Pontifex & Associates Pty. Ltd.

MINERALOGY - PETROLOGY • SECTION PREPARATION

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MINERALOGICAL REPORT No. 8238

by Alan C. Purvis, PhD.

June 20th, 2002

TO :	Mr Nigel Doyle Dept Business, Industry and Resources [NT Geological Survey] GPO Box 2901 DARWIN NT 0801
YOUR REFERENCE :	Order No. PB1-3247
MATERIAL & IDENTIFICATION :	Sample Nos. 1, 2 and 3
WORK REQUESTED :	Detailed petrographic descriptions.
SAMPLES & SECTIONS :	Returned to you with this report.
DIGITAL COPY :	Enclosed with hard copy of this report.

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INTRODUCTION

Three samples petrographically described from polished thin sections in this report, and as requested on O/N PB1-3247, are labelled as follows :

In covering letter/order	***Nos. on bag***
1	RN 33031, 199m
2	RN 33031, 51m
3	Robertsons Outcrop igneous sample

Samples 1 and 2 were stained for carbonate as requested.

These samples were submitted together with two others for preparation only, numbers 10345 and 10346. [Preparation of all five samples is covered by separate order number PB1-3258, but the entire job will be invoiced on one invoice, number 15110.]

INDIVIDUAL DESCRIPTIONS

Sample #1
RN33031, 199m

Weakly layered but basically massive micritic/microsparry low-Fe dolomite, incorporating subordinate coarser veinlike patches of dolomite or magnesite ± quartz. Several iron-rich carbonate stringers. Accessory fine schistose chlorite along one side of an unstained carbonate lens (pure dolomite or magnesite?).

This sample is dominated by carbonate minerals and the section offcut was stained with acidified alizarin red and potassium ferricyanide as requested. At least 65% of the stained offcut has taken a very pale blue stain indicating probable iron-poor dolomite (i.e. weakly ferroan-dolomite). There are subordinate lenses and patches that have not stained at all, suggesting pure dolomite or magnesite. [Staining alone cannot distinguish between these two carbonate species.] Rare stringers have stained a much darker blue colour compared with the host rock, with darker margins and a paler core in one of these. These stringers are interpreted as ferroan dolomite.

Petrographically, the bulk of the rock is seen to be composed of massive and broadly vaguely layered, microcrystalline carbonate with grains from 20 to 100μm in diameter, forming a micritic to microsparry micromosaic. The unstained areas noted above are irregular, partly as veinlike lenses and partly anastomosing and coarser carbonate with sparse grains of probably authigenic quartz to 0.8mm in diameter.

The largest lens is at least 20mm long and as much as 2.5mm wide, with carbonate grains locally over 2mm long but together with patches of fine-grained quartz and microcrystalline carbonate. Along one side of this lens there is a thin zone of quartz, enclosed in apparently low-Fe dolomite similar to that in the bulk of the rock. On the other side are sparse lamellae of very pale green optically positive chlorite, apparently Mg-rich but poor in Al. Later, apparently more iron-rich irregular carbonate veins are from 0.2 to 0.6mm wide and composed of microsparry carbonate about 0.2mm in grainsize. Quartz is rarely present in these veins.

Some of the larger, unstained grains seem to show exsolution, possibly with lamellae of dolomite in magnesite, although this is not entirely clear and may need to be tested by SEM or microprobe.

The estimated overall gross mineralogy is :

		Approx. vol. % of whole sample
*	Micritic to microsparry mosaic of iron-poor dolomite (stains very pale blue)	65-70%
*	Coarser "pure"-dolomite or magnesite (does not stain)	~25%
*	Quartz	~5%
*	Chlorite	1-2%

Sample #2
RB33031, 51m

Texturally heterogeneous carbonate-rich rock, of "pure" to very weakly ferroan-dolomite (± magnesite?). This forms micritic mosaic incorporating irregular network zones of coarser dolomite, also minor scattered patches of quartz mosaic. Sparse stringers of ferroan-dolomite.

