

UR1987\_40

## 1987/40. Completion report: Sub-basalt Drilling Project Hole 2

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**Abstract**

SBDP Hole 2 penetrated approximately 320 m of latest Eocene and Oligocene basalt and interbedded sediments unconformably overlying sedimentary rocks of the Lower Palaeozoic Gordon and Denison Groups.

**INTRODUCTION**

This report is the second in a series which will be written for each of the holes completed in the Department of Mines Sub-Basalt Drilling Project (SBDP). The hole is located on Racecourse Plain Road (fig. 1) at:-

Easting 391 808.5 m  
Northing 5 406 007.5 m

Chemical analyses were performed by the Department of Mines Laboratories, Launceston; XRD analyses by R. N. Woolley under the supervision of R. S. Bottrill; palynology by Dr R. Morgan, Maitland, South Australia; down-hole logging by J. V. Wright.

**STRATIGRAPHY**

The first 90 m of the hole was precollared; a lithological log of the fully-cored section (90-383.1 m) is presented as Appendix 1.

Basalt, often vesicular or brecciated, was encountered between 90 m and 317.5 m. Fresh basalt suitable for dating was not seen, and some degree of deuteric alteration is ubiquitous. Zones of brecciation, as seen at 183 m and 208 m, are probably of hyaloclastic origin and indicate that part of the pile was extruded either in or into water. Some basalt flows (e.g. 134, 188 m) have weathered tops and probably indicate subaerial conditions.

Several thin sediment horizons, usually less than 2 m thick, are present. Lithology is generally carbonaceous silt or clay, although minor sand and gravel is present.

Basement rocks were first encountered at 319.5 m and consist of a sequence of fine-grained, often burrowed, micrite and dolosiltite identical to other West Coast occurrences of the Ordovician Gordon Group.

Siliciclastic sandstone, siltstone, and pebble conglomerate encountered from 374.0 m to 383.1 m (TD) are correlated with the Denison Group; not enough section is present to allow precise correlation.

A very coarse sandstone from 381.4 m (101638) is a poorly-sorted lithic arenite consisting of often well-rounded clasts of metasedimentary origin (metaquartzite, metachert, vein quartz, common quartz, green tourmaline), together with lesser, but significant amounts of siltstone and volcanic quartz in a silicified, ferruginous matrix.

