1.0	9		<2	75
RS 206	610.52 - 610.79	<5	56	<5	4328	1.18%	260		4.76	6.90	1.10%	1023	<22	1.02%	730	0.32	1.5	4	4477	<2	1070
RS 207	615.55 - 615.86	<5	6	<5	848		180		9.51	2.20			<5		95	0.10	3.5	5		<2	510
RS 208	626.05 - 626.21	<5	61	<5	815	2368	30		9.59	4.40	5.20%	864	<25	1135	45	1.35	6.6	8	4220	5	95
RS 209	636.79 - 636.93	<5	1590	<5	936	1153	2600		4.78	3.85	8428	923	15	1122	160	0.43	20.9	<3	2901	<2	115
RS 210	642.3 - 642.4	<5	9	<5	4858	8077	15		8.53	6.70	1.79%	4308	9	1617	80	0.01	0.9	8	7184	3	65
RS 211	644.75 - 644.91	<5	20	<5	606	14.7%	25		7.56	1.23	6612	4688	<24	301	140	0.18	5.8	5	4829	<2	250
RS 212	649.14 - 649.27	<5	4	<5	295	5.54%	212		16.49	0.89	3.43%	7780	<5	1789	<5	0.01	2.7	45	1.79%	<2	145
RS 213	649.73 - 649.84	<5	12	<5	5497	1.15%	5		9.35	7.00	1.22%	2408	<16	2817	15	0.01	1.7	<3	5530	<2	80
RS 214	655.71 - 655.91	<5	8	<5	2711	4119	5		6.02	8.30	7558	1682	<25	1630	5	0.01	0.8	<3	4399	<2	40
RS 215	663.6 - 663.96	<5	21	<5	6480		175		3.00	9.95			<5		50	0.02	0.6	<3		<2	40
RS 216	669.15 - 669.45	<5	110	<15	2344	4772	220		9.70	5.50	2.88%	2642	<5	833	220	0.10	1.7	<3	3415	<2	170
RS 217	675.0 - 675.17	<5	57	<5	1713	2422	230		7.26	3.55	1.44%	1445	<5	1221	25	0.04	1.1	10	3132	6	60
RS 218	681.0 - 681.14	<5	21	<5	2300	4491	135		3.35	5.00	5170	1766	<10	3.34%	35	0.03	1.9	<3	6584	<2	25
RS 219	691.02 - 691.23	<5	19	<5	1358	1.90%	150		8.36	2.42	1.87%	2801	<30	2.72%	50	0.05	2.7	5	1.92%	<2	50
RS 220	697.34 - 697.52	<5	35	<5	167	1.75%	290		15.95	1.11	3.99%	7271	<5	316	<5	0.60	1.8	9	1.48%	12	90
RS 221	707.29 - 707.57	<5	<2	<5	808		35		3.00	5.95			<40		980	0.04	1.7	20		<2	100
RS 222	708.69 - 708.9	<5	3	<5	1293	1508	35		4.61	7.10	8871	759	<48	900	<5	0.11	1.5	10	2345	<2	25
RS 223	729.5 - 730.0	<5	9590	<20	778		2000	750	8.84	3.50			<5		95	0.72	22.9	<3		<2	75
RS 224	735.0 - 735.4	<5	>10000	<20	2020		3400	620	5.31	6.21			<5		690	1.80	168.0	8		<2	350
RS 225	744.5 - 745.0	<5	6280	<20	1960		3400	640	4.60	5.00			10		105	0.78	6.5	<3		<2	75
RS 226	756.0 - 757.0	<5	120	<5	195		30	1300	1.80	3.55			<84		10	0.09	1.8	10		<2	15

TABLE 15(cont.): PDD 11 TRACE ELEMENT GEOCHEMISTRY - 1988/89 SAMPLING PROGRAMME

6838RS No	DEPTH (metres)	Br ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Eu ppm	Hf ppm	Ir ppb	La ppm	Lu ppm	Nb ppm	Ni ppm	Rb ppm	Sc ppm	Se ppm	Sm ppm	Sr ppm	Ta ppm	Th ppm	U ppm	Y ppm	Yb ppm	Zr ppm
RS 152	183.5 - 184.0	<2	259	2	270	2	0.8	11	<20	119.0	1.4	28	<10	270	7.1	<5	22.6	36	4.1	116.0	33	110	8.3	289
RS 153	214.6 - 214.89	<2	263	8	420	2	0.8	10	<20	122.0	1.4			290	7.0	<5	22.2		1	103.0	30		7.4	
RS 154	226.14 - 226.34	<2	210	3	564	3	0.7	9	<20	103.0	1.5			360	6.4	<5	18.0		<1	84.1	66		8.8	
RS 155	227.17 - 227.35	<2	241	8	320	4	<0.5	9	<20	116.0	1.6	30	72	390	11.1	<5	20.1	13	4.4	87.9	20	36	10.0	246
RS 156	236.72 - 236.95	<2	214	4	450	8	<0.5	10	<20	93.4	1.2			156	7.8	<5	18.0		2	111.0	24		7.4	
RS 157	255.3 - 255.54	<2	423	5	64	7	0.8	18	<20	138.0	2.3	62	63	660	14.1	<5	33.1	20	4.8	179.0	87	36	14.0	470
RS 158	263.32 - 263.45	<2	347	2	220	5	0.6	9	<20	154.0	1.1			710	3.8	<5	24.0		3	154.0	67		6.7	
RS 159	266.52 - 266.69	<2	313	3	320	4	<0.5	6	<20	140.0	1.0	22	123	330	2.5	<5	20.8	19	<1.0	150.0	39	24	6.4	162
RS 160	271.4 - 271.83	<2	310	2	220	1	<0.5	9	<20	142.0	1.5	20	<10	330	3.9	<5	26.2	13	1.7	116.0	37	145	9.3	250
RS 161	272.4 - 272.58	<2	100	3	280	4	0.6	11	<20	47.0	1.5			670	3.6	<5	14.0		7	83.1	56		9.3	
RS 162	275.58 - 275.9	<2	292	4	150	3	0.9	11	<20	135.0	1.3			470	4.1	<5	24.3		2	121.0	75		7.8	
RS 163	276.15 - 276.35	<2	278	3	140	3	1.0	10	<20	126.0	1.2			590	2.8	<5	23.0		2	108.0	60		7.0	
RS 164	295.12 - 295.46	<2	318	3	160	3	0.6	11	<20	165.0	1.3			600	4.4	<5	24.8		2	107.0	48		7.3	
RS 165	302.28 - 302.54	<2	303	2	260	2	0.7	9	<20	140.0	1.1			390	4.9	<5	25.9		<1	97.5	46		6.1	
RS 166	309.22 - 309.34	<2	239	3	500	7	<0.5	10	<20	157.0	1.3			390	5.5	<5	23.3		2	123.0	54		7.4	
RS 167	323.16 - 323.44	<2	180	1	75	31	<0.5	6	<20	133.0	2.2			410	5.9	<5	23.0		1	58.0	56		12.0	
RS 168	336.48 - 336.7	<2	404	6	310	3	0.6	11	<20	199.0	1.3	28	<10	340	7.0	<5	28.8	24	<1.0	136.0	46	111	8.3	245
RS 169	361.0 - 361.13	<2	265	3	380	12	0.6	8	<20	112.0	1.2			440	3.1	<5	18.0		2	80.7	43		7.1	
RS 170	363.17 - 363.45	<2	338	6	440	15	1.0	9	<20	169.0	1.4			400	6.6	<5	28.5		<1	107.0	89		7.7	
RS 171	364.17 - 364.52	<2	52	3	290	14	<0.5	3	<20	42.0	<0.5	<10	<10	520	2.0	<5	6.3	52	1.4	9.1	150	116	3.3	83
RS 172	374.55 - 374.78	<2	37	<1	230	1	<0.5	1	<20	14.0	1.6	<10	<10	470	1.6	<5	4.4	48	1.5	21.0	10	163	8.9	35
RS 173	412.42 - 412.53	<2	150	2	614	4	<0.5	4	<20	78.1	0.8			310	2.4	<5	11.0		<1	72.3	42		4.6	
RS 174	413.1 - 413.39	<2	170	2	400	7	<0.5	6	<20	86.3	1.0	18	<10	400	3.1	<5	13.0	66	<1.0	102.0	50	88	6.2	126
RS 175	426.15 - 426.31	<2	78	5	624	4	<0.5	6	<20	38.0	1.4			210	4.9	<5	7.4		<1	96.8	64		8.0	
RS 176	428.57 - 428.79	<2	323	10	400	1	0.8	8	<20	154.0	1.6			420	5.3	<5	25.4		3	118.0	67		8.7	
RS 177	435.23 - 435.36	<2	371	4	350	2	0.8	10	<20	178.0	1.4			80	6.7	<5	25.4		4	91.6	63		8.3	
RS 178	437.5 - 437.6	<2	190	<1	370	2	<0.5	6	<20	84.0	1.3			330	4.9	<5	14.0		2	97.1	58		7.6	
RS 179	452.6 - 452.87	<2	355	3	310	2	0.7	8	<20	157.0	1.8	38	<10	440	5.4	<5	24.6	24	2.7	150.0	60	120	11.0	217
RS 180	486.5 - 486.79	<2	316	<1	330	1	0.5	9	<20	151.0	1.8			350	6.2	<5	23.9		3	106.0	42		10.0	
RS 181	489.07 - 489.3	<2	329	2	350	<1	1.5	8	<20	163.0	1.7			420	3.2	<5	25.4		3	85.0	38		9.1	
RS 182	499.24 - 499.82	<2	276	3	280	3	0.7	10	<20	129.0	2.0	33	<10	400	6.3	<5	21.4	31	3.8	120.0	49	106	11.0	200
RS 183	502.51 - 502.64	<2	306	2	290	4	0.5	8	<20	147.0	1.5			440	6.6	<5	23.0		2	98.3	45		8.0	
RS 184	505.81 - 505.98	2	828	8	310	<1	3.9	10	<20	405.0	1.8			390	9.0	<5	67.4		<1	103.0	25		8.5	
RS 185	509.29 - 509.58	<2	267	2	220	<1	<0.5	9	<20	132.0	1.6			310	5.1	<5	20.4		3	115.0	46		8.7	
RS 186	511.35 - 511.56	<2	326	1	250	2	0.5	8	<20	151.0	2.9			490	5.3	<5	28.0		5	148.0	63		17.0	
RS 187	515.21 - 515.55	<2	428	<1	360	3	0.9	8	<20	204.0	1.9			380	5.9	<5	31.3		3	124.0	64		10.0	
RS 188	523.36 - 523.56	<2	110	25	100	2	1.1	7	<20	62.3	1.8	24	<10	280	29.5	<5	13.0	16	2.8	15.0	3	42	10.0	169
RS 189	532.06 - 532.34	<2	297	3	210	<1	1.0	9	<20	147.0	0.9			310	3.9	<5	22.9		3	124.0	32		5.3	
RS 190	538.2 - 538.46	<2	100	9	180	1	<0.5	9	<20	52.2	1.8	25	<10	170	15.8	<5	12.0	15	2.3	93.8	66	123	11.0	242
RS 191	538.66 - 538.9	<2	235	4	310	2	0.6	8	<20	112.0	1.4			350	5.7	<5	16.0		3	118.0	59		7.7	
RS 192	540.5 - 540.65	<2	27	8	180	2	<0.5	6	<20	12.0	1.6			540	3.2	<5	3.4		1	67.9	52		9.4	
RS 193	541.0 - 541.49	<2	99	4	180	1	0.7	9	<20	43.0	2.8			280	8.7	<5	9.3		2	77.7	37		15.0	
RS 194	549.47 - 549.62	<2	219	12	280	3	0.7	8	<20	112.0	0.8			470	4.7	<5	18.0		3	88.7	100		4.0	
RS 195	551.31 - 551.51	<2	150	194	74	<1	1.8	7	<20	76.3	0.9			190	16.3	<5	11.0		2	18.0	5		4.4	

TABLE 15(cont.): PDD 11 TRACE ELEMENT GEOCHEMISTRY - 1988/89 SAMPLING PROGRAMME

6838RS No	DEPTH (metres)	Br ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Eu ppm	Ef ppm	Ir ppb	La ppm	Lu ppm	Nb ppm	Ni ppm	Rb ppm	Sc ppm	Se ppm	Sm ppm	Sr ppm	Ta ppm	Th ppm	U ppm	Y ppm	Yb ppm	Zr ppm
RS 196	554.4 - 554.85	<2	495	8	82	<1	3.4	8	<20	262.0	1.3	21	<10	250	32.0	<5	39.8	31	<2.1	12.0	13	83	7.2	206
RS 197	559.25 - 559.57	<2	36	2	100	<1	0.7	18	<20	13.0	1.6	32	<10	250	4.4	<5	5.7	68	2.4	38.0	36	108	9.0	331
RS 198	560.57 - 561.0	<2	190	7	150	2	1.2	13	<20	95.2	1.0			490	14.9	<5	16.0		2	27.0	8		5.0	
RS 199	564.28 - 564.55	5	9	130	340	1	<0.5	1	<20	4.2	0.4			410	1.8	<5	0.9		<1	9.2	8		1.7	
RS 200	566.35 - 567.0	<2	160	17	81	5	1.3	10	<20	83.0	1.4			450	20.2	<5	14.0		2	26.0	8		7.5	
RS 201	574.25 - 575.0	<2	35	41	120	3	0.8	18	<20	15.0	1.3			270	12.5	<5	6.4		4	43.0	13		7.5	
RS 202	580.4 - 580.88	<2	190	26	37	4	0.6	14	<20	98.3	1.8			190	16.0	<5	14.0		1	44.0	11		9.2	
RS 203	587.05 - 587.43	<2	226	3	140	2	3.0	8	<20	119.0	0.8			400	24.8	<5	19.0		5	20.0	5		4.4	
RS 204	591.27 - 591.59	<2	200	3	110	<1	2.3	10	<20	104.0	1.1			410	15.7	<5	20.0		3	31.0	5		6.1	
RS 205	605.62 - 605.81	<2	110	24	57	12	2.4	8	<20	58.5	1.4	16	12	490	41.2	<5	15.0	69	3.9	15.0	5	101	7.7	266
RS 206	610.52 - 610.79	<2	120	30	93	1	1.6	16	<20	58.2	1.0			410	15.5	<5	11.0		3	23.0	13		5.2	
RS 207	615.55 - 615.86	<2	100	28	96	<1	2.6	8	<20	50.0	1.1	21	12	180	39.7	<5	13.0	100	<1.0	14.0	4	115	6.3	235
RS 208	626.05 - 626.21	<2	180	40	69	4	0.9	8	<20	88.6	0.8			320	17.3	<5	15.0		3	34.0	14		4.0	
RS 209	636.79 - 636.93	4	130	15	190	<1	1.1	5	<20	68.0	0.8			270	10.6	<5	11.0		1	15.0	4		3.9	
RS 210	642.3 - 642.4	<2	68	7	39	2	1.4	10	<20	36.0	0.7			580	16.6	<5	7.6		3	12.0	6		4.1	
RS 211	644.75 - 644.91	<2	180	7	89	<1	1.9	10	<20	91.2	1.5			310	17.3	<5	15.0		2	29.0	14		8.2	
RS 212	649.14 - 649.27	<2	110	23	74	3	2.8	9	<20	48.0	1.3			180	46.5	<5	14.0		3	15.0	6		7.4	
RS 213	649.73 - 649.84	<2	68	13	53	1	1.6	19	<20	36.0	0.8			510	13.7	<5	8.0		4	25.0	9		4.7	
RS 214	655.71 - 655.91	<2	170	4	79	1	2.6	15	<20	87.6	1.0			430	23.3	<5	16.0		2	28.0	15		5.8	
RS 215	663.6 - 663.96	<2	305	5	70	1	2.8	8	<20	153.0	1.2	29	48	630	13.6	<5	24.4	159	2.2	32.0	8	94	6.6	148
RS 216	669.15 - 669.45	<2	933	41	63	2	5.8	9	<20	534.0	1.6			530	18.8	<5	65.5		<1	110.0	<2		8.0	
RS 217	675.0 - 675.17	<2	257	8	120	1	1.4	6	<20	128.0	0.8			310	15.9	<5	19.0		2	25.0	3		4.1	
RS 218	681.0 - 681.14	<2	190	1	88	1	1.6	22	<20	97.9	1.3			320	14.1	<5	15.0		6	55.0	11		6.8	
RS 219	691.02 - 691.23	<2	471	11	78	<2	4.7	85	<20	276.0	3.6			180	47.9	<5	39.4		14	61.1	18		18.0	
RS 220	697.34 - 697.52	<2	85	77	89	<1	2.1	7	<20	44.0	1.1			120	32.6	<5	10.0		3	10.0	<2		5.9	
RS 221	707.29 - 707.57	<2	285	2	120	1	1.7	12	<20	140.0	1.7	40	<10	390	10.4	<5	24.3	27	3.3	70.6	24	71	10.0	314
RS 222	708.69 - 708.9	<2	261	7	91	<1	2.7	14	<20	133.0	2.1			360	9.2	<5	22.3		4	91.8	29		11.0	
RS 223	729.5 - 730.0	22	68	636	150	3	0.8	2	<20	41.0	1.4	13	<10	260	16.8	<5	6.2	34	<2.0	16.0	12	80	2.9	138
RS 224	735.0 - 735.4	43	89	67	92	<2	1.0	<1	<20	54.0	1.3	<10	<10	550	15.2	<5	8.5	87	<2.0	12.0	<2	70	1.1	97
RS 225	744.5 - 745.0	8	140	2230	120	<3	<0.5	2	<20	88.4	<0.5	10	16	380	17.3	<5	11.0	81	<2.0	19.0	<2	69	<0.5	133
RS 226	756.0 - 757.0	<2	585	9	230	3	0.9	11	<20	317.0	2.3	37	<10	300	8.5	<5	38.5	15	4.1	66.2	50	126	12.0	346

TABLE 16: RARE EARTH ELEMENT ABUNDANCE, PARABARANA COPPER PROSPECT

ELEMENT	CRUSTAL ABUNDANCE			PARABARANA	
	HENDERSON (1984)	NORMANN (1988)		AVERAGE GNEISS	AVERAGE VOLC-SED
	1:1 mix mafic-siliceous igneous rocks	MORB normalised to primitive mantle			
		TM-1	TM-2		
La	30	26.06	30.95	124.8	103.5
Ce	60	20.61	23.73	260.1	195.4
Pr	8.2	16.12	17.78		
Nd	28	13.45	13.45		
Sm	6	9.06	9.57	23.1	16.9
Eu	1.2	7.56	7.56	0.7	1.9
Gd	5.4	6.44	7.02		
Tb	0.9	6.38	6.81		
Dy	3	5.81	5.80		
Ho	1.2	5.48	5.76		
Er	2.8	5.28	5.52		
Tm	0.48	4.98	4.98		
Yb	3	5.31	5.31	8.6	6.3
Lu	0.5	4.71	4.71	1.5	1.2

Copper assays varied from 0.5 - 12% with an average of 1.1% in the thickest part of the mineralised zone.

DISCUSSION

The present author believes Every and most earlier company geologists (Table 4) primarily based their mineralisation model on lithological and petrological characteristics of the deposit. Although recognising alteration and structural relationships these were apparently considered to be post mineralisation events.

During the course of resampling three geological units were outlined:

1. Gneiss, extensively mylonitised with zones of post mylonitic breccia and fracture systems and associated alteration.
2. Volcanogenic - Metasedimentary sequence, undeformed feldspar porphyry, schists, minor amphibolites and interlayered volcanic-granitic-schistose units locally sheared and mylonitised, variously brecciated, fractured and altered.
3. ?Granite, extensively chloritised; drilling terminated only 2 metres into this unit.

An extensively brecciated zone at the base of the gneiss and top of the volcanogenic - metasedimentary sequence is extensively chloritised with pyritisation common in the breccia matrix (Plate 1). This zone is considered to represent a tectonic contact between the two units.

At least two phases and three styles of brecciation are indicated, all of which are post mylonitisation. They are:

- brecciation associated with chlorite and/or hematite alteration
- brecciation associated with a siliceous matrix
- a later phase in which chloritised fragments are enclosed in a carbonate matrix (Plate 2).

Alteration types observed include:

- silicate, hematite, chlorite alteration associated with brecciation and fracturing (Plate 3)
- calc-silicate alteration associated with fracturing (Plate 4)
- hematite associated with fracturing (Plate 5)
- chlorite associated with veins (Plates 4 and 6)
- potash metasomatism (Plate 3).

Veining, with or without associated alteration comprises:

- calc-silicate (Plate 6 and 9)
- quartz/silica/±pyrite (Plate 7)
- carbonate (Plate 8)
- hematite (Plate 8 and 9)
- pegamite (Plate 9).

Chalcopyrite, pyrite and arsenopyrite are associated with carbonate veins, in chlorite altered areas in the matrix of breccias, quartz (chalcedonic) veins and in fracture systems. Plate 10 shows trace chalcopyrite mineralisation along fine fractures within the feldspar porphyry.

On the information available the author agrees with Freytag (1972) that mineralisation is associated with hydrothermal activity, possibly with intrusion of the Mount Neill Granite Porphyry and is probably remobilised and concentrated in later shear zones.

RECOMMENDATIONS

1. The geology and mineralisation at Parabarana should be fully appraised and interpreted prior to any further work using data from both open and confidential files.
2. Processing of LANDSAT Thematic Mapper data should be undertaken to aid in evaluating data at Parabarana.

   - TM imagery shows a possible alteration halo at the base of the Pepegoona Porphyry extending from Parabarana Hill southwards to near Mount Adams where it is widest and most intense;
   - Palaeodrainage patterns in the Frome Basin may be defined. Structural features effecting the drainage pattern may act as sediment traps;
   - Processing would help in defining the Paralana Fault system.

3. Petrography and analyses show the rock units to be anomalous in rare earth elements, with uraninite, thorite, xenotime, allanite, synchesite, rutile and monazite values ranging from trace to 1%. Any adjacent palaeodrainage systems should be investigated for heavy mineral concentrations.

4. Tectonism and hydrothermal activity of the Mount Painter Block is known through to the Quaternary. High levels of erosion probably deposited mineralised material into the Frome Basin. Potential hosts for transported and remobilised metallic mineralisation in the Frome Basin might include Cretaceous gypseous and pyritic shales and marly limestones as found in the Mount Babbage Block

E A DUBOWSKI

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PLATE 1: Chloritised breccia with pyrite. Considered to represent a tectonic contact between the gneiss and volcangenic-metasedimentary unit.

Depth - 551.4m; 6838 RS195

Slide No. 38123; Down hole is ↓

PLATE 2: Brecciated gneiss with carbonate matrix. Fragment edges altered to chlorite.

Depth - 323.35m; 6838 RS 167

Slide No. 38124; Down hole is ↑

PLATE 3: Superimposed alteration associated with fracturing in gneiss. Progression appears to be calc-silicate, pale green chlorite, potash metasomatism, dark green chlorite followed by silica veining.

Depth - 272.5m; 6838 RS161

Slide No. 38125; Down hole is ↑

PLATE 4: Calc silicate alteration along fractures. later chlorite alteration associated with fine veins.

Depth - 511.45m; 6838 RS186

Slide No. 38126; Down hole is ↓

PLATE 5: Hematitic and chloritic alteration associated with fractures in?gneiss. Hematite alteration preferentially affects K-feldspar. Globular pyrite associated with chlorite.

Depth - 549.1m; Slide No. 38127

Down hole is ↑

1

2

3

4

5

PLATE 6: Siliceous or felsic volcanic. Fractures with bright green calc-silicate and dark green chlorite. Pyrite associated with chlorite. Thin white veins consist of later carbonate.

Depth - 585.9m; Slide No. 38128

Down hole is ↑

PLATE 7: Silica and pyrite veins in mylonitic gneiss.

Depth - 266.6m; Slide No. 38130

Down hole is ↑

PLATE 8: Red hematitic and white carbonate veins in altered volcanic.

Depth - 646.45m; Slide No. 38130

Down hole is ↑

PLATE 9: Thin pegmatite veins in heavily altered felsic volcanic.

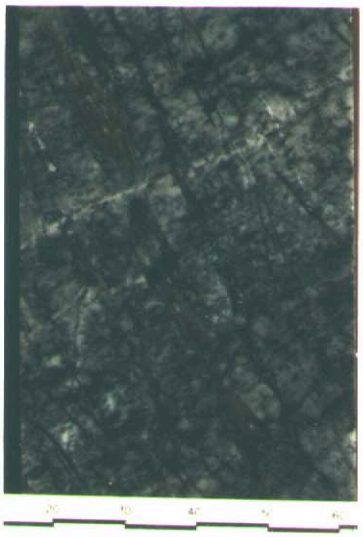
Depth - 559.65m; Slide No. 38131

Down hole is ↑

PLATE 10: Chlorite altered feldspar porphyry. Small 0.5mm yellowish chalcopyrite in fine veins and fractures.

Depth - 589.3m; Slide No. 38132

Down hole is ↑



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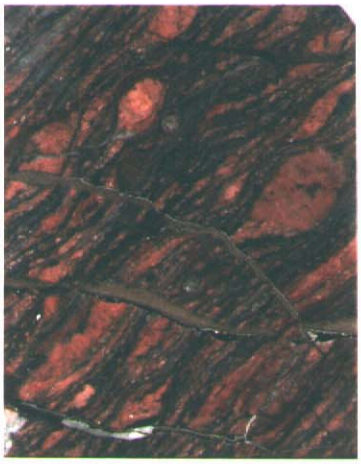

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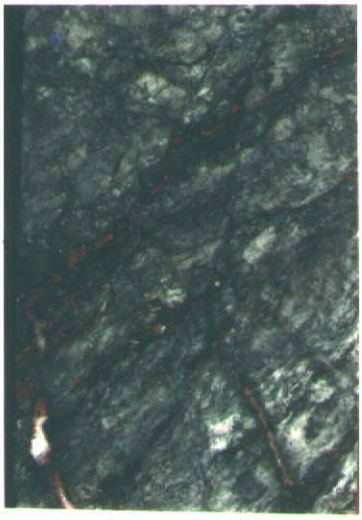

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DEPARTMENT OF MINES - SOUTH AUSTRALIA

PROJECT

PARABARANA COPPER PROSPECT - NORTH FLINDERS MINES LTD.

HOLE NO PDD8

TYPE OF HOLE (0-33m Rotary Percussion, 33-196m Rotary, (196-265.2m Diamond Cored HQ

MACHINE NO (1-167.5m Gryphon

BORE SERIAL NO (5MKII DM 185 DD911/73 (167.5-265.5m Failing (1500C DM 101

SURVEY DATA

INCLINATION Vertical) see hole

AZIMUTH -) survey

DEPTH 265.20m (870 ft)) data below

PLAN REFERENCE 72-117cc 77-314, 77-195

ASSAY REFERENCE AN3724/73 AN 3581/74 AN3740/73 AN2461/74 AN3788/73

COORDINATES Approx 800W/500N

ELEVATION Approx. 4990 ft. (Local arbitrary datum) Accurate survey not done.

DATE COMMENCED 6th November 1972

DATE COMPLETED 24th February 1973

DRILLER J. Martin (0-167.5m) T. Jarvis (167.5-265.2m)

LOGGED BY K. EVERY

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	
			UNWASHED SLUDGE SAMPLES BAGGED IN 2 metre intervals by drillers			ABBREVIATIONS USED IN LOG C.A. = core axis cp = chalcopyrite py = pyrite	
				0	10m	GNEISS: Pink to brick red	
				0	32.8ft	Upper 2-3m weathered to a crumbly, clayey streaked white and dull brick red rock with small irregular patches of greenish ?chloritic material. The glassy quartz bands, which occur in the fresher material below, are not prominent in this upper weathered zone. Rock also calcareous in upper 6m weathered portion. Below 3m rock is well indurated and foliated; foliation defined by streaky irregular bands of quartz generally 1mm thick. Slightly thicker irregular bands of generally pink feldspar (mostly ?orthoclase) are interfoliated with the quartz. Many feldspars, probably white plagioclases - have a washed-out pinkish ?hematitic ?iron stained appearance. Most feldspars appear crushed or brecciated, with more intense ?iron staining occurring in fractures and intergranular spaces. 4-8m, feldspar-quartz ratio approximately 2:1. Above 4m and below 8m, ratio is 3:1. In 4-8m zone, minor, thin, very irregular lamellae of dark greenish-black ?chloritic material occur in feldspathic bands. The quantity of chloritic material increases towards the base with an apparent concomitant decrease in quartz content.	

HOLE SURVEY DATA - Tro Pari Readings.

Depth (m)	Depth (ft)	Inclination (°)	Azimuth (°mag)	Remarks
30	100	89	150*	In casing/ bit.
61	200	88	143*	"
91	300	86	129*	"
22	400	84	175*	"
34	440	87*	80*	"
59	520	78	146*	"
181	593	76	176*	In bit
278	608	76*	155	On Al rod
211	693	74	124*	In bit
215	708	77*	152*	On Al rod
242	793	75	170*	In bit
246	808	77*	150	On Al rod
254	833	73	180*	In bit

*Unreliable readings
Assumed mean azimuth for entire hole 152° magnetic, 15.8° grid.

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CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	
			UNWASHED SLUDGE SAMPLES BAGGED IN 2m INTERVALS	10m 32.8'	12m 39.4'	PINK GNEISS - 50% AMPHIBOLITE (?) - 50% Gneiss as for 8-10m, - ie. crudely foliated grey-pink granite composed mostly of crushed and brecciated grains of pink feldspar (?orthoclase) in crude irregular bands with thinner caloritic lamellae and minor, streaked-out quartz lamellae. Rock is softer and more weathered (clayey and crumbly) than quartz-rich zone from 4-8m. ?Amphibolite chips are dark greenish-grey, chloritic and slightly micaceous (muscovite) amphibolite (or schist or schistose amphibolite). No foliation evident although chips tend to be flatter than gneiss chips.	0-12m chips up to 2cm diameter with many over 1cm Drilled 5½ inch hammer to 33m in 21 hours (6 to 8/11/72)
				12m 39.4'	20m 65.6"	GNEISS Pink to pink and grey, generally foliated with pink feldspar; quartz ratio approximately 2:1 as for 6-8m zone. Occasional chips in 12-14m zone are more chloritic. Note: chlorite content in gneiss related to proximity of amphibolitic zones, ie. compositional gradations between amphibolitic and gneiss bands occur.	Below 12m chips decrease in size; larger chips approximately 1cm across and occasionally up to 1.5cm
				20m 65.6'	22m 72.2'	CHLORITIC GNEISS (mostly) and SCHISTOSE AMPHIBOLITE (occasional chips) Gneiss: weathered, crumbly, clayey, mottled dark green and dull brick red, with minor white patches of ?kaolinised feldspar. Amphibolite:: dark greenish-black, chloritic, schistose (more pronounced than that in 10-12m). SCHISTOSE AMPHIBOLITE - tabular chips as above, but more biotitic. Note: no compositional segregation banding. Occasional quartz chips with chloritic smears on surface. Also occasional chip of chloritic pink gneiss - probably contamination.	
				24m	26m	As above but most chips more massive or hornfelsic. One hornfelsic amphibolite chip (approximately 5mm across) with 5 minute pyrite grains. Also more chips of pink gneiss, (quite rounded and probably contamination).	
				26m 85.3'	28m 91.9'	HORNFELSIC AMPHIBOLITE and PINK GNEISS More gneiss than hornfelsic amphibolite fragments, gneiss fragments also larger. Gneiss - most with quartz lamellae; some chloritic gneiss. Hornfelsic amphibolite as above, but with abundant minute micaceous mineral with metallic sheen (?micaceous hematite) - also in gneiss but traces only.	

DEPARTMENT OF MINES - SOUTH AUSTRALIA

HOLE NO P.D.D.8 — PARABARANA PROJECT —

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	
			UNWASHED SLUDGE SAMPLES BAGGED IN 2m INTERVALS	28m 91.9'	30m 98.4'	CHLORITIC GNEISS (mostly) - crudely banded dark greenish-grey, chloritic and muscovitic amphibole and pink, weathered feldspars; one chip with numerous grains of pyrite and abundant micaceous hematite. Lesser quantity of amphibolitic chips with small, irregular patches of pink feldspar surrounded by amphibole matrix - one chip with a crude band, 1mm wide, of scattered pyrite grains up to 0.5m across.	
						Note: many pyrite grains in bag sample; one 2.5mm wide broken dube with faceted corner and obliquely faceted edges.	
				30m 98.4ft.	32m 105ft.	CHLORITIC GNEISS - as above with occasional specks of pyrite. One rounded fragment of white, powdery calcareous material with minor, very small, dark grey patches (?chlorite). Odd chips of amphibolite and quartz-rich gneiss probably contamination.	
				32m 105'	34m 111.6'	AMPHIBOLITE, schistose in part (?phyllonite). Very dark greenish-black, highly chloritic rock with minor, small, elongated pink feldspar patches - as pink feldspar content decreases the degree of schistosity increases (probably related to zone of increased shearing - dislocation metamorphism rather than tectonic shearing (?). Occasional bands up to 2-3 mm thick with scattered small pyrite grains, in more feldspathic rocks. Chlorite-rich rocks crumble easily in hand and break up on emersion in water, whereas feldspathic rocks are harder and do not break up in water.	Water table approximately 32m Samples above water table composed of loose grains; samples below caked into a friable solid block with 50-80% mud fraction. Very approximate water flow rate 5 000 gals/hr.
				34m 111.6'	38m 124.7'	CHLORITIC GNEISSIC GRANITE - no obvious foliation or banding although chloritic patches tend to be crudely elongated in a rough "preferred" direction. Pink (or brick-red) feldspars dominant mineral - possibly crushed although not distinct due to completely pervassive ?hematite staining. Very few recognisable quartz grains. Occasional isolated small grains and patches (up to 2.3mm across) of granular pyrite.	Drilled 33-44.5m 5½hrs.
				38m 124.7	40m 131.2'	PINK AND GREY GNEISS AND SCHISTOSE AMPHIBOLITE. Large chips of crudely foliated greyish and pink gneiss; quartz content greater than above, although chlorite content only slightly decreased; also occasional flakes of ?muscovite on surface of chlorite bands. Some small chips of chloritic (only) gneiss probably in proximity to amphibolite band.	
				40m 131.2'	42m 137.8'	CHLORITIC GNEISS as above and minor AMPHIBOLITE	

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	
			UNWASHED SLUDGE SAMPLES BAGGED IN 2m INTERVALS	42m 137.8'	44m 144.4'	CHLORITIC GNEISS (small chips only 1cm) - some with calcite smears on joint surfaces.	
				44m 144.4'	46m 150.9'	CHLORITIC GNEISS and a few chips of AMPHIBOLITE - chloritic and slightly schistose. One chip of pale green opalescent vein mineral - scratches with knife (not easily) no cleavage, concoidal fracture, not effervescent with 10% H_2SO_4, crystallised at right angles to vein surface. One chip of streaked dark red (?chert) and paler green ?chloritic material.	Drilled 44-88.8m 8½hrs.
				46m 150.9'	52m 170.6'	CHLORITE GNEISS. Occasional small pyrite grains and flakes of muscovite in 46-48m. Occasional smear of epidote on joint surface in 48-50m, also one chip of very weathered, limonitised, micaceous, chloritic gneiss - ?contaminant.	46-48m chips mostly 2-3mm 48-52m chips approximately 5mm
				52m 170.6'	56m 183.7'	CHLORITIC GNEISS and HORNFELSIC CHLORITIC AMPHIBOLITE Occasional chloritic gneiss chip with quartz lamellae in 52-54m - more chips with quartz lamellae in 54-56m. Amphibolite shows very little schistosity - irregularly shaped, non-tabular chips.	Chloritic gneiss chips approximately 1cm. Amphibolite chips larger >1cm.
				56m 183.7'	64m 210.0'	CHLORITIC GNEISS as above ie. some chips with crude quartz lamellae (not well defined - more of a thin band of closely spaced quartz grains). Proportion of quartz lamellae greater in 60-64m. Note: quartz content less than in top of hole, and foliation not as pronounced.	Very small chips from 58-62m. Chips richer in quartz are larger - up to 2cm
				64m 210.0'	74m 242.8'	CHLORITE (or amphibolitic) GNEISS - crudely foliated. Segregation banding, into dark grey-black hornfelsic amphibole and brick red feldspar bands; amphibolite is only very slightly chloritic, but appears slightly micaceous although not schistose. Segregation banding appears to incease downward (ie. thicker but very irregular). Occasional pyrite grains mainly in amphibole bands. Rock grades to more chloritic gneiss with some comparatively quartz-rich gneiss towards base (ratio 3:1 respectively over 72-74m).	
				74m 242.8'	80m 262.5'	AMPHIBOLITE - hornfelsic, hard, very little chlorite, dark grey in upper part. becomes more chloritic, softer and more schistose in lower part. Occasional pyrite grains in upper part.	Small chips (approximately 2mm) in upper part.

HOLE NO. P.D.D.8

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CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	
			Unwashed Sludge Samples Bagged in 2m Intervals			One large chip in 76-78m zone of igneous-looking rock - equigranular (approximately 1mm), slightly elongated ?hornblendes set in a pinkish feldspathic matrix; approximately 1% disseminated pyrite grains (some cubes but most irregular, moderately equant shape). (Also one large chip in 76-78m zone of non-schistose, chloritic, amphibolite and a few (?contaminants) chips of quartz-rich gneiss).	Larger chips in lower part up to 2cm.
				80m 262.5'	82m 269.0'	CHLORITIC GNEISS - sheared, kaolinised, weathered(?), soft and crumbly.	
				82m 269.0'	92m 301.8'	AMPHIBOLITE - grey, hornfelsic, slightly chloritic; occasional more chloritic, schistose chips. Occasional larger chips of very chloritic gneiss with indistinct foliation. Becoming more calcareous, schistose and micaceous towards base. Small calcite grains occur below 86m. Rare epidote smears in 90-92m sample. Occasional pyrite grain in upper samples.	Variable chip size, most <0.5cm and generally about 2-3mm, but some up to 1-1.5cm
				92m 301.8'	94m 308.4'	MUSCOVITE SCHIST - grey small falkes 50% of sample of rounded, globular, very white grains of amorphous substance which powders to a silty material when crushed in hand; contains minute very rounded inclusions of a very dark mineral (??) white material does not effervesce with 10% H_2SO_4 (?kaolinised feldspar).	Drilled 88.80-92.70m 2 hrs. Changed to fluid drilling Drilled 92.7-96.2m 4½hrs " 96.2-111.2m 6 hrs " 111.2-126.2m 8 hrs " 126.2-151.5m 4½ hrs " 151.5-157.5m 3 hrs " 157.5-160.5m 4½ hrs " 160.5-167.5m 4 hrs
				94m 308.4'	116m 380.6'	As above - only a few white grains from 94-96m. Muscovite schist is slightly chloritic; becomes more hornfelsic in texture and less micaceous from 108m. Occasional gneiss fragments (probably contaminant) to 112m - slightly more quartzitic gneiss fragments below 112m.	
				116m 380.6'	167.5m 550'	SCHISTOSE AMPHIBOLITE and CHLORITIC GNEISS. Amphibolite chips dominant over gneiss (which decrease from 50% of total in upper portions to about 30% of chips below 126m). Amphibolites grey and vary from schistose to non-schistose. Amphibolite chips from 158-168m contain more muscovite and quartz and are more schistose in general and slightly chloritic (?quartz-muscovite schist). Proportion of gneiss appears to decrease below 158m.	Chips all about 2mm down to 158m then increase slightly to about 3-4mm with some up to 1 cm Logged to 167.5m 31/1/73 Drilling to 167.5m completed 4/12/72 Operations continued 1/2/73 Completed running 5 inch casing to 167m 5/2/73 Rotary drilled with 4½ inch roller bit (Chips - tabular flakey shape from 2.5mm across).
			Washed Sludge Samples.	167m 547.9'	168m 551.2'	MUSCOVITE SCHIST and QUARTZ. Schist fragments mostly contamination at bottom of hole from 1972 drilling - mostly grey muscovitic schist fragments; some slightly greenish-grey (slightly chloritic) and many hornfelsic with very little muscovite or chlorite. Some pink gneiss with quartz lamellae (contamination). Quartz fragments about 15-20% of sample — many with chloritic smears and/or small grey patches.	