Almost the entire offcut slab of this massive microcrystalline carbonate rock, stained with acidified alizarin red and potassium ferricyanide shows a relatively diffuse very pale bluish colouration gradational throughout to non-stained carbonate. This suggests essentially pure (to very weakly Fe-bearing) dolomite, or possibly magnesite, but the staiing alone cannot distinguish between these two species of carbonate. Several random stringers and threads of very dark blue stained carbonate seem to be ferroan-dolomite.

In thin section this is seen as a heterogeneous rock, overall massive, with domains of carbonate micromosaic, to 4mm in diameter and individual carbonate grains from 20 to 100μm. These domains are separated by irregular discontinuous networks of coarser sparry carbonate to 0.5mm in grainsize, forming about 35% of the rock.

Large, irregular and lensoidal or cuspate lenses of sparry quartz occur within the coarser carbonate patches, to 10mm long and as much as 3mm wide (8-10%). These patches contain quartz from 0.2 to 0.8mm in grainsize forming an inequigranular micromosaic. Smaller, individual quartz grains also occur in these areas. There is no distinction in the thin section between the diffuse areas staining very weak blue and the non-stained areas.

The approximate gross mineralogy is :

		Approx. vol. % of whole sample
*	Massive micritic micromosaic of "pure" to very weakly ferroan-dolomite (± magnesite?)	65%
*	Coarser crystalline probable dolomite in irregular networks throughout the above	25-30%
*	Patches of quartz mosaic	5-7%
*	Stringers of ferroan-dolomite	2-3%

Sample #3
Robertson's Outcrop

Altered fine-grained biotite-hornblende-pyroxene monzonite, with very minor quartz and abundant clays (sericite and chlorite ± smectite). Trace possible zircon.

Field Note: *Igneous Sample*

This handspecimen is apparently igneous and was stained with HF and sodium cobaltinitrite to reveal K-spar with a yellow stain, which is more or less subequal with plagioclase, both together with fairly abundant mafic minerals.

Mineral	Vol %
Plagioclase	35%
Orthoclase	30%
Pyroxene + clays + actinolite	25%
Hornblende	3%
Biotite + clays	4%
Quartz + granophyre	2%
Oxide	1%
Apatite	<1%

Abundant sericite-clouded plagioclase in this thin section, occurs as random laths to 2mm long, with abundant interstitial orthoclase to 3mm in grainsize. The mafic grains include rare residual clinopyroxene, partly as kernels within uralitic actinolite and apparently ophitic grains, to 3mm in diameter, altered to chlorite-smectite or to smectite ± limonite. Separate fresh grains of clinopyroxene occur in some areas. Less abundant flakes of biotite, to 4mm long, are partly or completely altered to clays and leucoxene and there are relatively rare prisms and poikilitic grains of zoned brown to green hornblende to 2mm long. Very minor quartz occurs as interstitial grains to 1mm in diameter, locally passing into granophyre. Accessory opaque oxide is disseminated and there are sparsely disseminated prisms of apatite to 0.5mm long. The opaque oxide is mostly ilmenite with rare magnetite enclosing microcrystalline pyrite. Rare small, possible zircon crystals occur, to 50μm long, mostly in clays after pyroxene or biotite.

This sample has an unusual mineralogy and seems to represent a relatively mafic fine-grained monzonite with low temperature alteration. The presence of granophyre suggests a shallow emplacement level.