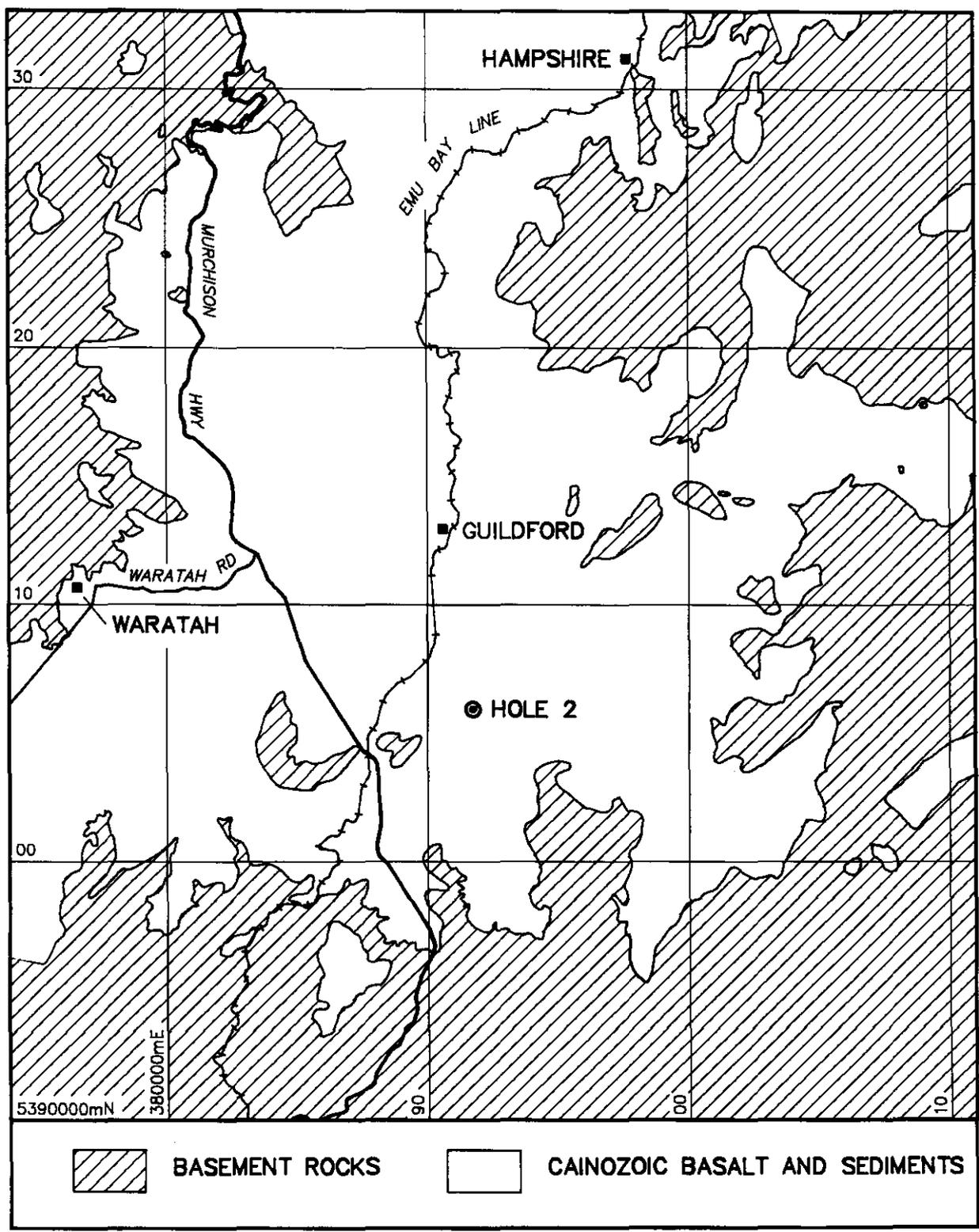


Figure 1. Location of Hole 2

### GEOPHYSICAL LOGGING

Gamma ray (GR) and caliper tools were run in the upper 318 m of the hole. Figure 2 shows the GR log and demonstrates a precise correlation between high gamma counts and the logged sedimentary horizons. Given the speed of logging (6 m/min), the high peaks probably represent API values of about 120, although precise calibration is not possible.

The principal source of the gamma rays is probably radioactive <sup>40</sup>K, derived from illite (average 6.7 K% weight) and/or montmorillonite (average 1.6 K% weight) in the clay fraction of the sediments (Schlumberger, 1982).

### PALYNOLOGY

Ten samples were submitted for palynological analysis; all yielded palynomorphs, although some were very lean. A checklist of determined palynomorphs is presented as Appendix 2.

Samples from the interval 129.0-184.0 m are assigned to the lower *Proteacidites tuberculatus* Zone (Stover and Evans, 1973; Stover and Partridge, 1973; Partridge, 1976).

The samples are totally dominated by *Nothofagidites* spp. in a relatively low diversity assemblage. The co-occurrence of *Beaupreadites verrucosus* and *Cyatheacidites annulatus* indicates assignment to the lower *Proteacidites tuberculatus* Zone of early Oligocene age. The presence of *Periporopollenites vesicus* and absence of younger indicators confirm the assignment. Non-marine environments are indicated by the absence of marine indicators, and the presence of the freshwater alga *Botryococcus*.

Samples from the interval 187.3-318.9 m are slightly older, and assigned to the upper *Nothofagidites asperus* Zone. These assemblages are extremely rich in pollen, totally dominated by *Nothofagidites* spp. and are of low diversity. The presence of *Periporopollenites vesicus* without younger or older indicators, along with the dominance of *Nothofagidites* spp., indicates assignment to the upper *N. asperus* Zone, of latest Eocene