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HOLE NO P.D.D.8 — PARABARANA PROJECT —

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	
			Washed Sludge Sample	168m 551.2'	168.53m 552.9'	CHLORITIC QUARTZITE 90% of chips quartz, many with chloritic smears and patches. Remainder of chips grey schist and occasional pink gneiss (probably contamination).	(Note: sample actually labelled (168-170m but includes reamed (sludge sample over cored section; (sample was logged before reamed (portion put in bag. Slow pene-(tration rate - 1 day, 2 VH1 bits (for approximately 60cm.
168.53m	168.76m	23cm	23cm	168.53m 552.9'	168.76m 553.7'	CHLORITIC QUARTZITE Light whitish grey colour with short (< 1cm) discontinuous green chloritic fracture lines on surface of core, non-oriented and evenly distributed. Rock consists of brecciated quartz grains up to 1 cm across in a chloritic intergranular matrix making up approximately 5% by volume. Chloritic smears occur on core ends. Rock very hard and coherent. Chlorite-coated shear surface across core at 30° to C.A. at 168.76m. Small chlorite fractures increase in intensity towards shear from about 1.5cm away from shear.	Diamond drilled BQ core from 168.53m to 170m. Core unbroken from 168.53 to 168.76m 4½ inch roller bit from 170-196m
168.76m	169.16m	39cm	34cm	168.76m 553.7'	169.15m 554.9'	As above but numeous chlorite-coated shear surfaces and great intensity of chloritic fractures - about 15% by volume of chlorite. Chlorite-coated shear surface across core at 35° to C.A. at approximately 169m. Other chlorite shears are very irregular and are mainly broken surfaces along thin fractures.	Core very broken - many wedged - shaped fragments from 3.5 cm across. Drillers record 0.55m core recovered from 168.53-170.00m
169.15m	170.0m	85cm	10cm	169.15m 554.9'	170.0m 557.7'	CHLORITISED GRANITE - not foliated. Mottled pink and light grey colour with small green patches and streaks. Very hard and coherant. Equigranular, brecciated quartz and feldspar (pinkish to brick red) grains, 2-3mm in longest dimension, in roughly equal amounts, and interlocked with patches of dark green intergranular chlorite; chlorite content approximately 10% by volume. One chlorite-coated shear surface at approximately 10° to C.A.	Assumed wedging of chloritic quartz fragments in core barrel resulted in jamming of core and no core recovery after 169.25m.
			Washed Sludge Samples in 2m Intervals	170m 557.7'	174m 570.9'	As for core sample 169.1-169.2m (ie. just above driller's footage tag 170m). Chloritic quartz and pink feldspar granite; slightly more chloritic ?amphibole in 172-174 sample and also about 10% of sample is white amorphous grains which powder easily between fingers and have no reaction with 10% H_2SO_4 (as in 92-94m sample) - probably kaolinised feldspar. Note: granite chips strongly magnetic.	Note cored section reamed and rotary drilling continued as above. Chips average approximately 2mm
			Unwashed Sludge Samples in 2m Intervals	174m 570.9'	182m 597.1'	Chloritic HORNFELS - massive dark greenish-grey (black when wet); some chips very chloritic with flakey habit. Some chloritic quartz-feldspar granite fragments in 174-176 m bag. Below 176 m occasional chips with small pink corroded (?) feldspar grains - feldspar content increases slightly in 180-182 m sample; also some chips slightly epidotised. A few hornfels fragments with disseminated minute sulphide (probably pyrite) specks throughout. Approximately 50% of samples consist of white ?kaolinised feldspar grains as above (vein material (?)). Occasional quartz grain with hornfels material adhering. Hornfels moderately magnetic.	Hornfels chips from 1 to 3 mm, white ?feldspar grains up to 5 mm Drilled 174-188.5 m 6 hours

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS				
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	% Cu	% As ppm
			Unwashed Sludge Samples in 2m Intervals	182m 597.1'	186m 610.2'	Chloritic HORNFELS - very fine grained (<0.5mm diameter) dark greeny-grey, chloritic and slightly epidotic with numerous small brick red feldspar grains (Occasionally elongated). Very occasional white ?kaolinised feldspar lumps (1-4mm across). Very occasional quartz chips and weakly magnetic.	180m 590.5'	182m 597.1'	2m) 6.6')	205 0.05	< 3
							182m 597.1'	184m 603.7'	2m) 6.6')	206 0.08	< 3
							184m 603.7'	186m 610.2'	2m) 6.6')	207 0.49	4
				186m 610.2'	190m 623.4'	Chloritic HORNFELS - as above but slightly more flaky habit - ie. more chlorite and less feldspar. Becoming more epidotic below 188m and increase in quartz (with adhering hornfels). Also occasional whole chip composed entirely of brick red feldspar. 5-10% white kaolinised feldspar. Sulphide content increases, but still only traces. Weakly magnetic.	186m 610.2'	188m 616.8'	2m) 6.6')	208 0.08	< 3
							188m 616.8'	190m 623.4'	2m) 6.6')	209 0.04	< 3
				190m 623.4'	194m 636.5'	Chloritic HORNFELS - as above but increase in quartz, epidote and sulphide (still only minor). Sulphides form larger blebs (up to 1.5mm but most ≈1mm) in hornfels and quartz grains - mostly py, some ?cp. Occasional pink feldspar - most intimately associated with quartz. Occasional white ?kaolinised feldspar, and one chip of calcite with sulphide smear in 190-192m sample. Weakly magnetic.	190m 623.4'	192m 630.0'	2m) 6.6')	210 0.09	12
							192m 630.0'	194m 636.5'	2m) 6.6')	211 0.08	5
UNWASHED SLUDGE SAMPLES BAGGED IN 2m INTERVALS				194m 636.5'	196m 643.0'	TOP OF MINERALISED ZONE Chloritic HORNFELS - as above but marked increase in quartz and brownish-pink feldspar content to approximately 30%. Sulphide content as 190-194m but mostly cp. Also weakly magnetic.	194m 636.5'	196m 643.0'	2m) 6.6')	212 0.36	4
196m	198.2m	2.20m	2.17m	196.00m 643'	200.60m 658.1'	Felsic ?METASEDIMENT ("LEUCOMICROADAMELLITE" of N.F.M.) Light grey on dry core surface; medium to dark grey on freshly broken surface. Fine grained, generally massive, crudely banded or laminated in upper portion (?relict sedimentary structure).	196m 643'	197m 646.3'	100cm) 3.3')	726 0.55	< 3/140
						Composed mostly of white feldspar and some quartz grains (<0.5mm diameter) with interstitial very fine grained, dark grey matrix (?chlorite and/or biotite); occasional patches and rare fine lamellae of pinkish ?K-feldspar. Core generally coherent and intact except for a number of shears and fractures - numerous small fractures and micro faults give a pseudo-brecciated texture. Shear surfaces generally irregular with slickensided smears of chlorite and a blackish mineral (?biotite); sulphides also associated with shears - most shears and fractures discontinuous, and at variable angles to C.A.; also often en echeloned across micro faults; very few planar shears completely across core.	197m 646.3'	198m 649.6'	100cm) 3.3')	727 0.55	< 3/280
							Silicate Analysis Sample				
							198m 649.6'	199m 652.9'	100cm) 3.3')	728 0.60	3/140
							199m 652.9'	200m 656.2'	100cm) 3.3')	729 0.44	< 3/380
							200m 656.2'	200.60m 658.1'	60cm) 2')	730 0.45	< 3/220
						Three other minor types of vein filling in fractures and shears: 1. Thin calcite smears with occasional sulphides. A 1mm thick calcite vein at approximately 197m, 25° to C.A. and roughly at 90° to a 1-2mm thick pink K-feldspar band. (?relict sedimentary stratification) at 15-20° to C.A.					

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS				
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	% Cu	% / ppm
						2. Quartz veins with pink ?K-feldspar selvages, often with discontinuous sulphide mineralisation along centre of vein. Quartz or pink K-feldspar also occur separately. 3. White (?kaolinised feldspar) and pale yellow-green clay smears, without mineralisation, occur mainly in shear zones as at 197.9m and 198.4m Most copper sulphides occur without gangue vein minerals; but in a very fine stockwork of small discontinuous microveinlets (< 5mm long) in hairline fractures; some very finely disseminated throughout rock, and occasional irregular-shaped blebs. Sulphides mostly chalcopyrite (cp) with some pyrite (py) and trace marcasite. Sulphides average 1-2 volume %, but tend to occur mostly in the darker (non-pink) portions of the rock. cp : py ratio 5 :.1 or more in some parts. Fracture controlled : disseminated mineralisation 5:1 (or even 10:1). Cut Surface of Petrological sample: ?Relict sedimentary laminations approximately 15° to C.A. defined by wavy lamellae 1mm thick; consist of discontinuous, lensoidal pink ?K-feldspar, 2-3mm long, and separated by more-or-less continuous dark grey irregular, wavy lamellae with the thicker portions containing numerous white micro specks - ?feldspar (visible under hand lens). These lamellae are cross-cut by irregular, discontinuous fractures containing black vein material (?biotite + ?chlorite) approximately 1-5cm apart and 45-60° to C.A. and in same sense (direction) as reflict ?sedimentary structures - giving a pseudo - cross bedded effect. The thicker veins are associated with irregular blebs of pyrite poikolitically enclosing minute silicate mineral grains (including some quartz) and a few small (< 1mm diameter) equant grains of silvery ?marcasite or ?arsenopyrite. Small cp (and minor py) -filled microfractures extend at right angles and up to 1cm from the biotite/chlorite-filled fractures. Note: some of larger vein-fractures are micro faulted (displaced by up to 1cm). Remainder of cut surface: Similar to Pet. sample from beginning of core. Many biotite/chlorite-filledfractures with salmon pink K-feldspar (some with other felsic silicate minerals - mostly feldspar) along centre of vein filling. Sulphides form blebs associated with felsic silicate minerals in veins. Very occasional thin discontinuous quartz veins in biotite-chlorite fractures. A 1cm-thick py-biotite vein at 200.1m - 60° to C.A. Some fractures at 90° to C.A.					

Diamond drilling of HQ core from 196m commenced 21/2/73

Note: geological log obtained from undisturbed core in field, ie. prior to transport to Adelaide and splitting for assay

Additional notes from more detailed inspection of cut surfaces of split core, appended at end of description for each unit.

Pet. Sample P130/73 197.20 - (Adl Lab. 4064/73) 4491/73
197.40m

A00009

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS					
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	AN/73	Cu %	Au/As ppm
						Probably > 50% of mineralisation related to chlorite-biotite fractures, remainder in (or associated with) microfaults as microveinlets or blebs. Only very little truly disseminated mineralisation.						
						?Sedimentary banding near top of core with some coarser grained feldspar bands - at approximately 20° to C.A.						
						Relict ?sedimentary banding over most of unit although some parts very indistinct; mostly absent over basal 1.5m of unit.						
198.20m	201.30m	3.10m	3.03m	200.60m 658.1'	201.35m 660.6'	As above but sulphide content 3-5%. Cut section also similar. Lithological banding mostly absent, very faint in part. Note overall decrease in pink ?K-feldspar content with apparent concomitant increase in cp content and cp:py ratio. More than 75% of sulphides in grey-rock portions distinctly lacking in pink K-feldspar. cp:py 4:1. Only occasional blebs of py and mostly associated with chloritic (+?biotite)-filled fractures. Most of cp in microfaults without chlorite.	200.60m 658.1' Silicate Analysis Sample) 200.6m) 658.11) Pet. Sample P78/74 (Rep. RS 3360/74.)	201.35m 660.6'	75cm) 2.5')	731	0.90	3/200
						Note also isolated, moderately equant patches of rusty brown ?biotite, (or ?tourmaline) 2-4mm diameter and scattered throughout zone - not obviously related to mineralisation in upper part of unit apart from their marked increase in content within this zone, but are associated with py-chlorite fractures (shears) over basal 30cm.	Weighted Average: 196.0m 643.0'	201.35m 660.6'	5.35m) 17.6)	-	0.57	3
						Note: 20cm zone of relatively suphide-poor, pink K-felspar-rich rock in centre of unit.						
						Note possible streaking of cp parallel to saw cut marks giving an illusionary parallel microveinlet appearance						
201.30m	204.40m	3.10m	3.05m	201.35m 660.6'	202.13m 663.1'	FAULT CONTACT ZONE (shear zone) between greyish rock, in interval above and pinkish grey rock in interval below.	201.35m 660.6'	202.13m 663.1'	78cm) 2.6')	732	0.30	< 3/240
						Note white clay minerals on chloritised shear surfaces.						
						Contact very irregular with pink K-feldspar and quartz vein filling (5-15mm thick) occurring irregularly along contact sub-parallel or at slight angle to C.A.						
						Cut surface shows pink K-feldspar enclosing a thin granular quartz vein situated near contact with more pinkish ?sediments, (massive, even - not laminated - fine sandy texture).						
						Pink vein sub-parallel to banding in "grey" unit and offset by microfaults with throws in same sense as offset of bands in "grey" unit. Fault contact and vein filling therefore probably a very early metamorphic feature. Note: general lack of mineralisation except in grey portions.						
				202.13m 663.1ft	203.10m 666.3ft	METASEDIMENTS (?) Felsic, fine grained, pink-grey colour. Marked increase in salmon pink ?K-feldspar content, and a greater tendency towards laminations of	202.13m 663.1'	203.10m 666.3'	97cm) 3.2')	733	0.85	3/1750

A00010

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS				
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL (Au g/t)	Cu %	Mo/As ppm
						separate pink and grey bands in the order of 1cm thick. Total sulphide content not much less (ie.3-5%) than in 200.60-201.55m grey zone, although distinctly more dispersed throughout rock: mostly in finer microveinlets < 3mm long. Microfaulted pink bands in upper part of unit with throws (offsets) of up to c. 1cm. Larger chloritic shears, which cut completely across core, have throws in excess of core diameter. Note dark grey selvages to some pink bands. Cut surface: At 202.50m - chloritic shear 2-3mm wide at c. 60° to C.A. with fragments of rock 2mm diameter, enclosed in chloritic matrix. Contact zone (or shear?) at 20° to C.A. immediately below chloritic shear - between: (a) pinkish-grey rock, faintly laminated in part, and (b) salmon pink, massive (no banding) rock below. Pinkish-grey zone (a) consists of quartz grains up to 2mm diameter, very fine grained (silt-sized) black ?biotite and white ?plagioclase, with some pinkish patches and brown biotite patches; Contains 3-5% total sulphide, cp : py approximately 1:1 or slightly more cp; most of py occurs in irregular blebs associated with quartz and biotite-rich zones. Salmon-pink zone (b) below has a very fine grained (visible under hand lens) silty texture, composed of pink ?K-feldspar and white ?plagioclase grains (or crystals) but no black biotite grains; rock is cut by a stockwork of ?chlorite fractures, giving a slightly brecciated appearance; total sulphide content as for zone (a) above but cp:py>10:1 and is very finely and evenly dispersed, throughout in short hair-line veinlets. A high concentration of sulphides occurs along the contact and increases down the contact to massive blebs of pyrite with some granular ?marcasite or ?arsenopyrite and small angular black fragments (??biotite). The pyrite occurs along the grey rock side of the contact and the cp along the pink rock side. Pinkish zone continues to base of unit with wavy crenulated and microfaulted laminations becoming more obvious over basal 30cm - subparallel to C.A.					
				203.10m 666.3'	205.95m 675.7'	METASEDIMENTS (?) Similar to above. Decrease in sulphide content to 1-2% overall, but patchy distribution. Shear zone over upper 25cm (core very broken) with calcite, minor white clay and some sulphide vein filling.	203.10m 666.3'	204.55m 671.1'	(145cm) 4.8')	734	0.49	3/1950
204.40m 671.1'	207.45m 680.8'	3.05m	3.03m			?Relict sedimentary laminations as above (slightly more obvious), generally subparallel to C.A. but up to 30° to C.A. in small microfaulted blocks.	204.55m 671.1'	205.95m 675.7'	(140cm) 4.6')	735	0.37	5/860
						Micro-ptygmatic quartz vein at 203.8m with thin, black ?biotitic selvages and an outer, wider, alteration zone of salmon-pink K-feldspar. Also many brown biotite-quartz-chlorite-sulphide (+marcasite) veins and irregular patches with salmon-pink alteration envelopes - over central portion of unit (?metasomatism). Pink feldspar content higher in lower half of unit.	Weighted Average 202.13m 663.1'	205.95m 675.7'	3.32m) 12.6')	~	0.54	4/1500

HOLE NO P.D.D.8

DEPARTMENT OF MINES - SOUTH AUSTRALIA
PARABARANA PROJECT

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS				
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	Zn %	Cu %	Pb/As ppm
						Brecciated appearance finer and more pronounced towards base - chlorite fracture intensity increases to one per 5-10cm; strongl brecciated portions at base - fragments with granulated margins - sulphide-rich shear zone with abundant white clay and calcite in very irregular fractures.						
				205.95m 675.7ft	206.07m 676.1ft	CHLORITIC HORNFELS. Soft, dark grey metasiltstone, chlorite/biotite(?) and quartz rich, crudely laminated black and pale pinkish grey but contorted and irregular, ≥ 5% sulphides, cp:py approximately 5:1, irregular, elongated blebs intermixed with sediment. Moderate calcite veining.	205.95m 675.7'	206.07m 676.1'	12cm) 0.4')	736	1.75	25/200
						Basal contact with underlying pink felsic rock sharp, irregular surface, brecciated (?fault contact). Note contact partly concordant and partly discordant - possibly disrupted by diagenetic compaction of two different sediment types with different competencies. Upper contact probably similar, although indistinct as core badly broken.						
				206.07m 676.1ft	207.12m 679.5ft.	METASEDIMENTS as above 205.95m. Mainly pinkish and brecciated, etc. with occasional fault-contacted greyer zones (not richer in sulphides). Slight increase in sulphide content to about 2% over basal 30-40cm.	206.08m 676.1'	206.77m 678.4'	70cm) 2.3')	737	0.43	25/170
						Note: pinkish bandes and patches may have been tuffaceous components. It also appears that the amount of pink component and sulphides are inversely proportional.	206.77m 678.4'	207.12m 679.5'	35cm) 1.1')	738	0.55	10/350
							Weighted Average:					
				207.12m 679.5'	207.45m 680.6'	MASSIVE SULPHIDES - mostly cp and some ?marcasite. Sulphides are zoned: granular marcasite and quartz blebs (10-20% of marcasite zone) are rimmed with annealed massive cp. In Pet. Sample, a large bleb 2 x 6cm at upper contact, has core of cp (7mm diameter) surrounded by 5mm-wide zone of marcasite-quartz, and a thin outer rim of massive cp. Some small brecciated fragments of country rock in massive sulphide zone.	196m 643'	207.12m 679.5'	11.12m) - 36.5')		0.55	/666
							207.12m 679.5'	207.45m 680.6'	33cm) 1.1')	739	12.0	3/65
							Pet. Sample P240/73 207.21-207.30m					
						Upper contact is extremely irregular with "flame structures" and large blebs of massive sulphides extruded into overlying felsic metasediments. Lower contact is sharp and roughly planar, at c. 30° to C.A., and with thin chlorite selvage - probably a fault contact. Lower contact also microfaulted with chlorite in faults - at 90° to C.A.						
207.45m	210.48m	3.03m	3.07m	207.45m 680.6'	208.27m 683.3'	LAMINATED METASEDIMENTS (?). Compositional banding of dark greenish-grey chloritic laminae with fine grained white feldspar and quartz (laminae up to 1cm thick) and pale pink laminae up to 2cm thick - of pink K-feldspar, white feldspar and quartz grains and very minor, chlorite (or ?biotite). Pink component minor compared with zone above massive sulphide band. Most pink bands have dark greenish-black selvages approximately 2mm thick. Banding 20° to C.A., laminae very crenulated due mainly to small offsets (throws) on numerous microfaults at 60° to banding and approximately 40° to C.A. One fault 15cm from top with a throw of	Silicate Analysis Sample) 207.45m 680.6'	208.27m 683.3'	82cm) 2.7')	740	0.55	5/45
							207.6m Pet. Sample P 79/74					

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS					
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	Ag g/t	Cu %	Au/As ppm
						c. 3cm. Laminations become less obvious towards base, pink feldspar content decreases slightly and epidote increases. Top 20cm - sulphides (mostly cp) in chlorite-biotite fractures and microfaults. Sulphide content increases in 207.65-207.90m zone to >2%. (Note no pink components or epidote.) Dark selvages to pink bands increase from <1mm. in upper 20cm zone to 3mm in central zone; also dark green chloritic vein filling with black ?biotite selvages; also calcite in some veins - one with abundant salmon pink alteration streaks and blebs. Below 207.90m total sulphide content <1%, rock very contorted and breaks along uneven fracture surfaces with white clay coatings. Note: crudely banded and blotchy epidote bands with associated blotchy disseminated sulphides. (Note: less sulphides where epidote occurs - ie. originally more carbonate rich sediments)						
				208.27m 683.3'	208.65m 684.5'	CHLORITIC METASEDIMENTS (?) - grades from overlying unit. Dark greenish-grey, very contorted (turbid-looking). Strong copper mineralisation (> 1.5% Cu) as numerous sulphide blebs (up to 5mm diameter) and streaks of cp and some marcasite in coarse grained quartz and fine grained ?feldspar veins with occasional blebs of black biotite; veins interconnecting and very irregular with main veins subparallel to C.A. Note no pink K-feldspar alteration or bands. Basal contact more abrupt - gradational over 2-3cm.	Silicate Analysis Sample) 208.27m 683.3' 208.4m	208.65m 684.5' Pet. Sample P80/74	38cm) 1.2')	741	1.75	5/45
				208.65m 684.5'	210.55m 690.8'	LAMINATED METASEDIMENTS - Similar in composition and texture to 207.45-208.27m but laminations more distinct; also epidotic and pink bands stronger than above 207.90m Some dark grey laminae up to 3cm thick, very fine grained with very little felsic minerals and slightly less disseminated mineralisation than in chloritic, slightly coarser grained bands. Virtually no mineralisation in pink K-feldspar laminae. Zone 208.65-209.33m shows sharp compositional changes in a lateral direction along some laminae and across several laminae together (typical in Pet. Sample P132 - a pink K-feldspar laminae, interlaminated between two grey laminae, changes abruptly to a grey laminae). No fractures or microfaults apparent along compositional breaks therefore probably due to penecontemporaneous slumping and/or facies changes or diagenetic adjustments within sediments. Note blotchy greenish epidote-feldspar bands between pink feldspar bands. Banding varies from 8-10° to C.A. to approximately 25-30° just above break (fault) in unit at 209.33m - fault at 70° to C.A. and strike of banding below at 20° to C.A. and ratated c.25° anticlockwise w.r.t. banding above fault. 209.33-209.56m zone mostly laminated grey fine grained sediments with thin, pink, K-feldspar laminae - true thickness of grey zone c. 8cm. Pink feldspar content decreases below (note increase in Cu content) 209.56m - c.f. above 209.33m and banding less distinct. Sulphide content <1% in upper part of unit - mostly cp and occasional py and marcasite grains; sharp increase to approximately 1.5% sulphides in greyish zone	Silicate Analysis Sample) 208.65m 684.5' 209.20m 686.3' 209.56m 687.5' Pet. Sample P13/73 208.87-209.04m	209.20m 686.3' 209.56m 687.5' 210.55m 690.8'	55cm) 1.8') 36cm) 1.2') 99cm) 3.3')	1422 742 743 744	0.38 0.55 0.75	5/40 18/45 5/10

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS				
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	Ag gm/t	Cu %	Mo/As ppm
						immediately below fault at 209.33m and patches of stronger mineralisation below 209.56m. Cut Sections: Pet. Sample P132 shows typical abrupt compositional changes along laminae. Numerous, thin, dark ?biotite veins (in fractures and microfaults) and occasional veins of pink feldspar and rare quartz. Sulphides mostly in biotite-chlorite veins, but very poor. Note thin calcite vein across core of constant thickness (c. 1mm) but irregular, wavy surface - cuts across banding. Note milky white vein quartz in very irregular-shaped blotches immediately above fault contact at 209.33m. Sulphides in more greyish zone below fault mainly in very fine grained quartz-biotite-feldspar veins. Some greyish bands between pink feldspar bands have a streaked, very finely laminated (c. 1mm thick) appearance similar to rock at beginning of cored section. A few equant, irregular blebs of pyrite, c. 2mm diameter, scattered over cut surface in 209.45-209.55m zone.						
210.48m	213.60m	3.12m	3.08m			Below 209.56 m patches of strong disseminated sulphides in, or associated with, biotite-quartz-feldspar (pink and white) veins; brighter red feldspars associated with some vein quartz more abundant from 210.15-210.40m. Several faults and calcite-filled fractures (of irregular surface but constant vein thickness) at c. 80° to C.A..						
				210.55m 690,8'	211.25m 693.1'	BRECCIATED METASEDIMENTS - Very contorted, brecciated mass of greyish rock with > 10% sulphides - mostly- blebs of cp with small brecciated fragments of black ?biotitic material throughout some blebs, or streaked out close to margins of blebs; some py associated with quartz grains. Moderately sharp upper contact. White quartz blow over basal 22cm in sharp fault contact (irregular surface) with crudely laminated sediments - banding parallel to C.A. near contact but curves to c. 10° to C.A. at top of unit below; cp blebs within quartz blow and cp and py blebs on parts of margins of quartz blow. Strongest mineralisation over central 30cm. (Note:contorted texture possibly result of penecontemporaneous slumping or movements.)	210.55m 690,8' Weighted Average: 207.12m 679.5'	211.25m 693.1'	70cm) 2.3') 4.13m) 13.6')	745 - -	3.6 2.12	10/25 /34
				211.25m 693.1'	213.29m 699.8'	LAMINATED METASEDIMENTS - Crudely laminated and broadly curved, approximately 15° to C.A.; distinct between 212.20-212.40m. Note pink component increases in lower half of unit with concomitant decrease in sulphide content. Calcite vein 3mm thick at c. 212.40m. Sulphide content approximately 1%, mostly cp in microveinlets, many with black biotite, and most at 90° to banding. Abundant microfaulting.	211.25m 693.1' 212.29m 696.5'	212.29m 696.5' 213.29m 699.8'	104cm) 3.4') 100cm) 3.3')	746 747	0.55 0.40	5/20 15/ 10

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS					
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	Au gm/t	Cu %	Mo/As ppm
						At least 4 calcite and white clay-filled shears with minor pink smears and sulphides - at 35-40° to C.A.						
213.60m	216.70m	3.10m	3.06m	213.29m 699.8'	213.88m 701.7'	BRECCIATED METASEDIMENTS - similar to zone at 210.55m Highly contorted (turbid-looking) dark grey; >10% total sulphides cp:py 2;1 associated with quartz-biotite filled fractures and shears b ut also disseminated in blebs throughout dark grey, very fine grained, ?biotite-rich sediment. Note marked absence of pink K-feldspar and high sulphide content.	213.29m 699.8'	213.88m 701.7'	59cm) 1.9')	748	3.0	5/90
							Weighted Average:					
							207.12m 679.5'	213.88m 701.7'	6.76m) 22.2')	-	1.70	/33
				213.88m 701.7'	216.50m 710.3'	LAMINATED METASEDIMENTS - crudely laminated as for zone between two sulphide-rich contorted zones. Sulphides 1.5-2%.	213.88m 701.7'	215.00m 705.4'	112cm) 3.7')	749	0.75	10/10
							Silicate Analysis sample)					
216.70m	219.73m	3.03m	2.98m			Upper 30cm moderately contorted; banding varies from 40° to C.A. in gradation zone from contorted to laminated zones through c.20° at approximately 214.4m 25° at approximately 214.9m, 30-35° and wavy just below 3mm calcite vein (30° to C.A.) at 215.05m, slightly contorted zone at c. 215.9m, to regularly laminated sediments at 25° to C.A. over basal 40cm; note zone of faulting and rotation of banding just above calcite vein. Microfaulting strong: also zones of well crenulated laminae.	215.00m 705.4'	216.50m 710.3'	150cm) 4.9')	750	0.55	5/<10
							Pet. Sample P132/73 and P133/73					
							214.48m-214.67m					
						Mineralisation stronger in upper 30cm than in zone from 214.20-215m, but stronger (>2% sulphides) from 215.0-215.5m, then decreases to about 1% in basal metre. Note: can not relate variation in sulphide contact here to variation in pink content as pink content appears fairly uniform over whole unit. Mineralisation associated with black ?biotitic-?chloritic patches and veins in shears and fractures; py mostly associated with biotite-quartz (or feldspar) shear fillings (also clear quartz veins with pink K-feldspar selvages and cavity linings); cp mainly in small microfractures at 90° to major shears which sub-parallel laminations in upper 30cm but cut across core in next 30cm.						
						Note: soft, deep purplish-red vein mineral, streaked out along ?chlorite-feldspar vein, and black ?biotitic material at c.215.90m in slightly contorted zone.						
						Note also pink alteration halos at intersection of thin white veins with chlorite-biotite fractures.						
				216.50m 710.3'	219.68m 720.7'	VOLCANICS - (?) ACID FLOW ROCKS ("LEUCOMICROADAMELLITE" of N.F.M.) Massive, pink grey rock - extremely contorted crude laminations over upper 30cm at 30° to C.A. - rest very brecciated and microfaulted. Note fault contact approximately 10cm from top - with overlying well-laminated zone. Crudely laminated zones - may be highly tuffaceous sediments as at 202.13 - 207.12m zone.	216.50m 710.3'	217.50m 713.6'	100cm) 3.3')	751	0.29	25/<10
							217.50m 713.6'	218.50m 716.9'	100cm) 3.3')	752	0.65	25/50
							Silicate Analysis A1423/73)					
						Mineralisation generally sparce, sulphides <1% overall - mostly cp in darker bands and thin laminae - very little in pink feldspar zones. Zones of stronger mineralisation over basal 52cm.	218.50m 716.9'	219.16m 719.0'	66cm) 2.2')	753	0.14	10/10
							Silicate Analysis Sample)					

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS					
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	Ag oz/ton	Cu %	Mo/As ppm
						Cut Surfaces:	219.16m 719.0'	219.68m 720.7'	52cm) 1.7')	754	2.1	22/55
						216.50-217.90m. Sulphide content approximately 1%, cp:py c. 2:1, cp in short minute micro-fractures, py in blebs; pink K-feldspar alteration along quartz-filled fractures; calcite veins at 90° to C.A.						
						217.93m : 7cm ?shear zone with c.5% cp in a crudely banded dark grey quartz-rich chloritic hornfelsic ?metasediment with very fine grained biotite; shear contacts at top and base at 90° to C.A.						
						218.0-219.16m: Massive salmon pink rock, barren of sulphides -< 0.5%. Slickensided shears with a 2cm-wide zone above each shear of whitish feldspar and minor chlorite mixture at approximately 218.7m - 55° to C.A. and 219.0m-85° to C.A.; rock more micro faulted and contorted below lower shear. 219.16-219.68m: rock as above but distinctly brecciated as at 205.50m; strong cp in a fine microstockwork of fractures, some also with black biotite; several calcite fractures across core, faint foliation in upper portion at 45° to C.A. Note strong brecciation result of being near major shear zone at base of unit - cp mobilised into fractures from massive sulphide zone below.	Pet. Sample P662/73 218.32m					
				219.68m 720.7'	220.34m 722.9'	SULPHIDE-RICH HORNFELS(?). Massive sulphides, mostly cp over upper 5cm (approximately only as core very broken). Rock below 219.73m dark-grey ?metasiltstone or hornfels - moderately massive (core intact), although cut surface shows very faint banding (lamination) at 35° to C.A. at top to 45° at massive sulphide zone at 220.10m. Laminae of microspeckled (silty texture), black and whitish minerals, and generally thicker bands (up to 15mm) of almost aphanitic texture and drab olive-green colour. Note unit not sheared as similar rock below 220.34m.	219.68m 720.7'	220.34m 722.9'	66cm) 2.2')	755	7.0	1500/540
219.73m	221.06m	1.33m	1.30m				Silicate Analysis Sample) *AAS values approximate in this range					
						Sulphide content increases notably from just below massive sulphide band at top to an almost massive sulphide band from approximately 220.10-220.20m (7cm true thickness) and concordant with ?sedimentary banding.	Pet. Sample P241/73 220.07m	220.09m				
						Note: Pet. Sample P241 cut across massive sulphide band at 35° to C.A. and approximately 90° to banded structure.						
						Sulphides occur in irregular elongated blebs controlled by microfractures, occasionally filled with calcite.						
						Note:: Cube of ?marcasite or ?arsenopyrite of 1mm side, near (?5cm) base. ?Fault gouge zone at base, 2cm wide, concordant with ?sedimentary banding at 45° to C.A., composed of black clay with shiny slickensided (?graphitic or ?molybdenitic) upper and lower contacts. 2cm-wide zone above ?fault gouge zone with large irregular blebs of py and minor smaller blebs of cp elongated along ?bedding planes.	220.32m (See AMDEL Rpt. MP2461/74 for XRU examination)	220.34m	2cm	A1433	-	2.0% MO
221.06m	222.25m	1.19m	1.12m	220.34m 722.9'	223.18m 732.2'	CHLORITIC HORNFELS or ?METASILTSTONE. Dark green-grey, very broken (sheared) rock; some zones of 10cm or so of less broken more massive hornfels as above. Sulphide content decreases rapidly towards base.	220.34m 722.9'	221.06m 725.3'	72cm) 2.4')	756	1.25	240/100

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS				
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	Au gm/t	Cu %	Zn / As ppm
222.25m	223.70m	1.45m	1.41m			Cut sections: 220.34-221.06m : rock similar to sulphide-rich hornfels above but sulphide content considerably less although still substantial (> 5%), and more finely laminated - at 45° to C.A.; cp as lenses and veinlets in chloritic fractures or shears and quartz-rich segregations; py as hair-line veins in calcite and clay-filled fractures; rock well sheared with abundant chlorite and whitish-pale green clay throughout. 221.06-221.95m : rock as above but marked decrease in sulphide content to about 1-2%; cp and minor py blebs associated with quartz-rich segregations as above, (quite marked in 10cm cut section at 221.46m); cp also mobilised into chloritic fractures cutting patches of quartz-rich segregations; note brick red smears on chlorite and clay fractures - stronger where calcite occurs over basal 20cm. 221.95-223.18m : rare suphides - only small blebs in quartz-rich segregations. Note cut section at 222.18m (7cm long) with deep brick-red soft patches associated with drab greenish, very fine grained ?epidotised ?feldspathic patches; no obvious banding as above; also a salmon-pink ?K-feldspar vein with elongated whitish mineral in centre - not calcite (no reaction with HCl) although calcite veins in close proximity to similar and thicker pink veins over 20cm zone immediately below. Rock below becomes very veined with grey-greenish, soft material and more salmon-pink blebs over basal 20cm.	221.06m 725.3'	221.95m 728.2'	89cm) 2.9')	757	0.40	950/20
							221.95m 728.2'	223.18m 732.2'	123cm) 4ft)	758	0.15	240/60
							Weighted Average:					
							207.12m 679.5'	221.06m 725.3'	13.94m) - 45.8')		1.49	93/56
							Pet. Sample P234/73 221.18m - 222.25m					
							Weighted Average:					
							196.00m 543.0'	221.95m 728.2'	25.95m) - 85.1')		1.05	89/316
						BASE OF MINERALISED ZONE						
223.70m	226.24m	2.54m	2.48m	223.18m 732.2'	223.98m 734.8'	CALC-SILICATE ROCK (?HORNFELS) ("Altered Microadamellite" of N.F.M.) Calcareous epidote-chlorite-feldspar rock. Similar to footwall rocks below 225.58m. Mottled pale green, dark grey green and white colour. Mostly pale green epidote (?epidotised feldspar) and some white calcite patches, and veins with sub-ordinate patches and occasional veins of pale salmon pink K-feldspar and very intermixed dark green chloritic material. Unmineralised. Irregular basal contact at 223.95m (ie. actually 3cm from base of unit as sampled for assaying) with underlying dark grey hornfels as above. 6cm zone above contact of very contorted, brecciated greyish rock probably containing mostly sheared grey hornfels material mixed with minor calcsilicate material from above. (See Pet. Sample P236 taken over contact zone).	223.18m	223.98m	80cm)	759	0.04	5/< 10
							Pet. Sample P235/73 at 223.83m					
							Pet. Sample P236/73 223.83-223.98m					
				223.98m 734.8'	225.58m 740.1'	CHLORITIC HORNFELS or ?METASEDIMENT - Similar to rock above 223.18m with more salmon-pink K-feldspar patches (surrounded by drab green, soft, translucent ?epidote) and ptygmatic veins (also displaced by microfaults). Calcareous patches increase towards base where large, white intermixed and contorted calcite patches form approximately 50% of rock over basal 20cm - sharp upper contact where thin (5mm) band of sulphides at 55° to C.A. (parallel to contact), in grey hornfels.	223.98m 734.8'	224.86m 737.8'	88cm) 2.9')	760	0.06	5/15

HOLE NO P.D.D.8

DEPARTMENT OF MINES - SOUTH AUSTRALIA

PROJECT PARARARANA

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS				
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	Au g/t	Cu %	Au ppm
				225.58m 740.1'	238.33m 765.5'	Chloritic CALC-SILICATE ROCK (?HORNFELS)("Altered Microadamellite" of N.P.M.) Chloritic epidote-feldspar rock. Mottled pink and pale greyish-green. Unmineralised. Brecciated 3cm-long calcite lenses from 226.23-226.43m (20cm zone); moderate calcite veining over rest of core.						
226.24m 228.65m 231.75m	228.65m 231.75m 234.75m	2.41m 3.10m 3.00m	2.32m 2.99m 2.98m			Strong pink colour - approximately 50% pink feldspar - with pale green epidote and minor dark green chlorite down to 229.00m where pink K-feldspar content decreases to approximately 30-40% over portion below to 229.69m then generally <10% - ie. mostly epidote - a pale green colour. Chlorite content increases gradually from about 231.40m with a slight decrease in epidote and pink K-feldspar (approximately 20%) - rock has a blotchy dark green, pale green and salmon-pink appearance. Chloritic shears, approximately one per 10-15cm at 50° to C.A. and generally in same sense (ie. parallel to each other over a coherent section of core). Calcite veins and blotches approximately 1/30cm.						
				233.33m 765.5'	234.37m 768.9'	CALC-SILICATE ROCK. Very pale green and pinkish brecciated epidote-feldspar with very little chlorite. Upper contact on calcite vein-filled shear at 25° to C.A. Occasional brecciated fragment and shear of green chloritic material; larger fragments appear to be result of shearing but also with smaller (<1cm) siliceous cherty, angular fragments; whole section appears moderately cherty(?).						
234.75m 236.95m 238.60m	236.95m 238.60m 241.60m	2.20m 1.65m 3.00m	2.16m 1.64m 2.85m	234.37m 768.9'	239.95m 787.2'	Chloritic CALC-SILICATE ROCK - Similar to above, but becomes considerably more chloritic (darker green), banded and brecciated. Crude banding moderately prevalent over most of interval, becoming more pronounced over basal few metres - at 55°-60° to C.A. Fragments and bands of dark grey-black, very fine grained hornfels (?metasediment) increase towards base, especially over basal 40cm - contain moderate, very finely disseminated py with very occasional cp smear; fragments and bands usually associated with irregular blebs of calcite up to 2-3cmx1cm, with occasional py grain. Only a few grains and smears of pyrite noted on very occasional shear and fracture surfaces.	Pet. Sample P237/73 237.50m - 237.55m 237.14m	238.55m	1.41m	1421		
							Silicate Analysis Sample				
				239.95m 787.2'	241.50m 792.3'	Dark grey HORNFELS or METASEDIMENT - very fine grained, massive, with abundant irregular veining of calcite. Moderate (<1%) very finely disseminated py throughout with occasional belbs and smears of cp. Faint micaceous banding (laminae) parallel to calcite veins at 30° to C.A.	Pet. Sample P238/73 240.45m - 240.50m					
241.60m	243.10m	1.50m	1.48m	241.50m 792.3'	244.00m 800.50'	Chloritic CALC-SILICATES - similar to above 239.95m although slightly more sulphides including traces of cp smears - mostly associated with dark grey calcitic hornfels material and more specifically with the micaceous material in the hornfels. Scattered sulphide grains - mostly py with trace cp also occur inside cavities in calcite veins. From 242.76-243.38m: very little epidote (except from 242.90-243.0m) - mostly crudely ~~banded (contorted and microfaulted) pink K-feldspar and dark green-grey~~						

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	
						chloritic, fine grained material; trace mineralisation - mostly py grains with some cp blebs - generally associated with calcite blebs. From 243.38-244.00m: texture and fabric as above - but all pink K-feldspar replaced by epidote; contorted bands in part, strongly sheared and calcareous over basal 10cm just above contact.	
				244.00m 800.5'	244.11m 800.9'	Dark grey HORNFELS - upper and lower contacts parallel at approximately 50-55° to C.A. Slightly epidotic at top but sheared brecciated and very chloritic (noepidote) over central portion.	
243.10m 243.90m	243.90m 247.00m	0.80m 3.10m	0.80m 3.07m				
				244.11m 800.9'	245.13m 804.2'	Strongly chloritic CALC-SILICATES - slightly epidotic with occasional blotchy patches of pinkish feldspar up to several cm wide. Trace disseminated sulphides-mostly py, possible very occasional speck of cp - mostly associated with abundant calcite veining (mostly on margins of vein), and some very finely disseminated sulphides in rock not apparently associated with calcite veins; veins irregular, contorted, discontinuous and at various angles to C.A.	
				245.13m 804.2'	245.55m 805.6'	Massive CHLORITE-BIOTITE ROCK - dark green, strong irregular fractures filled with calcite and slickensided at steep angle to C.A. No mineralisation. Only occasional very small pink K-feldspar patch.	
				245.55m 805.6'	246.75m 809.3'	Chloritic CALC-SILICATES as for zone above 245.13m but becoming progressively more enriched in brick red feldspar patches towards base. Only slight amountof epidote except for a 10cm zone from 245.78-246.88m of epidote-chlorite rock (no pink feldspar) - slightly gradational upper contacts (over 1-2cm) and sharp, chloritic, slickensided shear contact at base at 35-40° to C.A. Only occasional sulphide specks in upper portions but more in lower feldspar-rich portions. Core broken over basal 60cm.	
247.00m	249.95m	2.95m	2.85m	246.75m 809.5'	247.10m 810.7'	Pink CALC-SILICATES. 90% pink to brick red K-feldspar with green chlorite in irregular patches and streaks and with abundant, discontinuous and irregular calcite veinlets.	
				247.10m 810.7'	250.80m 824.0'	Strongly chloritic CALC-SILICATES - as above 246.75m. Rapid decrease in pink feldspars with more abundant epidotic patches. Rock appears mostly very churned up, becoming crudely banded below approximately 248.75m at 20° to C.A. Crude laminae with very contorted margins - brick red feldspar and/or green epidote in same band, in very dark greenish-grey chloritic hornfels. No mineralisation. Core quite broken to 249.95m - below very little epidote and banding very indistinct or absent; also less pink K-feldspar - core a dark grey-green colour. Numerous discontinuous microveinlets of calcite. One calcite-filled shear at 250.43m at 35° to C.A. - cuts across top of 10cm (true thickness) band of chloritic quartz dipping at 50° to C.A. - "strike" at 90° to calcite	
249.95m	253.00m	3.05m	3.03m				

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	
						shear. 7cm zone immediately above quartz with more abundant red streaks. Another quartz band at base - 4cm thick - and 10cm below above quartz band.	
				250.80m 822.8'	251.15m 824.0'	Grey HORNFELS - no pink feldspars. Abundant calcite blebs and bands. Core very broken. Note brecciated (sheared) 50cm zone at base with pink feldspar and fragments of dark grey hornfels in a calcitic matrix.	
				251.15m 824.0'	252.80m 893.4'	Chloritic CALC-SILICATES - similar to above quartz bands but with irregular zones of up to 10cm thick quartz-rich patches. Very littleor no epidote. Banding very indistinct or absent. Note quartz-rich zone from 252.12-252.25m with associated abundant pink K-feldspar.	
				252.80m 893.9'	265.20m 870.1'	Strongly?chloritic CALC-SILICATES - Crudely banded, very?chloritic epidote and pink K-feldspar rock - bands thicker than above - up to 2cm thick - and very indistinct in part. Content of pink feldspar and epidote varies. Unmineralised except for odd speck of py. Calcite shears and microveins throughout. 1cm thick calcite veins at 90° to C.A. at 259.0m, 259.17m and 259.56m. Banding at 255.00 - 255.24m - 55° to C.A., 255.90m - 40°, 260.40m - 25°, 264.60m - 35°, 264.90m - 60°, (shear at 264.80m). Note (a) epidote veining quite strong, especially at approximately 261m, and (b) epidote generally rims pink K-feldspar in crude bands (epidote replaces K-feldspar?).	Pet. Sample P239/73 259.90m - 259.94m
253.00m	255.95m	2.95m	2.94m				258.90 260.94 2.04m 1421
255.95m	259.05m	3.10m	3.04m				Silicate Analysis Sample
259.05m	262.15m	3.10m	3.01m				
262.15m	265.20m	3.05m	3.03m				
						END OF HOLE 265.20m (870 feet)	All casing recovered.
196m	265.2m	69.20m	67.97m				
Total % core recovery = 98.22%							
196m	223.18m	27.18m	26.78m				
% core recovery over mineralised zone = 98.52%							

Sample P78/74; T.S. 32253

B00002

Location: DD 8 200.6 metres

This sample was collected from a depth close to that of sample P130/73 which was described as a gneissic hornfels probably of sedimentary origin. This sample is somewhat different from that rock although the description as a hornfels of probable sedimentary origin holds for this rock also.

