

1988/06. Completion report: Sub-basalt Drilling Project Hole 6.

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Abstract

SBDP Hole 6 penetrated approximately 226 m of latest Eocene and Oligocene basalt and minor interbedded sediments unconformably overlying sedimentary rocks correlated with the Bell Shale (Lower Devonian) of the Zeehan area.

INTRODUCTION

This report is the fourth in the 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 Road, close to the Hatfield River (fig. 1) at:-

Easting 392 645 mE
Northing 5 402 735 mN

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

STRATIGRAPHY

The hole penetrated 316.0 m of the Tertiary and Palaeozoic section; a lithological log is presented as Appendix 1.

Basalt, often vesicular or brecciated, was encountered from 0 to 226.4 m. Fresh basalt suitable for dating was not seen, and some degree of deuteric alteration is ubiquitous. A well-developed hyaloclastic succession is present from 186 - 226.4 m and consists of glassy hyaloclastic debris and often broken pillow lavas.

Several intrabasalt sedimentary horizons are present (76.1 - 79.8 m; 99.9 - 101.2 m; 117.8 - 119.9 m; 151.0 - 161.5m).

The lowermost horizon is of some interest and provides new data concerning the origin of 'silcrete'. Pinkish-coloured, very hard, silicified conglomerate ('silcrete') was encountered between 151.0 m and 154.1 m, overlying soft, brown/grey silt and clay (154.1 - 161.5 m). The 'silcrete' is similar to rocks cropping out sporadically in the St Valentines region (?Tss - silicified quartzose sediments of Baillie et al., 1986). Silicification is clearly diagenetic and related to the original high permeability of the gravels. The underlying low permeability silt and clay are relatively impervious to groundwater movements, and no alteration has taken place.

Basement rocks were first encountered at 226.4 m and consist dominantly of dark to very dark grey, well-cleaved siltstone and mudstone becoming sandier towards the bottom of the section. Bioturbation ('Chondrites') is common, and rare solitary corals and shelly debris are also present. A zone of weathering is present to a depth of 275 m and is probably the result of pre-Eocene weathering.