NATURAL RESOURCES DIVISION

Dept of Lands, Planning & Environment, **P.O. Box 30, Darwin, N.T. 0831**

Geological Log of Bore RN 33031

Name of the Project & Area: **Berry Springs Coring**
Grid Ref.: 716320 E – 8591654 N WGS 84 Map: Bynoe Scale: 100 000
Drilling Commenced/Completed: 1 May 2001 – 15 May 2001
Driller: Ian Gillespie/Denis Low Rig: 26 Total Depth: 199.00 m
Logged by: *M. N. Verma* Dated: 1 – 15 May 2001 TOC: RL:

Depth (m)	Graphic Log	Core Depth	Strata Description, Stratigraphy, etc	Water Struck Depth
0.0 - 4.5			Red brown laterite	
4.5 - 9.0			Mixed sandy clay, light grey clayey sand	
9.0 - 12.0			Claystone, siltstone, white	
12.0 - 15.0			Fine sand, light grey - clayey sand + Qtz pebbles rgravel	
15.0 - 30.0			Fine sand, siltstone,, white	
30.0 - 36.0		K1	Siltstone, white /clay + Qtz frags	Dirty water in Aquifer @ 35m
36.0 - 36.2			Yellow clay, some silicified dolomite, Qtz frags	
36.2 - 38.8		----------	Coring – within the Aquifer – H. W. Silicified dolomite with layers of limonite and weathered rocks,	
		----------	Calcite and quartz crystals in geods.	
38.8 - 50.2			As above with thin layers of laterite, brown clayey patch, walls caving-in Fractured/brecciated in core bedding/veining 70-80°	
50.2 - 50.3			as above	
50.3 - 51.5		----------	Coring – 50.3 to 51.5m. Magnesite (red) layers	Aquifer at 51.0 m
			Light to dark grey silicified dolomite with pyrite crystals and calcite crystals. Amount of pyrite	
		----------	increasing with depth up to 60.8 m.	
51.5 - 68.0			Deep blood red crystalline magnesite layer along solution cavities (61 – 61.5m)	
			Aquifer from 65.3 to 66.8 m - a big water supply (>40.0 L/s), not tested	
			Red crystalline magnesite	
68.0 - 68.6	Rsd	----------	Coring from 68.0 to 68.6 m. Red magnesite and grey silicified dolomite, quartz veins, breccias in haematitic layers.	

68.6 - 69.5			Grey dolomite with quartz-veins (geods), haematite layers with breccias	
69.5 - 74.5			Dark grey massive dolomite, water-stained around 70m depth –	Aquifer @ 70m
-			Pinkish light grey dolomite around 71.2m	
-			Dark grey dolomite again at 72.4m	
-			Aquifer from 73 to 74m – A big water supply, limonite, water-worn quartz	
74.5 - 79.0			As above with some graphitic-shale (?), which may be from the in the rod from previous drilling?	
79.0 - 89.0			Grey dolomite, fresh from 79m	
89.0 - 90.0			Again some H. W. layer in aquifer	- some more water supply
90.0 - 98.0			Around 93m some more H. W. light grey dolomite,	
98.0 - 108.0			Red magnesite interbedded with dolomite from 98 to 108 m ,	More water supply
@100 m			-	
108.0 - 114.3			Red magnesite, crystalline, light brown, pink & white dolomite. Highly fractured magnesite within solution cavity, highly fractured magnesite within solution cavity with quartz crystals, water marks, water-worn	
114.3 - 123.3			Another aquifer from within the solution cavities & red magnesite, highly fractured magnesite within solution cavity with quartz crystals, water marks,	
123.3 - 131.0			Another aquifer from within the solution cavities & red magnesite, highly fractured magnesite within solution cavity with quartz crystals, water marks from 125.5 to 128m & at 131m	
131.0 - 138.6			Pink dolomite and another aquifer within the solution cavities & red magnesite from 138.6 to 139.3m	
138.6 - 139.3			H. W. red magnesite & quartz crystals in solution cavities	
139.3 - 146.5			H. W. dolomite, solution cavity, red magnesite crystals	more water supply
146.5 - 147.0			Solution cavity with red magnesite crystals	more water supply
147.0 - 149.3			Hard red and yellow cherty dolomite	
149.3 – 150.3			Solution cavity with red magnesite crystals	more water supply

Standing Water Level; **EC** - Electric Conductivity (µS/cm), Water Struck;
TOC - Top of Casing above ground level, Bore Status: Prod/Monit/Obs/Backfilled/Open/Abandoned