Most of the rock in fact consists of a very fine grained aggregate of sericitic material which is dense, compact and homogenous and retains no structures from the original rock from which it was derived. In this sericitic material are numerous crystals of quartz which range in size from about 0.02 mm to about 0.5 mm. Some of the larger of the quartz grains appear to be of secondary origin and probably represent the vein quartz introduced into the sample. In many parts of the thin section however there is an even scattering of relatively small quartz crystals which could be relicts of clastic grains. The rock shows no evident banding in thin section and cannot therefore be described in any way as being gneissic.

The rock has been veined largely by chlorite-bearing veinlets which have an irregular and discontinuous distribution through the sample. Some patches of chlorite are more than 1 mm in diameter and opaques and quartz are associated with this chlorite and it is clear that these minerals have been introduced into the rock. As mentioned above there are patches of coarse grained quartz which also appears to represent introduced vein material. The sample also contains piedmontite which is clearly associated with the chlorite-bearing veins. In one place in the thin section opaque minerals are associated with this piedmontite.

In summary therefore, this rock consists apparently of relicts of detrital quartz grains in an abundant sericitic groundmass which probably represents at least in part a recrystallized argillaceous matrix. Chlorite, piedmontite and quartz have all been introduced during a period in which the rock was intensely brecciated. Opaque minerals are commonly associated with chlorite and quartz in the wider veins intersected in the thin section.

Sample P79/74; T.S. 32254

Location: DD 8 207.6 metres

This sample is similar in some respects to P130/73 and it appears that it is a metasedimentary rock which now consists of quartz, ? potassium feldspar and biotite. The description of P130/73 in report MP 4064/73 fits the present specimen well and the reader is referred to this description.

The relative proportions of biotite, quartz and feldspar vary somewhat in the sample and in some parts of the rock biotite occupies at least 50% of the thin section. In other parts of the area the biotite probably represents no more than about 10% of the volume of the rock. Opaques are widely distributed throughout the sample but there are a few veins in which opaques are concentrated as well as some completely barren veins (or shear planes).

Sample P80/74; T.S. 32255

Location: DD 8 208.4 metres

This rock is similar to the hornfels types of rock described in earlier petrographic work on the Parabarana prospect. The rock consists essentially of granular quartz and biotite with minor amounts of feldspar and chlorite in veins. Throughout most of the rock the biotite occupies 30 - 50% of the thin section and has a grain size in the order of0.1 mm. Generally the biotite forms a continuous network throughout the sample and the felsic minerals occupy the irregularly shaped spaces between the biotite. The sample is permeated by introduced chlorite most of which is clearly associated with irregular veinlets.

One vein is notably wider than most in the thin sections and has well developed comb-structure and consists of both chlorite and quartz. The opaque minerals are clearly spatially associated with this relatively broad vein and it seems likely that all the chlorite and opaques and most of the quartz in the rock have been introduced during a period of brecciation and veining.

The original rock was probably a relatively basic and aluminous sediment and it has undergone moderate grade metamorphism which has resulted in the development of biotite.

Sample: P662/73 TS 31614 PS 21594

Location: DDH8 218.32 m

Rock Name: Chlorite-feldspar rock

Hand Specimen: A massive reddish siliceous rock which has been extensively fractured. The fractures are now sealed with ?chlorite and chalcopyrite.

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

	%
Quartz, Feldspar	85-90
Chlorite	10
Opaques	2
Siderite	Tr-1
Sphene	Tr
Apatite	Tr

The rock contains scattered, broken and partly granulated larger feldspar grains, 0.2-0.5mm in diameter, surrounded by a "groundmass" of finer grained quartz, feldspar and minor chlorite. Pale green chlorite, with subordinate opaques, also occurs in veinlets and irregular small patches up to 0.4 mm in diameter.

The greater part of the rock is fine grained, 0.02-0.1 mm in diameter giving the effect of an interlocking 'jigsaw' mosaic. The proportion of quartz to feldspar is indeterminate because of the pervasive turbidity. However, feldspar is dominant and there is very little quartz.

Both albite and microcline twinning are present but many feldspar grains are untwinned. Staining with sodium cobaltinitrite shows the feldspar to be largely K-feldspar. The larger grains also have irregular boundaries with some apparent change in composition at the boundaries of some of the grains.

The chlorite is of two varieties- with anomalous blue and with anomalous brown interference colours respectively. In places it appears isotropic. It occurs interstitially within the feldspar mosaic and in veinlets. The veinlets have irregular boundaries and may be 1-3 mm long and up to 0.2 mm wide. Opaques are associated with the chlorite along many small veins.

Accessory minerals include siderite, in one vein, granular sphene, which is disseminated and also occurs in the veins with chlorite, and apatite, which occurs as small, stumpy crystals. A small group of apparently relict sedimentary (well rounded) zircons are embedded in one grain of feldspar.

Polished Section:

The dominant opaque mineral is chalcopyrite. In addition there is a trace of sphalerite and a minute trace of either arsenopyrite or marcasite, probably the latter.

The chalcopyrite occurs as disseminated irregular grains up to 0.3 mm in diameter. It also occurs discontinuously along some fractures where it is associated with a little sphalerite and transparent minerals as indicated in the thin section description. Marcasite (or arsenopyrite) occurs as porous elongate aggregates, showing relict lamellar texture suggesting that it has replaced pyrrhotite. Some of this is veined by chalcopyrite.

Comment

The general appearance in thin section shows that the rock was recrystallised and later was extensively fractured, but not otherwise deformed. These fractures have acted as channelways for copper, iron and minor zinc sulphides, and also contain chlorite and secondary titanium minerals, these latter may be a result of lateral secretion. The rock may have been an acid volcanic but other possibilities cannot be eliminated.

Textural relationships indicate that the chalcopyrite crystallised late in the history of the rock - after the phase of extensive fracturing.

Sample P130/73: TS 30323: PS 20721

Location:
DDH 197.20-197.44.

Rock Name:
Gneissic hornfels.

Hand Specimen:
A dark grey and dark red rock with an ill defined banding. The rock is cut by abundant veins, many of which contain chalcopyrite.

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

	%
Quartz) Feldspar)	55-65
Biotite	5-10
Muscovite	10-15
Opaques	5-8
Chlorite	10
Tourmaline (orange brown)	1

This metamorphic rock is relatively simple mineralogically, consisting of feldspar, quartz and phyllosilicate minerals. Though the rock shows well defined banding this appears to reflect original sedimentary features rather than a metamorphic event and the rock was probably once a siltstone. It contains abundant mica but the texture is not schistose although some tendency for parallelism of the mica flakes is evident.

Quartz and feldspar occur as aggregates of equant/sub-equant grains and fine grained mica fills the interareas. Both quartz and feldspar are abundant, with feldspar probably dominant. Some grains show twinning (either microcline or albite type) but the large majority do not. Many grains of feldspar are turbid and brown, possibly due to incipient alteration (?weathered). Others, however, are colourless and unaltered. Quartz and feldspar grain size is commonly in the range 0.05 to 0.15 mm. There is abundant fine grained sericite and pale brown, partly altered biotite. Biotite forms larger, irregular grains than the sericite and is up to 0.1 mm. In addition to the sericite which forms elongate aggregates, coarser general flakes of muscovite are present. Traces of orange brown (uniaxial) tourmaline occur sporadically through the rock which also contains granular opaques which are not obviously related to later veining.

The rock has been fractured, with penetration of the fractures by veins of chlorite and opaques. The fracturing has produced minor offsets in the banding of the rock and there appears to have been some granulation and recrystallisation in the vicinity of the veins. The chlorite is pale green and of two varieties, (a) with green-brown to grey interference colours, (b) with anomalous blue and purple interference colours. The chlorite is well crystallised with grains up to 0.12 mm long. Some fans of chlorite grains occur. Rare chlorite veins parallel the banding but the majority cut across the banding at a high angle. Small fragments of felsic minerals and mica have been incorporated in the veins, apparently from the walls, and there is some recrystallisation of quartz. Irregular grains and aggregates of opaques are prominent with the chlorite and have evidently developed with the chlorite. Rare infilled 'geodes' contain lamellae of chlorite and irregular grains of quartz. Opaques are not prominent in these pods.

Polished Section:

Arsenopyrite, chalcopyrite, pyrite and marcasite are the major opaques with minor rutile and traces of ?ilmenite and graphite.

Arsenopyrite occurs as large, corroded and partially shattered rhombs (0.05-3 mm in diameter) which contain small inclusions of chalcopyrite. Both pyrite marcasite and chalcopyrite occur as ragged anhedral masses dispersed interstitially between non-opaque vein minerals. The marcasite is very fine grained and is intimately associated with the pyrite. The grains as a whole show a peculiar (slightly irregular) ribbing which is perhaps indicative of their pseudomorphous replacement of pre-existing pyrrhotite. The marcasite is usually concentrated along grain boundaries and margins of individual rib lamellae. A few grains of pyrite show euhedral faces, which, together with the replacement of pyrrhotite, probably developed due to weathering.

The pyrite (+marcasite) and chalcopyrite are intimately associated in many places and small fingers of the former are locally observed penetrating the latter. More rarely very fine graphic intergrowths of the iron disulphides and chalcopyrite appear. This probably does not represent replacement of the chalcopyrite by the pyrite (+marcasite), but rather a primary textural feature of chalcopyrite and pyrrhotite perhaps developed during deposition.

These sulphides are mainly confined to chlorite rich veins with traces of chalcopyrite and pyrite dispersed in the host quartz-feldspar-mica rock.

Minor amounts of fine grained rutile and one or two grains of magnetite also occur in the veinlets.

Ilmenite and rutile are dispersed through the host rock sometimes as short stringers of dissociated sub-spherical to elongate grains mostly less than 0.1 mm in diameter.

A few fine flakes of ?graphite are also in the host rock.

Sample P131/73: TS 30324: PS 20722

Location:

DD8 208-87 - 209-04.

Rock Name:

Acid gneiss.

Hand Specimen:

A fine grained gneissic banded red and dark grey green rock. The rock has been fractured and veined at a late stage in its history.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz) Feldspar)	50-60
Biotite	5-30
Chlorite	5-10
Opaques	5
Sphene	2-3
Calcite	2-3
Tremolite	5-15
Epidote	1-3

This rock is similar to the last but has a more complex mineralogy. The rock contains bands of differing mineralogical composition and proportions, believed to be derived from the original sedimentary layering of the rock. Proportions given above are therefore very approximate. Calc-rich bands vary from 2.5 mm to 1 cm thick while arenaceous bands are up to 2 cm thick.

In parts of this rock there is some suggestion of the retention of shape of original silt sized grains. Elsewhere recrystallisation appears to have been total. Quartz and feldspar are both abundant. They are commonly subequant and vary in size from 0.01 mm to 0.3 mm. Biotite is greenish-brown and ranges in grain size up to 0.2 mm. It has no preferred orientation. Sericite occurs with poikiloblastic tremolite (up to 1.5 mm) and largely replaces it. One band of the rock contains abundant greenish biotite with epidote, chlorite and minor quartz.

The rock is sieved with small grains of sphene (dominant), rutile (minor) and apatite (very minor). Irregular, anhedral opaque grains are dispersed through some of the quartz/feldspar/biotite bands.

The host rocks therefore probably represent a sequence of thinly bedded marls and siltstones. There is evidence of more calcium present than in P130/73.

The rock has been cut by a number of veins of different ages and composition. Early formed veins, which for the most part cut across the bedding, contain green or green-brown (degraded) biotite (?or chlorite). Chlorite (blue interference colours) has followed the mica, filling cracks formed in the micaceous veins, in some instances, and veins of calcite (with very, very slight dolomitisation) cut all type of preexisting veins.

Small amounts of finely granular opaques, possibly titaniferous, are associated with the mica veins. Opaques are slightly more common with the chlorite, but do not appear to be related to the calcite at all.

Polished Section:

The opaques consist mainly of chalcopyrite, pyrite (+marcasite) - probably after pyrrhotite, with traces of ilmenite and rutile.

The sulphides appear to be largely restricted in the host rock occurring in and near the margins of fracture planes. Like P130/73, they occur as ragged, interstitial aggregates of anhedral grains and bear the same textural relationships and characteristics as in P130/73. The rib texture of the pyrite+marcasite association is not quite so strongly developed but more of the pyrite exhibits euhedral outlines.

A considerable proportion of the sulphides appear as short disaggregated stringers penetrating the host rock away from the fracture and joint plane surfaces.

Traces of ilmenite and rutile are scattered evenly through the rock and are mostly locked within individual quartz/feldspar grains.

Sample P132/73: TS 30325: PS 20723

Location:
DD8 214.48-214.67.

Rock Name:
Altered, metasomatised calc acid gneiss.

Hand Specimen:
A weakly banded, rather hornfelsic rock dominantly dark grey green in colour but with red patches particularly near veins. The rock is highly fractured and cut by veins with chalcopyrite and with lighter coloured material.

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

	%
Quartz) Feldspar)	10-70
Tremolite) Sericite)	0-50
Biotite	5-20
Chlorite	5
Opaques	2-5
Sphene) Apatite)	Trace-1
Epidote	1-2

This sample is very similar to P131/73 but is overall more heavily chloritized, contains a greater proportion of opaques and contains little epidote. There are very marked mineral segregations which make estimates of relative proportions very approximate. The greater part of the mineral segregation still reflects the primary sedimentary layering of the rock. The layers vary from about 2 mm to over 2 cm in thickness, with quartz/feldspar rich layers predominating.

The texture and size of the quartz, feldspar and mica are very similar to those of earlier specimens. The quartz/feldspar is markedly turbid, with fine grained ?hematite inclusions, in certain parts of the rock.

This specimen is about equally divided into tremolite-sericite (quartz-calcite) layers and quartz-feldspar (mica-chlorite) layers.

The rock has been subjected to stress with microfaulting and other fracturing. The fractures, which are generally at a high angle to the banding, are infilled with mica, chlorite, opaques, carbonate and some quartz. Where they cut the tremolite-sericite rock, there is little apparent mineralogical change from the sericite host; however, the fractures are marked by a zone of more turbid phyllosilicate with or without traces of calcite. Both host and fracture material appear to have been partly recrystallised. Opaques, quartz and chlorite are all prominent where the fractures/veins cross the quartz-feldspar rich zones. Calcite is variable in distribution and there is recrystallization of quartz-feldspar matrix along veins. Most of the veins are perpendicular (or nearly perpendicular) to the banding. However a few veins have apparent random orientations. The sericite rich rock appears to have been a poor environment for the deposition of either chlorite or opaques, nonetheless open paths must have been available for the passage of the mineralising fluids. A few pockets of mineralised material mixed with host material occur between the two major rock types where veins intersect their contact.

Small irregular grains of opaques are dispersed through the 'host' rocks. Their relationships are not always clear as in many cases they are shrouded by a thin zone of clear colourless ?quartz.

Polished Section:
Because of their marked similarities, the polished section of this specimen and of P133/73 will be described together.

Sample P133/73: TS 30326: PS 20724

Location:
DD8 241.48-214.67.

Rock Name:
Altered, metasomatised calc acid gneiss.

Hand Specimen:
A weakly banded, rather hornfelsic rock dominantly dark grey green in colour but with red patches particularly near veins. The rock is highly fractured and cut by veins with chalcopyrite and with lighter coloured material.

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

	%
Quartz) Feldspar)	60-70
Opaques	10
Calcite	2-5
Chlorite	10-15
Tremolite) Sericite)	2-3
Green mica) Biotite)	2-5
Fluorite	Trace
Apatite	Trace
Sphene	1

This sample is from a part of the core quasi-adjacent to P132/73 and texturally and mineralogically has similar characteristics. The main variations lie in (a) the greater proportion of quartz-feldspar and a wider distribution of chlorite through this type of rock, and (b) the presence of a larger micro-fault. This, the largest noted, is stepped and has a total throw of about 1 cm. Quartz appears to exceed feldspar in abundance in this rock (unlike P130-P132/73).

The channelways of the fault and the other fractures are filled with opaques, calcite, chlorite, fluorite, included and altered/recrystallised quartz and feldspar, and sphene.

In many cases the chlorite forms the margins of the veins while opaques occupy a central position. Elsewhere carbonate occupies the centre of the veins. It seems clear that calcite, chlorite and the opaque minerals have been introduced more or less simultaneously. Colourless fluorite occurs rarely in the veins but is not one of the main vein minerals. Where quartz and feldspar are associated with the vein they are probably recrystallised from material originally present. Opaques occur mainly in and near the veins but fine disseminationsare also locally present in the body of the rock.

Other features of interest in the rock include trains of fine opaques which cross grain boundaries of quartz in places, and the small granules of a pale green mineral of high relief and low birefringence which are scattered through the rock. This mineral is probably apatite.

Polished Section:

The sulphides present are chalcopyrite, pyrite+marcasite with rutile, minor ilmenite and a trace of leucoxene.

The sulphides and the rutile are confined mainly to cross cutting fracture planes (microfaults) which have in places displaced the foliation of the host rock. These faults are mostly less than 0.5 mm wide but one or two are up to 1mm in width.

The pyrite+marcasite and chalcopyrite have the same textural characteristics and relationships as in P130 and P131. Pyrite euhedra are well developed, indicating some redistribution of sulphide (during the oxidation of the pyrrhotite?) and the rib texture is also present indicative of replaced pyrrhotite. The marcasite is associated with the pyrite showing the rib texture, and mixtures of these two phases commonly replace pyrrhotite. Marcasite is not associated with the euhedral pyrite, which is not a pseudomorphous replacement feature.

One or two round inclusions of sphalerite occur in the chalcopyrite and themselves contain extremely minute blebs of exsolved chalcopyrite.

Anhedral, ragged grains of rutile are scattered along the fault planes and the host rock immediately adjacent. These are relatively small interstitial grains, mostly no larger than 0.1 mm, and are loosely associated with the sulphides.

One or two small grains of ?ilmenite less than 0.03 mm in diameter and partially altered to leucoxene were also observed.

Sample P234/73: TS 30487

Location:
DD8 222.18-222.25.

Rock Name:
Sericite-chlorite rock of metasomatic origin.

Hand Specimen:
A rather dark green rock with blotchy veined yellower patches and irregular pink zones and veins.

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

	%
Muscovite/sericite	75-80
Sphene	3
Feldspar	3-5
Chlorite	15-20

The rock is composed of a turbid intergrowth of generally fine grained sericite/chlorite, penetrated by veins containing partly altered K-feldspar. Small grains of sphene are widely dispersed through the rock. The texture is that of a metasomatised rock.

Sericite occurs as a tangled, or felted mass of grains 0.015 mm - 0.03 mm long, with some development of grains up to 0.12 mm in places. It shows no foliation.

Chlorite, almost colourless, is intergrown with sericite in a number of places, forming a diffuse aggregate of small grains. It has low grey-yellow interference colours.

Sphene occurs in elongate to subequant grains from 0.03 to 0.1 mm long. It is present throughout the phyllosilicate.

The veins of K-feldspar are accompanied by chlorite and/or sericite. The sericite appears to have been incorporated from the host rock for the most part, but chlorite appears to have been added with the feldspar. In places the veins split and interdigitate with the chlorite. The feldspar shows indications of simple twinning; most is brown and turbid with incipient kaolinisation and development of finely divided opaques. Though the greater part of the feldspar chlorite interdigitation appears to have been a growth feature there are indications that the feldspar has been subjected to weak shearing stress. Cross veins also containing feldspar and chlorite transect the main veins at high angles, and in at least one area, veinlets of sericite (0.04 mm in width) cross the main feldspar veins. The mica veinlets are much more irregular in shape and direction than other veins.

The veins do not appear to be significantly mineralised except in one small area where a vein contains both chlorite and opaques. There is minor development of granular opaques, probably titaniferous, probably partly altered ilmenite.

To summarise: A rock of uncertain origin has first been transformed to dominant chlorite. The chlorite has now been largely replaced by sericite. Later veins of K-feldspar with chlorite have penetrated both chlorite and sericite. Subsequent minor stress has allowed partial remobilisation of feldspar, chlorite and sericite.

Sample P235/73: TS 30488

Location:
DD8 223.83.

Rock Name:
Altered calc silicate hornfels.

Hand Specimen:
A light yellow-green rather brecciated looking rock containing small pink patches.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Epidote	70-80
Calcite	17-20
Dolomite	2-3
Chlorite)	
Sericite)	5-10
Biotite)	
Clay)	
Opaques	1-2
Quartz/feldspar	0-3
Sphene	1

The dominant texture of this rock is that of a modified hornfels. The most abundant mineral is epidote which commonly occurs as a mosaic of granular grains each in the range 0.1 -0.7 mm in diameter. In places the epidote has been penetrated by veins composed dominantly of chlorite (with other phyllosilicates) and elsewhere by veins and impregnations of calcite. A few grains of altered ?sphene are dispersed through the rock. Feldspar is present in one area only and opaques are very rare.

The greater part of the rock appears to have once been epidote with minor feldspar and biotite in places. Much of the epidote now contains intergranular calcite which occurs as irregular 'pools' between the epidote grains. The epidote has convex margins towards the calcite. Biotite, a very pale brown form, also occurs rarely in the epidote mosaic where it appears to have been formed by the initial metamorphism. Both biotite and calcite in this situation are up to 0.2 mm in diameter but commonly near 0.1mm.

In one part of the rock feldspar appears to have been a significant component of the original metamorphic rock. It occurs as a partly replaced granular mosaic. In one or two places outlines of prismatic crystals remain.

The first veins which cross the rock are dominantly of phyllosilicate but do contain minor amounts of calcite. Chlorite appears to be dominant but a ?partly degraded pale brown or pale green mica is also present. This type of material has also partly replaced the feldspar originally present. The veins of phyllosilicate are up to 2 mm wide but the grain size within the vein is very small. In places phyllosilicates appear to pseudomorph prismatic ?amphibole grains.

Calcite veins appear to have formed last of all. Veins are of varying width (0.1-0.5 mm) and in places they transect the phyllosilicate veins. It is not clear, however, whether all the calcite in the rock has developed at this late stage. Texturally it seems unlikely.

It seems clear that this rock was once a calcareous sediment, however it has been first thermally metamorphosed and subsequently veined in several stages.

Sample P236/73: TS 30489

Location:
DD8 223.98.

Rock Name:
K-metasomatised calc silicate hornfels.

Hand Specimen:
A blotchy pale yellow green and dark green metamorphic rock.

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

	%	
Epidote-clinozoisite	10-15	
Chlorite	10-15	
Mica	60-70	
Feldspar	5-8	
Calcite/dolomite	1-2	
Sphene	1	
Opaques	Trace-3	(irregular distribution)
Zircon	Trace	
Apatite	Trace-1	
Tourmaline	Trace	

This rock seems to represent a stage intermediate between P234/73 and P235/73. In its present state the rock is a partly metasomatised calc silicate hornfels.

The original rock appears to have been an epidote rich hornfels similar to P235/73. The relics of this material occur as dark brown partly altered epidote embayed and partly replaced by pale brown mica.

The dominant phyllosilicate is a very pale brown mica. It is associated with a smaller proportion of similar-coloured chlorite. The coloration deepens where the mica is replacing the early formed epidote. Most of the mica is fine grained but in places the grain size reaches 0.3 - 0.5 mm. The mica encloses granular sphene, probably a component of the original metamorphic rock.

The main mass of the mica is cut by (a) veins rich in epidote, (b) veins rich in mica, (c) veins rich in chlorite (with signs of shearing), and (d) veins rich in feldspar.

Mineralisation (opaques) occurs with the mica veins and with K-feldspar. The opaques are highly irregular and occur as discrete grains or in aggregates, massive or sieved. The most common association is with K-feldspar.

In one place there are signs of rotational strain, with incipient development of a curved foliation. Opaques, coarser mica and K-feldspar are all present in this area. Elsewhere in the rock there appears to have been little strain. This pocket of strained material has been cut by the later fractures and part of the mica and K-feldspar appear to be recrystallised.

Calcite is one of the last formed of all minerals. It occurs in ovoid pods in mica and elsewhere with opaques.

Sample P237/73: TS 30490

Location:
DD8 237.6.

Rock Name:
Calc-silicate hornfels.

Hand Specimen:
A fine grained metamorphic rock containing alterations of irregular dark pink and grey green bands. The rock has been extensively veined later.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Feldspar	40 (absent in places)
Calcite/dolomite	10
Actinolite/hornblende	30–40
Epidote	10–25
Sphene	1–2
Apatite	Trace–1

In thin section the rock is divided into dominantly green and dominantly pink areas.

The dominantly pink areas are composed of an hornfelsic mosaic of small (0.05–0.15 mm) feldspar grains with small amounts of hornblende, sphene, epidote and apatite. This rock type contains small variably sized and shaped aggregates of granular yellow epidote. It is cut by narrow veins of epidote(up to 0.1 mm) and calcite (0.02–0.04 mm). The included pods of epidote have a similar hornfelsic texture. The calcite veins are later than the epidote veins, but the latter do contain small amounts of calcite. In the smaller, feldspar rich areas variable amounts of granular, green, weakly pleochroic amphibole are also present. It is almost impossible to identify the feldspar accurately but this specimen does contain plagioclase as well as K-feldspar. Quartz is apparently absent.

The remainder of the rock contains dominant amphibole with subordinate epidote and minor amounts of pale brown mica and granular sphene. In places amphibole grains reach 1 mm in length. The mosaic is composed of rather ragged, non equant (elongate) grains, probably a feature of the amphibole development. There is no preferred orientation. Epidote veins are not common in this rock variety, but it is cut in a number of places by veins of coarse sparry calcite.

Opaques are not common in this rock but are associated with calcite where they occur. Apatite is a common accessory mineral.

This rock appears to be a hornfelsed metasediment (?a mixture of calcareous shales and non calcareous shales or siltstones) which does not appear to have undergone extensive metasomatism, but has been cut by veins of mobilised epidote and the calcite.

Sample P238/73: TS 30491

Location:
DD8 240.5.

Rock Name:
Subschistose mica rock.

Hand Specimen:
A uniform dark grey green rock, mostly fine grained but with rare coarser grained patches.

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

	%	
Sericite)		
Muscovite)	90	
Green 'biotite)		
Calcite	1-5	
Quartz	5-8	(very irregular, absent in places)
Zircon	Trace	
Apatite	Trace-1	

The rock is dominantly composed of greenish brown pleochroic mica which has a subschistose to matted texture. Under crossed nicols the rock is characterised by a large number of pleochroic haloes in the mica. Mica grain size varies from about 0.04 mm to 0.1 mm over most of the rock. Local recrystallisation to veins and patches of coarser mica (0.25-0.5 mm) has taken place.

The pleochroic haloes surround zircon, or in some cases possible sphene. In one area the darkening of the mica is so intense that the effect is that of a partly digested piece of the country rock. From this zone irregular trails of darkened mica extend for up to 5 mm.

Most of the rock is free of other impurities but isolated grains and clusters of anhedral quartz grains remain in places. The raggedness of their margins suggests that they have been attacked by the mica. Irregular apatite grains up to 1 mm in diameter occur in the one area.

The rock is cut, at a high angle to the 'foliation' by veins of sparry calcite up to 0.7 mm wide. Emplacement of these veins has followed all recrystallisation of mica.

This rock appears to be the product of metasomatic activity and all traces of the rock from which it has been formed are lost, except for remnant quartz and apatite.

Sample P239/73: TS 30492

Location:
DD8 259.9.

Rock Name:
Calc silicate hornfels.

Hand Specimen:
A massive rock with irregularly banded alterations of fine grained red and dark green material. The green is dominant.

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

	%
Hornblende	10-15
Opaques	1
Quartz)	45-50
Feldspar)	
Epidote	30
Diopside	10
Sphene	1
Calcite/dolomite	2-3
Apatite	Trace

This section shows irregular banding into dominantly green and dominantly colourless areas.

The dominantly green areas have a blue green pleochroic amphibole (hornblende) and a yellowish epidote as the main minerals with smaller proportions of fresh feldspar and colourless granular diopside. The texture is that of an interlocked mosaic of sutured or irregular grains. Grains vary up to about 0.5 mm in diameter.

In the colourless areas the main minerals are feldspar and diopside with lesser amounts of hornblende, opaques and calcite. The texture is that of an interlocked hornfelsic mosiac. The feldspar is dominantly untwinned K-feldspar with some grains showing microcline twinning. The grain size is of the range 0.1-0.2 mm. Quartz is present with the feldspar in some places and there are rare grains of sphene 0.1-0.2 mm long.

Both varieties are cut by veins of epidote (with subordinate amphibole) but these veins are in turn cut by veins of calcite. The latter contain rare opaques. Other opaques are distributed through the rock.

For the most part pyroxene, hornblende and epidote appear to coexist with little visible sign of reaction. A few grains of pyroxene show partial replacement to amphibole. In places the epidote of the veins gives way to amphibole. In places epidote seems to replace part of the amphibole.

This appears to have been a calc silicate rock composed of pyroxene, amphibole, feldspar and quartz which has been veined with epidote and partly replaced by epidote. The last event has been veining by calcite. Opaque minerals appear to be related to calcite and to epidote more than to amphibole or pyroxene.

Sample P240/73: PS 20810

Location:
207.21 - 207.30.

Rock Name:
Gold-copper ore.

Hand Specimen:
Dark grey-green rock cut by an irregular vein of chalcopyrite and pyrite.

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

	%
Chalcopyrite	85-90
Pyrite	10
Marcasite	1-3
Ilmenite	Trace
Rutile	Trace
Gold	Trace

The vein itself is 5 to 8 mm wide and quite massive, containing very few non-opaque inclusions. It is comprised mainly of chalcopyrite with a core of loosely aggregated, often highly irregular grains of pyrite and marcasite.

The chalcopyrite is massive showing no obvious grain boundaries within the vein itself, apart from a few variously spaced, compound fractures which cut across the vein.

The pyrite appears to be supergene in origin. It has a grainsize of 0.02 to 2 mm and the grains for the most part are fairly irregular possessing anhedral boundaries! Nevertheless, a few crystal faces do appear and some of the smaller grains, particularly those less than about 0.2 mm across have euhedral outlines. The surface of the pyrite contains numerous irregular pits of varying sizes 0.002 to 0.2 mm across and the immediately associated chalcopyrite contains even larger ones.

Pyrite, together with non-opaques, also fills one or two of the larger fractures 0.05 to 0.2 mm wide cutting across the vein.

The marcasite, occurs in sets of parallel, slightly curved rib-structured lamellae within the confines of clearly defined 'granular' areas almost completely filled with irregularly pitted to near framboidal chalcopyrite up to 1 mm across. Within each of these pitted areas (hosted by massive chalcopyrite) the marcasite lamellae are parallel but from area to area the orientation of the lamellae may change. It can therefore be said with reasonable certainty that these areas were once pyrrhotite grains (which often oxidize to this rib textured marcasite), which have been subsequently oxidized to marcasite and either subsequently or conjointly, supergene chalcopyrite has been precipitated between the lamellae (hence its pitted to almost framboidal appearance). This is reasonable considering that in supergene profiles, pyrrhotite oxidizes to secondary iron disulphides well below the water table whereas chalcopyrite is stable right up to the water table itself. It is also believed that the pyrite has formed as a result of oxidation of pyrrhotite and reprecipitation virtually in situ, although apart from the pitted nature of this pyrite and the immediately surrounding chalcopyrite there is no positive textural evidence to support this.

Both chalcopyrite and pyrite have penetrated intergranular sites away from the vein. They also occur as disseminated material occurring in a band about 1 cm wide each side of the massive portion of the vein. The grains are highly irregular, interstitial, and most vary in size from 0.05 to 1 mm. Again the pyrite is probably secondary after pyrrhotite. It occurs as skeletal, almost weblike masses up to 1 mm across and fine veinlets penetrate surrounding non-opeque interstices.

Accessory phases include ilmenite which appears as a few small equant grains mostly less than 0.1 mm in diameter scattered through the massive, disseminated and barren sections of the ore. Some rutile is also present with a similar grain size and shape but is mostly confined to the barren rock.

Two irregular grains of gold were observed included in a grain of chalcopyrite in the disseminated zone. The grainsizes are 0.015 and 0.13 mm. The gold is a bright yellow probably due to some copper and/or silver in solid solution.

Conclusion:

This was a hydrothermally emplaced gold-chalcopyrite-pyrrhotite vein which has suffered subsequent supergene oxidation of the pyrrhotite to pyrite and marcasite and minor (supergene) remobilization of the chalcopyrite.

Sample P241/73: PS 20911

Location:

220.07.

Rock Name:

Copper ore.

Hand Specimen:

Dark greenish grey to almost black rock with a web-like mass of massive to disseminated chalcopyrite.

Polished Section:

An optical estimate of the constituents gives the following:

	%
Chalcopyrite	99
Pyrite	Trace
Cobaltite	Trace
Marcasite	Trace
Ilmenite	Trace
Rutile	Trace
Leucoxene	Trace
Molybdenite	Trace
Sphalerite	Trace

The chalcopyrite occurs as a web-like mass of irregular massive, veined to disseminated material. Broad patches of near massive sulphide up to 2 cm across, sieved with fine non-opaques 0.05 to 2 mm in diameter, are common. The cobaltite is present mostly as small massive euhedral grains less than 0.05 mm in diameter scattered through the non-opaque gangue and the chalcopyrite. Minor marcasite with typical rib texture and associated with pyrite is also present, having formed by supergene replacement of pyrrhotite as described for P240/73.

Ilmenite is present as small anhedral grains less than 0.1 mm in diameter usually hosted by the non-opaque gangue, and is partially altered to leucoxene. Rutile is the most abundant titanium mineral. It is anhedral, prismatic (up to 0.2 mm in length) and is dispersed through the non-opaque gangue.

Molybdenite flakes less than 0.1 mm long, 0.02 mm in thickness occur as patches of scattered flakes in the non-opaque gangue matrix.

Small irregular inclusions of sphalerite less than 0.02 mm across and containing exsolved blebs of chalcopyrite are present in trace quantities through the chalcopyrite.

Conclusion:

This ore has probably been through the same genetic history as that in P240/73.

DEPARTMENT OF MINES SOUTH AUSTRALIA

PROJECT

PARABARANA COPPER PROSPECT - NORTH FLINDERS MINES LTD.

HOLE NO. P.D.D. 11

TYPE OF HOLE 0-182m Rotary Percussion, 182-426m Diamond drilled HQ core

MACHINE NO 426-757.2m " NQ

182-757.2m falling 1500c DM101

BORE SERIAL NO DD926/73

SURVEY DATA

INCLINATION (Vertical) see hole survey data below.

AZIMUTH -

DEPTH 757.2m(2484.4ft)

PLAN REFERENCE 77-314 and 77-195

ASSAY REFERENCE AN2152/74 AN2153/74 AN3581/74 AN2460/74 AN1646/74 AN2315/74 AN2461/74

COORDINATES Approx.1075W/1825N

DATE COMMENCED 27/3/73) Boring Services 1/5/73)
DATE COMPLETED 29/3/73) 7/11/73) Dept. Mines

DRILLER Boring Services (0-182m) T.Jarvis(182-757.2m)

LOGGED BY K. Every

ELEVATION Approx.5125 ft (local arbitrary datum)
Surveyed by Brunton Compass. Accurate survey not done.