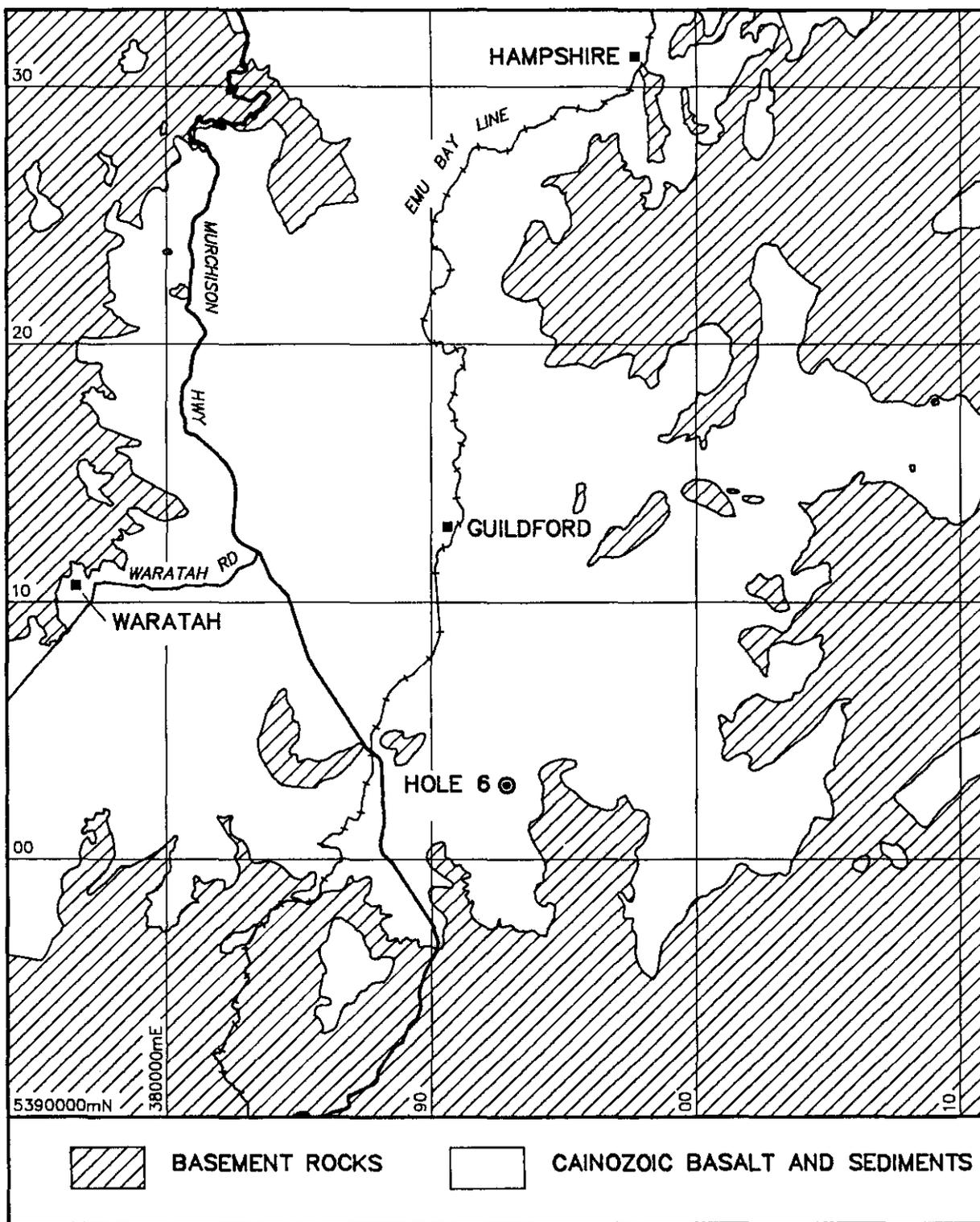


Figure 1. Location of SBDP Hole 6.

5 cm

On litho- and bio-stratigraphic grounds the succession is correlated with the Bell Shale (Eldon Group; Lower Devonian) of the Zeehan area.

GEOPHYSICAL LOGGING

A gamma ray (GR) tool was run in the top 230 m of the hole; the log is shown as Figure 2. Sedimentary horizons are clearly visible; silty layers have a higher GR count than basalt, the 'silcrete' is lower. Basement rocks (below 226 m) have a higher GR count than the Tertiary sedimentary horizons.

PALYNOLOGY

Two core samples were submitted for palynological analysis; both yielded excellently preserved, diverse assemblages. A checklist of determined palynomorphs is presented as Appendix 2.

A sample from 79.3 m is dominated by *Nothofagidites* spp., but contains frequent *Ischyosporites*, *Lygistepollenites* and *Stereisporites*. The co-occurrence of *Granodiporites nebulosus* with *Cyatheacidites annulatus* indicates assignment to the lower *Proteacidites tuberculatus* Zone, i.e. early Oligocene (Stover and Evans, 1973; Stover and Partridge, 1973; Partridge, 1976). The presence of *Periporopollenites vesicus* is general confirmation. Non-marine environments are indicated by the common and diverse spores and pollen, and absence of dinoflagellates or significant cuticle.

A sample from 157.2 m is also dominated by *Nothofagidites*, but contains frequent nondescript *Proteacidites* spp. and *Stereisporites* spp. The absence of *C. annulatus* (seen in the sample above) and the multitude of older (middle *N. asperus* Zone) indicators defines assignment to the upper *Nothofagidites asperus* Zone, i.e. latest Eocene - early Oligocene. The presence of *Beaupreadites verrucosus*, *Periporopollenites demarcatus* and *P. vesicus* broadly confirms a lower *P. tuberculatus* or older assignment.

Non-marine environments are indicated by the frequent and diverse spores and pollen, and lack of dinoflagellates. Plant cuticle is notably rare, with *Nothofagidites* spp. comprising the bulk of the oxidised residue.

GEOCHEMISTRY

Analyses of four relatively fresh basalt samples (874881-84) are shown in Table 1. Figure 3 is an alkali-silica diagram (constructed after Brown, 1986), and shows that the analysed specimens, in general, are similar to other alkaline and tholeiitic basalts in the region. The data from this hole also indicate that the alkali-olivine basalts (874883, 4) erupted prior to the tholeiites (874881, 2).