0 1 2 3 4 5cm
|.....|.....|.....|.....|.....|

Geological Log of Bore RN 33031

Name of the Project & Area: **Berry Springs Coring**
Grid Ref.: 716320 E – 8591654 N WGS 84 Map: Bynoe Scale: 100 000
Drilling Commenced/Completed: 1 May 2001 – 15 May 2001
Driller: Ian Gillespie/Denis Low Rig: 26 Total Depth: 199.00 m
Logged by: *M. N. Verma* Dated: 1 – 15 May 2001 TOC: RL:

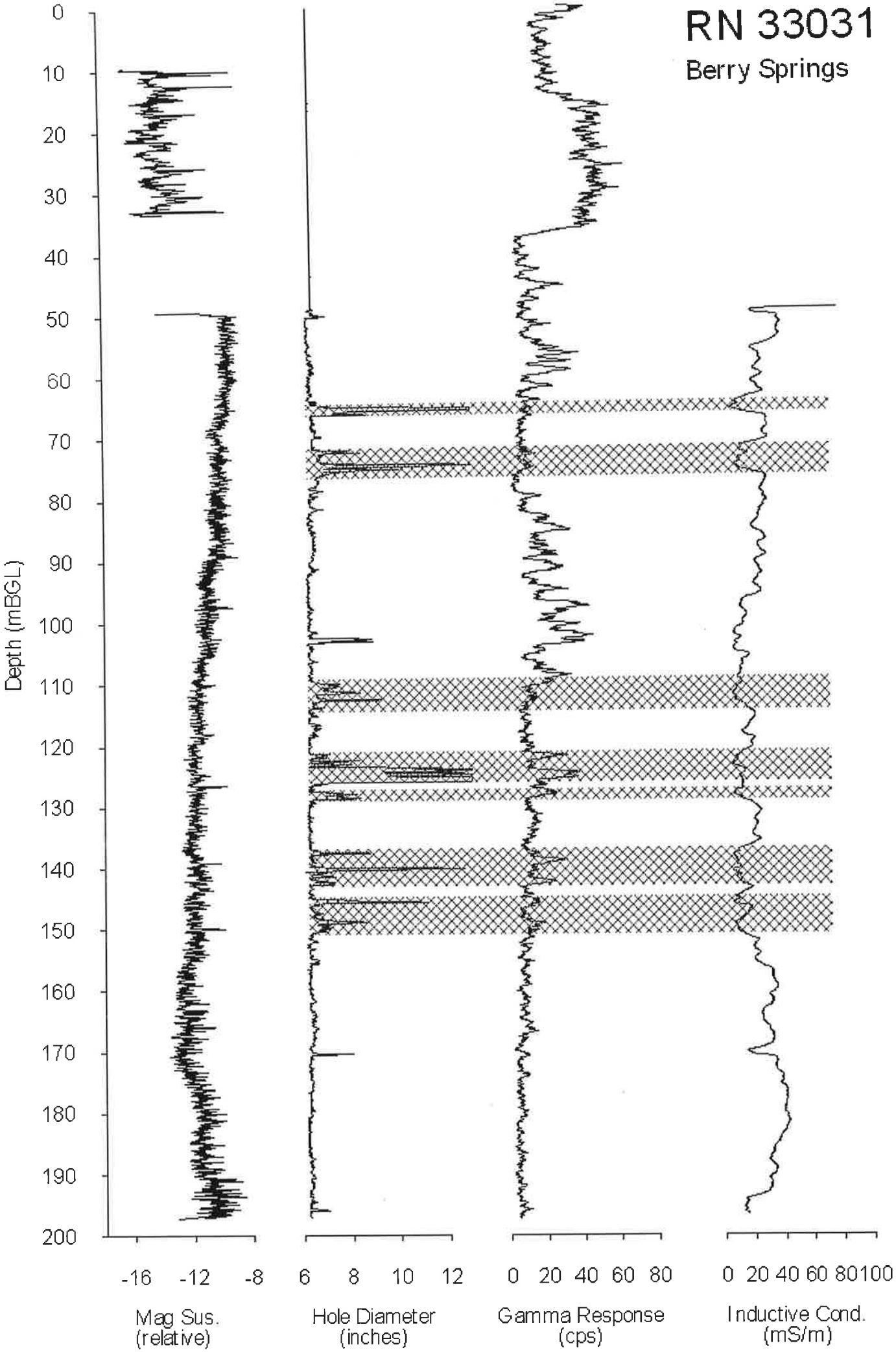
Depth (m)	Graphic Log	Core Depth	Strata Description, Stratigraphy, etc	Water Struck Depth
150.3 -168.5			S.W., hard, fresh pink and yellow dolomite, massive, cherty	
168.5 - 188.0			Yellow and white dolomite, cherty, a very thin weathered layer of red magnesite at 171, 183.6, 186.3m & 187.3 m	
188.0 - 198.3			Pink dolomite, yellow dolomite at 188.4 m, cherty	
198.3 - 199.0		---------	Coring from 198.3 to 199.0 m – S.W., yellow dolomite, broken, cherty, water stained more water	