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	REMARKS
				0	182m	Not logged - all augen gneisses, schistose and amphibolitic rocks.	HOLE SURVEY DATA (Tro Pari Readings)
				0	600ft	Bagged samples at 2 m intervals are stored at S.A.D.M. Core shed.	
						ABBREVIATIONS USED IN LOG	
						C.A. = core axis	
						py = pyrite	
						cp = chalcopyrite	

Depth(m)	Azimuth(mag)	Inclination (°)
190	162	89
234	82	154
263	84	152
320	80	163
342	79	137
372	76	140
405	77	139
440	77	136
470	76	139
500	77	153
501	75	145
534	73	148
571	74	141
612	72	141
681	71	138
748	70	153

Average Azimath of hole 138° magnetic, 144° grid.

5 inch diameter rotary-percussion hole drilled by Boring Services and 5 inch casing run to 182m (600ft).

C00002

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	REMARKS
182.60m	183.50*	0.90m	0.91m	182.60m	241.75m	AUGEN GRANITE GNEISS (?Paragneiss) Crudely foliated salmon pink and grey augen gneiss of granitic composition. Pink K-feldspar augen and lenses 5-15mm wide x 1-5cm long, generally 1cm x 2cm; mostly elongated (stretched?) into lenses, some more equant s-shaped augen with "tails" elongated in direction of shearing stress. Pink augen and lenses composed of a mosaic of small crystals. Augens and lenses enveloped by ribbons of light, whitish-grey, fine grained granular quartz and ?feldspar matrix and streaked dark greenish black ?chloritic material with slickensided shear surfaces. Foliation defined by elongation of pink feldspar lenses, varies from 25° to 35° to C.A.; 30° at top, 35° at 185.4 m, 30° at 190 m and 198 m, 25° at 201 m, 30° at 208-209 m. Where K-feldspars are augen-shaped rather than elongated lenses, supplementary foliation is defined by shear planes at approx. 20° to main elongation of augen; 55° to C.A. at 185.4m, 50° to C.A. or 208-209m. Zone of well foliated gneiss with markedly thinner lenses at 222.3-222.5 m, at 25° to C.A. Normal augen below 222.5m, foliated at 25° to C.A. Planar shears, overaging 1/20 cm over upper section, with white and pale green soft talcy clay coatings and some brick red (?hematitic) clay smears, vary from sub-parallel to 90° to C.A.; some shears also with pyrite cubes. Occasional secondary vuggy quartz veins with trace pyrite. Two 1cm-wide chloritic and brecciated shear zones at 185.7 and 185.97m containing pyrite blebs up to 7 mm across. Brecciated zone from 226.7 to 228.0m - most strongly brecciated from 227.3 to 227.4 m - small angular white and pink fragments in a dark greenish grey matrix. Occasional large (2-3 cm diam.) pink ovoids composed of a mosaic of whitish (with pale pink tinge or staining) crystals - 1-2mm diam. with interstitial bright salmon pink ?hematitic material which appears to have discoloured the white crystals. Most ovoids also contain several dark greenish black, irregular-shaped patches of chlorite and/or biotite from 1-5mm across. These ovoids become more frequent just below breccia zone where isolated dark greenish black fragments also occur near the ovoid. Occasional ovoids rimmed with brick red ?hematitic material 1-2 mm thick e.g. at 235.1m; some mantled with thicker rims (>2mm) of pink feldspar and separated from inner portion by a dark greenish thin ?biotitic zone-rapakivi-like texture. Below 229.5m rock very fractured and more weathered looking with greenish clay and brick red ?hematitic clay smears along fracture surfaces. Rock less foliated in "pebbly" zones especially from approx. 234-236m. Foliation more prominent at approx. 238.5m - 30° to C.A. Very strongly hematitic, broken rock from 240.2 to 241.2 m -some black shiny specularite.	Pet. Sample P302/73 185.54-185.68m Silicate Analysis Sample A535/74 183.00-197.65m (1.52m total length of core pieces sampled within the interval). Silicate Analysis Sample A1424/73 185.52m (2cm-thick disc of HQ core)
*Tag should probably read 183.60m				599.1ft	793.2ft		
183.50m	184.50m	1.00m	0.88m				
184.50m	185.35m	0.85m	0.72m				
185.35m	189.30m	3.95m	3.56m				
189.30m	191.35m	2.05m	1.83m				
191.35m	193.15m	1.80m	1.65m				
193.15m	195.55m	2.40m	2.19m				
195.55m	198.25m	2.70m	2.40m				
198.25m	199.30m	1.05m	0.87m				
199.30m	200.15m	0.85m	0.85m				
200.15m	201.80m	1.65m	1.67m				
201.80m	202.90m	1.10m	0.91m				
202.90m	205.30m	2.40m	2.35m				
205.30m	206.58m	1.28m	1.23m				
206.58m	207.45m	0.87m	0.79m				
207.45m	207.80m	0.35m	0.35m				
207.80m	210.10m	2.30m	2.13m				
210.10m	212.00m	1.90m	1.79m				
212.00m	214.05m	2.05m	1.99m				
214.05m	215.10m	1.05m	0.92m				
215.10m	217.30m	2.20m	2.04m				
217.30m	217.85m	0.55m	0.49m				
217.85m	218.60m	0.75m	0.70m				
218.60m	220.50m	1.90m	1.64m				
220.50m	221.70m	1.20m	1.11m				
221.70m	225.25m	3.55m	3.34m				
225.25m	228.00m	2.75m	2.59m				
228.00m	230.00m	2.00m	1.87m				
230.00m	231.90m	1.90m	1.74m				
231.90m	233.45m	1.55m	1.38m				
233.45m	234.85m	1.40m	1.29m				
234.85m	237.30m	2.45m	2.29m				
237.30m	237.90m	0.60m	0.48m				
237.90m	238.75m	0.85m	0.79m				
238.75m	239.10	0.35m	0.27m				
239.10m	241.15	2.05m	1.80m				

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	REMARKS
241.15m	244.15m	3.00m	2.80m	241.75m 793.2ft	263.55m 864.7ft	CHLORITIC AUGEN SYENITE GNEISS. Crudely banded, well foliated pink and dark green augen gneiss. Interstitial material between pink K-feldspar dark greenish, fine grained chlorite (or chloritized biotite)-note absence of light grey quartz ribbons associated with chloritic matrix in rock above.	Silicate Analysis Sample A536/74 243.37-258.00m (2.00m total length of core pieces sampled within the interval).
244.15m	247.10m	2.95m	2.74m			Texture more erratic than rock above breccia zone at 226.7m, and s-shaped lenses less obvious-most of pink feldspar being irregular-shaped elongate lenses. Mantled ovoids more obvious in lower half of unit. Moderate epidote as small augen and elongated lenses. Sheared sharp contact at top of unit. Core becomes fresher looking than above and more intact with less fracturing (1/20-40cm). Very little hematitic clay. Core pitted over upper half of unit.	Silicate Analysis Sample A1425/73 249.92m (2cm-thick disc of HQ core)
247.10m	250.10m	3.00m	2.79m			Foliation 30-35° to C.A. over upper portion of unit. Chloritic shear zone 1-2cm thick at 246.65m. 10 to 15 cm-wide zone at 249.7m of very thinly laminated (approx. 2mm), very chloritic rock with some small folds and crinkles in laminations - foliation conformable with coarser augen gneiss above and below at approx. 30° to C.A. 20cm zone at 253.25m where foliation parallel to C.A. and folded at top and bottom of zone. Strongly chloritic shear zones - dark green soft rock with angular pink feldspar fragments - from 255.9-256.28m, 258.2-258.3m and 258.7-258.9m. Light grey, puggy clay shear zone from 259.0-259.25m.	Pet. Sample P303/73 249.71-249.89m
250.10m	253.25m	3.15m	2.94m				Pet. Sample P74/74 251.2m
253.25m	256.28m	3.03m	2.92m				
256.28m	257.70m	1.42m	1.41m				
257.70m	258.90m	1.20m	1.10m				
258.90m	259.25m	0.35m	0.27m				
259.25m	260.05m	0.80m	0.70m			259.25-263.55m: brick red, slightly chloritic augen gneiss similar to above but considerably less interstitial chlorite. Core very broken over upper 40cm, becoming less broken towards base. Gradational over basal 10cm to more interstitial grey quartzose matrix as above 241.75m.	
260.05m	263.10m	3.05m	2.68m				
263.10m	263.95m	0.85m	0.77m				
263.95m	265.80m	1.85m	1.69m	263.55m 864.7ft	287.90m 944.6ft	AUGEN GRANITE GNEISS. Similar to beginning of cored section some epidotic augen from 268.5-270.2m From 270.2m occasional blebs and equant patches of dark greenish grey chloritic rock up to 1cm across - more prevalent at top and bottom of 40cm-zone from 271.45-271.85m in which pink augen content conspicuously less and quartz content (>40%) greater than normal granite gneiss (metamorphic shearing stresses appear to be greater than those which formed augen gneiss fabric); similar zone from 272.4-272.55m with pink augen-rich 10cm-wide zone immediately below.	
265.80m	266.80m	1.00m	0.92m				
266.80m	269.15m	2.35m	2.18m				
269.15m	271.20m	2.05m	1.81m				
271.20m	273.60m	2.40m	2.38m				
						272.55m: pale greenish, chloritic, ?epidotic, ?calc-silicate band 3cm wide, conformable with gneissic foliation at 70° to C.A. Dark greenish-grey chloritic 7cm wide band immediately below, with a 1-2cm wide conformable irregular quartz band in centre; sulphide blebs (mostly pyrite) just below quartz band.	Pet. Sample P306/73 272.52-272.69m

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	REMARKS
273.60m	276.35m	2.75m	2.46m			Gneissic foliation 35° to C.A. at 264.3m, 45° at 269.8m, 70° at 272.8m 60° at 274.4m.	
276.35m	276.88m	0.53m	0.42m				
276.88m	278.78m	1.90m	*0.41m			Moderately brecciated zone from 274.9-281.2m - most strongly brecciated near top with some brecciated zones in lower portion. Larger than normal irregular quartz patches up to 2cm across at 280.4m. Quartz content variable. Zone of syenite composition from 275.65-277.00m - gradational 10cm-wide contact zone at top, no quartz over upper 40cm and 1-2% quartz over basal 90cm.	
*Core Loss 277.00-278.48m							
278.78m	279.20m	0.42m	0.30m				
279.20m	282.15m	2.95m	2.83m				
282.15m	285.00m	2.85m	2.75m			281.2-287.1m: More pink feldspar than above. Some zones distinctly more "pebbly" - i.e. with round (one perfectly circular) pink feldspars, especially at about 282.8m (see Pet. Sample P304/73) where some round feldspars mantled with pale yellow-green ?epidote or clay mineral. Zone slightly epidotic throughout. Also some pink ovoid feldspars mantled with pink feldspar which has been streaked out in the direction of foliation. Foliation cruder than above - about 55° to C.A. throughout. Zone fairly pyritic - mostly in chloritic shear zones - note large pyrite blebs and shear at 284.25m. Green and brick red ?hematitic clay-filled shears every 10-15cm at various angles to C.A., generally 25°-70°.	Pet. Sample P304/73 282.69-282.88m Silicate Analysis Sample A537/74 281.27-285.63m (1.05m total length of core pieces sampled within the interval).
285.00m	285.85m	0.85m	0.83m				
285.85m	286.90m	1.05m	0.93m				
286.90m	291.00m	4.10m	2.98m(?)	287.90m 944.6ft	302.90m 993.8ft	287.1-287.9m Brecciated zone, especially upper and lower 10cm portions (see Pet. Sample P305/73 from centre of zone). AUGEN GRANITE GNEISS INTERBANDED WITH SYENITE GNEISS. Gradational over 287.9-288.1m from augen granite gneiss of unit above to finely laminated, well foliated, chloritic syenite gneiss with <10% grey interstitial quartzose lamellae. Laminae of discontinuous and irregular lenses of pink feldspar, 2-3mm thick, and a dark green chloritic matrix - 55° to C.A. Gradational zone at top strongly pyritic. Coarser lenses over centre of syenitic zone at approx. 288.7m; also microfaulted with throws of up to 1cm.	Pet. Sample P305/73 287.39-287.52m Silicate Analysis Sample A1426/73 287.37m (2cm-thick disc of HQ core).
						Chloritic, brecciated contact at 288.7m with thinly laminated, slightly augen, granite gneiss with interstitial, pale whitish grey, quartzose lamellae (or ribbons) intermixed in a chloritic matrix. A 5mm quartz band at 289.35m conformable with foliation at approx. 50° to C.A.	
291.00m	293.50m	2.50m	2.34m			Followed by approx. 20cm-wide zone of thinly laminated, soft ?epidotic (or clayey) feldspar, pink feldspar and dark grey crinkled lamellae. Grades over basal 10cm back into typical "quartzose" augen granite gneiss at 289.6m. "Pebbly" from 291.45-291.55m with thicker quartz lenses up to 2cm wide. Foliation 50° to C.A. Chloritic, brecciated shear zone at 294m - approx. 15cm wide.	
293.50m	294.30m	0.80m	0.70m			Grades to chloritic, syenitic (<10% quartz) zone at 294.6m very contorted and no foliation.	

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	REMARKS
						From 295.0-295.7m grades back to "quartzose" augen granite gneiss as above 294.6m.	
						Green clay-filled shears every 20-40cm from top of unit.	
294.30m	297.25m	2.95m	2.82m			From 295.7m generally thinly laminated chloritic gneiss with zones containing minor interstitial quartzose material within the chloritic matrix; well foliated at approx. 45° to C.A. Very contorted blebs with no foliation and brecciated in part from 298.9-301.25m. Thence thinly foliated as above and slightly brecciated. Strongly chloritic shears from 301.1-301.6m.	Silicate Analysis Sample A538/74 299.59-299.96m and 300.85-301.68m. (92cm total length of core pieces sampled within the two intervals).
297.25m	299.20m	1.95m	1.94m				
299.20m	302.27m	3.07m	2.95				
						5mm quartz band at 301.7m - 50° to C.A.	Pet. Sample P75/74 299.86m
302.27m	303.15m	0.88m	0.88m			Quartz segregation sub-parallel to C.A. cross cutting gneissic foliation from 302.5-302.9 (along one side of core).	Silicate Analysis Sample A539/74 300.12-300.79m (67cm)
303.15m	303.85m	0.70m	0.60m	302.90m	346.00m	AUGEN GRANITE GNEISS. Gradational from above unit to typical "quartzose" pink-feldspar augen granite gneiss as at top of cored section. Foliation gradually steepens from approx. 45° to C.A. just below quartz blow to 40° at 308m to 35° from about 313m and 30° from about 324m.	Pet. Sample P76/74 300.16m
303.85m	305.25m	1.40m	1.32m	993.8ft	1135.2ft		
305.25m	308.35m	3.10m	2.97m				Hand Specimen 302.62-302.73m
308.35m	309.85m	1.50m	1.35m				
309.85m	310.75m	0.90m	0.89m				
310.75m	312.30m	1.55m	1.47m				
312.30m	314.50m	2.20m	2.09m			Shear zone from 323.2-323.6m. Brecciated granitic blocks several cm across with thin dark grey band, a few mm thick, on upper surfaces. Shear zone filled with white calcitic vein filling (?scapolite).	
314.50m	317.20m	2.70m	2.48m				Hand Specimen 323.16-323.45
317.20m	317.80m	0.60m	0.55m				
317.80m	320.90m	3.10m	2.90m			Pink ovoids at 325.4m mantled with black biotitic or chloritic material.	
320.90m	321.80m	0.90m	0.85m				
321.30m	323.95m	2.15m	1.96m			Rock fairly uniform in composition and texture to base of unit.	
323.95m	326.80m	2.85m	2.82m				
326.80m	328.60m	1.80m	1.62m			Occasional chloritic brecciated shear zones < 5cm thick (e.g. 331.7m) and moderate clay-filled fractures or shears - thickest being 2.5cm at 334.95m, 60° to C.A. - several thinner ones down to 336.7m.	
328.60m	330.35m	1.75m	1.69m				
330.35m	331.85m	1.50m	1.43m				
331.85m	332.95m	1.10m	1.08m				
332.95m	335.30m	2.35m	2.28m			Slightly epidotic in patches, notably at 303.85m, 307.3m, 318-319m and 334.6-336.8m.	Hand Speciman 335.05-335.18m.
335.30m	336.70m	1.40m	1.31m				
336.70m	338.80m	2.10m	1.92m				
338.80m	340.40m	1.60m	1.55m			Quartz blow at approx. 339.0-339.3m. Contacts not sharp as for quartz blow at 302.6m - 1-2 cm wide border zone of quartz with very thin lamellae of country rock parallel to contact.	
340.40m	342.75m	2.35m	2.00m				
342.75m	343.55m	0.80m	0.67m			"Pebbly" or "conglomeratic" zones occur particularly below quartz blow - contain more equant, round (some stretched or elongated), pink ?clasts composed of a mosaic of quartz and feldspar grains with occasional angular mafic fragments.	

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	REMARKS
343.55m	344.40m	0.85m	0.75m			Chloritic and clayey (some with minor calcite) shears - 1/metre or less (e.g. at 243.5m) - and numerous joints - 1/10-20cm, e.g. at 344.2-345.0m set of parallel joints (1/5-10cm, 40° to C.A.) at right angles to foliation (25° to C.A.)	
344.40m	345.40m	1.00m	0.81m			Core very broken from 344.0-344.2m.	
345.40m	346.10m	0.70m	0.63m	346.00m	363.30m	"PEBBLY" AUGEN GRANITE GNEISS - Quartz content variable - syenitic composition in part. Quartz content in matrix between pink lenses decreases from about 346m (no sharp boundary) and is minor from 347.15-347.50m where rock consists of >80% very streaked out pink laminae (no augen) composed of a mosaic of granular quartz and feldspar crystals, with very thin (1.2mm), discontinuous, dark green chloritic interlamellae and minor quartz (<10%).	Hand specimen 347.21-347.40m Silicate Analysis sample A540/74 346.62-359.00m (1.56m total length of core pieces sampled over interval.
346.10m	348.70m	2.60m	2.40m	1135.2ft	1192.0ft		
						Proportion of pink components (augen, lenses and "pebbles") slightly more over most of unit than above 346m - >60% c.f. 50% above. (although overal both units are very similar).	
						Many rounded "pebbles" of granitic rock - quartz & feldspar & minor mafic fragments.	Pet. Sample P545/73 350.0m Hand Spec. 353.28-353.55m
348.70m	351.75m	3.05m	2.84m				
351.75m	352.60m	0.85m	0.78m			Grades to a more quartz-rich zone from about 351.7m with chloritic mafic clots up to 1cm daim. scattered throughout. From 353.30-353.55m rock is very quartz rich and thinly laminated.	
352.60m	353.75m	1.15m	0.96m				
353.75m	356.10m	2.35m	2.18m			Below 353.55m quartz content decreases slightly and pink components increase - at approx. 354m rock similar to that above more quartz rich zone. Particularly "conglomeratic" with large sub-round "pebbles" up to 5cm long near base (e.g. at 360m).	Hand specimen 359.87-360.00m
356.10m	357.15m	1.05m	1.04m			Rock very broken over quartz-rich interval (except for finely laminated zone) and from 356.6m to base of unit - also very fractured with calcerous clayey smears, and very well jointed.	Comment: "Conglomeratic" texture may result from K-feldspars, which have not deformed plastically to form the augen texture as at the top of cored section, but, under a more brittle stress regime, have either retained their original ovoidal (rapikivi?) shape with some brittle rupturing, or where the maximum tenancity of the ovoids is exceded, have been completely ruptured, granulated and sheared out in to ribbons.
357.15m	358.65m	1.50m	1.27m				
358.65m	360.15m	1.50m	1.48m			360.80-363.30m: matrix more quartzose. Strongly sheared and fractured especially above 361.70m with hematitic clay and chlorite on shear surfaces. Brecciated over upper 40cm and moderate calcite matrix and veining with occasional pyrite selvages also occasional pale green epidotic grains up to 1cm diameter.	
360.15m	361.70m	1.55m	1.48m				
361.70m	363.80m	2.10m	2.07m				

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	REMARKS
363.80m	365.20m	1.40m	1.34m	363.30m 1192.0ft	364.90m 1197.2ft	EQUIGRANULAR ?GRANITIC ROCK or COARSE GRAINED ?ARKOSIC ROCK. Brick-reddish coloured grains 1-2mm diam. in a dark-green chloritic matrix - some grains pale greenish ?epidotic from 364.00-364.20m. Massive - not foliated. Sharp upper contact with strongly brecciated (internally*) zone over upper 65cm. decreasing below to 364.6m - fragments several cms across with a green chloritic and ?epidotic matrix and moderate calcite from 363.4-363.8m. Minor quartz veining and quartz fragments (similar to quartz blows above) some with hematitically stained margins. Basal 30cm not brecciated and more of a rusty red brown colour, and a faint, fine foliation becomes more apparent - grades back to augen granite gneiss over approx. 2-3cm.	Pet. Sample P596/73 364.9m Silicate Analysis Sample A1427/73 364.55m (2cm - thick disc of HQ core) * Comment:rock has rewelded into a coherent rock - i.e. brecciation appears to have formed towards the first major dynamic metamorphic event and is not a post-carpentarian event as is most of other britle un-rewelded brecciation.
365.20m	367.35m	2.15m	1.97m	364.90m 11972ft	373.15m 12243ft	AUGEN GRANITE GNEISS. Quartzose matrix as above 363.3m, becoming more quartzose towards base. Occasional ovoid"pebbles". Numerous hematitic and/or chloritic clay shears below 368m.	
367.35m	371.70m	*4.35m	4.16m				
*Tag missing as core barrel only 3m long							
371.70m	373.05m	1.35m	1.27m	373.15m 12243ft	376.30m 12346ft	GRANITIC ROCK - unfoliated, coarse grained rock with sharp upper and lower contacts. Rock consists of 90% pink componenets which are composed of a mosaic of irregular pink ?feldspars (0.5-1mm diam.) and smaller quartzes with minor interstitial mafic (?chloritic) material. Two zones of foliated augen granite gneiss from 373.65-373.9m (core very broken) and 374.50-376.0 (contact 10^{0} to C.A.) - strongly brecciated zone from 374.50-374.75m with abundant calcite stockwork. Basal 30cm even grained granitic rock with a very coarse grained sandstone texture (grain size 1-2mm) - quartz, feldspar and mafics in approximately equal proportions. Quartzite band on edge of core near base.	
373.05m	373.65m	0.60m	0.55m				
373.65m	374.35m	0.70m	0.56m				
374.35m	374.70m	0.35m	0.37m				
374.70m	376.30	1.60m	1.49m				
376.30m	377.25m	0.95m	0.86m	376.30m 12346ft	418.50m 13731ft	AUGEN GRANITE GNEISS - as for above 373.15m "Conglomeratic" over upper 3m, becoming generally more finely foliated below with occasional "conglomeratic" zones. Zone of generally very finely foliated rock from 400-408m. Whitish grey quartzitic patches up to 5cm across at 397-408m. Larger quartz zones up to 10cm across at 407.3m and 407.9m - margins finely laminated with country rock. Rock brecciated at upper quartz contact at 407.3m - with granular <u>pyrite</u> fragments up to 5mm diam. Rock becomes progressively more brecciated towards base from below quartz patches, with chloritic matrix and clay coated shear surfaces. Massive <u>pyrite</u> vein, 1cm thick, with thin (1mm) quartz selvages at 413.10m. A clear quartz bleb, 2cm in diam., with purple ?fluorite and some pyrite crystals at 413.20m. Pyrite-coated shears at 412.60m.	
377.25m	378.95m	1.70m	1.61m				
378.95m	379.75m	0.80m	0.79m				
379.75m	380.55m	0.80m	0.72m				
380.55m	381.90m	1.35m	1.17m				
381.90m	382.75m	0.85m	0.76m				
382.75m	383.20m	0.45m	0.39m				
383.20m	383.70m	0.50m	0.41m				
383.70m	384.65m	0.95m	0.77m				
384.65m	386.30m	1.65m	1.45m				
386.30m	387.55m	1.25m	1.18m				
387.55m	388.15m	0.60m	0.56m				
388.15m	390.05m	1.90m	1.72m				
390.05m	391.10m	1.05m	0.93m				
391.10m	391.50m	0.40m	0.28m				

CORE RECOVERY LOG				LOG OF DRILL HOLE			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	REMARKS
391.50m	392.05m	0.55m	0.40m			Core over unit generally very sheared and broken - 50% of core broken into small fragments in upper half and 50% broken in lower half - completely sheared and broken from 401-407m with abundant clay smears.	
392.05m	393.00m	0.95m	0.79m				
393.00m	393.65m	0.65m	0.51m				
393.65m	394.35m	0.10m	0.59m				
394.35m	394.90m	0.55m	0.36m	418.50m	427.35m	SHEAR ZONE Strongly brecciated, light grey rock with small (<3mm - diam.) pink feldspar and white quartz fragments scattered throughout a light greenish grey fine-grained crushed matrix. Less brecciated from 426.4m - i.e. mostly brecciated quartzitic gneissic rock with very little grey crushed matrix. Pyrite grains on shear surfaces near base.	Roller bit used from 419.65-426m - no core recovered. Cored NQ from 426m Core loss from 426.95-427.09m
394.90m	395.80m	0.90m	0.77m	1373.1ft	1402.1ft		
395.80m	396.10m	0.30m	0.20m				
396.10m	396.55m	0.45m	0.40m				
396.55m	397.35m	0.80m	0.52m				
397.35m	397.75m	0.40m	0.26m				
397.75m	398.50m	0.75m	0.55m	427.35m	431.20m	GRANITE GNEISS Thinly foliated (crudely), pink and light grey quartzitic granite gneiss - foliae 2-3mm thick, 45° to C.A. Brecciated shear zones with greenish ?chloritic matrix from 427.95-429.70m. Foliated as above from 429.7-429.9m. Below 429.9m foliation distorted and brecciated in part with a 2cm-wide granulated shear zone at 90° to foliation at approx. 430.4m.	
398.50m	399.55m	1.05m	0.93m	1402.1ft	1414.8ft		
399.55m	400.40m	0.85m	0.80m				
400.40m	401.20m	0.80m	0.63m				
401.20m	401. 60m	0.40m	0.31m				
401.60	404.00m	2.40m	*0.95m				
*1m core loss from 401.92 -402.92m				431.20m	431.85m	CHLORITIC GRANITIC ROCK Mottled, salmon pink and dark green rock - large irregular shaped pink patches up to 2cm diam. (75% of rock) in a dark green chloritic matrix with rare, small, light grey quartzitic patches. Strongly brecciated at upper and lower contacts.	
404.00m	404.55m	0.55m	0.43m	1414.8ft	1416.9ft		
404.55m	405.70m	1.15m	0.61m				
405.70m	406.40m	0.70m	0.67m				
406.40m	406.75m	0.35m	0.24m				
406.75m	407.80m	1.05m	0.94m	431.85m	470.55m	GRANITE GNEISS - sheared and brecciated as immediately above 431.20m. Moderately brecciated with chloritic matrix between fragments and in shears. Slightly less brecciated from about 442.2-445.7m - foliation approx. 60° to C.A. Moderately brecciated from 445.7-458.7m - sulphides (pyrite) and some calcareous clay fractures, e.g. 453.2m. Chlorite blebs throughout moderately brecciated zones. Core very broken with numerous calcite veins from 433.8-458.7m.	
407.80m	408.25m	0.45m	0.45m	1416.9ft	1543.9ft		
408.25m	408.70m	0.45m	0.42m				
408.70m	409.50m	0.80m	0.63m				
409.50m	409.90m	0.40m	0.29m				
409.90m	410.20m	0.30m	0.25m				
410.20m	410.65m	0.45m	0.36m				
410.65m	411.90m	1.25m	0.82m			Less brecciated from 458.7-467.5m although frequent faults or shears with some brecciation adjacent to shears. Less calcite vein filling than above. Crude foliation at 60° to C.A. Core more intact with unbroken lengths up to 50cm.	
411.90m	412.40m	0.50m	0.43m				
412.40m	413.10m	0.70m	0.63m				
413.10m	414.05m	0.95m	0.85m			Core very broken and rock sheared and brecciated from 467.5-470.3m. Also more calcareous clay vein fillings. - many containing breccia fragments.	
414.05m	414.30m	0.25m	0.21m				
414.30m	414.55m	0.25m	0.13m				
414.55m	414.75m	0.20m	0.08m	470.55m	479.30m	GRANITE GNEISS - "pebbly" - blotchy feldspar granite gneiss, brecciated and sheared in part.	
414.75m	415.55m	0.80m	0.73m	1543.9ft	1572.6ft		
415.55m	416.85m	1.30m	1.30m			470.55-470.75m very thinly foliated, strong red feldspar zone with very little chlorite and quartz.	
416.85m	419.65m	2.80m	*1.65m				
419.65m	426.00m	6.35m	**			470.75-471m quartz and feldspar lenses very elongated (streaked out) and wavy (folded).	
* 73 cm core loss							
** See Remarks Column						471-475m pink feldspars become blotchy (irregular shaped) and slightly elongated, defining a crude foliation - 50° to C.A. at 473.8m. Core generally less fractured,	
426.00m	426.60m	0.60m	0.47m				
426.60m	427.40m	0.80m	*0.44m				
*Lost 14 cms.							

FROM	TO	INTERVAL	RECOVERY	FROM	TO	DESCRIPTION	REMARKS
427.40m	428.50m	1.10m	0.96m			although very broken and brecciated with chloritic shears from 472.3-473.0m. Chloritic blotches and streaks occur within quartzitic matrix throughout section.	
428.50m	430.20m	1.70m	1.68m				
430.20m	430.50m	0.30m	0.18m				
430.50m	431.90m	1.40m	1.24m			475.0-475.85m becomes more "conglomeratic" - "pebbles" generally well fractured and slightly brecciated. Sheared and brecciated from 475.6-475.85m.	
431.90m	432.20m	0.30m (?)	1.17m				
432.20m	433.80m	1.60m	. 0m				
433.80m	434.60m	0.80m	0.57m			Below 475.85m becomes richer in pink feldspar and very thinly foliated as at top of unit. Chlorite in cross fractures and a feathered shear structure at 476.4m. A thin (1cm) quartzitic band with occasional black mafic grains scattered throughout at 476.6m - at 30° to C.A. and cuts across foliation at 60° to C.A.	
434.60m	436.00m	1.40m	1.27m				
436.00m	436.33m	0.33m	0.25m				
436.33m	436.65m	0.32m	0.31m				
436.65m	437.75m	1.10m	0.91m				
437.75m	438.15m	0.40m	0.29m			Grades to more gneissic rock with more quartzose matrix from about 476.8m, and becomes more fractured and moderately brecciated. Chloritic angular fragments and irregular shaped quartzitic patches and bands cutting across foliation throughout.	
438.15m	439.13m	0.98m	0.90m				
439.13m	440.60m	1.47m	0.98m				
440.60m	440.90m	0.30m	0.18m				
440.90m	441.20m	0.30m	0.23m			Finely brecciated and very chloritic from 477.85-478.1m and 478.8-479.3m - foliation at 30° to C.A.	
441.20m	441.40m	0.20m	0.13m				
441.40m	442.05m	0.05m	0.47m				
442.05m	442.65m	0.60m	0.49m	47930m	508.85m	AUGEN GRANITE GNEISS - similar to near top of hole. Well foliated 25°-30° to C.A. Occasional rounded "pebbles" up to 2.5cm diam. containing small angular chloritic fragments throughout.	
442.65m	442.90m	0.25m	0.06m	15726ft	16695ft		
442.90m	443.30m	0.40m	0.21m				
443.30m	444.05m	0.75m	0.64m				
444.05m	445.00m	0.95m	0.79m			498.75m - a 3mm quartz vein parallel to foliation at approx. 23° to C.A.	
445.00m	446.45m	1.45m	1.25m				
446.45m	447.50m	1.05m	0.82m				
447.50m	447.85m	0.35m	0.20m				
447.85m	448.75	0.90m	0.48m				
448.75m	449.85m	1.10m	0.55m				
449.85m	450.20m	0.35m	0.26m				
450.20m	451.10m	0.90m	0.68m				
451.10m	452.60m	1.50m	1.30m				
452.60m	453.80m	1.20m	1.19m				
453.80m	454.55m	0.75m	0.64m				
454.55m	455.90m	1.35m	1.29m				
455.90m	457.43m	1.53m	1.50m				
457.43m	458.30m	0.37m	0.80m				
458.30m	459.10m	0.80m	0.76m				
459.10m	459.90m	0.80m	0.80m				
459.90m	461.90m	2.00m	1.94m				
461.90m	463.10m	1.20m	1.14m				
463.10m	464.00m	0.90m	0.87m				
464.00m	466.50m	2.50m	2.46m				
466.50m	468.10m	1.60m	1.51m				
468.10m	468.50m	0.40m	*0.23m				

FROM	TO	INTERVAL	RECOVERY	FROM	TO	DESCRIPTION
*No core from 468.33-468.50m						
468.50m	468.80m	0.30m	*0.16m			Sharp change at quartz vein from "pebbly" gneiss, with very little chlorite matrix over preceding 25cm, to more thinly foliated augen gneiss with more chloritic matrix as above 498.5m, and with only rare pebbles. Foliation increases from 25° to C.A. at 501m to 30° below 502.5m. Slighly "pebbly" from 503.9 - 504m.
*No core 468.76-468.80m						
468.80m	469.10m	0.30m	0.23m			
469.10m	469.60m	0.50m	0.47m			
469.60m	471.30m	1.70m	1.63m			(a) Occasional moderately brecciated zone and/or (b) strongly chloritic shear zones
471.30m	472.60m	1.30m	1.18m			(a) 481.6m, 483.1-483.3m, 485.5m, 501.9-502m (with trace pyrite);
472.60m	473.00m	0.40m	0.29m			(b) 487.2m, 489.5m, 491.0-491.15m, 498.8m, 496.1m, 498.2m (thin shear at 20° to C.A. - note other thin shears throughout core at various angles to C.A. not recorded, approx. 1 per m) and 500.9m (also slightly brecciated with sparse pyrite);
473.00m	474.05m	1.05m	1.04m			
474.05m	475.75m	1.70m	1.58m			
475.75m	477.20m	1.45m	1.33m			
477.20m	478.65m	1.45m	1.35m			
478.65m	481.83m	3.18m	3.02m			
481.83m	483.35m	1.52m	1.44m			
483.35m	484.60m	1.25m	1.17m			
484.60m	485.65m	1.05m	1.03m			
485.65m	487.00m	1.35m	1.23m			
487.00m	489.45m	2.45m	2.40m			
489.45m	490.10m	0.65m	0.61m			
490.10m	491.10m	1.00m	0.92m			
491.10m	492.00m	0.90m	0.80m			
492.00m	493.95m	1.95m	1.93m			
493.95m	495.20m	1.25m	1.15m			
495.20m	496.60m	1.40m	1.30m			
496.60m	497.70m	1.10m	1.07m			
497.70m	499.05m	1.35m	1.31m			
499.05m	499.90m	0.35m	0.83m			
499.90m	500.90m	1.00m	0.95m			
500.90m	502.25m	1.35m	1.26m	503.30m	522.30m	GRANITIC ROCK - chloritic siliceous, moderately sheared. Gradational contact from 508.8-509.2m. Rock pinkish and greyish green.
502.25m	503.50m	1.25m	1.25m	1669.5ft	1713.7ft	
503.50m	504.10m	0.60m	0.52m			Sheared and brecciated in part with greyish-green chloritic vein stockworks in upper parts and strongly chloritic, very crudely foliated in other parts.
504.10m	504.65m	0.55m	0.42m			
504.65m	505.00m	0.35m	0.30m			
505.00m	505.65m	0.65m	*0.21m			Patch of quartz 5cm across at 509.6m and thin quartz bands at 511.05m & 516.5m.
*Core loss 505.21-505.65m						
505.65m	507.20m	1.55m	1.47m			Strongly chloritic and brecciated from 512.9-514.1m with quartzitic band, 3.5cm thick and 45° to C.A. at 513.8m. Thinly foliated (30° to C.A.) pinkish gneissic zones between chloritic breccia zones at irregular intervals throughout rest of unit. Rock slightly less siliceous below about 516.5m and grades over following metre to moderately brecciated strongly feldspathic rock at base.
507.20m	508.25m	1.05m	0.97m			
508.25m	511.35m	3.10m	3.06m			
511.35m	512.20m	0.86m	0.84m			
512.20m	512.70m	0.50m	0.48m			
512.70m	516.70m	4.00m	3.90m			
516.70m	518.20m	1.50m	1.44m			
518.20m	521.15m	2.95m	2.90m			Rock very hard and compact - core moderately intact.
521.15m	523.15m	2.00m	1.94m			

FROM	TO	INTERVAL			
501m	502m	1m	994	2	5/10
1643.8ft	1647.1ft	3.3ft			
Augen gneiss with pyrite.					
Sheared, slightly chloritic siliceous granitic rock.					
501m	511m	1m	)995	8	5/5
1673ft	1676ft	3.3ft)			
513.8m	Pet. Sample P663/73				
1685ft					
513m	514m	1m	)996	2	5/5
1683.2ft	1686.4ft	3.3ft)			
Quartz rich rock					
519m	520m	1m	997	5	3/<5
1702.8ft	1706.1ft	3.3ft)			
Moderately quartz-rich granitic gneiss with strong quartz-rich zone over basal 30cm (80% quartz).					

C00011

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PARJ BARANA

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CORE RECOVERY LOG

FROM	TO	INTERVAL	RECOVERY	FROM	TO	DESCRIPTION	ASSAYS FROM	TO	INTERVAL	Au ppm	Cu ppm	Mo ppm
523.15	525.55m	2.40m	2.32m	522.30m 1713ft	526.20m 1726.5ft	"AMPHIBOLITIC" ROCK. Dark greenish grey, massive, chloritic, hornfelsic amphibolite(?). Sharp horizontal upper contact. Strongly magnetic. Occasional patches a few cm across with brecciated granitic fragments down to 523.55m. Sharp contact at approx. 60° to C.A. with rock containing 50% brecciated, fractured and shattered quartz within a chloritic amphibolitic matrix as above. From 524.4m pink ?hematitically stained, irregular feldspar patches increase while quartz becomes more foliated, but remains fractured. Below 525.0m brecciated granitic fragments (50% of rock) in a chloritic amphibolitic matrix as above. Gradational basal contact over 10cm.	522.38m 1713.9ft	523.38m 1717.2ft	1m 3.3ft)	998	8	3/10
							Dark green massive chloritic rock. *"Amphibolitic" used as a field term to describe massive dark (usually) greenish grey chloritic rock - mineralogy indeterminant in field and are not necessarily amphibolites.						
525.55	527.80m	2.25m	2.19m	526.20m 1726.5ft	534.40m 1753.4ft	SHEARED CHLORITIC GRANITIC GNEISSIC ROCK. Brecciated granitic rock with dark green chloritic matrix (<10% of rock). Brecciation varies from weak, in portions of crudely foliated rock, to strong, with fragments up to 2cm diam. but generally < 1cm diam. Very weakly magnetic in zones of stronger brecciation. Grades to amphibolite below with increase in brecciation and chloritic content from 533.9m - becomes very muscovitic over basal 10cm.	529m 1735.6ft	530m 1738.9ft	1m 3ft)	999	5	3/5
							Strongly brecciated granitic gneissic rock - fragments of very thinly banded rock averaging ~1cm across in a dark green chloritic matrix (~10% of rock).						
527.80m	529.10m	1.30m	1.24m										
529.10m	531.80m	2.70m	2.56m										
531.80m	532.65m	0.85m	0.34m										
532.65m	533.60m	0.95m	0.37m										
533.60m	535.10m	1.50m	1.26m	534.40m 1753.4ft	538.30 1766.2ft	"AMPHIBOLITIC" ROCK with bands of sheared chloritic GRANITIC ROCK. 534.4-534.7m dark green amphibolite as above, strongly magnetic, core massive and coherent.	533.9m 1751.7ft	534.9m 1755.0ft	1m 3.3ft)	1000	5	3/<5
							Contact zone: strongly brecciated quartz-muscovite fragments in a strong chloritic matrix to 534.4m; dark green chloritic massive rock to 534.7m; sheared granitic rock over basal 30cm.						
535.10m	536.05m	0.95m	0.91m			534.7-536.05m sheared granitic rock with strong chloritic matrix, rusty red colour, very weakly magnetic, core very broken. Amphibolitic zone from 535.50-535.65m.						
536.05m	536.65m	0.60m	0.44m										
536.65m	537.00m	0.35m	0.34m			536.05-538.30m dark greenish grey, massive hornfelsic amphibolite. Occasional irregular quartzite patches, largest at 536.8m. Strongly magnetic near upper contact, decreasing away from contact. Core moderately broken.	537.0m 1761.9ft	538.0m 1765.2ft	1m 3.3ft)	1380	8	3/10
537.00m	538.60m	1.60m	1.53m				Central portion of "amphibolitic" rock.						
538.60m	540.50m	1.90m	1.79m	538.30m 1766.2ft	550.40m 1805.9ft	SHEARED GRANITIC GNEISSIC ROCK. Gradational zone from amphibolite to sheared granitic rock with strong chloritic matrix and foliated with streaked-out quartz lenses at approx. 60° to C.A. Pink brecciated feldspars increase from 538.70m. Rock variously sheared and brecciated - strongly sheared sections contain little or no pink feldspar and stronger chloritic matrix.	538.60m 1767.1ft	Pet. Sample P 597/73				
540.50m	542.10m	1.60	1.62										
542.10m	544.20m	2.10m	1.96m			Very coarsely brecciated with abundant calcite between fragments of augen granite gneiss from 540.6-541.6m. Abundant calcite-filled fractures in augen granite gneiss from 541.6-542.3m.						
544.20m	544.65m	0.45m	0.45m			Strongly sheared from 543.4-546.8m - mostly angular quartz with minor feldspar.	543.4m 1782.9ft	544.4m 1786.2ft	1m 3.3ft)	1381	5	4/5
544.65m	545.50m	0.85m	0.74m										
545.50m	547.20m	1.70m	1.62m										

C00012

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PARABARANA

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CORE RECOVERY LOG

FROM	TO	INTERVAL	RECOVERY
547.20	548.00m	0.80m	0.82m
548.00	549.80m	1.80m	1.86m
549.80m	550.90m	1.10m	1.01m
550.90	554.00m	3.10m	3.04m
554.00m	557.10m	3.10m	3.08m
557.10	560.20m	3.10m	3.08m
560.20	563.00m	2.80m	2.78m
563.00m	564.00m	1.00m	0.90m
564.00m	565.00m	1.00m	0.91m
565.00m	565.90m	0.90m	0.75m
565.90m	566.35m	0.45m	0.54m
566.35m	567.45m	1.10m	0.81m
567.45m	568.75m	1.30m	1.17m
568.75m	570.80m	2.05m	1.85m
570.30m	571.40m	0.60m	0.51m
571.40m	572.15m	0.75m	0.16m*
*Core loss 571.56 - 572.15m			
572.15m	572.80m	0.65	0.18m*
*Core loss 572.83 - 572.80m			
572.80m	573.90m	1.10m	0.60*
*Core loss 572.96 - 573.46m			

FROM	TO
550.40m (18059ft)	575.48m (18881ft)
575.80m (1888.1ft)	580.05m (1903.1ft)

Welded, brecciated granitic ?gneissic rock from 546.8m to base. Dark green, strongly chloritic zone from 548.92-548.97m with abundant disseminated pyrite grains approx. 1mm diam. and two thin bands of magnetite.