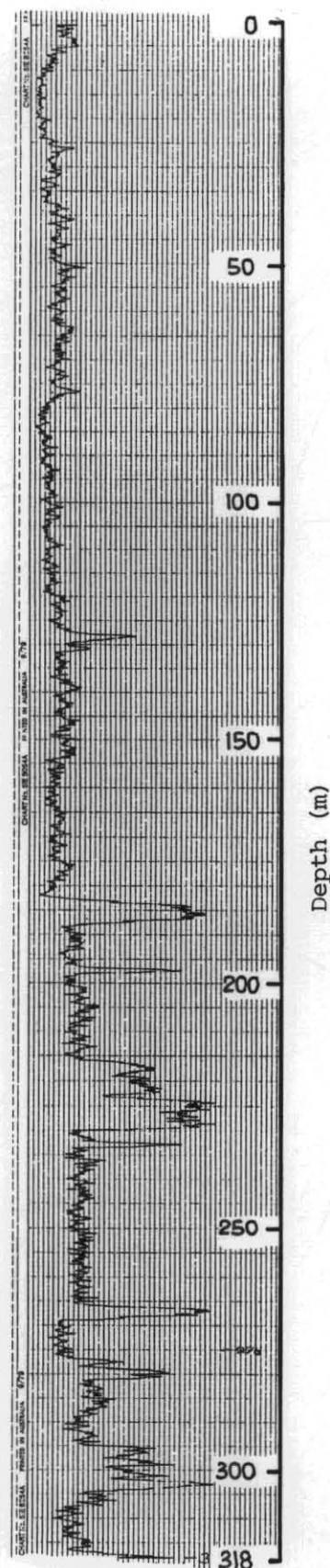


Figure 2. Gamma-ray log, SBDP Hole 2.

Low GR High

to earliest Oligocene age. The topmost sample (187.3 m) is very lean and could possibly belong to the overlying zone.

Non-marine environments are indicated by the absence of marine indicators. In the basal sample (318.9 m), common non-marine dinoflagellates (*Saepodinium tasmaniense* and ?*Trithyrodinium* sp.) suggest lacustrine environments.

WHOLE-ROCK ANALYSES

Analyses of six relatively fresh basalt samples (872167-72) are shown as Table 1; analysis of four representative limestone samples are shown as Table 2.

Figure 3 is an alkali-silica diagram (constructed after Brown, 1986) and shows that basalts from this hole have both alkaline and tholeiitic affinities, similar to other basalts from the region.

XRD DETERMINATIONS

Representative samples of vesicicle infillings were collected and mineral determinations made by XRD. Depths of samples and mineral species present are:-

- 90.0 m Chabazite  
Montmorillonite
- 114.4 m Chabazite  
Heulandite
- 169.3 m Chabazite  
Montmorillonite
- 275.4 m Calcite

SUMMARY

The hole has shown that a ridge of Denison Group correlate extends in a north-westerly direction from Moory Mount to the Two Hummocks area, although some cross-faulting must be present. The presence of Gordon Group limestone extends the known distribution of that sequence and so increases the area which is prospective for massive sulphide tin deposits or tungsten skarn deposits.

The presence of numerous sedimentary horizons within the basalt pile, and containing a *P. tuberculatus* Zone microflora at two horizons, indicates that the schematic geological section proposed by Brown and Forsyth (1984) is too simplistic, and that the Tertiary history is more complex than previously thought.

A summary geological log is:-

- 0 - 187 m Oligocene basalt with minor sediments
- 187 - 320 m Early Oligocene-late Eocene basalt and sediments
- 320 - 374 m Ordovician Gordon Group limestone
- 374 - 383 m Ordovician Denison Group siliciclastics