			End of Hole at 199.00 m	

SWL 11.4 m below ground level on 14 May 2001
Water Sample - Bottle No. BS1, BS2 & BS3

Standing Water Level; **EC** - Electric Conductivity (µS/cm), Water Struck;
TOC - Top of Casing above ground level, Bore Status: Prod/Monit/Obs/Backfilled/Open/Abandoned

0 1 2 3 4 5cm
|.....|.....|.....|.....|.....|


RN 33031
Berry Springs
Depth (mBGL)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
-16 -12 -8
Mag Sus. (relative)
6 8 10 12
Hole Diameter (inches)
0 20 40 60 80
Gamma Response (cps)
0 20 40 60 80100
Inductive Cond. (mS/m)

Amortization Schedule

Loan Amount = $ 140,000.00
Interest Rate = 6%
Payment Amount = $415.76 (26 times per year)
Number of Payments = 650

Year	Payments (annual)	Principal Paid (annually)	Interest Paid (annually)	$ Left on Loan
1	10,809.76	2,492.09	8,317.67	137,507.91
2	10,809.76	2,645.83	8,163.93	134,862.08
3	10,809.76	2,809.01	8,000.75	132,053.07
4	10,809.76	2,982.23	7,827.53	129,070.84
5	10,809.76	3,166.17	7,643.59	125,904.67
6	10,809.76	3,361.45	7,448.31	122,543.22
7	10,809.76	3,568.77	7,240.99	118,974.45
8	10,809.76	3,788.88	7,020.88	115,185.57
9	10,809.76	4,022.57	6,787.19	111,163.00
10	10,809.76	4,270.67	6,539.09	106,892.33
11	10,809.76	4,534.10	6,275.66	102,358.23
12	10,809.76	4,813.75	5,996.01	97,544.48
13	10,809.76	5,110.67	5,699.09	92,433.81
14	10,809.76	5,425.86	5,383.90	87,007.95
15	10,809.76	5,760.49	5,049.27	81,247.46
16	10,809.76	6,115.81	4,693.95	75,131.65
17	10,809.76	6,493.01	4,316.75	68,638.64
18	10,809.76	6,893.50	3,916.26	61,745.14
19	10,809.76	7,318.69	3,491.07	54,426.45
20	10,809.76	7,770.09	3,039.67	46,656.36
21	10,809.76	8,249.32	2,560.44	38,407.04
22	10,809.76	8,758.14	2,051.62	29,648.90
23	10,809.76	9,298.30	1,511.46	20,350.60
24	10,809.76	9,871.80	937.96	10,478.80
25	10,807.90	10,478.80	329.10	.0
Totals	**$270,242.14**	**$140,000.00**	**$130,242.14**	

http://members.aol.com/tracypaul/calcind.htm