"AMPHIBOLITIC" ROCK

550.4-551.5m sheared, dark greenish grey rock with angular (some round) quartz fragments in a green chloritic matrix with patches of brecciated angular fragments of grey ?graphitic schist up to 4cm long. Rare pyrite grains of similar size to quartz.

551.5-557.35m medium greenish grey massive rock with very weak foliation defined by thin (<1mm) discontinuous greenish ?feldspathic lenses at approx. 60° to C.A. Strongly veined with pink ?K-feldspar - associated with pale greenish soft ?soapstone or clay mineral and occasional grains of sulphides, mostly chalcopyrite. Occasional irregular bands of quartz - thickest being 8cm at 551.85m - rest very irregular patches<2cm across. Patches of massive pyrite, 1cm across, in sheared elongated quartz band at 555.05m. Occasional calcite veins.

557.35-558.4m dark grey, massive amphibolitic rock with no pink feldspar veins and associated 30ft green ?soapstone, but with numerous irregular quartz lenses up to 2cm thick. Sharp upper contact, gradational basal contact over 10-20cm.

558.4-566.35m as above 557.35m - gradually becomes a lighter grey. Massive salmon pink feldspar band from 559.25-559.53m, moderately sharp shear contacts, internally brecciated with some calcite in fractures. Irregular patches of salmon pink feldspathic material over following 1.5m. Very little feldspar veining below, but with occasional patches of brecciated pink feldspar. Brecciated quartzitic zone from 564.25-564.5m with grey matrix and irregular pink feldspar veining in patches. Very sheared, grey, greasy ?graphitic zone from 565.7-565.9m. Pale greenish ?epidotic feldspar over basal 40cm.

Good core recovery and moderately unbroken over amphibolitic zone to approx. 561m - core below, well fractured and brecciated rock with some calcite-filled fractures.

566.35-575.8m grey schistose phyllitic or schistise rock, very sheared and broken. Greasy graphitic zone over upper 1m. Rest brecciated and sheared grey amphibolitic rock with occasional pinkish siliceous patches, especially just below quarzitic bands from 569.48-569.80m (with chloritic smears in fractures) and 573.7-573.8m. Abundant white 50ft ?soapstone or clay mineral in very sheared rock from 574.25-574.7m.

SHEARED CHLORITIC GRANITIC ROCK. Pinkish grey granitic rock (sheared ?"augen granite gneiss*"). Mostly composed of siliceous - looking patches of angular irregular pink feldspars in a chloritic matrix. Also with narrow, dark grey,

FROM	TO	INTERVAL	Au g/t	Cu ppm	Mo/As ppm
548m (1793.0ft)	549m (1301 3ft)	1m (3.3ft)	1382	5	3/5
Minor chlorite matrix in sheared granitic gneissic rock					
555m (1821.0ft)	556m (1824 2ft)	1m (3.3ft)	1383	360	5/10
Green "amphibolitic" rock with K-feldspar veins - note sulphides.					
557.23 (1828.3ft)	557.44m (1829.0ft)	Pet. Sample P598/73 (over contact zone)			
557.45m (1829.0ft)	558.45m (1832 3ft)	1m (3.3ft)	1384	150	5/5
Grey "amphibolitic" rock with quartz lenses but no K-feldspar.					
561m (1840.6ft)	562m (1843 9ft)	1m (3.3ft)	1385	120	22/30
Grey sheared quartz-rich rock with moderate chloritic matrix - not "amphibolitic".					
566.35m (1858.2ft)	567.35m (1861 5ft)	1m (3.3ft)	1386	12	12/10
Graphitic especially over upper 10cm.					
573.57m (1881.9ft)	574.57m (1885 2ft)	1m (3.3ft)	1387	45	12/185
Mixed rock types.					
578m (1896.4ft)	579m (1899 7ft)	1m (3.3ft)	1388	50	12/35

* NOTE: "adamellitic" as used here refers

C00013

DRILLING LOG FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	ASSAYS FROM	TO	INTERVAL	Ag g/t	Cu ppm	Mo ppm
573.90m	574.25m	0.35m	0.27m			strongly chloritic more strongly sheared zones containing angular quartz fragments and patches but no apparent feldspar. Rock massive (no foliation) and coherent with a few fractures at approx. 45° to C.A. Core broken from 577.20-577.30m. Sample from 578-579m - quartz-rich rock, strongly sheared over basal half with a dark grey matrix.						
574.25m	575.45m	1.20m	1.14m									
575.45m	575.85m	0.40m	0.27m									
575.85m	577.30m	1.45m	1.41m									
577.30m	580.40m	3.10m	2.91m									
580.40m	581.45m	1.05m	0.91m	580.05m	584.10m	SCHISTOSE ROCK. Grey, strongly chloritic, mostly finely schistose ?phyllite (chlorite-muscovite-sericite rock). Hornfelsic in minor part with white ?plagioclase patches and rare, very fine grained pyrite patches up to 1cm diam.						
581.45m	582.95m	1.50m	1.30m	1903.1ft	1916.4ft							
582.95m	584.90m	1.95m	1.80m			From 582.25m to 582.85m, grades to massive, unbroken, sheared, pinkish-grey granitic rock as pink K-feldspar content increases (similar to above 580.05m) - minor calcite veining.	581m 19063ft	582m 19095ft	1m 3.3ft	1389 1428	10 Silicate Analysis Sample	7/20
584.90m	586.95m	2.05m	2.00m	584.10m	612.00m	SHEARED CHLORITIC GRANITIC ROCK. Pinkish-grey chloritic ?"adamellitic"* rock, generally uniform in texture and composition - pink K-feldspar moderately evenly distributed throughout - occasional irregular patches < 10cm thick of massive K-feldspar. Minor zones slightly more sheared with concomitant increase in chlorite content. Zone from 585.0-586.3m with abundant quartz but no pink feldspar - also with minor epidote veining. * see bottom of page 12.	581.2m 19069ft	Pet. Sample P 599/73				
586.95m	589.98m	3.03m	2.96m	19164ft	2008.0ft							
589.98m	591.70m	1.72m	1.68m				588m 19292ft	589m 19325ft	1m 3.3ft	1390	100	18/90
591.70m	593.70m	2.00m	2.05m				593.32m 19467ft	594.32m 19500ft	1m 3.3ft	1391 1429	8 Silicate Analysis Sample	5/15
593.70m	596.30m	2.60m	2.51m									
596.30m	598.90m	2.60m	2.53m									
598.90m	600.30m	1.40m	1.32m			Core very coherent and unbroken except 593.6-593.7m and 598.6-593.8m. Only occasional flat fractures, > 45° to C.A., some chloritic, some with trace pyrite smears. Occasional calcite veins. Occasional quartz bands and irregular patches up to 3cm wide. One epidote and associated K-feldspar vein 2cm wide with chloritic selvages at 604.6m. Minor K-feldspar veining and smeared whitish clay on fracture surfaces below about 600m.	594.35m 19501ft	Pet. Sample P600/73				
600.30m	601.85m	1.55m	1.46m									
601.85m	604.80m	2.95m	2.87m				596.65m 19575ft	597.65m 19609ft	1m 3.3ft	1392	40	5/20
604.80m	607.00m	2.20m	2.19m									
607.00m	610.00m	3.00m	2.98m			605.6-606.9m grey hornfelsic, chloritic ?sericite-muscovite rock (?phyllite) with abundant irregular veins and patches of quartz and soft pale greenish white calcareous clayey material, and minor pink feldspar veining.	603.8m 19810ft	604.8m 19843ft	1m 3.3ft	1393	15	3/5
							605.9m 19880ft	606.9m 19912ft	1m 3.3ft	1394	10	5/5
610.00m	612.15m	2.15m	1.99m			More quartzitic-chloritic shear zones in granitic rock below grey phyllite band - also pink K-feldspars more angular and brecciated. Non-magnetic.						
				612.00m	627.45m	HORNFELSIC AMPHIBOLITE AND PHYLLITE. Dark greenish grey, massive, chloritic hornfelsic amphibolite - speckled whitish plagioclase giving a felted texture throughout most of coherent massive core to 623m - with narrow zones of lighter grey, "silty"textured muscovite-sericite-chlorite hornfelsic phyllite. Minor calcite, quartz and occasional K-feldspar veining throughout - occasional minor off setting along microfaults across some quartz veins.	*Dolerite dyke 614.0m 20145ft	Pet. Sample P601/73				
				20080ft	20587ft							
612.15m	614.95m	2.80m	2.69m				614.2m 20152ft	615.2m 20185ft	1m 3.3ft	1395 1430	110 Silicate Analysis Sample	3/5
614.95m	617.15m	2.20m	2.16m									
617.15m	620.25m	3.10m	2.96m									
620.25m	621.10m	0.85m	0.76m									
621.10m	623.85m	2.75m	2.46m				617m 20244ft	618m 20277ft	1m 3.3ft	1396	320	5/5

Typical amphibolites

HOLE NO P.D.D. 11

DEPARTMENT OF MINES AND ENERGY
PARABARANA PROJECT

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FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	ASSAYS FROM	TO	INTERVAL	Analysis	Cu ppm	Mo ppm
623.85m	625.20m	1.35m	1.23m			Grey schistose phyllitic shear zone from 623.0 to base of unit. Black spotted (?andalusite) phyllite with pale green, soft, waxy ?soapstone and light grey matrix 624.5m-626.35m; Black spots are irregular equant patches about 1cm in diameter evenly scattered through rock. Graphitic in part with minor pyrite below. 3cm black pug at base.*	Typical amphibolites					
625.20m	626.30m	1.10m	1.01m				Spotted andalusite schists					
							624.45m 20488ft	625.45m 20521ft	1m 3.3ft)	1397	28	4/40
							625.5m 20523ft	Pet. Sample P602/73				
626.20m	628.20m	1.90m	1.71m				626.35m 20551ft	627.35m 20533ft	1m 3.3ft)	1398	70	15/40
628.20m	630.20m	2.00m	2.00m	627.45m	635.10m	SHEARED CHLORITIC GRANITIC ROCK - most with blotchy pink K-feldspar occasionally associated with pale green ?epidotic blotches. Occasional irregular quartz bands with sharp irregular contacts and thin chloritic shears (showing some off-setting) and/or grey phyllitic bands (?metasediments). Chloritic fractures throughout. Core broken into 5-20 cm lengths.	Graphitic phyllitic. with py					
630.20m	632.50m	2.30m	2.24m	2058.7ft	20838ft		627.4m 20585ft	*Note: 3cm-wide black shear pug assayed separately for Mo i.e. Sample A1434 assayed 900 ppm Mo				
632.50m	633.20m	0.70m	0.65m									
633.20m	634.40m	1.20m	1.18m									
634.40m	635.50m	1.10m	1.04m				631m 20703ft	632m 20736ft	1m 3.3ft)	1399	110/18	18/640
							Sheared chloritic granitic rock with 10cm-wide grey phyllitic band.					
635.50m	637.00m	1.50m	1.44m									
				635.10m	639.30m	HORNFELSIC ?METASEDIMENTS. Medium grey, chloritic, ?plagioclase or quartz, hornfelsic metasediments. - no pink feldspar relics. Massive and coherent except for strong, white clay and grey graphitic shear zone from 635.1-635.5m and 638.15-638.35. Minor pink ?hematitic K-feldspar veining carrying trace sulphides mostly cp - some sulphides also disseminated. Brecciated veins and patches of quartz below 638.8m. Very faint, microfaulted banding at 637.45m (see Pet. Sample P664/73).	Grey ?metasediments (faintly banded) with sulphides.					
637.00m	638.80m	1.80m	1.70m	20838ft	20975ft		637m 20900ft	638m 20933ft	1m 3.3ft)	1400	310/25	25/2300
638.80m	640.70m	1.90m	1.87m				637.45m 20915ft	Pet. Sample P664/73				
640.70m	641.85m	1.15m	1.08m	639.30m	643.10m	?"AMPHIBOLITIC" ROCK AND/OR ?METASEDIMENTS-Very variable. Medium grey, plagioclase, hornfelsic amphibolite to hornfelsic or schistose chloritic muscovite-sericite phyllite/schist.						
				2097.5ft	21100ft							
641.85m	644.25m	2.40m	2.39m			In part moderate ?epidotic, blotchy and streaked soft waxy pale greenish ?soapstone or clay mineral. Foliation 50-60° to C.A. in a zone of schistose phyllite with streaked epidotic mineral from 540-541m. Moderate pink ?hematitic K-feldspar and minor calcite veining, with associated rare sulphides mostly pyrite.						
644.25m	645.90m	1.65m	1.61m	643.10m	646.65m	?CALC-SILICATE HORNFELS with narrow ?AMPHIBOLITIC ZONES. Massive hard internally brecciated pale greenish grey chloritic ?calc-silicate hornfels zones separated by narrow dark greenish grey amphibolitic zones with moderate calcite veining and ?hematitic K-feldspar selvages and associated rare sulphides.						
645.90m	648.90m	3.00m	3.02m	21100ft	21217ft							
648.90m	651.10m	2.20m	2.10m	646.65m	649.90m	PHYLLITE. Dark greenish grey massive chlorite-?muscovite-?sericite phyllite. Moderate storkwork of calcite veins occasionally with ?hematitic pink feldspar selvages. Minor quartz veins. Strong brick red K-feldspar (or ?hematitic) staining over basal 30cm. Veins (mostly calcite) <5% of rock.	Greenish and felted (?dolerite) over upper 50cm & dark grey micaceous over basal 50cm.					
				21217ft	21323ft		648m 2126.1ft	649m 2129.4ft	1m 3.3ft)	1401	15	3/20
										Silicate Anal. Sample		

C00015

HOLE NO P.D.D. 11

DEPARTMENT OF MINES
PARABARANA PROJECT

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CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS					
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	Au g/t	Cu ppm	As ppm
							648.5m	Pet. Sample P77/74				
				649.90m 2132.3ft	650.90m 2135.6ft	?CALC-SILICATE HORNFELS. Pale greenish grey and dark green chloritic ?siliceous ?epidotic ?calc-silicate hornfels. Rock brecciated internally but welded into a hard coherent rock. Moderate pink ?hematitic feldspar patches and veins.	649.9m 2132.3ft	650.9m 1m 2135.6ft 3.3ft)	1402	40	3/20	
							649.9m 2132.3ft	650.9m 1m 2135.6ft 3.3ft)	1431	Silicate Analysis Sample		
651.10m 653.55m	653.55m 654.85m	2.45m 1.30m	2.43m 1.28m	650.90m 2135.6ft	656.50m 2154Oft	SHEARED CHLORITIC GRANITIC ROCK - pink and dark green ?"adamellitic" rock. Chlorite content varies according to degree of shearing. Strong chloritic shear zone from 635.35-653.60m - core very broken. Brecciated massive pink K-feldspar zone with minor chlorite from 654.25-654.80m; chlorite content slightly more below, but considerably less than upper part of unit.	650.35m) 2133.8ft)	Pet. Sample P603/73				
654.85m	656.70m	1.85m	1.79m				652.55m 2141.0ft Chlorite-rich portion.	653.55m 1m 2144.3ft 3.3ft)	1403	2	3/45	
							656.1m) 2152.7ft)	Pet. Sample P604/73				
656.70m	657.40m	0.70m	0.65m	656.50m 2154.0ft	657.62m 2157.7ft	?CALC SILICATE HORNFELS. Pale greenish grey and dark green chloritic ?epidotic ?siliceous ?calc-silicate, as for 649.9-650.9m. Rock more sheared rather than brecciated as zone above, with thin chlorite coatings on shear surfaces - core broken.						
657.40m	658.95m	1.55m	1.54m									
658.45m 660.30	660.30m 661.55m	1.35m 1.25m	1.31m 1.19m	657.62m 21577ft	661.10m 21691ft	STRONGLY SHEARED CHLORITIC GRANITIC ROCK. Minor pink feldspar patches and veins throughout except for slightly chloritic strong pink feldspar zone 657.78-657.93m. Speckled pale greenish white soapstone (?epidotic material) from 659.65-659.90m. Core very broken.	Most strongly sheared chloritic-rich portion - stronger chlorite than 652.55-653.55m 660m 21655ft	661m 1m) 21687ft 3.3ft)	1404	15	10/350	
661.55m 663.60m	663.60m 666.70m	2.05m 3.10m	2.01m 3.02m	661.10m 21691ft	665.50m 21885ft	SHEARED SLIGHTLY CHLORITIC GRANITIC ROCK - ?augen gneiss. Brecciated pink K-feldspar (?augen) in a moderate chloritic matrix over most of zone, minor slightly chloritic massive pink K feldspar zones. Rock massive and coherent.	661.65m 21709ft	662.65m 1m) 21742ft 3.3ft)	1405	8	10/70	
									1432	Silicate Analysis Sample		
							662.65m) 21742ft)	Pet. Sample P605/73				
				665.50m 2183.5ft	666.70m 2187Aft	HORNFELSIC ?METASEDIMENTS - greenish medium grey, chloritic ?plagioclase or quartz hornfelsic ?metasediments, very minor pink K-feldspar patches and veins. Massive over upper 50cm tending to sheared, more schistose, strongly chloritic rock below. Trace sulphides mostly cp throughout, disseminated and chloritic and K-feldspar filled fractures. Similar to 635.10-639.30m.	665.7m 21842ft	666.7m 1m) 2187Aft 3.3ft)	1406	130	8/135	
666.70m 667.85m	667.85m 669.55m	1.15m 1.70m	1.12m 1.57m	666.70m 21874ft	668.20m 21924ft	SHEARED STRONGLY CHLORITIC GRANITIC ROCK. Moderate pink K-feldspar patches and veins and minor epidotic fractures throughout. No sulphides.						
				668.20m 21924ft	668.90m 21947ft	PHYLLITE - dark greenish-grey ?chloritic muscovite sericite rock. Epidotic over upper 5cm, moderate calcite veining throughout. From 649.5m minor calcite filled shears - except for phyllitic zone with moderate calcite veins from 668.2-668.7m.						

C00016

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PARABARANA

CORE RECOVERY LOG											
FROM	TO	INTERVAL	RECOVERY	FROM	TO		FROM	TO	INTERVAL	Au g/t	Cu ppm	Mo/As ppm
669.55m 671.50m 672.75m	671.50m 672.75m 674.40m	1.95m 1.25m 1.65m	1.86m 1.21m 1.64m	668.90m 2194.7ft	673.65m 2210.2ft	SHEARED MODERATELY CHLORITIC GRANITIC ROCK. Moderate pink feldspar and minor epidotic patches throughout. Strongly chloritic shear zones 671.7-671.8m, 672.35-672.80. No sulphides. Core broken from 666.0-669.2m.						
674.40m	676.90m	2.50m	2.44m	673.65m 2210.2ft	675.50m 2216.3ft	HORNFELSIC ?METASEDIMENTS. Greenish medium-grey, chloritic ?plagioclase or quartz hornfelsic ?metasediments. Moderate pink K-feldspar veining and patches over upper 50cm, minor over rest of zone. Rock massive and coherent except for strongly sheared chloritic zone from 674.2-674.5m. Minor calcitic, clay-filled shears throughout. Trace sulphides py and cp in fine stockwork of chlorite-biotite filled fractures.	674m 2211.4ft	675m 2214.7ft	1m 3.3ft)	1407	220	8/35
				675.50m 2216.3ft	676.60m 2219.9ft	Sheared strongly CHLORITIC GRANITIC ROCK. Grades from overlying unit as pink Fe stained feldspar and chlorite content increases.						
676.90m *Core loss 677.1 - 677.4m 677.40m	677.40m 679.50m	0.50m 2.10m	0.14m* 1.96m	676.60m 2219.9ft	678.80m 2227.1ft	HORNFELSIC ?"AMPHIBOLITIC" ROCK. Dark greenish-grey, sheared strongly chloritic rock with minor very irregular pink feldspar veining. Mostly massive - occasional graphitic schistose shear zones. Core moderately broken, core loss - from 667.1-677.4m	677.40m 2222.5ft	678.80m 2227.1ft	1.40m) 5.4ft)	1408	18	5/75
679.50m 680.90m	680.90m 681.80m	1.40m 0.90m	1.39m 0.88m	678.80m 2227.1ft	696.10m 2283.9ft	Sheared, slightly to moderately CHLORITIC GRANITIC ROCK. Grades from overlying unit as pink feldspar content increases to a sheared and brecciated slightly chloritic ?"augen granite gneiss" from 680.5-681.2m. Slightly chloritic quartz band from 681.2-681.4m.						
681.30m 685.35m 684.20m 684.90m *Core loss 685.19 - 686.27m	683.35m 684.20m 634.90m 686.40m	1.55m 0.85m 0.70m 1.50m	1.52m 0.71m 0.60m 0.30m*			Massive slightly chloritic granitic (?"adamellite") rock from 681.4m, moderately quartzose from 682.0m but becomes less obvious as rock becomes more sheared and chlorite content increases from 682.3-686.45m. Strongly chloritic mineralized shear zone from 684.8-685.05m approx. 1% disseminated sulphides py and cp; less chloritic and more granitic with only trace sulphides from 685.05-685.15m. Core loss - from 685.17-686.35m. Strongly chloritic moderately mineralized quartz band from 686.35-686.38m.	684.20m 2244.9ft	685.20m 2248.1ft	1m 3.3ft)	1409	460	18/500
686.40m	688.00m	1.60m	1.59m			Chlorite content and sulphide content decreases from 686.38-686.45m as rock becomes more granitic and grades into slightly chloritic, sheared massive pink adamellitic rock with occasional trace sulphides to 688.0m.						
688.00m 690.85m 693.25m 695.65m	690.85m 693.25m 695.65m 697.10m	2.85m 2.40m 2.40m 1.45m	2.82m 2.30m 2.36m 1.41m			688.0-696.1m. Sheared moderatlely chloritic augen granite gneiss with several thin (<10cm) strongly chloritic amphibolitic bands some with trace sulphides. A 1cm wide quartz vein at 688.9m with trace ?molybdenite* and cp and a barren 5cm wide chloritic quartz band at 689.9m. Becomes more sheared and chloritic over basal 3cm. * Not molybdenite according to assay.	688.0m 2257.3ft	689.0m 2260.6ft	1m 3.3ft)	1410	90	4*/10

C00017

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PARAEARANA

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CORE RECOVERY LOG

FROM	TO	INTERVAL	RECOVERY
697.10m	699.65m	2.55m	2.54m
699.65m	701.30m	1.65m	1.64m
701.30m	703.90m	2.60m	2.56m
703.90m	705.00m	1.10m	1.10m

FROM	TO	DETAILED CORE DESCRIPTION
		Calcitic clayey fractures throughout granitic unit which is generally barren.
696.10m 22839ft	703.10m 23069ft	HORNFELSIC ?"AMPHIBOLITIC" ROCK - dark greenish grey strongly chloritic massive rock with felted texture - schistose over upper 1m. Moderate to strong irregular calcite veining throughout with occasional trace sulphides. A 1cm wide brecciated shear zone at 698.3m filled with calcite and angular fragments of cp up to 7mm across. Core moderately unbroken.
703.10m 23069ft	704.90m 23128ft	CHLORITIC GRANITIC ROCK - moderately sheared. Some pale greenish ?epidotic feldspar patches. Moderate K-feldspar and minor calcite veining. Core broken over upper half - less so over lower half.

ASSAYS

FROM	TO	INTERVAL		Au g/t	Cu ppm	Mo/As ppm
692.0m 22705ft	693.0m 22737ft	1m 3.3ft	A1411	48		3/85
No sulphides observed but with 2 thin dark grey chloritic bands.						
698.0m 22901ft	699.0m 22934ft	1m 3.3ft	A1412		700	3/5
702.0m 23033ft	703.0m 23065ft	1m 3.3ft	A1413		70	3/30
Rock type as A1412 but with no massive cp in calcite veins.						

C00018

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FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	ASSAYS Au g/t	Cu %	Zn %	Pb ppm
705.00m	707.45m	2.75m	2.71m	704.90m 2312.8ft	707.00m 2319.7ft	SHEAR ZONE - very broken, dark greenish grey, strongly chloritic amphibolitic rock. Moderate green ?"soapstone" and associated minor brick-red hematitic patches throughout with trace sulphides. Moderate white calcareous clay smears throughout.							
707.45m	709.60m	1.85m	1.85m	707.00m 2319.7ft	709.15m 2326.7ft	CHLORITIC GRANITIC ROCK - as above. Moderately sheared, moderate chloritic matrix, except for slightly sheared and chloritic, massive pink K-feldspar zone from 708.5-709.0m. Core massive and coherent - no planar shears.	707.00m 2318.0ft	708.50m 2323.0ft	150cm) 4.9ft)	400	< 0.01		6/4
						Rare specks of sulphides in pink feldspathic zones and trace sulphides. (slightly more specks) for 2-3 cm on either side of sharp fault contact with amphibolite below.	708.50m 2323.0ft	709.15m 2325.1ft	65cm) 2.1ft)	401	< 0.01		3/<4
							708.9m	Pet. Sample P606/73					
						TOP OF SLIGHTLY MINERALIZED ZONE							
709.60m 710.00m	710.0m 711.20m	0.40m 1.20m	0.38m 1.13m	709.15m 2326.7ft	712.00m 2336.1ft	"AMPHIBOLITIC" ROCK GRADING TO GRANITIC ROCK - SLIGHTLY MINERALIZED Dark greenish strongly sheared and chloritic ?"amphibolitic" rock over upper 45cm, grading to slightly greenish medium grey siliceous more granitic rock towards base with pink K-feldspar patches over basal 30cm and a 5cm siliceous band at base. Also patchy granitic zone with patchy pink K-feldspar from 709.65-709.73m. Core moderately broken throughout - strongly sheared sections very broken.	709.15m 2325.1ft	709.40m 2325.9ft	25cm) 0.8ft)	402	< 0.01		3/<4
							709.40m 2325.9ft	710.00m 2327.9ft	60cm 2.0ft)	403	< 0.01		22/7
711.20m *Core loss 712-712.30m	713.45m	2.25m	1.87m*				710.00m 2327.9ft	711.50m 2332.8ft	150cm) 4.9ft)	404	0.03		20/50
						Only a few specks of sulphides over upper 25cm then increases with patches of up to ½ to 1% sulphides, mostly pyrite. Sulphides mostly disseminated down to 710m thence occurs more in chloritic fractures as rock becomes more granitic. Up to 2% sulphides from 711.50-711.70m with pyrite: chalcopyrite > 2:1, thence drops off to about 1% or less in pink feldspathic zone below. Note: also 5cm puggy shear zone in centre of 2% zone.	711.50m 2332.8ft	711.70m 2333.4ft	20cm 0.7ft)	405	0.06		8/105
							711.70m 2333.4ft	712.00m 2334.4ft	30cm 1.0ft)	406	< 0.01		8/60
				712.00m 2336.1ft	712.30m 2337.1ft	Core loss ("soft rock washed away").							
713.45m	714.90m	1.45m	1.46m	712.30m 2337.1ft	713.70m 2341.6ft	CHLORITIC ?"AMPHIBOLITIC" ROCK. Strongly sheared, chloritic rock, dark grey and slightly greenish-medium grey becoming slightly greenish-medium grey and slightly quartzo-feldspathic over basal 50cm. A 5cm-wide strong clayey chloritic shear zone at base. Core broken, ½ - 1% sulphides, mostly pyrite, in chloritic fractures throughout.	712.30m 2335.4ft	713.70m 2340.0ft	140cm) 4.6ft)	407	0.03		5/55
						BASE OF SLIGHTLY MINERALIZED ZONE							
				713.70m 2341.6ft	723.00m 2372.2ft	CHLORITIC GRANITIC ROCK. Sheared chloritic quartzo-feldspathic granitic rock. A few crude bands of pink feldspar and quartz over upper 25cm. Slighly greenish-medium grey, massive rock (similar to most mineralized zone above) grading to less sheared and chloritic rock as pink feldspar content increases and chloritic matrix decreases from approx. 715.15m. Core moderately coherent over less sheared portions except for 1m above core loss portion (where core barrel did not seat). Trace sulphides (few specks only) throughout.	713.70m 2340.0ft	715.55m 2346.1ft	185cm) 6.1ft)	408	<0.01	< 4/5	4/-
714.90m 715.45m 716.95m *Core loss 717.66 - 718.30m	715.45m 716.95m 718.30m	0.55m 1.50m 1.35m	0.51m 1.42m 0.57m*				717.3m 2353.5ft	Pet. Sample P607/73					

C00019

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CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS				
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	Cu ppm	Au ppm
718.30m	719.50m	1.20m	1.13m			718.30-719.05m: Grey sheared and brecciated quartz-rich granitic rock with subordinate angular pink feldspar patches throughout.	715.55m (2347ft)	717.55m (2354ft)	200cm (6.5ft)	409	<0.01/5 <4/-
719.50m	721.00m	1.50m	1.43m			719.05-720.9m: dark greenish-grey strongly sheared, strongly chloritic ?granitic rock, 10-15 cm-wide zones of pink feldspar more common over basal half as shearing intensity increases. Trace sulphides mostly pyrite - more common in more chloritic portions and shears. Core very broken.					
721.00m	721.70m	0.70m	0.69m								
721.70m	724.25m	2.55m	2.53m			Moderately sheared, brecciated, chloritic and feldspathic over rest of unit - slightly quartz-rich over basal 35cm. Core moderately broken - quartz-rich zone, less so.	721.88m (2368.5ft)	722.88m (2371.8ft)	1m (3.3ft)	1414	70 3/ < 5
							Pinkish zone with quartz band.				
				723.00m (2372.2ft)	727.68m (2387.5ft)	"AMPHIBOLITIC" ROCK - dark greenish, massive strongly chloritic. Occasional small irregular patches and veins of pink ?hematitic feldspar throughout - moderately feldspathic, granitic looking from 724.7-724.9m.					
724.25m	725.50	1.25m	1.24m								
725.50m	726.75m	1.25m	1.20m			Moderately epidotic (?calc-silicate) zone from 724.35-726.40m. Clots of brick-red crystalline ?hematite confined to epidotic zone.					
726.75m	728.60m	1.85m	1.83m			Strong calcite veining in non-epidotic portions - only slight calcite veining over epidotic portion.					
						Fragments of pale yellowish-green clayey looking material over upper non-epidotic portion, larger fragments up to 1cm across showing extremely fine foliation (?primary sedimentary origin).	726.68m (2384ft)	727.68m (2387.5ft)	1m (3.3ft)	1415	150 4/365
							Immediately above mineralised zone.				
						Core moderately broken over epidotic zone, slightly less broken over upper metre.					
						Very broken shear zone over basal 15cm.					

C00020

DEPARTMENT OF MINES AND GEOLOGICAL SURVEYS

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CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGIC DESCRIPTION	FROM	TO	INTERVAL	Ag oz/ton	Cu %	Au ppm
						TOP OF MINERALIZED ZONE						
				727.68m 2387.5ft	728.26m 2389.4ft	CHLORITIC GRANITIC ROCK - strongly sheared, brecciated and chloritic, pink feldspathic granitic rock. Moderate calcite veining. Only trace sulphides except for a 1cm-wide grey band approx. 50° to C.A. at base containing strong disseminated sulphides - mostly chalcopyrite with minor pyrite and with moderately strong arsenopyrite in a 1cm-wide zone in granitic rock on hanging wall side - also occasional thin hair veinlets of molybdenite.	727.68m 2387.5ft	728.26m 2389.4ft	58cm 1.9ft	968	0.13/ 0.155	5/ < 0.05
728.60m	730.60m	2.00m	1.96m	728.26m 2389.4ft	729.42m 2393.2ft	"AMPHIBOLITIC" ROCK as above 727.68m. Dark green, strongly chloritic massive rock. Strong calcite veining decreases over basal 35cm. Patchy pink feldspathic zone over basal 20cm. Approximately 1% (or less) sulphides mostly disseminated pyrite with occasional chalcopyrite assoc. mostly with calcite veins.	728.26m 2389.4ft	729.42m 2393.2ft	116cm 3.8ft	969	0.25/ 0.09	8/ < 0.05
				729.42m 2393.2ft	731.11m 2398.8ft	HYBRID ZONE. Mottled dark green and grey with occasional small patches and veins of pink K-feldspar, sheared and brecciated mixed rock - ?"amphibolitic"-phyllitic-granitic rock - i.e. angular fragments of grey chloritic ?muscovite/sericite phyllite and pinkish grey mineralised zone-type "adamellitic" rock in a strong chloritic "amphibolitic" matrix similar to unit above.	729.42m 2393.2ft	731.11m 2398.8ft	169cm 5.6ft	970	0.06/ 2.5	10/ <0.05
730.60m	733.70m	3.10m	3.06m			A 2cm-wide dark grey planar shear zone, with moderate calcite veining at 70° to C.A., at upper contact. Minor calcite veining throughout some with pink selvages. Very broken section from 730.85-731.00m with moderate irregular quartz and light yellowish green ?"soapstone" patches. Rest of core moderately coherent.						
						Sulphide content varies over unit - minor chalcopyrite and arsenopyrite over upper 20 cm, then minor arsenopyrite to 730m, then very strong arsenopyrite* (5%+) from 730.0-730.40m, then decreases abruptly to minor arsenopyrite at base.	730.15m	*Pet. Sample P658/73 - mineral sample confirmed arsenopyrite by X.R.D.				
				731.11m 2398.8ft	736.77m 2417.3ft	?META-SEDIMENTS (ADAMELLITIC MINERALIZED ZONE OF N.F.M.). To 731.75m: slightly pinkish medium grey, very indistinctly and crudely banded into grey and pinkish laminae 0.5-2cm wide which have been disturbed (micro-faulted and distorted) by shearing and brecciation - banding at various angles to C.A. depending on orientation of breccia segments; approx. 55° to C.A. in block at top (but not representative).	731.11m 2398.8ft	731.75m 2400.9ft	64cm 2.1ft	971	0.23/ 0.24	7/ < 0.05
						Moderate sulphide mineralization - mostly pyrite with minor arsenopyrite and less chalcopyrite. Most mineralization in veins and associated with calcite or quartz or pink ?K-feldspar or chlorite. Sulphides decrease towards base to approx. 1% over basal 15cm as chalcopyrite:pyrite ratio gradually increases.						
						731.75-733.48m: rock type as above but Cu sulphides stronger. Sulphide content average approx. 1% but varies from ½ to 1½%, the chalcopyrite: pyrite+arsenopyrite ratio variable from approx. 1:1 to 2:1. Pyrite and arsenopyrite contents and ratios also variable - pyrite more common than arsenopyrite down to approx. 732.8m	731.75m 2400.9ft 732.35m 2402.8ft	733.48m 2406.5ft Pet. Sample	173cm 5.6ft P665/73	972	0.46/ 0.63	4/ < 0.05

C00021

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CORE RECOVERY LOG FROM	TO	INTERVAL	RECOVERY	LOG OF DRILLING FROM	TO	DESCRIPTION	ASSAYS FROM	TO	INTERVAL	No.	Ag g/t	Au %	Cu %
						then vice versa below.							
733.70m 2407.6ft	736.70m 2417.3ft	3.00m	3.04m			733.48-733.80m: sulphides moderate in finely banded grey metasediments - mostly arsenopyrite, lesser chalcopyrite (in calcite veins and disseminated in patches) and still lesser pyrite.	733.48m 2406.5ft	733.80m 2407.6ft	32cm 1.1ft	973	0.44/ 0.75	18/ < 0.05	
						733.80-734.00m: pink quartzo-feldspathic ?intrusive granitic band, roughly comparable with narrow banding in grey metasediments at approx. 35° to C.A. - the granitic band is conformable at lower contact at approx. 733.97m and is approx. 5cm thick but cuts across the sedimentary banding irregularly at upper contact at approx. 733.80m, also with thin irregular bands 2-3mm thick "intruding" along sedimentary banding for up to 10cm above main contact. A thin (<1mm) black ?biotitic crinkly layer occurs along most sediment/granite contacts. The granite shows graphic texture on broken surfaces. Occasional patches of brownish-red brecciated ?garnet in a calcite matrix. Arsenopyrite, chalcopyrite and pyrite stronger than in grey metasediments on either side.	733.80m 2407.6ft	734.00m 2408.3ft	20cm 0.7ft	974	0.59/ 1.3	8/ < 0.05	
							733.95m 2408.1ft	Pet. Sample		P666/73			
						734.00-734.50m: very finely banded (<1cm wide) grey metasediments below granitic band - at 30° to C.A. - down to 734.5m. Only minor sulphides (approx. 1% total).	734.00m 2408.3ft	734.50m 2409.9ft	50cm 1.6ft	975	0.28/ 0.175	22/ < 0.05	
						734.5-735.5m: pinkish grey rock with crudely defined banding as above 733.48m. Sulphides average approximately 1% but varies from ½ to 1½% as above. Chalcopyrite + pyrite + arsenopyrite varies averaging roughly 1:1. Where arsenopyrite becomes prevalent, chalcopyrite becomes minor. Sulphides more finely disseminated over upper half than lower half in which most sulphides occur in veins < 1mm thick as in zone 731.75-733.78m. Occasional smears of ?molybdenite on fracture surfaces and in hair-line veinlets especially at approximately 734.9m.	734.50m 2409.9ft	735.50m 2413.2ft	100cm 3.3ft	976	0.23/ 0.65	10/ < 0.05	
736.70m 2417.3ft	739.30m 2425.9ft	2.60m	2.59m			735.5-736.77m Rock types as above but very sheared with numerous clayey-coated fractures and three 5cm-wide puggy shear zones. Core very broken. Sulphides - arsenopyrite, chalcopyrite and pyrite - appear minor (less than above).	735.50m 2413.2ft	736.77m 2417.3ft	127cm 4.1ft	977	0.18/ 0.52	10/ < 0.05	
						Minor to moderate calcite veining throughout the unit, some with pink ?hematitic ?K-feldspar selvages. Moderate pink K-feldspar veining and numerous hair fractures with chloritic coatings.							
				736.77m 2417.3ft	737.70m 2420.4ft	PINK GRANITIC ROCK. Sheared and brecciated pink feldspathic granitic rock with irregular quartz patches throughout and a greyish chloritic matrix which varies according to degree of shearing. Core very broken except for upper 23cm. Moderate sulphides - mostly arsenopyrite - very patchy - mostly in veins.	736.77m 2417.3ft	737.70m 2420.4ft	93cm 3.1ft	978	0.05/ 0.85	15/ < 0.05	
							736.95m 2417.9ft	Pet. Sample		P667/73			
				737.70m 2420.4ft	749.60m 2459.4ft	?METASEDIMENTS and ?ACID FLOW ROCKS (MICROADAMELLITE OF N.F.M.) Slightly pinkish medium grey and grey ?metasediments as above 736.77m crudely banded in part grading to pinker massive ?acid flow rocks (volcanics) from 739.4 -							