40-5

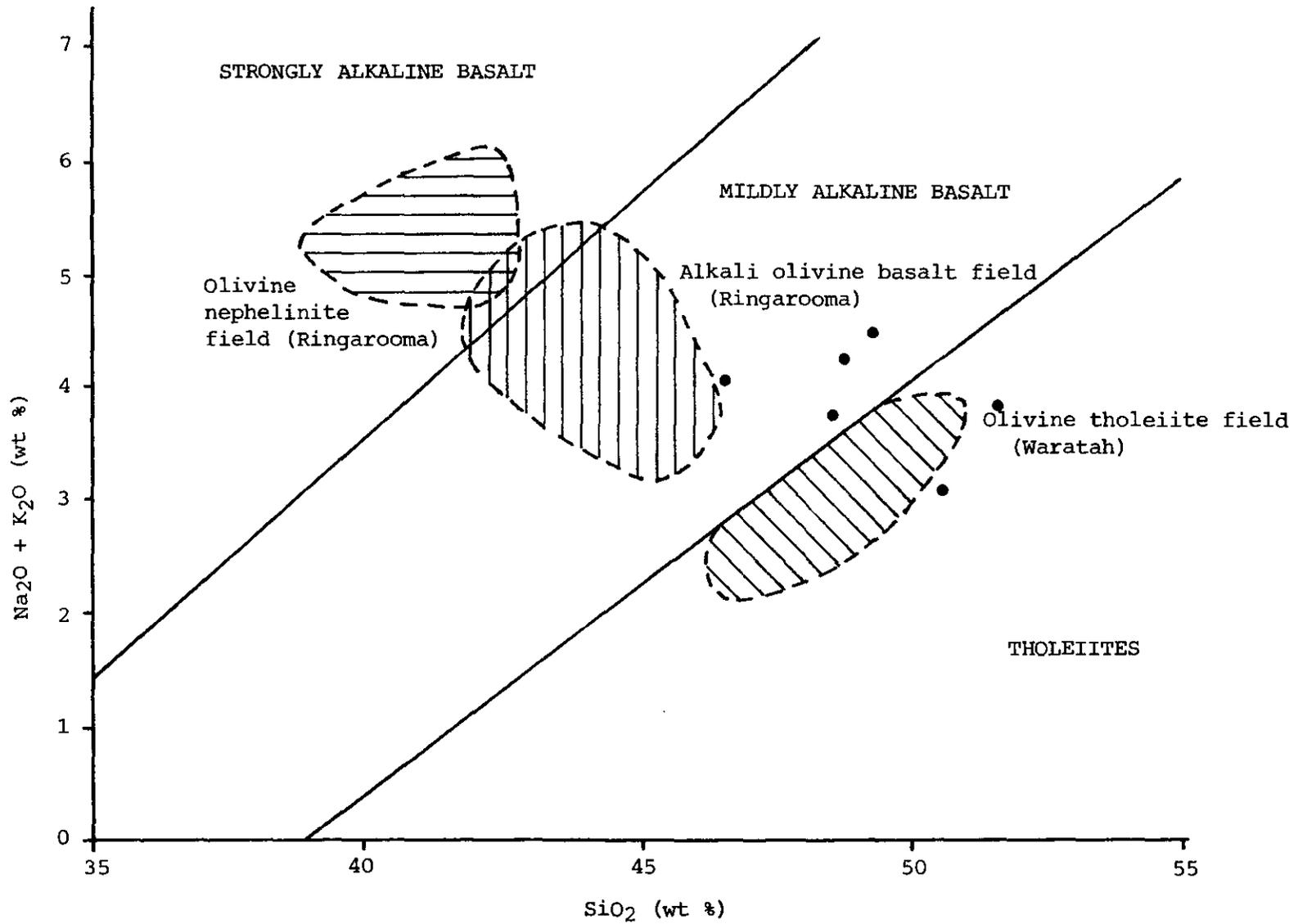


Figure 3. Alkali-silica diagram (after Brown, 1986), Tertiary basalt SBDP Hole 2

5 cm

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[15 September 1987]