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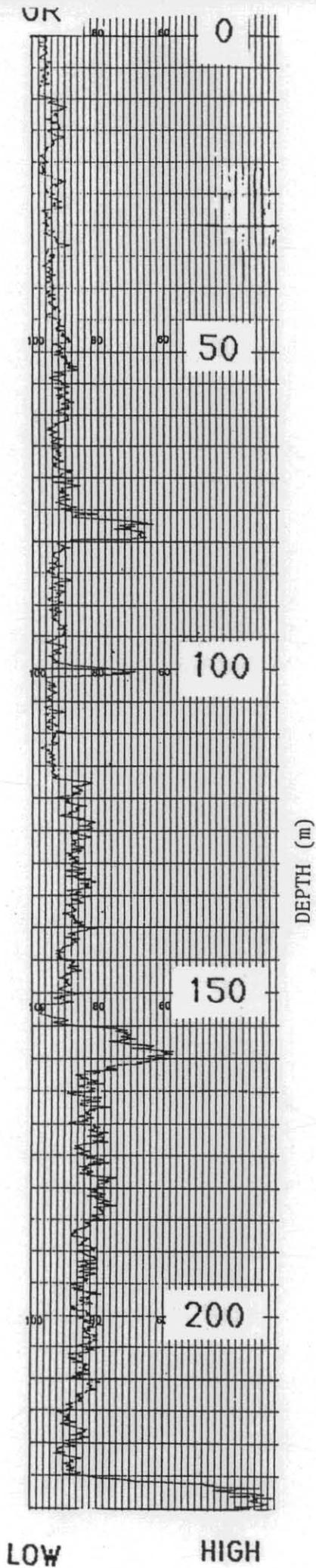


Figure 2. Gamma-ray log, SBDP Hole 6

5 cm

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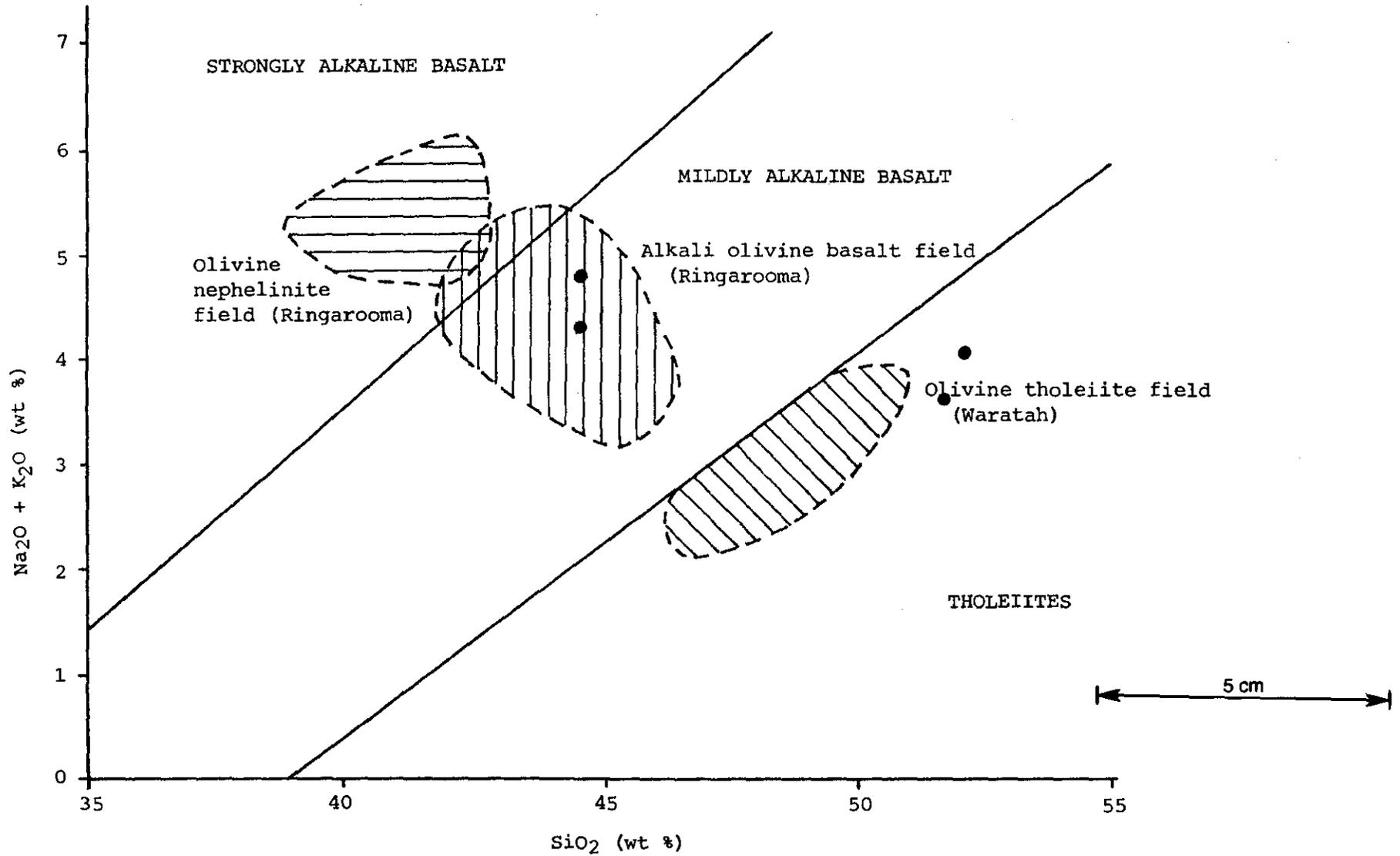