C00022

HOLE NO P.D.D. 11

DEPARTMENT OF MINES - GEOLOGICAL SURVEY
PARABARANA PROJECT

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL		oz/ton	%	oz/ton
						740.7m and approximately 743.0-747.0m Moderately brecciated internally and sheared. Core very broken over upper 1.3m, 742.15-742.40m and basal 2.5m - moderately broken from 739.3-741.4m.							
739.30m	742.40m	3.10m	3.09m			737.7-739.0m: Sulphide content approx. 2% - mostly pyrite and arsenopyrite with minor chalcopyrite - associated with quartz and ?sericitic feldspar veins.	737.70m 2420.4ft	739.00m 2424.7ft	130cm 4.3ft	979	Ag/ton 0.22/ 0.80	As % 15/ <0.05	
						739.0-739.35m: Stronger sulphides (>2%) mostly pyrite with minor arsenopyrite and less chalcopyrite. Sulphides associated with an irregular band of white speckled (quartz and ?sericitic feldspar) grey rock subparallel to C.A.	739.00m 2424.7ft	739.35m 2425.8ft	35cm 1.1ft	980	0.18/ 0.23	25/ <0.05	
						739.35-740.50m. Moderate Sulphides 1-2% - chalcopyrite:pyrite averages approx. 1:1. Minor arsenopyrite. Most chalcopyrite is in chloritic fractures where chalcopyrite :pyrite > 1:1. Occasional sulphide rich veins similar to rock from 739.0-739.35m - i.e. mostly pyrite - especially at 740.0m.	739.35m 2425.8ft	740.50m 2429.6ft	115cm 3.8ft	981	0.41/ 0.11	10/ <0.05	
							740.15m 2428.4ft)	Pet. Sample P668/73					
						740.50-742.0m: Minor sulphides - mostly arsenopyrite - very patchy distribution and very finely disseminated.	740.50m 2429.6ft	742.00m 2434.5ft	150cm 4.9ft	982	0.03/ 0.55	6/ <0.05	
						742.0-742.2m: Sulphides (approx. 1%) on chloritic fractures, occasionally with calcite vein filling. Chalcopyrite:pyrite approximately 1:1. Approximately half. sulphides arsenopyrite.	742.00m 2434.5ft	742.20m 2435.2ft	20cm 0.7ft)	983	0.10/ 0.31	5/ <0.05	
742.40m	745.50m	3.10m	3.02m			742.2-743.4m: Minor Sulphides - mostly arsenopyrite with trace chalcopyrite and pyrite in chloritic and/or calcite fractures. Stronger arsenopyrite from 743.0-743.4m.	742.20m 2435.2ft	743.40m 2439.1ft	120cm) 3.9ft)	984	0.07/ 0.50	5/ <0.05	
						743.4-745.05m: Minor sulphides, chalcopyrite + pyrite on chloritic fractures with trace arsenopyrite. Stronger arsenopyrite from 744.05-744.25m - only trace sulphides below.	743.40m 2439.1ft	745.05m 2444.5ft	165cm) 5.4ft)	985	0.11/ 0.38	3/ <0.05	
						745.05-745.50m: Stronger sulphides (average approx. 2%+), unevenly distributed in chloritic sheared portions. Mostly chalcopyrite with lesser arsenopyrite + pyrite.	745.05m 2444.5ft	745.50m 2446.0ft	45cm) 1.5ft)	986	0.87/ 0.39	5/ <0.05	
										1416*	0.88/ 0.53	18/ -	
							745.35m) 2445.5ft)	Pet. Sample P669/73					
745.50m	747.80m	2.30m	2.28m			745.5-746.52m: Minor sulphides (arsenopyrite, chalcopyrite and pyrite) over upper 20cm decreasing to trace below.	745.50m 2446.0ft	746.52m 2449.3ft	102cm) 3.3ft)	987	0.05/ 0.39	7/ <0.05	
										1417*	0.06/ 0.68	22/ -	
						746.52-747.45m: Moderate sulphides - approx. 1-2% - mostly arsenopyrite. Irregularly distributed over unit in fractures and shears. Chalcopyrite mostly in chloritic fractures. Note: should have approx. 5% sulphides and more chalcopyrite	746.52m 2449.3ft	747.45m 2452.4ft	93cm) 3.1ft)	988	1.05/ 0.81	7/ 0.1	
							* check assays			1418*	1.00/ 0.94	15/ -	

CORE RECOVERY LOG FROM	TO	INTERVAL	RECOVERY	LOG OF DRILL HOLE FROM	TO	LITHOLOGICAL DESCRIPTION
						than arsenopyrite according to assays - these sulphides are not apparent macroscopically.
547.80m 1797.2ft	748.35m 2455.6ft	0.55m	0.50m			
748.35m 2455.6ft	749.70m 2460.0ft	1.35m	1.29m			747.45-749.60: Trace sulphides, mostly arseno pyrite and pyrite. Extremely crushed and puggy sheared rock over basal 10 cm.
						BASE OF MINERALIZED ZONE
749.70m 2459.4ft	750.20m 2461.0ft	0.50m	0.43m	749.60m 2459.4ft	750.30m 2461.7ft	?PHYLLITE - medium to dark-grey, graphitic, chloritic muscovite/sericite rock - massive and hornfelsic with numerous chloritic (some graphitic) intersecting cleavage planes forming wedge shaped rock pieces. Unmineralized.
750.20m 2461.0ft	751.30m 2464.6ft	1.10m	1.10m			
751.30m 2464.6ft	751.65m 2465.8ft	0.35m	0.30m	750.30m 2461.7ft	753.00m 2470.6ft	SHEARED GRANITIC ROCK. Sheared and brecciated, pink feldspathic granitic rock (?hanging wall sheared granitic rocks or sheared Mount Neill Granite Porphyry). Strongly crushed and brecciated with a chloritic puggy matrix over upper 35cm.
751.65m 2465.8ft	753.15m 2470.6ft	1.50m	1.38m			Minor sulphides except for band of moderate sulphides - mostly chalcopyrite, some pyrite - from 751.5-751.6m. Remaining sulphides arsenopyrite - mostly very finely disseminated and occasional course-grained patches.
						Dark grey to black puggy fault gauge zones over basal 90 cm separated by narrow zones of strongly sheared and brecciated granitic rock - the widest from 752.36-752.37m with strong calcite veining.
753.15m 2470.6ft	753.75m 2472.6ft	0.60m	0.55m	753.00m 2470.6ft	757.20m 2434ft	STRONGLY SHEARED GRANITIC ROCK OR ?CALC-SILICATE ROCK. Pale greenish khaki, strongly sheared, slightly chloritic, ?epidote or clay-quartz rock. Slight pale pink tinge in part. The abundant light olive green mineral resembles soapstone and possibly results from strong shearing of epidotic calc-silicate rocks.
753.75m 2472.6ft	755.30m 2477.6ft *25cm core lost	1.55m	1.25m*			
755.30m 2477.6ft	756.00m 2479.9ft	0.70m	0.66m			Core very broken and clayey grit in part when wet - as the green mineral and quartz content varies so the rock is either soft and clayey (when wet) or hard respectively. Becomes more quartz-rich pink feldspathic and granitic looking towards base, especially zone 756.4-756.75m - slightly ?epidotic or clayey and strongly chloritic from 756.75-757.0m.
756.00m 2479.9ft	757.20m 2434ft *17cm core lost	1.20m	0.98m*			
						Core lost over basal 20 cm.

ASSAYS FROM	TO	INTERVAL	Ag g/t	As %	Au ppm
Weighted Average -					
731.11m 2398.8ft	747.45m 2452/4ft	16.34m 53.6ft)	-	0.27/ -	-/ -
747.45m 2452.4ft	749.60m 2459.4ft	215cm 7.0ft)	989	0.01/ 0.44	25/ < 0.05
			1419*	0.01/ 0.47	35/ -
			*check assays		
Weighted Average -					
729.42m 2393.2ft	749.60m 2459.4ft	20.18m 66.2ft)	-	-/ 0.68	-/ -
749.60m 2459.4ft	750.30m 2461.7ft	70cm 2.3ft)	990	0.01/ 0.06	15/ < 0.05
749.9m 2460.4ft	Pet. Sample P670/73				
750.30m 2461.7ft	752.37m 2468.5ft	207cm 6.8ft)	991	0.28/ 0.42	25/ < 0.05
752.37m 2468.5ft	753.00m 2470.6ft	63cm 2.1ft)	992	0.12/ 0.14	130/ < 0.05
753.00m 2470.6ft	755.00m 2477.2ft	200cm 6.6ft)	993	<0.01/ 0.06	8/ < 0.05
755.65m	Pet. Sample P656/73				
Weighted Average					
727.68m	755.00m	27.32m 89.7ft)	-	-/-	14/-
756.55m	Pet. Sample P657/73				

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DEPARTMENT OF MINES AND ENERGY

PARABURANA PROJECT

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CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS			
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	INTERVAL	Au g/t
182.60m	757.20m	574.60m	528.13m			Unmineralized				
Total %	core recovery		91.77%							
						757.2m BASE OF HOLE				
						(2484.4ft)				
727.68	749.60	21.92m	20.83m							
% core	recovery	over mineralised zone			95.03%					

Sample: P302/73: TS 30624:

D00002

Location:
184.54

Rock Name:
Adamellite gneiss

Hand Specimen:
A well foliated and sheared gneiss containing elongate lenses of red feldspar (up to 2 cm long) in a fine-grained, dark matrix.

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

	%
Quartz	20-25
K-feldspar	30-40
Plagioclase	20-30
Biotite-Chlorite	5-10
Opaques	2-3
Zircon	Trace-1
Apatite	Trace
Garnet	Trace
Fluorite	Trace

The rock has the composition of a granitic adamellite though little trace remains of any igneous texture. The present texture is gneissose with lenses of feldspar separated by arcuate ribbon aggregates of quartz. Biotite, partly chloritized, is a minor component. The dominant impression is of a sheared augen gneiss which has been partly recrystallized.

The feldspar augen are composed of an aggregate of K-feldspar grains (most with microcline twinning), possibly broken down from large single crystals. Individual grains vary in size from less than 0.2 mm to 5 mm. Intergranular boundaries are very irregular, crenulated or even granulated, a reflection, to some extent, of the stress under which they formed, and the modifying, partial recrystallization which has followed. The feldspar aggregates contain small stringers or individual grains of quartz, rare granular opaques and phyllosilicate. Locally, the K-feldspar contains abundant exsolution granules of ?hematite.

Plagioclase and some untwinned feldspar, possibly also plagioclase, occur with the K-feldspar, and in the interstitial areas, and there are a few remnants of large plagioclase grains. Such twinning as remains suggests oligoclase. This feldspar is characterised by more intense alteration, with the formation of brown alteration products, probably largely sericite. Plagioclase-plagioclase contacts are smoother than those for K-feldspar and modified triple-point junctions are present.

Laths of biotite, partly or completely altered to chlorite, occur mainly with plagioclase, ranging up to 0.5 mm in size. They reflect the main foliation but are locally deflected to parallel cross-cutting microfaults.

Quartz occurs in drawn-out ribbons of strained crystals, reflecting the extent of shearing. Individual grains tend to be small (0.1-1 mm) and elongate with highly sutured boundaries. The quartz shows rotationed and granular changes adjacent to the cross faults, and it is clear that the quartz has borne the brunt of the dynamic stress, having behaved more incompetently than the feldspar.

Traces of zircon, ?sphene, apatite, granular opaques and a colourless garnet are also present. The opaques include sulphide and ?magnetite. Some breakdown of euhedral primary opaques to smaller grains has occurred during deformation. Fluorite occurs with the sulphides and secondary quartz in small, irregular, cross-cutting veins.

Sample: P303/73: TS 30625:

Location:
249.71

Rock Name:
Feldspathic gneiss

Hand Specimen:
A well foliated, dominantly red gneiss. Large augen and ribbons of pink or grey feldspar are separated by dark green foliae. A series of subparallel microfaults cut the foliation almost perpendicularly. The thickness of the feldspathic layers varies considerably from about 1 mm to over 1 cm.

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

	%
Microcline	60-75
Quartz	5-10
Plagioclase	? 10
Siderite	5
Chlorite and chloritised biotite	5
Brown clay	2-3

This is a typical feldspathic augen gneiss showing the effects of cataclasis.

The dominant mineral is K-feldspar, which is either untwinned or shows microcline twinning. The augen were originally as large as 1-2 cm, but are now broken into a composite of smaller grains (0.3-0.7 mm) with irregular boundaries. Minor granulation has occurred between some of the grains. Even those grains which remain relatively unaffected show strain extinction and some degree of cracking. The narrower ribbons of feldspar are also broken into small grains similarly. The feldspar is turbid with exsolution of fine opaques and some formation of clay or chlorite.

Interstitial areas are composed of a confused, fine-grained, granular aggregate of feldspar with broken larger grains of feldspar (0.1-0.2 mm), flakes and comminuted aggregates of chloritised and degraded biotite, pockets of brown clay, carbonate and secondary quartz. The larger feldspar grains resemble those in the augen but a small proportion of highly altered plagioclase is present. Siderite forms irregular masses (0.5-1 mm in diameter) and is also found in cross-cutting, discontinuous veins; it usually occurs with clay and locally with quartz. The siderite is of late origin and does not reflect the foliation in any way. Secondary quartz forms small, subhedral prisms lining and extending into cavities in the rock.

The rock has had a complex metamorphic history. A feldspathic augen gneiss appears to have been severely sheared with a combination of plastic and cataclastic deformation. The finer cataclastic effects have been obscured by partial recrystallization of the feldspar. Quartz, carbonate and clay are all late minerals and show no indication of dynamic stress. Though there has been breakdown of large grains and some reconstruction of the feldspar, there is nothing to suggest that large-scale chemical changes have taken place. It is therefore considered that the primary rock was syenitic rather than granitic.

Sample: P304/73: TS 30626:

Location:
282.69

Rock Name:
Granitic (adamellitic) gneiss

Hand Specimen:
A coarse, augen gneiss with large augen of pink feldspar up to 2 cm in diameter, together with smaller, elongate ribbons of feldspar and a few small patches of light green material separated by fine-grained, dark grey material.

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

	%
Quartz	30-35
K-feldspar	40-50
Plagioclase	20
Chlorite	5-10
Opaques	2
Zircon	Trace
Sphene	Trace-1
White mica	1
Tourmaline	Trace
Apatite	Trace

This sample is similar to the two preceeding, in that it is an augen gneiss which shows the effects of extensive shearing followed by partial recrystallization of material granulated by the stress. Unlike the previous samples, the augen tend to remain large and individual crystals in the range 2-8 mm are common. The overall impression is of a deformed, partly recrystallized, granitic rock.

Both K-feldspar and plagioclase occur as augen, with the latter much more extensively altered than the former, having been transformed, in part, to sericite or clay. K-feldspar is still relatively fresh. The augen tend to have their long axes parallel to the foliation and there is a suggestion of rotation to this position in some grains. Many of the large grains are cracked, though no major displacement has occurred. Smaller feldspar grains average about 1 mm.

The main ferromagnesian mineral is chlorite which occurs in irregular, medium-sized grains between the feldspar or quartz, or in thin stringers in a similar position. Rare compound augen of feldspar and chlorite are enveloped in quartz, and chlorite has some tendency to be found in the shadow zones of the augen. The chlorite is medium green, with very low interference colours and is probably largely secondary after biotite. Many of the larger flakes of chlorite contain fine opaques, probably formed during the breakdown of biotite. A few grains each of coarse opaque minerals and sphene are locally intergrown with the chlorite.

Quartz has behaved least competently. It now occurs as extensively strained, granulated, elongate aggregates which have been deflected around the feldspar augen. Partial recrystallization of some of the granulated material has taken place. The quartz commonly contains small lenses of chlorite, and small feldspar grains are not uncommon.

Accessory minerals include granular sphene, subhedral, greenish apatite, and brown tourmaline.

Sample: P305/73: TS 30627:

Location:
287.39

Rock Name:
Gneiss

Hand Specimen:
A dark red and black gneiss which possibly contains a fragmental component. Late developed cracks, sealed with dark coloured material, cross the foliation at a high angle.

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

	%
Quartz	50-60
K-feldspar	15-20
Sericite	20
Chlorite	5-10
Zircon	Trace
Opaques	Trace

This specimen has possibly been a breccia which has been extensively sheared and recrystallized. Chlorite-sericite is of late origin, having formed after the main dynamic stress had been removed.

The rock has a gneissic texture but contains what appear tobe flattened and/or sheated fragments of rock as well as late-developed augen of K-feldspar.

The brecciated nature shows best in plane polarised light and the fragments (pebbles) consist of deformed vein-quartz, mica/chlorite or chlorite-quartz. Reconstitution of the quartz has taken place under the influence of acute confining and shearing stress with the development of aligned prisms of quartz which parallel the overall alignment of quartz in the body of the rock. By contrast, the chlorite and mica rich fragments show no foliation and included quartz has a random orientation. The chlorite 'pebbles' also contain fresh feldspar and are consistent with a derivation from an acid volcanic rock.

The remainder of the rock consists of a flattened intergrowth of quartz with mica and chlorite together with larger grains (?augen) of feldspar. The latter are commonly some 0.2-0.3 mm in diameter, but larger grains, subsequently cracked and veined by mica have reached 1 mm. There is some displacement of the quartz foliation round the feldspar. Individual quartz grains have a high length to width ratio (3:1) with a maximum length of about 1 mm. Stringers of quartz grains, however, may exceed 1 cm.

Neither chlorite nor muscovite/sericite show any major foliation. They occur as aggregates of small grains (less than 0.03 mm), interstitial to the quartz and feldspar.

Opaques occur in small stringers parallel to the foliation.

Late-stage veins of phyllosilicate material cross the foliation at a high angle, and cracks occur parallel to the veins. The incoming material includes a green chlorite as well as a white and pale brown mica. These veins add to the brecciated appearance of the rock but are not wholly responsible for it.

This specimen is considered to be sedimentary on the grouns that the quartz content is higher than is normal for an igneous rock. This begs the question of the extent of any introduction of silica.

The contrasting alignment of quartz with non-alignment of phyllosilicate is one of the more interesting features of the rock. It is possible that phyllosilicate has recrystallized (or been formed) at the close of the stress period when only the local vapour pressure was high (no shearing stress) and at moderate-low temperatures.

Sample: P306/73: TS 30628A & B:

Location:
272.52

Rock Name:
Gneiss

Hand Specimen:
This is a very mixed gneissic rock. TS 30628A is taken from an area which is mottled in red and pale green, with minor colourless quartz. TS 30628B is taken across a quartz-rich vein. The vein is flanked by dominantly green, fine-grained material showing apparent drag foliation. One large bent 'augen', 7.5 mm long, of red K-feldspar occurs adjacent to the vein in close proximity to visible chalcopyrite.

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

30628 A		%
K-feldspar		40-45
Chlorite	)	
Clay	)	45
Sericite	)	
Siderite		5-10
Quartz		10
Fluorite		Trace
Opaques		1-2

30628 B		%
Vein:	Quartz	90-95
	Clay	5
	Siderite	(1-2)
Host:	Chlorite/clay/ sericite	45-50
	Quartz	20
	K-feldspar	20
	Opaques	10-15

The complex nature of this rock revealed in hand specimen is confirmed in the thin section. The quartz vein has the only readily discernible texture. The remainder of the rock has a loosely gneissic texture modified considerably by cataclastic effects, local recrystallization and the introduction of veinlets and irregular patches of late-stage secondary material. As will be seen from the proportions indicated for the thin sections, proportions of any given mineral are apt to be very varied.

The mottledrock of TS 30628A is composed of broken grains of partly altered, turbid K-feldspar set in a matrix of fine-grained, comminuted phyllosilicates, feldspar and quartz. The feldspar is badly cracked with well developed strain twinning and some grains are cemented by recrystallized, less altered feldspar. The grain size is very variable; large feldspar grains range from 0.1-3 mm. Rare chlorite reaches 0.2 mm. The matrix has a grain size near 0.01 mm. In a few places incipient recrystallization of the matrix has occurred with the formation of an aggregate of granoblastic grains 0.05 mm in diameter.

One part of the thin section contains irregular rosettes or spherulites up to 1.5 mm in diameter of siderite. These rosettes occur with muscovite (approximately 0.15 mm in size) and relatively fresh feldspar and quartz. The muscovite also forms aggregates of flakes and occurs in late-stage veins. The opaques of this thin section include both iron oxides and sphene (altered) and have irregular outlines in most areas. Two grains of fluorite occur with sulphide in a veinlet of quartz.

The quartz of TS 30628A has two habits, (a) highly deformed veins and aggregates and (b) late-stage, largely unstressed veinlets. The deformed quartz shows the subparallel alignment of stress rupturing and it seems likely that larger grains have been broken down to give the present pattern. Quartz aggregates range up to 2 x 2 mm and a diamond shape (augen) is common. The late-stage veinlets vary from 0.07 mm to 0.5 mm in width and the wider ones commonly have a core of opaques or siderite.

The quartz vein of TS 30628B shows very similar characteristics to the comparable material of TS 30628A. The vein, 2-3 cm wide, has been deformed to give an aggregate of aligned prisms which simulate feldspar laths. The prisms are commonly separated by partings of clay or chlorite. The attitude of the grains changes slightly, indicating drag, at the edge of the veins, emphasizing the fact of the incompetence of the quartz. A zone adjacent to the vein contains abundant secondary opaques.

The remainder of the thin section has a texture similar to that of TS 30628A but differences include (a) more prominent, larger grained, dark green chlorite (0.1-0.3 mm) and (b) the presence of patches of authigenic, very pale brown/pink clay formed, in places, between quartz grains mantled with orange clay. A vein of siderite associated with pinkish clay runs through this section.

Comment:

The rock does not show any close resemblance to those described in Reports MP 4064/73 and 4491/73. There is, for instance, no sign of either epidote or amphibole. However, the rock does have a family resemblance to the more acid rocks described in the above reports in the sense that a similar mineralogy, including sericite and chlorite, is present. The dominant texture of the rocks of DD8 is that of a modified hornfels - a texture absent in this sample. It was, however, noted in the earlier reports that the hornfelsic textures might represent recrystallized mylonitized rock, especially in P132/73. The evidence for cataclasis is much stronger in this sample.

In summary, this rock is believed to have been an adamellitic igneous rock cut by a quartz vein. It has then been sheared to become a cataclastic gneiss. At or after the close of the main period of cataclasis and metamorphism, brittle fracturing has occurred with introduction of chlorite, sericite, clay, siderite and sulphides. This has been accompanied by minor recrystallization of the comminuted material.

Sample: P595/73 TS 31212

Location: 350.0

Rock Name: Augen gneiss with pebble of microcline, probably a metasediment.

Hand Specimen: An augen gneiss containing a pink pebble (well rounded) of felsic material some 2 cm in diameter.

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

	%	"Pebble"	%
Microcline	50	Microcline	80-85
Quartz	30-35	Opaques	1-2
Plagioclase	10	Altered? Plagioclase	5
Chlorite, Biotite	5-10	Quartz	5-10
Opaques	1-2	Chlorite	1-2
Zircon	Tr		
Apatite	Tr		

The rock contains an apparent pebble which is essentially one crystal/grain of microcline (with inclusions) enclosed in a sheared granitic rock. The texture of the bulk of the rock is gneissic.

The pebble, as noted above, is dominantly of microcline, turbid with red-brown opaque granules. The microcline contains irregular inclusions of clear quartz, deep brown highly altered ?plagioclase, small areas of opaques and grains of chloritised biotite. There are also small microcline grains with different orientation to that of the host. None of the inclusions show any particular orientation, but there is a zone through the middle of the grain, 1-3 mm wide, composed of a mosaic of equant quartz and feldspar grains with minor degraded biotite. In some places, small grains along the surface of the pebble show myrmekitic intergrowths with the minor reaction such as might occur between a pebble or xenolith and a surrounding medium of similar but not exactly the same composition. This zone is discontinuous and rarely exceeds 0.5 mm in width.

The foliation of the remainder of the rock is delineated by biotite trains, by lensoid aggregates of quartz, and by a combination of bands and aligned augen of feldspar. No mineral has well developed crystal faces. The grain size varies from about 1 mm for the larger feldspars down to 0.05 mm for some of the quartz.

The potash feldspar is either untwinned or shows incipient microcline twinning. It is weakly altered with some development of granular opaques. On the contrary plagioclase is now scarcely recognisable, with a more thorough alteration (opaques with clay/sericite). Quartz also, but to a lesser degree, carries trains of fine opaques.

Relicts of brown biotite remain but most is partly or wholly chloritised. Chlorite, where it occurs as discrete grains, is a peculiarly bright green colour, contrasting with the black-brown of the biotite. In a few places small aggregates of small secondary ?biotite have formed together with small aggregates of opaques. "Primary" opaques appear to be mainly iron oxide.

The few zircons noted appear to be metamict.

Augen shapes are not well shown in the thin section. Incipient augen are composed of aggregates of either quartz or K-feldspar.

There are a few smaller microcline grains which appear to have overgrowths on opposite ends of an originally rounded grain, and there are a few other relict textures which suggest the former presence of rounded grains 0.4-0.8 mm in diameter. Some of these show evidence of deformation.

The rock has possibly been a conglomerate before becoming a gneiss, and the microcline grain appears to be a true pebble rather than a xenolith or xenocyst. The present composition is that of a granitic gneiss.

Sample: P596/73 TS 31213

Location: 364.9

Rock Name: Quartz-feldspar gneiss (metaconglomerate)

Hand Specimen: A dominantly dark red, microgranitic rock

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

	%
Quartz	50-60
Microcline	5-Tr
Untwinned and altered feldspar clay	30-40
Mica/chlorite	5
Opaques	Tr-1
Calcite	Tr

The rock is composed of relicts of fresh untwinned feldspar (albite) and highly altered feldspar in a sheared and recrystallised mixture of quartz, microcline, mica and chlorite. To some extent the relict feldspars (commonly 1-2 mm in diameter) simulate augen as linear crush zones have been displaced around them, and there is a well developed foliation.

The thin section has been stained by Alizarin Red to help identify the carbonate which is present. However as a consequence of the staining the highly altered feldspars have taken on a pink colouration. These grains are now isotropic except for the inclusions of mica (sericite) and chlorite. The pattern of th inclusions suggests former albite twinning but this is not conclusive. The K-feldspar is fresh with no opaque exsolution products. Some feldspar grains show relict textures suggesting rounded grains 0.6-1.5 mm in size, and there are a few granulated quartz grains of similar size. In general quartz has been deformed and granulated more than feldspar.

Much of the remainder of the rock has an incipient mortar texture, but quartz, in particular, has partly coalesced to give grains of sizes varying from 0.01mm to near 1 mm, with highly sutured margins. In a few places microcline grains 0.2-1.0 mm (with minute opaque inclusions) have developed and in a few places submyrmekitic intergrowths of quartz and feldspar have occurred.

Chlorite, derived from biotite, and with opaques exsolved along its cleavage planes, forms rosettes or irregular aggregates of grains 0.2-0.5 mm in diameter. It is commonly associated with equant, granular muscovite (0.1 mm). Most of the chlorite occurs discontinuously on a line of weakness which is of later origin than the dominant foliation and cuts it at a high angle. A trace of calcite occurs with chlorite in one area.

This is probably a metamorphosed conglomeratic sediment which had an arkosic composition.

Sample: P663/73 TS 31615

Location: 513.8 m

Rock Name: Shattered vein quartz in quartz-chlorite rock (metasediment)

Hand Specimen: The rock consists of a quartz vein displaying very weak banding, set in dark grey banded ?metasediments.

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

	Vein %	Host
Quartz	90-95	?50
Chlorite) Sericite)	5-10	?50
Biotite	Tr	-
Opaques		Tr

The "vein" consists largely of quartz which has been shattered and veined by phyllosilicates. The "host rock" consists of fragments of quartz in a fine grained ground mass of quartz and phyllosilicates.

The vein quartz consists of highly stressed irregular to lozenge (diamond) shaped grains up to 5 mm in length. These irregular grains are separated by fine grained veinlets of phyllosilicates. The pattern of fracturing with associated veinlets is consistent with shattering by compression with minor shearing. A vein (0.25-0.5 m wide) of relatively coarse chlorite with partly oxidised biotite and minor quartz, cuts the vein at a high angle.

The host rock contains an assortment of quartz fragments of irregular shape and size, all showing shadowy extinction indicative of strain, separated by fine grained phyllosilicates with ?secondary silica. The quartz varies in size from 0.1 to over 2 mm. It is highly angular though most grains are corroded and penetrated by the groundmass. Several of the grains are compound. The groundmass contains sericite/muscovite but the greater part appears to be chlorite. Traces of K-feldspar, revealed by staining are present.

A zone, 4-5 mm wide, between the vein and the main part of the host rock, has very few quartz remnants and is composed largely of chloritic clay which displays incipient banding.

The supposed vein probably was once a genuine quartz vein. The nature of the host rock is less certain. It appears to have been quartz-rich, possibly a quartzite. Whether the phyllosilicate has been introduced or is a mobilised product of the original rock is not certain.

Sample: 597/73 TS 31214

Location: 538.6

Rock Name: Quartz chlorite-sericite gneiss (probably metasediment)

Hand Specimen: A dark coloured gneissic rock cut by crosscutting veins of chlorite.

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

	%
Quartz	60
Sericite/muscovite	5-10
Chlorite	25-30
Epidote	Tr
Altered sphene/rutile	1
Altered feldspar	2-5

The rock consists of alternations of bands of quartz, quartz with mica, and chlorite. It has a well developed foliation, defined by the alignment of the various bands.

Quartz occurs as irregular elongate grains up to 5-8 mm long, usually in bands or lenses of grains. All grains have irregular outlines, and, in the areas where muscovite is prominent, some grains enclose muscovite grains. Much of the quartz is turbid, with included opaque granules.

A few grains of altered red feldspar are present in a late stage vein, in association with chlorite. Elsewhere any other feldspar which may have once been present has been converted to muscovite. The latter mineral varies in size from 0.08 mm downwards to sericite size. It is granular and commonly occurs in aggregates of no particular internal orientation. In many areas it is intergrown with quartz, elsewhere, with chlorite.

Chlorite, pleochroic from pale brown to medium green, occurs in massive veins (with subordinate quartz) and in veinlets and aggregates which penetrate or occur within the enclosing quartz-rich host rock. The chlorite shows brown streaks reminiscent of biotite. The colour is possibly an indication of partial oxidation. Interference colours are either anomalous blue, isotropic, and simply the body colour. The overall relief of the chlorite appears high. The chlorite is accompanied by what appears to be altered ilmenite with minor sulphides.

The origins of this rock are not clear. The rock now contains too much quartz for it to have been an igneous rock and its general, overall appearance under low magnification, suggests a metamorphosed, coarse grained sediment which has been cut by subparallel veins of more basic composition.

Sample: P598/73 TS 31215-31216

Location: 557.23

Rock Name: Chlorite-mica-quartz rock (?metasediment)

Hand Specimen: The hand specimen shows a contact between a grey-green "amphibolitic"rock or schist (TS31215) with a dark green "amphibolitic"rock or schist (TS31216). The latter is cut by colourless, white and red veins, none of which cross cut each other.

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

TS31215	%	
Quartz	5-20	Very variable because of the brecciated nature of the rock
Chlorite) Clay) Amphibole) K-Feldspar)	60-80	
Opaques	5-8	
Calcite	15	
Apatite (oneband)	Tr	

TS31216		%
a.	Biotite	50-70
	Quartz	20-30
	Opaques	5
	Chlorite inc. serpentine	10
	Calcite	1-5
b.	Calcite	5-10
	Opaques	5-10
	Sericite	30-40
	Quartz	15-30
	Altered biotite	10-20
	Chlorite	10

TS31215 is from the rock given a field name of hornfelsic amphibolite by Mr Emery. In the hand specimen the rock is seen to be brecciated with two apparently different phases represented. One phase is pale green and contains a heterogenous granular mixture of granular calcite, colourless chlorite and quartz. The other assemblage contains a green chlorite, with prominent opaques as well as quartz. In this phase chlorite is restricted to marginal areas

and veins. Sulphides, oxides and titanium minerals are all represented among the opaques or near opaques.

K-feldspar is present with the calcite in some of the veins. The oldest rock appears to be the quartz-chlorite-opaques rock with minor amphibole. This consists of small recrystallised quartz grains, either single or in aggregates, and commonly elongate parallel to the foliation, separated by filaments of chlorite and opaques. Granules of carbonate are present in a few places. The chlorite has anomalous blue interference colours. In a few areas blades of chlorite appear to have replaced feldspar and some has partly replaced amphibole.

The second phase consists of a heterogenous mixture of fine grained clay, chlorite, calcite and opaques. There is no well developed foliation and calcite is dispersed throughout the whole of this type of material. Opaques are preferentially concentrated along cracks.

Both phases are cut by early veins containing essentially calcite alone (there are traces of chlorite), and then by a later, weakly zoned, vein. The outer zone of the latter is chloritic, there is an inner zone of K-feldspar and the core is sparry calcite. The two latter minerals form grains in the size range 0.2-0.4 mm in the vein. The margin of this vein appears locally sheared, and the vein itself cross cuts the pre-existing foliation of the quartz-chlorite rock.

The other part of P598/73, represented by TS 31216, is that given a field name by Mr Emery of phyllitic amphibolite. It is a complex rock. The thin section shows the contact between a dark phase, biotite-quartz-opaques schist and a light coloured phase, of sericite/chlorite-quartz-carbonate. An intermediate grey zone is the product of shearing, followed by recrystallisation, at the interface between the two phases, and is composed of dominant quartz and chlorite with opaques (oxides) and trains of leucoxene. Dolomite occurs with calcite and K-feldspar in a late stage vein which crosses this zone.

The biotite schist contains abundant aligned small (0.005-0.4 mm) grains of biotite, interspersed with small (0.1-0.3 mm) sub-equant grains of quartz. There are unusual cross-cutting patches of colourless phyllosilicate (grey interference colours) up to 5 mm long and up to 1 mm wide, possibly a serpentine variety of chlorite. The interference colours contrast markedly with the more common blues.

The sericite/chlorite-quartz-carbonate phase is unlike any other present in the present batch of thin sections. The colouration of the rock, pale brown in places, suggests that it was once a biotite schist, and that the biotite has been degraded to a large extent. No particular orientation direction is shown by the remnants. This phase is cut by veins of later chlorite with minor ?illite.

The origins of these rocks remain highly inconclusive. The biotite schist was probably once a sediment, but the nature of the remaining rock has been obscured by the subsequent metamorphic processes, which include shearing or crushing and probably some hydrothermal alteration (e.g. chloritization and introduction of calcite).

Sample: P599/73 TS 31217

Location: 581.2

Rock Name: Chlorite (-mica) schist

Hand Specimen: A dark chloritic, fine grained rock with a greasy feel

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

	%
Chlorite	80-85
Epidote	2
Sulphides and graphite	2-5
Quartz	2
Mica	5-10
Monazite	Tr
Titanium minerals	1-2
Apatite	Tr

The greater part of the rock is composed of very well foliated chlorite containing, in places, minor degraded biotite and muscovite, together with veins containing quartz or quartz and epidote. The chlorite is impregnated with fine granular or elongate opaques together with slightly larger, but more widely dispersed, altered titanium minerals.

The chlorite is colourless, with grey interference colours. Most shows a simple alignment more or less flexed, or, rarely, sheared. In a few places pods of chlorite (± mica) are orientated in their outer shapes parallel to the orientation, but internally the cleavage is at a high angle to the foliation. The mica and chlorite both occur in small grains, 0.05-0.2 mm long. The greater part of the mica, aligned parallel to the chlorite, is a pale brown degraded mica.

Locally the mica is co-abundant with the chlorite.

The opaques within the chlorite seem to be mainly pyrite, the titanium mineral is dark brown and was once either sphene or rutile. A grain of monazite has a halo of altered chlorite enclosing it.

The chlorite schist is cut by veins, which have penetrated along shears (microfaults), and have penetrated what were possibly once tension cracks. The veins are irregular in thickness (0.5-5 mm) and vary in attitude. Epidote occurs as subhedral prisms or tablets; quartz has an incipient sparry texture. One large grain of apatite was noted. Many of the veins were apparently emplaced at the close of the period of shearing, one vein is apparently much later.

The origins of the rock are not readily recognisable, but the rock was possibly a shale containing pyrite and carbonaceous material.

Sample: P600/73 TS 31218

Location: 594.35

Rock Name: Altered felspathised granitoid (granitic composition)

Hand Specimen: A medium to coarse grained, dominantly pink, granitic rock which contains dark coloured, fine grained inclusions and partings. The feldspar revealed on the cut surface appears to have either crystallised late earlier-formed minerals, or has been partly remobilised late in the rock's development.

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

	%
Quartz	15-20
Microcline Untwinned feldspar)	60
Biotite	Tr
Epidote/chlorite	20
Calcite	Tr-1
Opaques	2-5
Altered sphene	Tr
Apatite	

P600, 604, 605 (both) and 606/73 are all very similar. They consist of rocks which have been compressed, crushed and reconstituted with extensive development or redevelopment of K-feldspar and chlorite. Quartz has been recrystallised.

This sample is from a zone which changes from a massive granitoid through a fractured zone to a zone composed of chlorite with subordinate K-feldspar. The overall texture is highly modified allotriomorphic granoblastic. Many of the grains are in the range 0.05-0.1 mm diameter, but, in places, ?porphyoblastic growth (coalescent from the smaller grains) has allowed development of highly irregular microcline grains up to 0.5 mm diameter. In places similar features relating to longer grains (up to 3 mm) can be interpreted as being the product of partly broken down phenocrysts of feldspar.

The result is a confused melée of allotriomorphic quartz and feldspar and chlorite with irregularly distributed opaques, and rare apatite and sphene. The problem of identification is compounded by a host of minute inclusions.

About half the feldspar shows either well developed or incipient microcline twinning. Most of the remainder is untwinned. Albite twinning is shown in few grains. Quartz and apatite have, on the whole, fewer inclusions than the untwinned feldspar. The chlorite is pale green with "body colour" interference colours.

The cracks noted earlier are filled with a mixture of chlorite and K-feldspar. Opaques are largely oxides but one or more grains of pyrite are also present. The rock appears to have been a granite or adamellite which has been subjected to severe crushing and veining by late stage K-feldspar and chlorite.

Sample: P601/73 TS 31219

Location: 614.0

Rock Name: Altered amphibolite

Hand Specimen: A dark grey-green rock cut by several generations of veins. A pink and white vein cuts earlier formed white veins.

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

	%
Hornblende	70
Opaques	5
Chlorite	5
Titaniferous material	Tr-2
Feldspar & sericite	20
Calcite (in vein)	1-2
Sphalerite (in calcite vein)	Tr
Apatite	Tr

The rock is composed of irregular pale-medium green amphiboles and equally irregular opaques with the interareas filled with feldspar. The rock is extensively cracked and veined, with the vein material including titaniferous material, chlorite, K-feldspar and calcite. Several grains of sphalerite occur in the calcite vein. In places the feldspar is sericitised.

Some hornblende occurs in irregular sub-equant or prismatic grains up to 2 mm long, but, more commonly, it occurs irregular laths and fibres with essentially random orientation. The amphibole is fresh and is not chloritised.