**Table 1. CHEMICAL ANALYSES OF BASALTS; SBDP Hole 2**

Analysis No.	872167	872168	872169	872170	872171	872172
Field No.	101628	101629	101630	101631	101632	101633
Depth (m)	101.5	145.0	190.0	238.0	282.0	293.0
<i>Oxides (%)</i>						
SiO <sub>2</sub>	50.54	51.59	48.62	46.63	48.75	49.27
TiO <sub>2</sub>	1.60	1.52	1.79	2.18	2.05	2.18
Al <sub>2</sub> O <sub>3</sub>	14.13	14.34	14.24	12.86	15.18	15.73
Fe <sub>2</sub> O <sub>3</sub>	5.12	5.13	3.46	2.31	3.36	3.35
FeO	6.49	5.72	7.01	9.90	6.68	6.92
MnO	0.14	0.16	0.15	0.17	0.15	0.15
MgO	6.77	6.61	7.05	9.83	6.46	5.51
CaO	9.30	8.69	9.17	8.79	7.76	7.72
Na <sub>2</sub> O	2.71	3.01	2.83	2.84	2.75	2.82
K <sub>2</sub> O	0.44	0.79	0.95	1.21	1.52	1.69
P <sub>2</sub> O <sub>5</sub>	0.21	0.23	0.34	0.47	0.38	0.40
H <sub>2</sub> O <sup>+</sup>	1.99	1.86	2.78	2.29	2.50	2.77
CO <sub>2</sub>	0.27	0.26	0.92	0.16	0.54	0.38
Total S	<0.05	<0.05	<0.05	<0.05	0.11	<0.05
<i>Trace elements (g/t)</i>						
Ag	5	5	<5	8	<5	7
As	13	<10	11	<10	16	19
Ba	<9	52	110	77	1300	310
Bi	5	7	6	<5	<5	<5
Ce	41	52	60	78	74	76
Co	50	45	47	56	35	34
Cr	300	280	230	290	50	69
Cu	60	54	57	73	40	38
Ga	19	18	20	21	22	22
La	<6	7	15	15	12	19
Mo	22	15	17	11	10	13
Nb	9	15	26	32	33	29
Nd	14	10	20	17	19	20
Ni	175	140	160	230	44	54
Pb	10	6	4	7	4	<4
Rb	7	18	18	19	38	35
Sc	21	20	19	20	18	15
Sn	54	11	7	4	4	6
Sr	240	280	390	640	610	370
Ta	<9	<9	<9	9	<9	<9
Th	<4	<4	4	<4	<4	<4
U	<5	<5	<5	<5	<5	5
V	155	145	170	195	195	175
W	380	260	155	110	210	270
Y	21	17	20	20	23	23
Zn	125	120	125	135	120	120
Zr	99	100	115	185	160	155

Table 2. CHEMICAL ANALYSES OF LIMESTONES; SBDP Hole 2

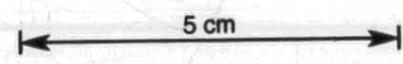
Analysis No.	872222	872223	872224	872225
Field No.	101634	101635	101636	101637
Depth (m)	329.6	343.9	361.0	367.8
<i>Oxides (%)</i>				
SiO <sub>2</sub>	10.27	12.76	5.34	2.64
TiO <sub>2</sub>	0.21	0.11	0.12	0.10
Al <sub>2</sub> O <sub>3</sub>	4.54	1.97	2.14	1.20
Fe <sub>2</sub> O <sub>3</sub>	0.44	0.07	0.19	0.25
FeO	0.76	0.33	0.30	0.80
MnO	0.04	0.01	0.02	0.08
MgO	6.30	2.14	1.43	3.83
CaO	38.96	44.88	49.48	47.73
Na <sub>2</sub> O	0.02	<0.01	0.01	0.20
K <sub>2</sub> O	0.82	0.36	0.43	0.26
P <sub>2</sub> O <sub>5</sub>	0.10	0.09	0.07	0.07
Total S	0.54	0.17	0.31	0.43
L.O.I.	37.66	37.40	40.12	42.01
<i>Trace elements (g/t)</i>				
Ag	6	8	13	13
As	<10	10	11	19
Ba	43	20	18	18
Bi	5	8	5	6
Ce	18	7	10	10
Co	<4	<4	<4	6
Cr	23	18	13	26
Cu	11	<3	3	9
Ca	4	<3	<3	<3
La	28	<6	<6	<6
No	2	4	3	2
Nb	2	2	<2	<2
Nd	<9	<9	<9	<9
Ni	6	3	6	16
Pb	16	9	11	27
Rb	37	17	22	17
Sc	16	21	20	24
Sn	<4	<4	<4	<4
Sr	240	270	270	240
Ta	<9	<9	<9	<9
Th	6	<4	<4	5
U	5	<5	<5	<5
V	20	4	9	16
W	83	115	70	40
Y	9	4	4	6
Zn	24	29	25	155
Zr	27	18	11	18

APPENDIX 1

Geological log of drill hole BDP-2

Core lift	Core loss (%)	Depth (m)	Graphic Log	Sample No. Depth (m) Prep'n	DESCRIPTION
		90		90.0 XRD	Dark coloured vesicular to massive basalt; vesicular zones indicated on graphic log
		100		101.5 Anal, TS	
		110		114.4 XRD	
		120			
		130		129.0 Paly	Brown carbonaceous siltstone with (washed out) basal siliceous gravel
	50				Basalt as above
	20				Khaki weathered top of flow 133.8 - 135.0 m
		140			
		150		145.0 Anal, TS	
		160			
		170		169.3 XRD	