Figure 3. Alkali-silica diagram (after Brown, 1986), Tertiary Basalt, SBDP Hole 6.

XRD DETERMINATIONS

Representative samples of vesicle infilling were collected, and mineral determinations made by XRD. Depths of samples and mineral species present are:-

90.5 m	Calcite Montmorillonite
145.4 m	Calcite

SUMMARY

The hole has shown the existence of a largely unexpected occurrence of Eldon Group rocks in the Hatfield River region. The nearest outcropping rocks, a little over one kilometre to the east, are shown as 'OS' (Undifferentiated Ordovician-Silurian siltstone and sandstone) on the Mackintosh geological map sheet (Barton et al., 1966), a tentative assignation due to the poor outcrop in the area.

The hole has also provided useful empirical data on the origin of 'silcrete'.

A summary geological log is:-

0-226 m	Oligocene and late Eocene basalt with minor sediments, including a 'silcrete' horizon overlying unlithified mudstone.
226-316 m	Bell Shale correlate.

REFERENCES

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STOVER, L. E.; EVANS, P. R. 1973. Upper Cretaceous-Eocene spore-pollen zonation, offshore Gippsland Basin, Australia. Spec. Publ. geol. Soc. Aust. 4:55-72.

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[8 March 1988]

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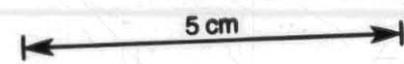
Table 1. ANALYSES OF FOUR BASALT SAMPLES

Analysis	874881	874882	874883	874884
Field no.	101688	101689	101690	101691
Depth (m)	75.8	108.0	177.0	202.8
Oxides %				
SiO ₂	51.01	50.73	44.57	44.53
TiO ₂	1.56	1.53	2.02	2.28
Al ₂ O ₃	13.94	14.25	13.06	14.
Fe ₂ O ₃	1.31	1.64	2.71	2.
FeO	9.59	9.61	9.31	8.78
MnO	0.15	0.16	0.16	0.16
MgO	8.52	8.39	10.73	8.41
CaO	8.41	9.22	9.98	10.57
Na ₂ O	3.06	3.13	2.96	2.51
K ₂ O	0.99	0.48	1.32	2.26
P ₂ O ₅	0.23	0.19	0.54	0.
H ₂ O ⁺	0.92	1.16	2.58	2.96
CO ₂	0.07	0.26	0.13	0.35
Total S	<0.05	<0.05	<0.05	<0.05
Trace elements (g/t)				
Ag	<3	<3	3	<3
As	<10	10	11	14
Ba	165	260	350	380
Bi	5	<5	5	<5
Ce	62	51	82	95
Co	49	52	54	50
Cr	410	360	430	300
Cu	53	60	63	66
Ga	15	15	16	17
La	16	<6	23	29
Mo	3	2	4	6
Nb	15	11	44	54
Nd	15	10	26	29
Ni	190	190	230	150
Pb	<4	<4	<4	<4
Rb	23	7	28	29
Sc	23	26	23	21
Sn	7	<4	<4	<4
Sr	320	290	870	840
Ta	<7	<7	<7	<7
Th	<4	<4	<4	<4
U	5	5	<5	8
V	180	195	220	230
W	25	15	18	17
Y	24	24	21	23
Zn	94	95	95	100
Zr	125	110	175	210