Opaques occur as irregular masses up to 1.5 mm long. They are commonly oxides but a few grains of sulphide are present. Many of the masses are fractured and veined. The oxides are remnants of moderately large (to 1mm) grains of magnetite and/or ilmenite in the original rock.

The interstitial feldspar is untwinned plagioclase. It occurs as small sub-equant to irregular grains 0.1-0.4 mm in diameter. Adjacent to the main veins the feldspar is sericitised.

The rock has been extensively cracked and veined, and the veins are of different ages though the sequence is not always clear.

The largest vein is margined with K-feldspar and has a core of sparry calcite. Opaques, particularly sphalerite (up to 1.5 mm in diameter), occur in the calcite. A vein parallel to the last, and 5-8 mm distant, is composed of a mixture of K-feldspar, chlorite, altered titaniferous material (?leucoxene), and contains opaques, some of which may have been included from the walls of the vein. This vein transects older K-feldspar/chlorite vein(lets). The chlorite in this rock is pale green with anomalous blue interference colours.

The rock could have been a moderately coarse grained basic igneous rock transformed to an amphibolite, however the proportions of hornblende to feldspar are higher than is typical for an igneous rock. A possible alternative origin

is therefore a calcareous shale. The rock has subsequently been cracked and veined by late stage ? hydrothermal fluids.

Sample: P602/73 TS 31220

Location: 625.5

Rock Name: Mica-andalusite schist

Hand Specimen: A well foliated rock, basically medium grey in colour, which contains irregular patches of dark green to black material, 3-8 mm in diameter, and elongate along the foliation.

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

	%
Muscovite/sericite	75
Biotite	10
Opaques	2-3
Chlorite	10
Relict andalusite	1-2
Apatite	Tr

The dominant mineral in the rock is white mica. This comprises the greater part of the groundmass, and a palely coloured form constitutes the green patches visible in the hand specimen. Other knot-like components include extensively cracked andalusite with, or without, prisms of biotite and bands of pale brown chlorite. The groundmass is well foliated, and the mass of the chlorite parallels this foliation, though individual grains cut across the foliation at a high angle.

The green patches of the hand specimen are composed of very pale brown mica (or talc) of essentially random orientation. The margins of the patches are highly irregular (though rounded) and tend to be convex to the surrounding mica which is deflected past the patches. Both these patches and the enclosing mica contain dispersed opaques and isolated flakes of biotite, or of chlorite after biotite. The latter minerals, in both cases, exhibit no preferred orientation. Both 'patches' and groundmass have been cut by veins of late chlorite.

In addition to the green patches, other nodes or knots occur. These are composed of colourless, highly fractured andalusite (up to 5 mm in diameter) containing, or associated with, randomly orientated blades of biotite. The margins of this material appear corroded by the white mica groundmass but the andalusites are scarcely altered. Sheared muscovite is present in some of the fracture zones within the andalusite. Opaques, and rare zircons are associated with the biotite.

The rock was probably once a sediment which was metamorphosed to a high andalusite-mica schist. Changes associated with subsequent shearing have cau alteration of some unidentified component to sericite, while andalusites have unaffected except for cracking, and there has been some remobilisation of the

Subsequently, or simultaneously, part of the biotite has been chloritized. The final event has been the cracking of the rock followed by veining with chlorite.

Sample: P664/73 TS 31316

Rock Name: Feldspathised mica schist (metasediment?)

Hand Specimen: A crudely banded dark rock with red zones along the banding and irregular red veinlets across the banding.

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

	%
Quartz	5-10
Muscovite	60-70
Chlorite	10-15
Opaques	2-5
K-feldspar	15
Sphene	1
Zircon	Tr
Sphalerite	Tr

The rock has a well marked foliation, defined by zones of preferentially concentrated minerals. In places there is wholly muscovite/sericite; elsewhere there is K-feldspar-sericite or K-feldspar and chlorite, and there are zones rich in quartz. All of these zones, together with the greater number of elongate grains, parallel the foliation. The foliation is cross-cut by veins of K-feldspar-chlorite-opaques and by veins of quartz. Muscovite (sericite) is colourless and irregular. Rare grains reach 0.2 mm long but most are about 0.04 mm.

K-feldspar, pink and turbid (with ?hematite inclusions), commonly occurs with colourless to very pale green chlorite. Grains in the body of the rock are irregular and contain abundant inclusions of chlorite and muscovite and of secondary opaques. In places these four minerals are so intergrown that the margins of the various grains are not well defined. The patches so produced tend to be elongate parallel to the foliation. Elsewhere there are larger irregular grains (0.25 mm) of feldspar intergrown with chlorite; these closely resemble the late cross-cutting veins.

In the body of the rock, quartz occurs as small sub-equant grains which are partly corroded and replaced by muscovite. In mainly cross-cutting veins quartz occurs by itself. These veins have a variable direction and, locally and for short distances, follow the foliation.

Opaques are dispersed through the rock, particularly in feldspar and chlorite, but are not common in the muscovite. The greater part of the opaques (sulphide), however, occur in the K-feldspar-chlorite veins which cross the foliation. Filamentous opaques margin some of these veins, elsewhere larger grains occur in the centre of the veins. Secondary opaques are present in some

places as indicated above and there is one grain, almost wholly replaced by granular opaques with minor chlorite, which cross-cuts the foliation. It is not certain whether this grain relates to a vein or represents an altered, included fragment.

A few grains of sphalerite occur in quartz rich veins.

It seems likely that the original rock was an argillaceous sediment which was converted by regional metamorphism to a muscovite schist. It is considered that this muscovite schist, which may have contained some quartz and chlorite, has then been penetrated by K-feldspar and chlorite, in part along the foliation, in part in crosscutting veins. In places there appears to have been some mixing of this added material with the original rock giving the diffuse zones noted earlier. Opaques (mainly yellow sulphide) have also been introduced, and sphalerite, in particular, has been introduced at a very late stage.

Sample: P603/73 TS 31221

Location: 650.35

Rock Name: Epidote-K-Feldspar rock

Hand Specimen: An apparently medium to coarse grained blotchy pale green and pink rock veined by later dark green ?chlorite.

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

	%
Epidote	65
Chlorite	5-10
Altered feldspar	25
Calcite	5
Opaques	1-2
Sphene	Tr-1

The red zones visible in hand specimen represent altered K-feldspar containing finely disseminated red brown opaques. The green areas represent composite zones composed of epidote minerals and chlorite. Less strongly coloured intervening areas are composed largely of epidote and a white patch in the rock is calcite with a small peripheral zone of specular hematite. There is no simple term to describe the very confused texture.

The K-feldspar tends to be exclusive of other minerals. However in places it is ?veined and penetrated by bright green chlorite. The feldspar itself is shapeless and occurs in aggregates up to 3 mm in diameter of smaller sub-equant to irregular grains. Very rarely it encloses aggregates off small epidote grains. However, whether the feldspar preceded the epidote or not is not clear, except in a few places where the K-feldspar occurs in late stage veinlets. In some places the red staining is so pervasive the feldspar is almost opaque.

The other main component, epidote, occurs in aggregates of small granular grains (colourless), as aggregates of large sparry grains (colourless - with trace amounts of quartz), and as aggregates of turbid grains. The latter are probably the first formed of the epidotes. The grain size of this mineral commonly varies between 0.04 and 0.25 mm, with the early formed turbid grains small, and the late sparry grains larger.

Chlorite occurs as a bright green variety as well as in the more usual pale form. The bright green variety is associated with specular hematite, calcite, and K-feldspar. The pale green chlorite is also associated with K-feldspar but, in addition, occurs in veinlets by itself. Small to large patches of either variety of chlorite are present locally within epidote aggregates.

Calcite is of very late development and occurs in veins and small pods with chlorite and specular hematite. Most calcite is coarse grained (up to 2 mm), with included hematite 0.5-1 mm long.

The only other opaque is ilmenite, which commonly occurs surrounded by an aggregate of fine grained sphene.

The origins of this rock remain obscure. No trace of a former premetamorphic rock can be identified with any certainty. A possible paragenetic sequence is that a sediment was transformed into a calc silicate rock. This was subsequently invaded by K-feldspar chlorite and calcite. Simultaneously part of the epidote was recrystallised. Finally, following cracking of the rock, it has been veined by chlorite and calcite together with such mineralisation as is present.

It could also be an extensively altered and epidotized igneous rock.

Sample: P604/73 TS 31222

Location: 656.1

Rock Name: Cataclastic chlorite-K-feldspar rock ("syenite")

Hand Specimen: A brecciated and veined granitic rock, rich in visible feldspar (up to 1 cm). One part of the rock (less sheared is more leucocratic than the remainder).

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

	%
Quartz	5
Feldspar	70-75
Calcite	5-10
Chlorite) Epidote	15
Zircon	Tr
Opaques (titaniferous)	Tr-1
Apatite	Tr

The rock has a texture related to that of P600/73. It consists of broken relicts of K-feldspar (including visible microcline) in a 'groundmass' of feldspar, calcite, chlorite, and apatite. Quartz is rare.

The leucocratic phase is more massive and has been less affected by crushing than the remainder of the rock. Large (>5 mm) broken grains of turbid microcline are separated by a sub-mortar textured mixture of feldspar, chlorite and ?quartz (possibly granulated).

In the remainder of the rock the relicts are fewer in number and smaller in size, and the greater part of the rock consists of reconstituted material. The recrystallised feldspar is granular with highly irregular margins and is, on the whole, less turbid than relict feldspar, though the intensity of the turbidity is very variable in different parts of the section.

The chlorite, recrystallised feldspar and quartz are all highly irregular and have a very similar texture to P600/73. They are generally fine grained (0.01-0.2 mm). True opaques are rare, some appear to be pyritic. More abundant subopaque particles are of leucoxene.

The rock has been veined at a late stage with K-feldspar and calcite, with calcite possibly being the later mineral. Elsewhere in the rock, particularly in the more massive phase with larger relicts, calcite occurs disseminated through the recrystallised crush material, as well as in well defined veinlets.

This appears to have been a granitic or ?syenitic rock which has been crushed and subjected to potash metasomatism, partial hydration and recrystallisation. The absence of major foliations in the secondary products indicates that this probably took place at the close of the major period of regional metamorphism. At a later time cracks developed and were filled by K-feldspar (which penetrated into the host rock) and calcite. The quartz level is low. There is no real indication of origin. The present rock has the composition of a chloritic syenite but it is doubtful if this represents its original composition

Sample: P605/73 TS 31223/4

Location: 662.65

Rock Name: Chlorite-K-feldspar rock ("syenite" gneiss)

Hand Specimen: TS31223 is taken from a zone of feldspar rich gneiss whereas TS31224 is taken from a zone also gneissic but much darker in colour with ?phenoclasts of feldspar, and veined by later pink ?feldspar.

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

TS31223	%
K-feldspar	80
Chlorite	10-20
Opaques	2-3
Calcite	1-2
Mica	Tr-2
Zircon	Tr

TS 31224	%
Feldspar	60
Opaques (mainly leucoxene)	5
Chlorite	30
Muscovite	10
Calcite	Tr-1

The feldspar-rich gneiss (TS 31223) has a texture comparable to that of P600/73 and a composition comparable to P604/73. It appears to have been a granitic rock affected by potash metasomatism.

The major features of difference with the two samples cited are:

a. The lack of relict feldspar (this rock is of more equigranular, almost totally reconstituted material).

b. The presence of veins of exceptionally turbid K-feldspar, and,

c. The presence of a foliation indicated by flattened patches of chlorite and elongate aggregates of leucoxene.

Quartz may be present but is unrecognisable in the prevailing textural relationships. A few less turbid grains may be albite as they appear to have a high positive 2V.

Leucoxene (? altered rutile) is the most common 'opaque'. There are a few grains of iron-?titanium oxide.

The general texture and mineral composition of this phase are so similar to P600/73 or P604/73 that it is likely to have had the same origins - with the proviso that the rock has been more completely reconstituted.

Identification of the proportions of minerals in TS 31224 is hampered by the pervasive turbidity. This phase reflects P604/73 even better than the preceding phase. There are relicts of partly broken down microcline and the whole rock has a more brecciated appearance. Chlorite is abundant and late developed veins of turbid K-feldspar with chlorite are prominent. Small patches of calcite are present.

The rock is obviously of similar origin to its neighbour but the reconstitution process has not progressed to as advanced a stage- or the original rock was slightly more competent. The present composition is again that of a chlorite syenite.

Sample: P606/73 TS 31225

Location: 708.9

Rock Name: Quartz-feldspar-chlorite gneiss

Hand Specimen: A red rock containing large grains of feldspar. In a few places the feldspathic rock is cut by veins of ?chlorite.

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

	%
Quartz	30
K-feldspar	60

	%
Chlorite	5-10
Opaques	1-2
Muscovite	1
Zircon	Tr

The texture of this rock is related to P600, 604 and 605/73 however the rock contains significantly more quartz.

There are again relicts of feldspar 1-2 mm in diameter. These are set in a 'groundmass' which is more variably sized than in the other samples cited. Quartz is much more prominent than in the other samples and occurs in aggregates of grains up to 3 mm in diameter, with highly sutured intra quartz boundaries. Irregular 'veins' of quartz are also present. The remainder of the material has a modified mortar texture with many grains between 0.005 and 0.02 mm in diameter.

Chlorite and titaniferous subopaques fill interstices and there are traces of opaque sulphides and oxides. Traces of muscovite occur with the chlorite. Some of the chlorite occurs in late stage veins with a very red-brown K-feldspar. These minerals appear to have been the last to form.

This could well have been a granitic rock which has been severely crushed and partly reconstituted. The late development of (some of the) chlorite and K-feldspar postdates the reconstitution period. Though there are veins of K-feldspar there is no real evidence to show that the rock has been extensively metasomatised. On the whole the impression is of reconstitution in situ with minor addition of chlorite and K-feldspar.

Sample: P607/73 TS 31226

Location: 717.3

Rock Name: Chloritised quartz-sericite-feldspar gneiss.

Hand Specimen: A brecciated pink and dark green granitic rock, veined with green ?chlorite.

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

	%
Quartz	40
Sericite	40-45
Chlorite	5
Feldspar	15
Titanium minerals	Tr-1

The rock contains relicts of quartz set in a foliated mixture of freshly developed sericite, chlorite, K-feldspar and quartz. There are also a few strained remnants of large feldspar grains. The relicts are variable in size, but commonly are less than 1 mm in diameter, though elongate aggregates may extend 2-8 mm parallel to the foliation.

Such relict feldspar as is present is untwinned. It is turbid with exsolution of red-brown opaques. A few grains are penetrated along the cleavage planes by sericite. Staining of the rock with sodium cobaltinitrite solution shows the feldspar to be largely plagioclase with but minor K-feldspar. Many of the quartz relicts show prominent strain extinction.

The matrix is locally wholly of fine grained sericite but more commonly it consists of a mixture of sericite with quartz (the latter in the range 0.01-0.1 mm in diameter). There are rare small discrete grains of feldspar and there are zones rich in chlorite.

Most of the chlorite occurs in fractures which transect the rock, but other chlorite forms patches within the matrix. The matrix chlorite is pale green with dominantly brown interference colours; in the veins it is a brighter green, and is almost isotropic.

Most opaques and subopaques are titaniferous, either altered sphene, rutile or ilmenite.

It is not possible to give an origin for this rock as the metamorphism history has been complex. The rock may have been either a medium-coarse arkosic sediment or a granodiorite, which has been extensively sericitised at the time of shearing. The last event has been fracturing of the rock across the foliation and the penetration of ?chlorite into the cracks. The rock has some similarity in composition and texture with P597/73. However the minerals of the rock are wholly recrystallised and chlorite is more prominent (at the expense of mica and feldspar).

Sample: P656/73

Location: 730.15 m DD 11

The mineral was identified by X-ray diffraction as arsenopyrite.

Sample: P665/73 TS 31617 PS 21550

Location: 732.35 m

Rock Name: Feldspar-chlorite rock, ?metasediment

Hand Specimen: A fine-grained pink/grey rock which has been externally veined with pink-red material.

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

	%
Feldspar	55-60
Quartz	10
Chlorite	20-30
Mica	1
Opaques	3-5
Tourmaline	Tr-1
Sphene	Tr-1
Apatite	Tr

The opaque minerals are:

Chalcopyrite	Tr
Pyrite	Tr-1
Arsenopyrite	Tr-1
Graphite	Tr-1
Sphalerite	Minute Tr

A host rock, now fragmented, is composed of a diffuse fine to medium grained mosaic of feldspar with minor chlorite and moderately abundant, widely disseminated opaques. It has been cut and penetrated by veins of K-feldspar with chlorite and minor quartz. Opaque grains also occur in a few places in the veins and some contain traces of yellow-orange tourmaline. The margins of some of the veins are rimmed with concentrations of fine grained opaques which, in general appearance resemble stylolitic seams.

The host rock consists of linked, non-directional aggregates of interlocking feldspar with interstitial chlorite and very minor muscovite. Small irregular blebs of opaque minerals (graphite and minor sulphide), from 0.03 to 0.16 mm long are dispersed through this material. Feldspar grains, which range up to 0.25 mm, are mainly untwinned though both K-feldspar and plagioclase are present. The chlorite of this phase is almost isotropic but rarely shows anomalous blue interference colours.

Veinlets, of K-feldspar and chlorite, apparently unconnected with the main veins, occur within the host rock.

One part of the host rock consists of a mosaic of strained quartz up to 0.5 mm in diameter, with minor K-feldspar, tourmaline and chlorite.

The rock is penetrated by larger veins, up to 3-5 mm wide, of sparry turbid K-feldspar (0.25 to 3 mm in diameter) with subordinate quartz and with chlorite which is either interstitial, or an integral part of the vein, or in later veinlets. Large opaque grains up to 1 mm diameter occur, in some places. Tourmaline, pleochroic from colourless to dark orange, occurs within the veins as irregular grains and poikiloblastically in the host rock adjacent to vein margins and one vein contains apatite. The veining appears to have occurred in several phases but the order of venation is not clear.

The 'stylolites' constitute a curious feature as these are not common to metamorphic rocks. They are typically of opaque material and leucoxene with chlorite adjacent on the host rock side and feldspar or chlorite on the inner (vein) side. They do not occur with all veins.

The origins of this rock are again complex. It is considered that it was once most likely to have been an alternating sequence of arenaceous (the quartzitic layer) and argillaceous (feldspar-chlorite) rocks which have been regionally metamorphosed and the presence of graphite suggests a carbonaceous sediment. Local mobilisation of part of the feldspar and chlorite, with possible introduction of similar material with opaques, has resulted in the formation of localised veinlets within the host rock and the injection of the complex system of larger veins. Though most of the vein material appears unstressed (though the feldspar is turbid) some evidence of strain is indicated by the stressed state of the quartz in the arenaceous layer. Poikiloblasts of tourmaline indicate probable incipient hydrothermal or metasomatic activity and the stylolite structures suggest solution of parts of the rock under compression.

Polished Section

The host rock contains dispersed flakes of graphite generally less than 0.1 mm long and some of these are subparallel. It also contains grains and aggregates of recrystallised leucoxenic material and a few scattered, small crystals of pyrite and arsenopyrite.

Chalcopyrite and sphalerite occur mainly in the larger veins as irregular grains 0.1-0.5 mm in size commonly associated with quartz and feldspar. Some chalcopyrite occurs with tourmaline and some with pyrite. Most of it fills interstices between non-opaque minerals indicting that it crystallised late in the history of the rock.

Sample: P666/73 TS 31618 PS 21551

Location: 733.95 m

Rock Name: Contact between metagranitoid and metasediment

Hand Specimen: A coarse grained red granitic rock is separated from a fine grained grey-black ?metasediment by a zone of a dark red-brown mineral.

Thin Section: The constituents are as follows:

	%
Quartz, in the granitoid, proportions vary	
Feldspar	dominant
Chlorite	abundant
Tourmaline	in vein
Opaques	in 'host rock' and veins
Calcite	in veins

The thin section contains a shattered granitoid rock separated from a feldspar-chlorite rock by a zone of pleochroic orange tourmaline. All these phases have been veined by K-feldspar, quartz, chlorite, calcite and opaques either singly or in combination.

The granitoid has an allotriomorphic granular texture modified by shearing. This has resulted in fracturing of the large feldspars, with some granulation at their boundaries and strain extinction of the quartz which is of irregular shape with highly sutured internal boundaries. No true 'igneous' quartz remains. The feldspar, which is a mixture of highly altered plagioclase and K-feldspar, occurs in grains up to 5 mm long even now, and quartz grains reach 1 mm. The feldspars are brown and turbid and contain inclusions of quartz and opaques as well as the crosscutting veinlets.

The tourmaline occurs in veinlike form. The grains were once as large as 5 mm but all are broken and fractured and penetrated by the various systems of veins. Early veins include quartz and/or opaques. These are cut by later veins containing chlorite, and more quartz and opaques, or by veins of chlorite and calcite (up to 0.7 mm wide). There is little K-feldspar within the tourmaline.

The rock which is 'intruded' is very similar to the host rock of P665/73, and is related to P662/73. There is some weak banding but the dominant texture is that of a diffuse interlocking mosaic. The banding lies parallel to the granitoid contact and is defined by the parallelism of elongate minerals and minor mineral segregation. The dominant mineral is feldspar (mainly potassic) (0.05-0.08mm) and there is abundant interstitial chlorite, together with medium-fine grained opaques (0.02-0.05 mm). The feldspar is variably turbid. This phase is cut by veins containing calcite, chlorite, opaques and K-feldspar. Some containing calcite and feldspar postdate some with chlorite. It is not possible to distinguish the relative ages of some calcite and the chlorite veins. The chlorite/opaques vein (in which the opaques have a stylolitic form) and a chlorite vein are cut by the K-feldspar-calcite veins. A small proportion of granular opaques are present with the calcite. Many of the veins appear to originate in the granitoid.

This rock appears to have had an origin similar to that conjectured by Mr Every. An 'igneous' granodiotite has 'intruded' metasediments. The rock has probably produced veining in the metasediments. At a later date the rock has been subjected to severe crushing with possibly some (re)mobilisation of K-feldspar and calcite. The latter material now veins both metasediment and 'igneous' rock.

Polished Section:

The grey metasediment contains disseminated grains of arsenopyrite and pyrite generally in isolated grainsless than 0.1 mm in size. There is a trace of finer grained chalcopyrite. The sulphide minerals occur in greater concentration along some of the veins and in this location they are coarser grained (0.1-0.3 mm) and chalcopyrite is more abundant being intergrown with arsenopyrite/pyrite.

The metasediment also contains graphite which occurs as scattered flakes and more particularly as a concentration along the dark contorted band which, in general appearance is similar to a stylolite.

The granitic rock contains a few scattered grains of arsenopyrite, pyrite and chalcopyrite (less than in the metasediment) and has greater concentrations of chalcopyrite along veins.

Sample: P667/73 TS 31619

Location: 736.95 m

Rock Name: Feldspar-quartz-tourmaline rock

Hand Specimen: A brecciated and altered granitic rock.

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

	%
K-feldspar) Sericite	80
Quartz	10
Tourmaline	2-5
Opaques	1
Calcite	5
Chlorite	2
Muscovite	1

The texture is irregularly granular possibly grossly modified from an allotriomorphic granular (granitoid) texture. The greater part of the rock is composed of sericitised feldspar rimmed and veined by fresh untwinned feldspar and quartz. Large broken crystals of tourmaline are veined by calcite, chlorite, and K-feldspar.

The shape of feldspar grains is poorly preserved and boundaries are very diffuse. The impression is of a mass of fine sericite flakes together with isolated patches of turbid, brown untwinned feldspar. This feldspar is margined and penetrated in places by less turbid K-feldspar, much of which has a later (vein) origin. Patches of very pale green chlorite are present wtihin the sericite/feldspar as well as in veins and veinlets cutting this material.

A major feature of the rock is the presence of relatively abundant, broken and largely replaced red-brown tourmaline grains. Fragments left in optical continuity are up to 5 mm long. The replacing material is chlorite, calcite, and K-feldspar. These tourmalines occur in the body of the rock and predate the veining.

Recrystallised patches of quartz occur in positions which would be expected from a modified granitoid.

All the veining appears to belong to one phase though chlorite occurs more commonly in separate veins, or in veins which pass into K-feldspar-carbonate veins. Rarely calcite occurs in the centre of feldspar veins and, in one place, it demonstrates a later origin by branching out of the feldspar vein and forming a veinlet independent of the feldspar. Opaques (sulphides) occur with most of the vein minerals. The late K-feldspar is sparry with grains up to 0.5 mm long. Opaques in the veins vary but are typically 0.2-0.4 mm in diameter. The veins themselves vary from 0.2 to 0.5 mm in width.

This rock has probably been a granitoid though little trace of any igneous/plutonic nature remains. There is little evidence of strain, but sericitisation of the feldspar and alteration of the tourmaline took place before the injection of the vein minerals. The latter was also accompanied by little

strain as the remnants of the tourmaline are still in optical continuity.

Sample: P668/73 TS 31620

Location: 740.15 m

Rock Name: Massive feldspar-quartz-chlorite rock (metasediment?).

Hand Specimen: A faintly banded fine grained dark pinkish-grey siliceous rock which has been fractured and veined by the greenish black material.

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

	%
Quartz	30
Feldspar	40-50
Opaques	5-10
Chlorite	10-20
Sericite/Muscovite	1-2
Tourmaline	Tr
Apatite	Trace

The rock has a relatively even sub-equigranoblastic interlocking texture, similar to that of a modified hornfels. There are, in addition, rather coarser uniform patches of quartz and feldspar. The framework consists of quartz and somewhat turbid feldspar, 0.05-0.2 mm in diameter, with interstitial chlorite and granular opaques of a slightly smaller size. In the veins (0.2-0.5 mm wide) and veinlets (0.04 mm wide), the feldspar grains reach 0.3-0.4 mm with rare patches of chlorite 0.25-0.4 mm in diameter. One vein includes traces of orange tourmaline. Opaques are present in one chloritic vein. The vein is 0.1-0.15 mm in width with lumps of opaques up to 1.3 mm long by 0.5 mm wide.

There are no signs of broken down large grains.

This is a metamorphic rock in which foliations are not well defined. The present texture is almost hornfelsic and probably represents a totally recrystallised rock. The present texture is not igneous and there are no signs of phenocrysts to suggest that the origin was once volcanic - however this hypothesis made in the field, cannot be disproved. A metasedimentary origin is also possible and, in general, the overall texture shows a greater similarity to a metasediment than to a metavolcanic.

Sample: P669/73 TS 31621

Location: 745.35 m

Rock Name: Contact of altered or metagranodiorite with feldspar-quartz-chlorite rock.

Hand Specimen: A mixed rock showing zones of coarse light pink/grey felsic material with zones of finer grained bluish grey material.

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

	% Granitoid Phase		% "Hornfels" Phase
Quartz	30-40	)	80
Feldspar	40-50		
Chlorite	15-20		15-20
Opaques	5		1-2
Calcite	Tr		Tr
Muscovite	5		1-2
Tourmaline	Tr		Tr

The thin section contains two phases. A coarse grained, non-potash bearing microgranitic phase is present together with a granoblastic sub-hornfelsic mosaic of feldspar, chlorite, muscovite and quartz.

The latter phase is almost identical to P668/73 and need not be described separately. The typical grain size is about 0.1 mm. The main difference lies in the presence of orange-brown tourmaline similar to that described previously. This occurs as the remnants of former ?large grains (>5 mm) which now appear as isolated, irregular fragments retaining their original optical continuity. The feldspar includes both K-feldspar and plagioclase (oligoclase) but much is untwinned.

The granitoid phase has a modified granitic texture. It is coarser, with most grains in the size range 0.2-1.0 mm, and contains 'igneous proportions' of feldspar and quartz. The proportion of both opaques and chlorite is high for granitoids, however. Plagioclase (? andesine-oligoclase), the dominant feldspar, is moderately sericitized. There is very little K-feldspar. The grain outlines are more irregular than those of normal igneous rocks. Opaques and chlorite (ultrablue interference colours) occur, with quite coarse grained muscovite (0.25 mm) interstitial between the felsic minerals. The opaques occur in irregular stringers and aggregates of varying sizes up to 2 mm; though they occur with chlorite they do not appear to be directly related to the development of the chlorite. Neither chlorite nor muscovite appear to be pseudomorphs after any preexistant ferromagnesian minerals.

Veins, which are dominantly chloritic, extend from the granitoid through the granular rock. These veins, which contain minor ?porphyroblastic opaques, are normally 0.2 mm wide, with the opaques reaching 1 mm. In a few places these chlorite veins cut what appear to be incipient veins within the granular rock. These veins or zones are elongate and are characterised by quartz and feldspar of size similar to that of the granitoid phase. Most of the tourmaline noted earlier appears to be related to these zones.

The contact between the granitoid and the other phase is marked, for the most part, by a thin chlorite zone, though this is absent in some places. Thin veins of calcite also occur in this area.

The rock displays a pattern consistent with a contact between a former granitic rock (granodiorite) and a country rock which may have been either sediment, metasediment, igneous or meta-igneous. There is no evidence to show whether the undoubted recrystallisation of the country rock took place before, during or after the intrusion of the granodiorite. The appearance of recrystallised zones, with tourmaline, in the country rock may be related to the granodiorite. Both rocks, then, appear to have been modified giving the present textures, with chlorite veins penetrating the country rock, altering and replacing part of the tourmaline.

Polished Section:

Chalcopyrite is the most abundant opaque mineral constituting 3-5% of the section. It occurs along grain boundaries and in interstices particularly in the coarser grained, granitic phase and locally it forms an irregular network of small veinlets. It has crystallised after the silicate minerals. Grain size varies generally from 0.05 to 0.2 mm but there are a few more massive patches up to 1 mm in size. These latter contain inclusions of pyrite which appear to be remnants of grains which have been veined and partly replaced by the chalcopyrite.

A trace of sphalerite is intergrown with some chalcopyrite and in one zone there are aggregates of pyrite with very little chalcopyrite.

A few arsenopyrite grains less than 0.1 mm in size are disseminated through part of the rock not generally associated with the chalcopyrite. These occur mainly in the finer grained phase of the rock.

Sample: P670/73 TS 31622

Location: 749.9 m

Rock Name: Graphitic sericite-quartz rock (metasediment).

Hand Specimen: A fine grained massive grey rock with breaks along vein filled fractures. White calcite is present in some of the latter.

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

	%
Quartz	5-10
Calcite	2-3
Sericite	75-85
Chlorite	1-2
Tourmaline	Tr-1
Opaques	15-20

The rock has a modified granoblastic texture and is composed of sub-equant grains of quartz and opaques, together with interstitial sericite/?degraded biotite. Rare orange tourmaline grains are scattered through the rock.

The rock is penetrated by veins of two types:

a. chlorite-quartz-(calcite) and,

b. calcite,

and there is some suggestion that pre-existing quartz-feldspar veins have been present but the feldspar is now represented by sericite.

Opaques in the rock are probably mainly graphite possibly with some iron sulphide. Much of it is soft and micaceous and floats on water. The dominant phyllosilicate is sericite, most of this is colourless, but a pale brown colouration in some grains suggests that these grains were once biotite. The overall mica grain size is 0.02-0.04 mm and no interference figures could be determined. The sericite/mica shows no sign of a preferred orientation.

Quartz occurs as individual, irregular, granular grains with little sign of strain. Most grains are about 0.04-0.08 mm in diameter. Opaques have a similar size to the quartz. Grains are variably irregular.

Tourmaline occurs in angular subprismatic grains of similar size to quartz, with a few grains up to 0.35 mm.

Of the recognisable veins the chlorite-quartz (-calcite) appear earlier than the calcite veins. The chlorite is unusual for this suite of rocks in that it has green interference colours. Calcite occurs in veins up to 5 mm wide. Its exact relationship with the chlorite cannot be determined as the two types of vein do not cut each other except in one place where calcite appears in the centre of a chlorite-quartz vein, and then diverges independently to one side. The veins are not associated with opaques.

This rock was probably a carbonaceous argillaceous siltstone. Judging from the amount of opaque material it was laid down in reducing conditions which have prevailed throughout the sericitisation metamorphism which has transformed the greater part of the rock. There is some suggestion that veins containing (K)feldspar were formed before sericitisation but no trace of any feldspar remains.

Sample: P656/73 TS 31526

Location: 755.65

Rock Name: Quartz-sericite-chlorite rock

Hand Specimen: A highly brecciated rock containing fragments of grey quartz with a softer pale green mineral in fractures and veins.

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

	%
Quartz	65
Sericite)	
Chlorite)	30
Muscovite)	
Calcite	5
Goethite	Tr

The rock consists of remnants of strongly deformed quartz, possibly vein quartz, separated by a fine grained non-oriented phyllosilicate matrix. Additional secondary quartz (unstressed) is present within the matrix. The rock was then veined by calcite (partly dolomitised in one or two places).

Coarse quartz (1-3 mm) combines to form aggregate masses up to 5 mm in diameter. Quartz-quartz contacts vary from smooth through irregular to sutured. In some places the contacts are penetrated by phyllosilicate. Much of the quartz has a quartzitic texture except where there have been undoubted veins. The latter show minor granulation at their edges suggesting they pre-existed before stress was applied.

The greater part of the matrix is fine chloritic clay. However sericite is abundantly distributed through the chlorite and, rarely, is large enough to be called muscovite. Secondary quartz appears to be related to the later calcite veins but some may have been generated during the sericite/chloritisation. In a few places the original quartz appears to have recrystallised virtually in situ.

Traces of goethite and sphene are present.

The last event has been the penetration of veins of calcite (with minor quartz). The veins cross the rock quite irregularly though there are two dominant directions at about 35-40° to each other.

This rock should be compared with P657/73 as both have undergone similar alteration processes. The lack of feldspar in this specimen and the large proportion of quartz suggests either that this rock was once a sediment, or that a granitic rock with quartz veins has been altered with the whole of the original feldspar sericitised/chloritised.

Sample: P657/73 TS 31527

Location: 756.55

Rock Name: Partly sericitised and chloritised deformed granitoid rock or gneiss.

Hand Specimen: A brecciated rock containing dark red fragments (feldspathic), dark grey gragments (quartzose) and lighter softer grey green material. The rock is abundantly veined with a grey/off-white mineral.

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

	%
Quartz	40-45
Feldspar	15-20
Sericite)	
Clay)	40
Chlorite)	
Calcite	1-2
Opaques	Tr

The rock is composed of remnants of largely untwinned K-feldspar, together with quartz, part of which appears primary and part secondary, in a matrix of phyllosilicates with traces of calcite. The texture may once have been granitic but this has been greatly modified by crushing and by the advent of the phyllosilicate.

The remnants of feldspar still exceed 2-3 mm in places. The margins of the grains are corroded, the grains themselves are turbid, and have been cracked and veined with phyllosilicate and/or calcite. In addition much of the original quartz has been attacked and veined in a similar manner. Most of the feldspar is K-feldspar, but 2 grains of plagioclase were recognised.

The quartz shows marked strain extinction andit has had a tendency to be broken into grains which are elongate and subparallel, thus giving the rock a definite foliation. The grains have a maximum length of about 2 mm though most are however 1 mm. Secondary quartz (<0.2 mm) has developed apparently at the expense of feldspar where this has been replaced by the phyllosilicate.

The phyllosilicate matrix is a complex mixture of sericite with pale chloritic clay, and, in places, patches of coarser, darker green chlorite are present. Some of the latter is possibly degraded from biotite. Calcite is very patchily distributed and occurs mainly as very thin, irregular veinlets within altered feldspar.

The few opaques present appear to be leucoxene after ilmenite. A few granules of ?sphene occur with some of the darker chlorite grains.

This sample appears to have been a granitic rock which has been crushed and partly chloritized/sericitised but the possibility of a metamorphosed arkosic sediment cannot be excluded. The last event has been the penetration by veinlets of calcite. This rock is evidently related to P656/73 and is probably a less altered form of the same rock. It is also similar in alteration to P607/73.

Sample P74/74; T.S. 32248

Location: DD 11 251.2 metres

This sample has been compared with P303/73 and it is clear that both samples are collected from the same augen gneiss. In the present sample (P 74/74) alteration to clay material is considerably more extensive than in the sample described earlier and the whole rock has a somewhat turbid brown appearance. Siderite, which was described in sample P303/73, is not present in this sample but late formed pockets of quartz are very similar in each of the two thin sections.

Some of the fractured and brecciated zones in P 74/74 are 2 to 3 mm in width and have a dark, very turbid appearance. Apophyses of this material intrude adjacent fractured feldspar crystals and it is likely that this material consists of fine grained feldspar together with a little quartz, opaques and clay material. The sample contains only a moderate amount of quartz and most of that is clearly a late formed material deposited in cavities and hence the syenitic character of these rocks appears to be confirmed.

Sample P75/74; T.S. 32249

Location: DD 11 299.86 metres

This rock has a granitic composition and a gneissic texture and it is similar in most respects to sample P304/73. The thin section contains augens only of potassium feldspar and these, although slightly turbid, are generally moderately fresh. Potassium feldspar is also abundant within the bulk of the rock and here too, it is commonly fresh. Some deformation of the feldspar (as well as fracturing) appears to have occurred. The chlorite is an unusually dark green colour and it occurs in similar positions as in sample P304/73. Some pale coloured mica is commonly associated with the chlorite and in some places there is massive mica around aggregates of chlorite flakes. In one or two places chlorite forms fine grained mats and these appear to have penetrated in fissures in adjacent large feldspar crystals so that it is clear that the chlorite has crystallized either during or after the period of brecciation. Some of this bright green, moderate to low birefringent material could be a copper bearing phyllosilicate and it is possible that X-ray diffraction studies of this mineral may indicate that it has unusual spacing. Another feature of this rock is the presence of limonitic material which in some cases forms a gossan-like network as though it represents replaced primary sulphide minerals. Hence apart from the rather extensive aggregates of secondary mica this sample is similar to the granitic gneiss, P304/73. Thin section A contains a trace of late carbonate.

Sample P76/74; T.S. 32251

Location: DD 11 300.16 metres

This sample has a distinctly sheared appearance and the thin section contains no augen. Much of the sample is in fact secondary quartz which occurs in lenticular masses composed of elongate and strained crystals of quartz; there is abundant secondary pale coloured mica and a little fine grained brecciated material.

Potassium feldspar is present as crystals up to about 0.5 mm in size which are probably sheared relicts of original somewhat larger crystals. The feldspar tends to occur with quartz and mica in elongate masses parallel to monomineralic patches of quartz. The orientation of the alternating bands of new quartz and sheared feldspar gives the rock its foliated appearance. Mica, bright green chlorite and fine grained mats of clay are fairly abundant throughout the sample and all appear to be secondary components. The mats of clay are up to 2 mm in size and tend to have highly irregular shapes since they penetrate between fragmented crystals of feldspar. The mica and some of the bright green chlorite occur in porous lenticular areas which may be related to veining of the sample.

In summary therefore, this rock appears to be a little different from P74/74 and P75/74 in that there is a moderate amount of secondary quartz and the rock overall has a more acidic and granitic composition than the rather more feldspathic gneisses described above. The pattern of brecciation and alteration involving fracturing and the crystallization of green chlorite, epidote and fine grained clay is similar in all three of these rocks.

Sample P 77/74; T.S. 32252

Location: DD 11 648.5 metres

This sample was collected from a position adjacent to sample P603/73 which is an epidote-potassium feldspar rock of unknown origin; the present sample, P77/74 has several characteristics in common with that sample but chlorite appears to be significantly more abundant and potassium feldspar cannot be positively identified, therefore a brief description of P77/74 will be given.

Most of the rock consists of a dense turbid and fine grained aggregate in which epidote, chlorite and altered biotite can be seen. A considerable amount of sphene and of semi-opaque material is present also; in fact in some parts of the rock the sphene probably occupies 10% of the thin section.

This material, which is relatively homogenous over the whole thin section, is cut by a large number of irregular veins, most of which contain abundant chlorite but there is also quartz and carbonate in the largest of these veinlets. Where all three of the vein minerals occur together quartz and the carbonate tend to be coarse grained and to occupy the centres of veins and the chlorite occurs as a thin and discontinuous peripheral zone. Most of the veins however are narrow and apparently discontinuous and consist largely of chlorite with minor amounts of quartz. In some places in the section these veinlets occupy up to about 30% of the rock.

The origin and the detailed quantitative mineralogy of this rock are both difficult to determine by optical methods alone; the sample clearly has affinities with sample P603/73 and probably represents an even more extensively replaced variety of rock. No original textures or structures can now be detected in the sample. The abundance of sphene suggests the possibility of a basic igneous rock.