40-10

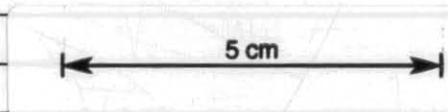


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Core lift	Core loss (%)	Depth (m)	Graphic Log	Sample No. Depth (m) Prep'n	DESCRIPTION
		170			
		180			Brecciated base of flow 182.3 - 183.5 m
		184.0		184.0 Paly	Brown carbonaceous siltstone and claystone
		187.3		187.3 Paly	Grey weathered zone at top of basalt 187.6 - 187.9 m
		190.0		190.0 Anal. TS	197.0 - 198.0 m Brown carbonaceous siltstone
		197.6		197.6 Paly	Brecciated and rubbly top of next flow
		210			Agglomerate or brecciated basalt
		220		220.8 Paly	218.4 - 223.2 m Brown carbonaceous siltstone and claystone with minor lighter coloured very fine-grained sandstone
		223.2		223.2 - 223.7 m	Thin massive basalt ?flow
		229.5		229.5 Paly	223.7 - 229.9 m Brown claystone as above
		230			Basalt as above
		238.0		238.0 Anal. TS	
		250			

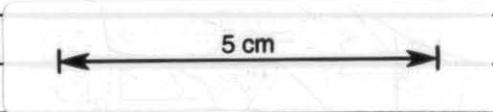
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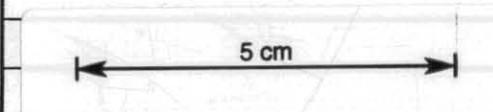
Core lift	Core loss (%)	Depth (m)	Graphic Log	Sample No. Depth (m) Prep'n	DESCRIPTION
		250			
		260		268.6 Paly	266.6 - 269.0 m Dark brown claystone with lesser, lighter coloured, carbonaceous poorly-sorted sandstone
		270		275.4 XRD	277.2 - 279.3 m Dominantly grey/brown, moderately well-sorted fine to very fine-grained sandstone
10		280		279.0 Paly	
				282.0 Anal TS	
		290		293.0 Anal TS	
40		300			Dominantly brown claystone as above with upper horizon of sandy siliceous gravel
				303.5 Paly	304.0 - 317.5 m Weathered and altered (swelling clays) basalt
30		310			
10		320		318.9 Paly	317.5 - 319.5 Brown claystone as above 319.5 - 324.0 White, weathered limestone 324.0 - 373.0 Gordon Limestone
		330		329.6 Anal	



40-12

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Core lift	Core loss (%)	Depth (m)	Graphic Log	Sample No. Depth (m) Prep'n	DESCRIPTION
		330			Dominantly fine-grained, often burrowed micritic sequence of mud and dolomitic siltstone. Occasionally laminated. Abundant stylolites.
	40				
	60				
	20	340		343.9 Anal	
	10				
	70				
	10	350			
	40				
	50				
		360		361.0 Anal	
	30				
				367.8 Anal	
		370			
	20				
	40				374.0 - 376.9 m Green to brown coloured siltstone and very fine sandstone
	10				376.9 - 381.0 m Red coloured sandstone, with few pebbles
		380		381.4 TS	381.0 - 383.1 m Red pebble conglomerate
		390			



40-13

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APPENDIX 2

TASDM SBDP #2

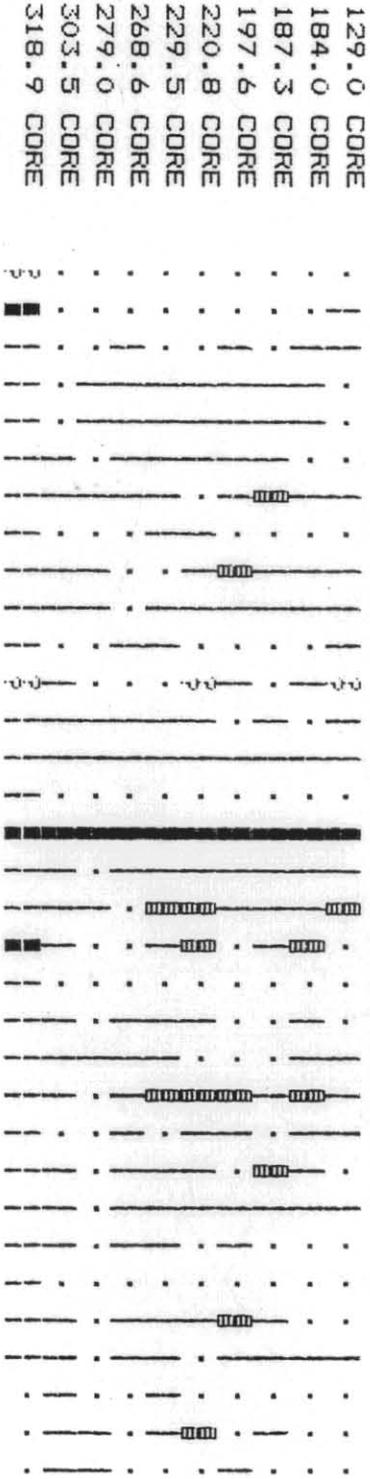
DESCRIPTION:

ALL DEPTHS IN METRES

CHECKLIST OF GRAPHIC ABUNDANCE BY LOWEST APPEARANCE

-  = Abundant
-  = Common
-  = Few
-  = Rare
-  = Very Rare
-  = Questionably Present
-  = Not Present

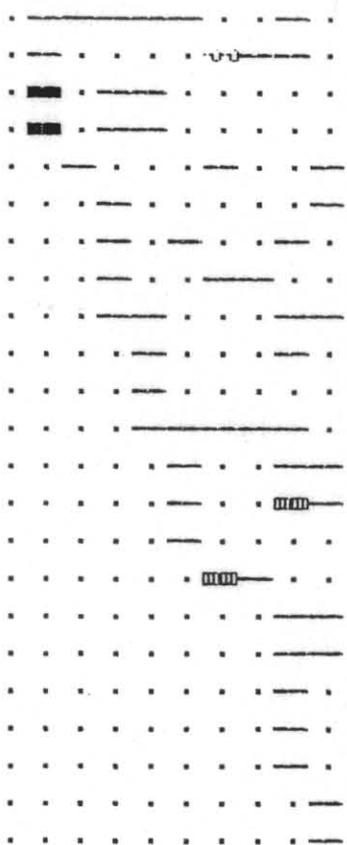
- 1 \*SARPTODINIUM TASMANIENSE\*
- 2 \*TRITHYROIDINIUM SP.\*
- 3 DACRYCARPITES AUSTRALIENSIS
- 4 DILWYNITES GRANULATUS
- 5 DILWYNITES TUBERCULATUS
- 6 GLEICHENIIDITES CIRCINIDITES
- 7 HALORAGACIDITES HARRISII
- 8 ILEXPOLLENITES SP.
- 9 ISCHYOSPORITES GREMIUS
- 10 LYGISTEPOLLENITES FLORINII
- 11 MALVACIPOLLIS SUBTILIS
- 12 MATONISPORITES ORNAMENTALIS
- 13 NOTHOFAGUS ASPERUS
- 14 NOTHOFAGUS BRACHYSPINULOSUS
- 15 NOTHOFAGUS DEMINUTUS
- 16 NOTHOFAGUS EMARCIDUS/HETERUS
- 17 NOTHOFAGUS FALCATUS
- 18 NOTHOFAGUS FLEMINGII
- 19 NOTHOFAGUS VANSTEENISII
- 20 PERIPOROPOLLENITES DEMARCATUS
- 21 PERIPOROPOLLENITES POLYORATUS
- 22 PERIPOROPOLLENITES VESICUS
- 23 PHYLLOCLADIDITES MAWSONII
- 24 PODOSPORITES MICROSACCATUS
- 25 PROTEACIDITES SPP.
- 26 STEREISPORITES ANTIQUISPORITES
- 27 TRICOLPITES SPP.
- 28 VERRUCATOSPORITES ATTENATUS
- 29 VERRUCATOSPORITES SP.
- 30 VERRUCOSISPORITES KOPUKUENSIS
- 31 CLAVIFERA TRIPLEX
- 32 CYATHIIDITES SPP.
- 33 DICTYOPHYLLIDITES SPP.