APPENDIX 1
Lithological log of Hole SBDP 6

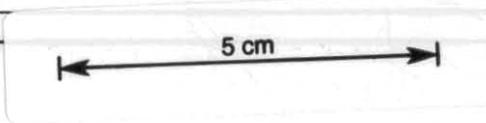
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INTERVAL		REC. (%)	Core lift	Core loss	Depth (m)	Graphic Log	Min	DESCRIPTION	SPECIMEN		
From (m)	To (m)								Number	Depth	Prep'n
					0			0 - 226.4 m Sequence of interbedded basalt flows and minor sedimentary horizons; much of the basalt is hyaloclastic			
					10			Basalt: Dark coloured, massive or vesicular, may be glassy especially when brecciated. Vesicles commonly infilled with clay, occasionally with zeolite			
					20						
					30						
					40						
					50						
					60						
					70						
					75.8			76.1 - 79.8 m Brown coloured carbonaceous siltstone	75.8 m	Anal.	
					79.3				79.3 m	Paly	
					90.5				90.5 m	XRD	
					99.9			99.9 - 101.2 m Brown silt			
					100						
					110						



INTERVAL		REC. (%)	Core lift	Core loss	Depth (m)	Graphic Log	Min	DESCRIPTION	SPECIMEN		
From (m)	To (m)								Number	Depth	Prep'n
					110						
					120			117.8 - 119.9 m Grey-brown clay-rich ?epiclastic sediment			
					130						
					140						
					150			151.0 - 154.1 m Pinkish coloured very hard silicified conglomerate; clasts usually well rounded and ≤ 25 mm, well sorted ("silcrete")		145.4 m	XRD
					160			154.1 - 161.5 m Brown/grey often carbonaceous silt and clay		153.2 m	Ts
					170						
					180						
					190			186 - 226.4 m Brecciated sequence of pillows and hyaloclastite debris; basalt often glassy; margins of pillows often diffuse		157.2 m	Paly
					200						
					210						
					220						
										177.0 m	Ts, Anal
										202.8 m	Ts, Anal

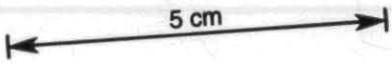
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1912

INTERVAL		REC. (%)	Core lift	Core loss	Depth (m)	Graphic Log	Min	DESCRIPTION	SPECIMEN		
From (m)	To (m)								Number	Depth	Prep'n
					220	▲▲▲▲▲					
					230	▧▧▧▧▧		226.4 - 316.0 m Devonian Bell Shale correlate: Dark to very dark grey, well cleaved siltstone and mudstone. Bioturbation (" <i>chondrites</i> ") common; rare corals and shelly debris present. Becoming sandier near bottom of section. Zone of weathering extends to 275 m			
					240	▧▧▧▧▧					
					250	▧▧▧▧▧					
					260	▧▧▧▧▧					
					270	▧▧▧▧▧					
					280	▧▧▧▧▧					
					290	▧▧▧▧▧					
					300	▧▧▧▧▧					
					310	▧▧▧▧▧					
					315	▧▧▧▧▧				315 m	Ts
					320	▧▧▧▧▧					

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APPENDIX 2

Checklist of determined palynomorphs

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

SBDP #6 079.3
 SBDP #6 157.2

	BEAUPREADITES VERRUCOSUS
	BEAUPREADITES ELEGANSIFORMIS
	BEAUPREADITES TRIGONALIS
	CYATHEACIDITES ANNULATUS
	CYATHIDITES SPP.
	DACRYCARPITES AUSTRALIENSIS
	DILWYNITES GRANULATUS
	DILWYNITES TUBERCULATUS
	ERICIPITES SCABRATUS
	GRANODIPORITES NEBULOSUS
	HALORAGACIDITES HARRISII
	ISCHYOSPORITES GREMIUS
	ISCHYOSPORITES SP.
	LAEVIGATOSPORITES
	LYGISTEPOLLENITES FLORINII
	MATONISPORITES ORNAMENTALIS
	NOTHOFAGUS ASPERUS
	NOTHOFAGUS BRACHYSPINULOSUS
	NOTHOFAGUS EMARCIIDUS/HETERUS
	NOTHOFAGUS FALCATUS
	NOTHOFAGUS FLEMINGII
	PERIPOROPOLLENITES DEMARCATUS
	PERIPOROPOLLENITES POLYORATUS
	PERIPOROPOLLENITES VESICUS
	PHYLLOCLADIDITES MAWSONII
	PODOSPORITES MICROSACCATUS
	POLYCOLPITES SP.
	PROTEACIDITES SPP.
	RETITRILETES AUSTROCLAVATIDITES
	STEREISPORITES ANTIQUISPORITES
	TRIPOROPOLLENITES CHNOSUS
	VERRUCATOSPORITES SP.
	VERRUCOSISPORITES KOPUKUENSIS