APPENDIX E

PETROGRAPHIC DESCRIPTIONS, PDD11, 1989

Extracted From ANALABS Report 1000 0 07 707

Sample RS 227 PDD 11 301m

Drill core "mylonitic gneiss"

Thin section

FRAGMENTS	
Quartz	dominant
K feldspar	minor to major
Muscovite	minor to accessory
Chlorite	accessory
Opaques	accessory
Zircon	trace

CARBONATE LENSES/VEIN	
Carbonate 1	dominant
Carbonate 2	accessory
Opaques	accessory

VEIN
K feldspar

MATRIX	
Quartz	major
Alk feldspar	major
Chlorite	minor
Mica	accessory
Zircon	trace

This is a BRECCIA containing fragments of a Quartz Feldspar Gneiss that show strong deformation fabric, in a breccia matrix that is rich in K feldspar(staining) as well as quartz and phyllosilicates.This matrix is in the slide also crossed by lensing veins of calcite.

The gneiss fragments vary from Quartzites that have an almost ribbon textured quartz, to 50/50 quartz K feldspar where the deformed quartz wraps around equant fresh feldspar.In some there are strips of Fe chlorite or a pale green muscovite possibly phengite, the latter typically decussate.

The matrix is a non deformed erratic widely sized quartz K feldspar mica chlorite association, with the quartz feldspar areas of chert-like texture.There is also a euhedral quartz within a chlorite patch. Ores are confined to rare pyrites, and a rim to the calcite.The latter also has a margin of a higher RI carbonate. There are veinlets of K feldspar crossing the matrix.

Sample RS 228 PDD 11 412.4m

Drill core "mylonitic brecciated silicified gneiss"

Thin section

FRAGMENTS	major
K feldspar	major
Quartz	major
Chlorite	minor
Muscovite	accessory
Opaques	trace
MATRIX	
Silica	dominant
K feldspar	minor
Opaques	trace

This is a BRECCIA that is largely cemented by Silica that often shows a vuggy chalcedonic character.The fragments are composed of quartz and K feldspar that vary from non deformed plutonic sized K feldspar -rich masses to strongly deformed Quartzites.There is also a fragment where the quartz feldspar are an interlocking 0.1-0.2mm mosaic, possibly a recrystallized arkose.

Fragments are mostly angular and range down to 0.1mm or less. Staining shows that K feldspar in the matrix cement is very subordinate to quartz. The fragment feldspar shows some iron staining. The chlorite in the quartz feldspar gneissic fragment occurs as oriented single flakes probably altered biotite.

Ores are limited to scattered ?pyrite in the nucleus of silica filled vugs, or strips along fragment contacts.

Sample RS 229 PDD 11 418.75m

Drill core "crushed gneiss"

Thin section

Quartz	35-40%
"Sericite"	30-35%
Muscovite	10-15%
Opaques	10-15%
K feldspar	1-2%
Rutile	1%
Tourmaline	1%
Biotite/Chlorite	<1%

This is an altered Porphyroblastic Gneiss in which the porphyroblasts are entirely altered to a fine sericite-rich product.These masses are of 4-6mm diameters with fairly extensive quartz and opaque inclusions or intergrowths.Some of them have a relic cleavage, others are totally lacking.Their outline is quite irregular.Rarely a very fine zircon? appears to have a yellow halo preserved in the sericite supporting cordierite as one of the prograde species.

These are surrounded by a semi schist matrix with lineated quartz>oriented muscovite.There is also an extensive fine opaque population in trails following the schist.Chlorite is confined to some narrow bands in this fabric, some appear crosscutting. In the slide there are several patches of fine yellow brown tourmaline that are confined to less deformed parts of the mat and appear totally fresh.Cobaltinitrite staining shows a little K feldspar is preserved.

Sample RS 230 PDD 11 426.15m

Drill core "brecciated silicified gneiss"

Thin section

FRAGMENTS	major
Quartz	major
K feldspar	major
Chlorite	minor
Biotite	accessory
Rutile	accessory
Opaques	trace
MATRIX	major
Silica	dominant
Feldspar	accessory
Chlorite	accessory
Muscovite	accessory

This is a BRECCIA in which the silica dominant cement or matrix can be more abundant than the fragments. The fragments are again mainly composed of quartz and K feldspar, with textures both strongly deformed and non deformed.Fragments are both lithic and mineral, there being some perfect 0.2mm rectilinear K feldspars. One quartz-rich very lineated fragment contains fine biotite, and no feldspar. In contrast a K feldspar-rich piece is non lineated and locally has extensive chlorite, but this lithology can be part of a larger roughly banded quartz feldspar ?gneiss.The stained feldspar is otherwise fresh, but fine chlorite can penetrate the cleavages and contacts.The linear frgaments are lying in various directions.

The matrix is itself multiphase with a less pure silica area surrounded by the later ultrafine pure silica.Staining suggests a little K feldspar.

Sample RS 231 PDD 11 428.6m

Drill core "gneiss brecciated silicified"

Thin section

FRAGMENTS	
Alkali feldspar	dominant
Quartz	minor to major
Mica	minor
Chlorite	minor
Thorite	accessory
Synchesite	accessory

MATRIX/VEINS	
Silica	dominant
Chalcedony	minor
Opaques	minor
Pyrite	major
Magnetite	minor
Hematite	minor
Marcasite	accessory
Galena	accessory

The rock is a BRECCIA in which the breccia fragments are dominated by plutonic sized alkali feldspar, which is always iron stained.These can exceed 4mm, but much is rather finer, due in part to cataclasism.These are now commonly cemented by fine chlorite, while strain extinction is prevalent.Patches with feldspar grains sizes below 0.25mm are the result.The distribution of quartz is erratic, locally dominant or absent, with a variably lineated character responsible for the gneissic appearence. A pale green pleochroic mica(Fe muscovite), is occasionally developed,in one area it is the dominant phase , as a very fine secondary appearing fabric.Accessories include a euhedral crystal of thorite rimmed by pyrite. It contains U and Y(SEM). The SEM also noted a possible synchesite(Ce,La,Ca).

The main cement to the fragments is a microcrystalline silica , itself containing slightly coarser matrix fragments.It is also vuggy with cavities lined by chalcedonic quartz.Locally it is dominant in volume over the fragments.

The ores are mainly within the cement, with a major vein-like mass of pyrite and subordinate marcasite , with perfect euhedralism for the pyrite. Pyrite is also widespread in the cement as fine crystals.Within the fragments it is a hairlike vein following feldspar cleavages.Magnetite is present along fracture zones within the fragments associated with fine hematite and a little pyrite.Galena and pyrite follow one fracture zone.

Sample RS 232 PDD 11 531.2m

Drill core "hematitic? gneiss"

Thin section

Quartz	45-55%
K feldspar	45-50%
Chlorite	3-5%
Opaques	1%
Zircon	1%

SECONDARY
Muscovite

VEINS/FRACTURE FILLINGS	
Chlorite	major
Opaques	major
K feldspar	minor

This is classified as a QUARTZ FELDSPAR GNEISS.Typically for this sequence , the quartz is very strongly deformed of a mylonitic affinity, whereas the K feldspar remains largely unaffected although locally replacement by muscovite is quite advanced. The fresh K feldspar,always iron stained, is distributed in linear clusters of 0.1-0.5mm equant rather than elongate crystals.

There is one mass of chlorite of a 3mm diameter that appears have been after a prograde ferromagnesian.Slightly darker chlorites of a much smaller nature also occur within the feldspar. Zircon is a common accessory ranging from small euhedra to a subrounded 0.4mm grain. There are nonmagnetic oxide opaques that may be pre deformation but most ores are associated with veinsthat are also chloritic.Staining also revealed a few K feldspar veins.

Sample RS 233 PDD 11 551.1m

Drill core "chloritic breccia"

Thin section

FRAGMENTS
Muscovite Chlorite Schist
Sericite Chlorite Quartz rock
Quartzite
Quartz

MATRIX

Chlorite	87%+
Quartz	3-7%
Opaques	1-5%
Muscovite	1-3%
Monazite	<1%

VEIN
Carbonate

The core is classified as a BRECCIA based on the presence of lithic fragments of differing composition, although the quite close relationship between these lithologies supports a non sedimentary type. The most extensive type is a coarse Mica Chlorite Schist with locally ores following the phyllosilicate cleavages.Others contains quartz sericite and chlorite, with the sericite apparently retrogressive. One example of these has a cellular fabric with patches of chlorite set in a sericite framework.There are fine quartzites with or without ores.

The matrix to the above is not always readily separated, being composed of similar minerals. Where the quartz or chlorite is coarse, its post breccia origin is clear .The Fe chlorite commonly forms decussate patches with flakes around 0.2-0.3mm in length.Likewise this later quartz forms coarsely bladed interlocking masses, into which star clusters of chlorite may penetrate.Some of these appear almost amygdular.The late chlorite can be rather rich in ores, pyrite particularly.There are fine opaque strips commonly around many of the clasts. There is one carbonate vein

Sample RS 234 PDD 11 564.28m

Drill core "felsic? volcanic"

Thin section

A

Quartz	dominant
Chlorite	minor
K feldspar	minor
Muscovite	accessory
Opaques	accessory

B
K feldspar

VEINS
K feldspar
Sphalerite

The sample is a contact between a K feldspar rock(?SYENITE), and a QUARTZITE that has been veined by the feldspar and is also slightly brecciated with chlorite , feldspar and ores filling the ?voids. The feldspar rock is slightly sericitised. A later K feldspar veining cuts both types and lacks the iron stain of the wallrock.It is also the site for sphalerite of variable iron content.

At the contact , the feldspar patches are lined by opaque material. The quartzite has strong strain extinction but remains quite coarse.There is a non dusty vein type.The contacts exploited by the chlorite,often appear very corrugated.

Sample RS 235 PDD 11 585.96m

Drill core "felsic volcanic?"

Thin section

MACROCRYSTALS	5%
Plagioclase	
MATRIX	70%
Plagioclase	
Sericite}	85-90%
Quartz	5-10%
Chlorite	2-5%
Opaques	2-4%
Apatite	1%
Allanite	1%
VEIN	15%
K feldspar	major
Chlorite	major
Opaques	minor
Quartz	minor
SHEARS	10%
Sericite	

This sample is classified as a possible PLAGIOCLASE PORPHYRY Plagioclase of dimensions to 4mm are preserved. in a matrix that is dominantly plagioclase.The fabric is overall fairly well lineated, including alignment of the long dimension of the macro feldspar .All feldspars are slightly spotted with fine sericitic material. The matrix texture has 0.1-0.2mm untwinned plagioclase containing scattered weakly aligned anhedral quartz, plus trails of oriented chlorite and ores. The accessories are a rather anhedral apatite, scattered throughout, and local clusters of brown allanite .

The above is cut roughly normal to the lineation(?flow) by zones of sericite, possible shears, and parallel veins of K feldspar with chlorite, often as the margin.Some ores follow the veins and sphalerite is significant.There is a rare quartz ?vein cut by the K feldspar, following the feldspar fabric.

Sample RS 236 PDD 11 589.3m

Drill core "felsic volcanic'

Thin section

MACROCRYSTALS	25%
Feldspar	
MATRIX	75%
Feldspar	60-70%
Quartz	10-15%
Chlorite	10-15%
Muscovite	5-7%
Opaques	2-3%
Apatite	1%
Zircon	<1%
VEIN	
Fluorite	major
Allanite	minor
Sphalerite	accessory
K feldspar	major

This sample has the fabric of a FELDSPAR PORPHYRY.The numerous possible phenocrysts are complex associations of microcline and plagioclase, which is well demonstrated by cobaltinitrite staining.The plagioclase usually appears as an irregular core , with a slight cloudiness , separating it from the enveloping fresh twinned microlcine.This indicates K metasomatism.These 0.5-3mm feldspars are set in a groundmass again of two feldspars and some quartz.This is a mosaic of 0.1-0.2mm material,where replacement is less evident. Chlorite is variable locally forming an extensive network , an incipient preferred fabric. Accessories include corroded? apatites,isometric non magnetic opaques, and fine zircon.

The porphyry is crossed by a discontinuous vein of fluorite with a rim of allanite , plus sporadic sulphides including sphalerite.there is a separate vein of K feldspar, also with ores.

Sample RS 237 PDD 11 605.5m

Drill core "Volc/metasediment contact"

Thin section

A		D
Plagioclase	65-80%	Alt.Plagioclase
Quartz	5-15%	K feldspar
Chlorite	10-15%	
Opaques	3-5%	
Apatite	<1%	

B
K feldspar
Sericite}
Chlorite }

C	
Biotite/Chlorite	83%+
Opaques	3-15%
Apatite	1-2%

VEIN
K feldspar
Chlorite
Laumontite?
Carbonate
Sphalerite

Part of this interval(A) represents a PLAGIOCLASE PORPHYRY that is obviously cognate with the two earlier porphyry samples.It is composed of albite with K feldspar part replacement and in veins.The phenocrysts are moderately fresh with habit rather irregular, and sizes to 4mm.The groundmass is a combination of the feldspars , and subordinate quartz and chlorite,although much of the latter is associated with the K feldspar veins.

This is in contact with a narrow band(B), essentially composed of potash feldspar of around 0.1mm .
This is in contact with (C) a zone
essentially biotite now part chloritised, uniformly a fine decussate fabric. This has a contact with a coarse plutonic textured plagioclase association(D),where grain dimensions may be 5mm+.

The veins that cross A and B particularly,include a calcium aluminium silicate, that is possibly laumontite(large extinction angle), and this is being replaced by calcite, sphalerite is present in this vein.K feldspar veins are separate.

Sample RS 238 PDD 11 616.85m

Drill core "metasediment(?schist)

Thin section

Biotite/Chlorite	75-80%
Quartz	10-20%
Opaques	3-5%
Sphene	1%
Clinozoisite	<1%
Apatite	<1%

VEIN
Carbonate
Quartz
Sphalerite
Clinozoisite
Chlorite

The interval is mainly composed of dominant biotite part chloritised, and subordinate quartz. There are opaque grids some associated with sphene .These are ilmenites with a very high Mn content(SEM). The most biotitic areas show a descussate fabric, , elsewhere where chlorite is dominant, it is more schistose. There is a rare patch of clinozoisite suggestive of an altered plagioclase ?phenocryst.

The sample is strongly veined by calcite varying to quartz.Within the calcite there may be extensive low Fe sphalerite.Chlorite and K feldspar are part of the same system.

Although now feldspar is visible, the composition of the rock is at least compatible with a K metasomatised metabasite, as with a sediment.

Sample RS 239 . PDD 11 625.65m

Drill core "biotite andalusite sericite schist"

Thon section

BLASTS	30%
"sericite"	50%
"Chlorite"	50%
MATRIX	70%
Muscovite	80-90%
Quartz	10-15%
Opaques	3-5%
Allanite	<1%

This is an altered Porphyroblastic Schist. The numerous porphyroblasts are coarse sericite/muscovite replacements or smaller mostly chloritised biotites.The former frequently exceed 5mm, being composed of sericite, that can retain a single extinction position and involves a possible parallel cleavage preserved, consistent with andalusite. There are also yellow haloes around tiny accessories, more typical of an iron- bearing cordierite.The chloritised biotite is often included within the sericite palimpsests apparently erratically.Elsewhere the altered biotite shows no strong alignment with the matrix fabric.

The matrix is dominated by a muscovite schist component with fine quartz quite subordinate .Ores are either fine Ti rich ?secondary clusters, or coarser sulphides including iron sphalerite, in semi vein-like associations . Although not visible in the slide, the offcut does show a positive K feldspar stain in one patch.

Classified as a Metasediment.

Sample RS 241 PDD 11 642.35m

Drill core "altered volcanic?"

Thin section

WALLROCK	80%
K Feldspar	
Sericite)	70%
Quartz	30%
Apatite	<1%
VEINS	20%
K feldspar	dominant
Opaques	minor
Chlorite	minor
Sericite	accessory
Sphene/Rutile	accessory

The sample consists of a part altered fine grained K feldspar dominant lithology lacking unequivocal igneous texture. Heavy veining is mainly alkali feldspar , but there is also narrow secondary ores and chlorite in vein-like distribution. Cobaltinitrite staining on the offcut suggests a very high K feldspar content, whereas optically there seems to be extensive sericite, that may represent some plagioclase.

There are two types of vein, K feldspar dominant, and Chlorite ores, and both appear to cross each other.

It may represent a more heavily potash metasomatised equivalent of the shallower porphyries.

Sample RS 242 PDD 11 658.4m

Drill core "felsic volcanic ,plutonic igneous?"

Thin section

Plagioclase	85%+
Chlorite	5-10%
Garnet/Chlorite	3-5%
Apatite	<1%

VEINS

K feldspar	dominant
Chlorite	major
Opaques	minor
Carbonate	minor
Fluorite	accessory

This rock is a occasionally GARNET Blastic ALBITITE that is heavily veined. The veins are dominated by K feldspar, but also have extensive chlorite etc. The garnets are locally common as 0.5mm perfect dodecahedra whose composition is The main fabric consists of a sub 0.1mm mosaic of stained untwinned albite.There are masses of chlorite with elongate top rhombic habits that suggest a replacement of a ferromagnesian phenocryst.

The various veins are dominated by non stained K feldspar. Chlorite is also associated that is distinguished from the other chlorite by deeper colours.Locally carbonate predominates, and rarely fluorite

Sample RS 243 PDD 11 688.15m

Drill core "igneous plutonic?"

Thin section

Plagioclase	45-55%
Quartz	10-20%
K feldspar	10-20%
Chlorite	5-7%
Opaques	3-4%
Rutile	2-3%
Apatite	<1%
Zircon	<1%
Xenotime	<<1%

This is classified as a partly shattered GRANODIORITE.. The primary texture consisted of 3-5 mm feldspars and quartz, with both species now either largely recrystallized(quartz), or very fractured with distorted twinning.(plagioclase.) The K feldspar is less affected.Staining shows that it is largely present as a replacive phase of the plagioclase, from a few veinlets in the others cleavage to extensive substitution.Both feldspars remain quite fresh.The quartz invariably becomes a quartzite .This lacks an apparent preferred fabric. The composition of the plagioclase is intermediate.

The slide contains a zone of mylonitised G.diorite where grain sizes are commonly less than 30 microns. The rock is crossed frequently by fractures that are the site for development of chlorite. Also noticeably associated with these structures are aggregates of ores and other accessory non opaques , including zircons to 0.25mm. The ores are Mn ilmenites and iron sulphides with galena inclusions, and the former may enclose TiO2(?rutile).

Sample RS 244 PDD 11 698.35m

Drill core "cp in calcite, metased,volc.?"

Polished thin section

Chlorite	70-75%
Plagioclase	15-20%
Sphene	3-5%
Opaques	1-2%
Ilmenite	
Quartz	1-2%

VEIN
Carbonate
Chalcopyrite
Quartz

This interval contains a wide carbonate sulphide vein cutting a rather altered Chloritised Intrusive. The latter is identified as an intrusive igneous rock based on the fabric of fresh feldspars .These are poorly twinned slightly sericitised laths to 1mm length classified as plagioclase .They are set in a a dominant chlorite .The chlorite may occur as single extinction areas of 0.5mm suggesting a pseudomorph.The chlorite is heavily sprinkled with fine sphene suggesting a CaTi bearing ferromagnesian as the precursor.There are linear zones of ilmenite rimmed by sphene also.Quartz is fine and sporadic and probably linked to the vein, and there are carbonate microveins.

The carbonate of the vein occurs as mm + crystals with very minor quartz at contacts. The ore zone polished is essentially massive chalcopyrite, also a thin separate zone at the contact.

The nature of the intrusive is better preserved in the similar sample RS 245.

Sample RS 245 PDD 11 699.15m

Drill core "metasediment/alt. volc."

Thin section

Plagioclase	35-45%
Clinoamphibole	35-45%
Biotite	10-15%
Opaques	2-3%
Sphene	1-2%
VEIN	
K feldspar	major
Carbonate	major
Quartz	minor
Opaques	accessory

The rock is identified as a Metamorphosed Basic Intrusive, a MetaDolerite, although lacking evidence of an ophitic texture.The texture is dominated by laths of slightly sericitised plagioclase between 0.5 and 1mm lengths and semi allotriomorphic clinoamphibole, probably ex pyroxene.The amphibole is a yellow green to blue green pleochroic probable actinolite .It is being marginally replaced by biotite, which is also sprinkled through the feldspar. The feldspar retains its igneous zonary nature.

The accessories are opaques rimmed by sphene supporting an ilmenite.Veins vary in size, orientation and composition.The largest is mainly carbonate with minor quartz varying to an offshoot with K feldspar and chlorite grown on the contacts to a quartz-rich centre with some ores.The parts of the wallrock adjacent to these thick veins shows a more altered nature with chlorite replacing amphibole, and no biotite.(cf RS 244.).

Sample RS 246 PDD 11 703.15m

Drill core "cp in ?metased/volc."

Thin and polished section

A	Chlorite	80%+
	Quartz	10-15%
	Sphene	3-5%
	Opaques	1%
	Pyrite	
	Alt. Ilmenite	
	Zircon	<1%
B	Chlorite	87%+
	Quartz	5-10%
	Sphene	1-2%
	Opaques	<1%
	Pyrite	
	Alt. Ilmenite	

VEIN	
Quartz	
Carbonate	
K feldspar	
Opaques	major
Chalcopyrite	dominant
Galena	accessory
Pyrite	accessory
Sphalerite	trace

This is a largely altered rock dominated by fine chlorite. It lacks palimpsest textures.There is a rough bedding or banding. It is cut by a coarse sulphide quartz carbonate vein.Part A differs in detail from B. There is a suggestion of a former lathy component, ie, feldspar now present as quartz strips. these are set in a dominant chlorite through which is disseminated secondary sphene, and occasional opaques, of relic grid nature.These are altered ilmenites.Pyrite is an occasional cluster of euhedra, rarely veined by chalcopyrite.

Part B has a more uniformly fine chlorite with quartz present only as occasional euhedral crystals of 0.3-0.4mm.There are signs of fragments of A in B. The main vein has coarse carbonate with euhedral quartzes included, separate K feldspar and a massive sulphide. This is fresh chalcopyrite,containing rare euhedral pyrites, a trace of sphalerite, and in one part extensive galena composite with the copper mineral.

Sample RS 247 PDD 11 720m

Drill core "igneous plutonic"

Polished thin section

K feldspar	
Muscovite}	dominant
Zircon	<1%

VEIN	
Chlorite	major
Quartz	major
Rutile	minor
Opaques	minor
Hematite	
Magnetite	
Pyrite	

This is petrographically a GRANITE that is rather altered fractured and part recrystallized. The remnant primary texture consists of a number of 4-5mm feldspars, that are intensely stained with iron oxide dust, and otherwise often part altered to white mica.Their cleavages are penetrated by chlorite.Quartz present is now in linear vein-like structures or local non lineated fine quartz muscovite associations. Zircon to 0.3mm was euhedral. The evidence optically and by staining suggests that replacement by K feldspar of plagioclase may have been extensive.

The main constituent of the fractures is chlorite while much of the altered opaque material seems to be dispersed in the chlorite.Likewise euhedral ores appear with the chlorite. These are pyrites to 0.5mm. There is also a pyrite of corroded appearence.The former pyrite may have magnetite included as regular rectilinear bodies. Magnetite and hematite are both locally predominant in the chlorite, occasionally in excess of 0.5mm.The hematite is then a bunch of small laths.The magnetite can be single small octahedra,or a semi massive cluster.Rarely is there evidence of a martitic hematite, and the two iron oxides are rarely in contact.

Sample RS 248 PDD11 723.5m

Drill core " metasediment/alt. volc."

Thin section

Quartz	30-40%
Chlorite	30-40%
Feldspar Sericite)	10-20%
Sphene	4-6%
Opaques	3-5%

VEINS	
Carbonate	major
Feldspar	major
Quartz	minor

This is a highly altered and deformed rock that is also extensively veined.The nature of the fresh rock is largely obscured but there are some sericitic masses that often have a shape suggesting a crystal pseudomorph probably feldspar.Sizes are typically 0.5mm but can reach a mm. They are set in a fine rather foliated matrix dominated by quartz and chlorite. Sphene and associated ores are rather common, and their relatively coarse nature , to 1mm is evidence for an Igneous rock of this grainsize, while their abundance supports a Mafic type.

The veins are coarse carbonate with subordinate quartz of a euhedral nature, and two feldspars that is more irregular less continuous and certainly earlier, shown by fragments in the carbonate.The staining shows the pink stained plagioclase as a nucleus to a K feldspar rim.

Classified as a SHEARED MAFIC INTRUSIVE.

Sample RS 249 PDD11 723.9m

Drill core "alt. volc./metased."

Thin section

Chlorite	40-45%
Quartz	20-30%
Clinozoisite	10-15%
Opaques	10-20%
K feldspar	<1%
Sphene	<1%

Fragment
Quartz

VEIN
Carbonate

This is a a Magnetic totally altered rock containing quartzite fragments and numerous carbonate veins. The host rock is composed of fine chlorite and quartz without palimpsest texture through which is disseminated fine magnetite, and granular aggregates of clinozoisite epidote. The latter are not obviously replacing feldspar. The magnetite is common as sub 0.1mm isometric single grains and clusters .It is present in the quartzite mass but not in the veins.

The apparent fragment composed of quartz has an irregular deformed texture and appears to contain remnants of the wallrock, as well as the magnetite separately, although never in bands or linear zones. The carbonate veins are monomineralic apart from some coarse chlorite at contacts.It penetrates the quartz.There is some chlorite in rare fractures .

Cannot be classified except as a MAGNETITE CLINOZOISITE QUARTZ CHLORITE ROCK.It is significantly different from the adjacent RS 248 interval, and may be heavily metasomatised

Sample RS 250 PDD11 734.5m

Drill core "altered and brecciated volc.?"

Polished thin section

Quartz	45-55%
Plagioclase	45-55%
Chlorite	3-4%
Opaques	2-3%
Tourmaline	<1%

VEINS	
Chlorite	major
K feldspar	major
Opaques	major
Pyrite	major
Chalcopyrite	major
Marcasite	minor
Sphalerite	minor
Arsenopyrite	minor
Galena	accessory
Thorite	trace
Uraninite	trace

THis is a fine grained aphyric KERATOPHYRE which is cut by sulphide bearing chlorite /K feldspar veins. The fabric of the host is non porphyritic ,even grained almost saccharoidal nature and grain diameters never coarser than 0.1mm. There is accessory chlorite and rare yellow dichroic tourmalines. The feldspar is red stained.

The veins are major chlorite with little feldspar to finer K feldspar rich veins.There are also discontinuous subparallel ?fractures filled with quartz. Ores generally follow these veins but there are also several very large to 4mm crystals of arsenopyrite, that are almost free of other ores except for rare veining by chalcopyrite .Arsenopyrite is a rare single euhedral crystal also adjacent to the main sulphide complexes.

These complexes are a combination of pyrite>marcasite=chalcopyrite>sphalerite> galena. Some pyrite is a coarse networks of subhedral grains following the chlorite veins and these usually are replete with gamgue inclusions. Otherwise pyrite is a relic series heavily veined and replaced by the base metal sulphides mostly chalcopyrite but less commonly low iron sphalerite and rarely galena. Marcasite is also commonly associated with the pyrite and has a coarsely twinned nature. Chalcopyrite can be separate as 0.05-0.25mm anhedral masses. Uraninite was detected as a 5 micron speck within a coarse arsenopyrite by SEM, plus several similar sized grains of uraniferous thorite.

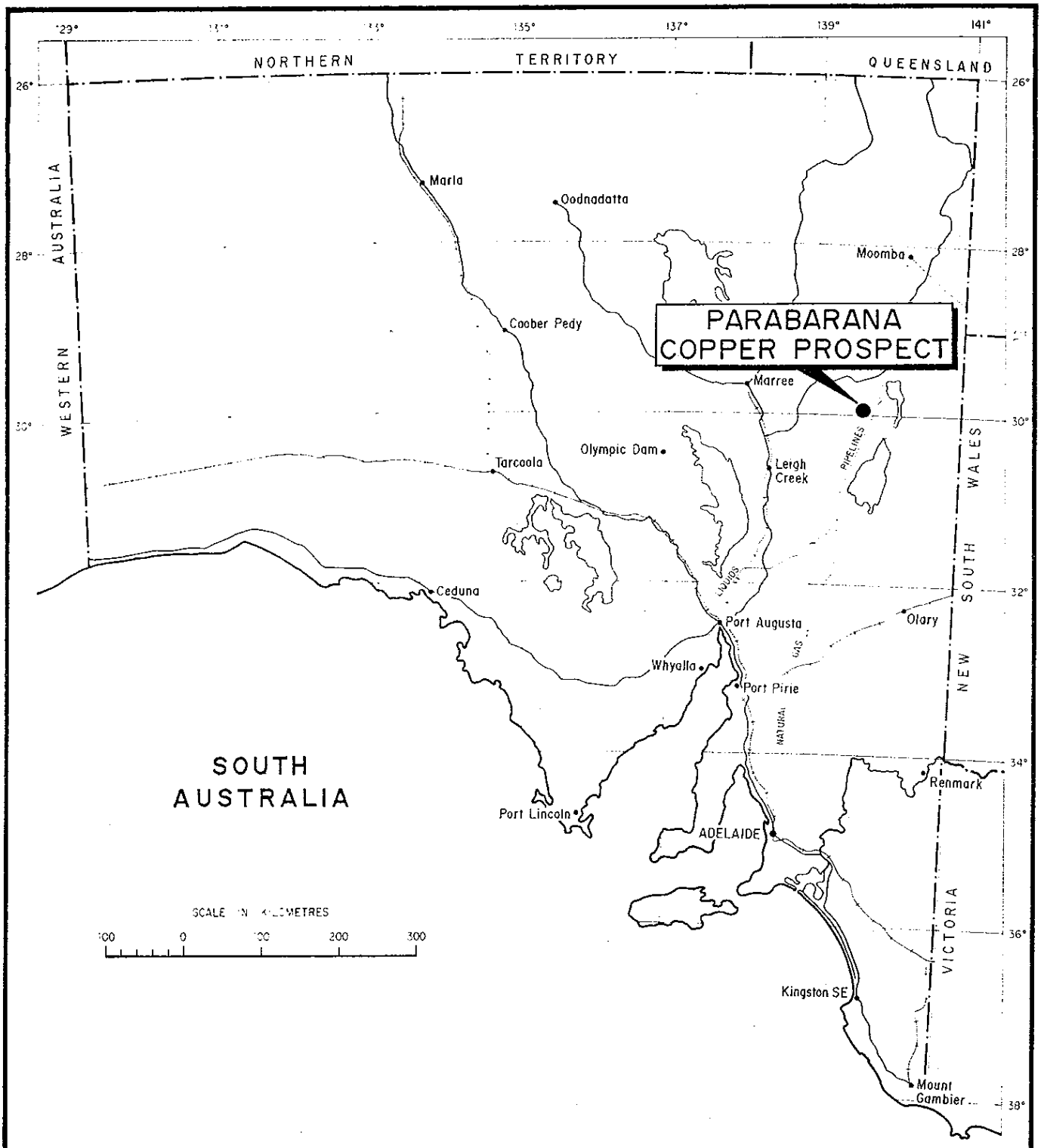
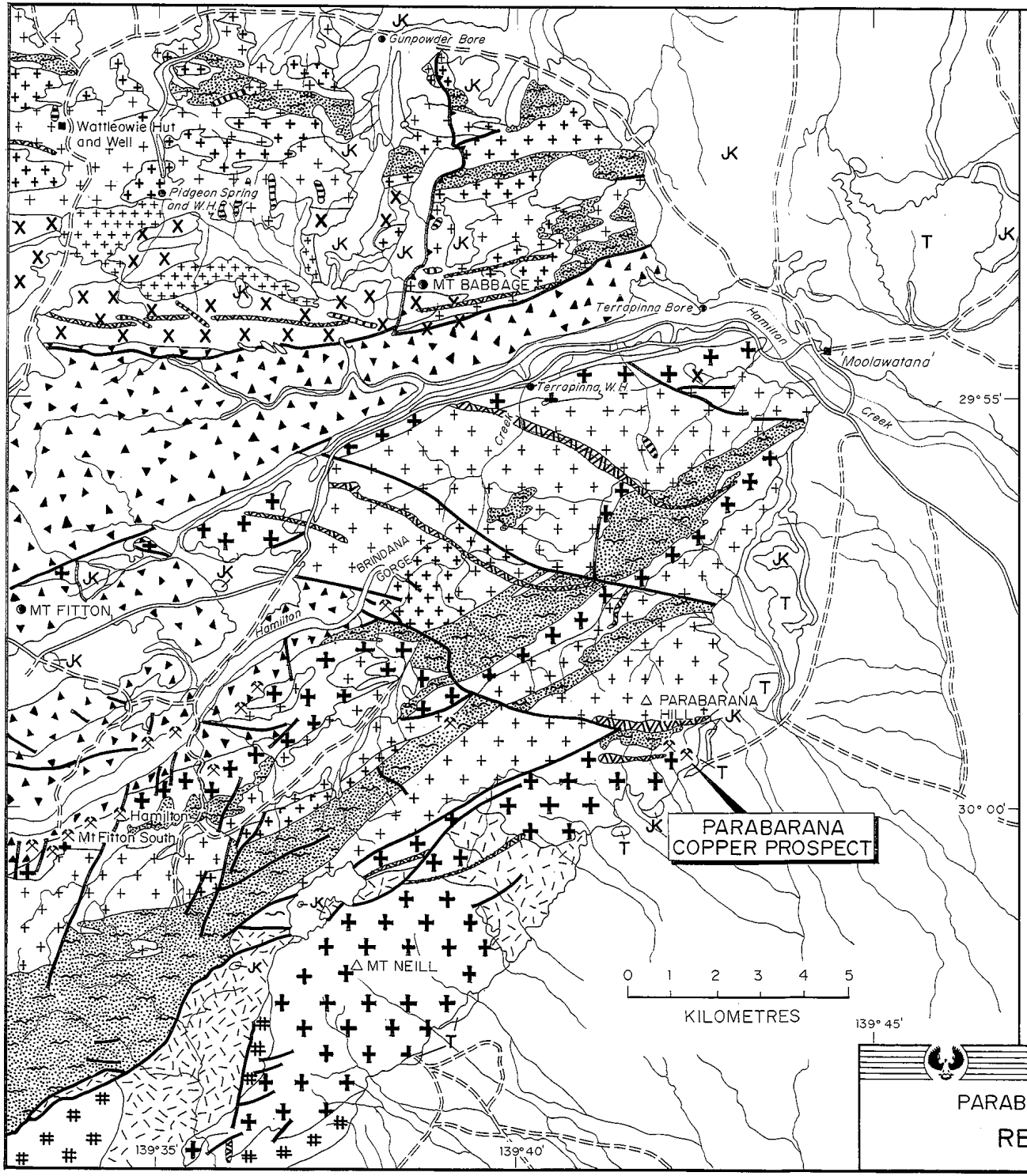


Figure 1

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED E. A. D.	C.D.O. 13-2-90 DATE
PARABARANA COPPER PROSPECT	DRAWN LAW	SCALE as shown
LOCALITY PLAN	DATE Sept '89	PLAN NUMBER S 21050
	CHECKED	

4947



CAINOZOIC

QUATERNARY

Alluvium, outwash and slope deposits, gibbers, sand dunes, scree deposits

TERTIARY

T — Etadunna Formation, silcretes, Murnpeowie Formation

PALAEOZOIC

JURASSIC-CRETACEOUS

JK — Marree Formation, Pelican Well Formation, Parabarana Sandstone

ORDOVICAN

Mudnawatanna Granite and pegmatites

Amphibolites

PROTEROZOIC

STURTIAN

Yudnamutana Sub-Group

CARPENTARIAN

Terrapinna Granite

Mount Neill Granite, porphyry

Massive microgranite

Wattleowie Granite

Yerila Granite

Radium Creek Metamorphics
Pepegoona Porphyry

Ephemeral stream

Mine or prospect

Trig station

Faults
Overthrust
Undifferentiated

Modified from Coats, R.P. and others 1969
Mount Painter Province, SADME
Geological Atlas Special Series 1:125 000

Figure 2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

PARABARANA COPPER PROSPECT

REGIONAL GEOLOGY

COMPILED	E.A.D.	CDO DATE
DRAWN	L.A.W.	SCALE As shown
DATE	Aug.'89	PLAN NUMBER
CHECKED		89-314

4847

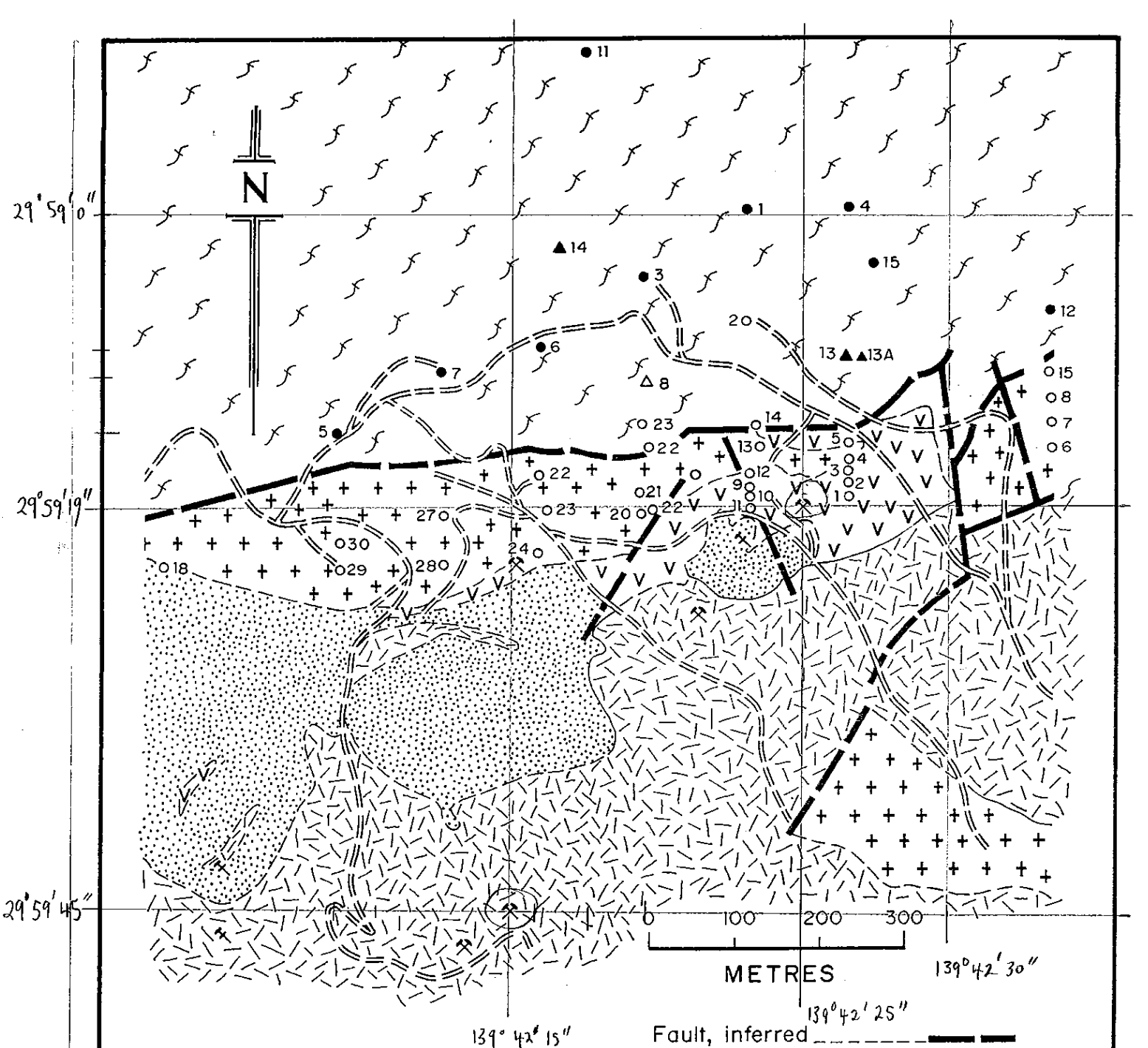


Fig. 3

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED E.A.D.
C.D.O. 13·2·90 DATE
DRAWN L.A.W.
SCALE As shown
DATE Aug. '89
CHECKED
PLAN NUMBER S21006

PARABARANA COPPER PROSPECT
GEOLOGY AND DRILLHOLE LOCATIONS

4847