5 cm

40-14

129.0 CORE  
 184.0 CORE  
 187.3 CORE  
 197.6 CORE  
 220.8 CORE  
 229.5 CORE  
 268.6 CORE  
 279.0 CORE  
 303.5 CORE  
 318.9 CORE



- 34 ERICIPITES SCABRATUS
- 35 RUGULATISPORITES MALLATUS
- 36 RUGULATISPORITES SPP.
- 37 VERRUCOSISPORITES SPP.
- 38 VERRUCOSISPORITES "BUBBLY"
- 39 BEAUPREADITES VERRUCOSUS
- 40 PROTEACIDITES OBSCURUS
- 41 RETITRILETES
- 42 VERRUCOSISPORITES CF. CRISTATUS
- 43 MICROCACHRYIDITES ANTARCTICUS
- 44 PROTEACIDITES INCURVATUS
- 45 TRICOLPITES WAIPARAENSIS CF.
- 46 BEAUPREIDITES TRIGONALIS
- 47 LAEVIGATOSPORITES
- 48 PROTEACIDITES ANNULARIS
- 49 AGLAOREIDIA QUALUMIS
- 50 \*BOTRYOCOCCUS\*
- 51 CYATHEACIDITES ANNULATUS
- 52 PEROMONOLITES DENSUS
- 53 RUGULATISPORITES MALLATUS CF.
- 54 TRIPOROPOLLENITES CHNOSUS
- 55 MICROFOVEOSPORITES
- 56 MILFORDIA HOMEOPUNCTATUS

5 cm

40-15

SPECIES LOCATION INDEX

Index numbers are the columns in which species appear.

INDEX NUMBER	SPECIES
50	*BOTRYOCOCCUS*
1	*SAEPTODINIUM TASMANIENSE*
2	*TRITHYRODINIUM SP.*
49	AGLAOREIDIA QUALUMIS
39	BEAUPREADITES VERRUCOSUS
46	BEAUPREIDITES TRIGONALIS
31	CLAVIFERA TRIPLEX
51	CYATHEACIDITES ANNULATUS
32	CYATHIDITES SPP.
3	DACRYCARPITES AUSTRALIENSIS
33	DICTYOPHYLLIDITES SPP.
4	DILWYNITES GRANULATUS
5	DILWYNITES TUBERCULATUS
34	ERICIPITES SCABRATUS
6	GLEICHENIIDITES CIRCINIDITES
7	HALORAGACIDITES HARRISII
8	ILEXPOLLENITES SP.
9	ISCHYOSPORITES GREMIUS
47	LAEVIGATOSPORITES
10	LYGISTEPOLLENITES FLORINII
11	MALVACIPOLLIS SUBTILIS
12	MATONISPORITES ORNAMENTALIS
43	MICROCACHRYIDITES ANTARCTICUS
55	MICROFOVEOSPORITES
56	MILFORDIA HOMEOPUNCTATUS
13	NOTHOFAGUS ASPERUS
14	NOTHOFAGUS BRACHYSPINULOSUS
15	NOTHOFAGUS DEMINUTUS
16	NOTHOFAGUS EMARCIDUS/HETERUS
17	NOTHOFAGUS FALCATUS
18	NOTHOFAGUS FLEMINGII
19	NOTHOFAGUS VANSTEENISII
20	PERIPOROPOLLENITES DEMARCATUS
21	PERIPOROPOLLENITES POLYDRATUS
22	PERIPOROPOLLENITES VESICUS
52	PEROMONOLITES DENSUS
23	PHYLLOCLADIDITES MAWSONII
24	PODOSPORITES MICROSACCATUS
48	PROTEACIDITES ANNULARIS
44	PROTEACIDITES INCURVATUS
40	PROTEACIDITES OBSCURUS
25	PROTEACIDITES SPP.
41	RETITRILETES
35	RUGULATISPORITES MALLATUS
53	RUGULATISPORITES MALLATUS CF.
36	RUGULATISPORITES SPP.
26	STEREISPORITES ANTIQUISPORITES
27	TRICOLPITES SPP.
45	TRICOLPITES WAIPARAENSIS CF.
54	TRIPOROPOLLENITES CHNOSUS
28	VERRUCATOSPORITES ATTENATUS
29	VERRUCATOSPORITES SP.
38	VERRUCOSISPORITES "BUBBLY"
42	VERRUCOSISPORITES CF. CRISTATUS
30	VERRUCOSISPORITES KOPUKUENSIS
37	VERRUCOSISPORITES SPP.