DEPARTMENT OF NATIONAL RESOURCES

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1977/19

BMR STRATIGRAPHIC DRILLING IN THE BURKE RIVER STRUCTURAL BELT, SOUTHEAST GEORGINA BASIN, 1974

by

J. Kennard and J. Draper

Appendix I by J.H. Shergold

Record 1977/19

BMR STRATIGRAPHIC DRILLING IN THE BURKE RIVER STRUCTURAL BELT, SOUTHEAST GEORGINA BASIN, 1974

by

J. Kennard and J. Draper

Appendix I by J.H. Shergold

CONTENTS

SUMMARY

During 1974, six stratigraphic holes were drilled by BMR in the Burke River Structural Belt, southeast Georgina Basin. The holes were continuously cored within Palaeozoic sequences which included the Chatsworth Limestone, Ninmaroo Formation, Swift Formation and Pomegranate Limestone. This Record presents a detailed lithologic log for each hole, wireline logs and palaeontological determinations for some of the holes, and geochemical analyses of the core material.

INTRODUCTION

The Georgina Basin (Fig. 1) occupies an area of 325 000 km^2 in Queensland and the Northern Territory. It contains predominantly marine Palaeozoic rocks, mainly carbonates in the north and east, and mixed carbonates and siliciclastics in the west, of Middle Cambrian to Middle Ordovician age. The Burke River Structural Belt (Fig. 1), which was defined by Opik (1960), occupies the southeastern portion of the basin. In this area the Palaeozoic sequence is some 2500 m thick and consists of Middle Cambrian to Lower Ordovician marine carbonate rocks overlying 75 m of "Vendian" to Lower Cambrian rocks, which in turn overlie the Lower Proterozoic basement. The stratigraphic sequence within the Burke River Structural Belt is described in Smith (1972), Shergold, Druce, Radke & Draper (1976), and Shergold and Druce (in prep.). A preliminary special 1:100 000 map of the southern Burke River Structural Belt is available.

During 1974, at the start of the Georgina Basin Project (Druce, 1974), a stratigraphic drilling program was undertaken in the Burke River Structural Belt.

Six holes were drilled between July and November 1974 by the Petroleum Technology Section (BMR), initially by K. Huth, later by K. Huth and T. Shanahan supervised by A. Zoska. A Mayhew 1000 drilling rig was used. Resistivity, S.P. and gamma-ray logs were run for three holes by B. Radke and A. Spence using portable logging equipment. Technical problems prevented the logging of the remaining three holes.

Cores for each hole were described briefly in the field. In the laboratory, the cores were slabbed, photographed in colour and sampled for petrological, palaeontological and geochemical studies. The cores were then re-examined, with thin-section studies of Boulia No. 5, Boulia No. 6 and Duchess No. 13, and detailed lithological logs prepared (Figs 2-7). Dunham's limestone classification, which is based primarily on textural maturity, was used (Dunham, 1962). In this classification, mud-supported carbonates with less than 10 percent grains are mudstones; those with more than this are wackestones. Grain-supported carbonates containing mud are packstones; those without mud are grainstones. Two further types cannot be related to maturity - boundstones, in which an organic framework binds the sediment, and crystalline carbonates. The symbols and abbreviations used on the logs are shown in Tables 1 & 2.

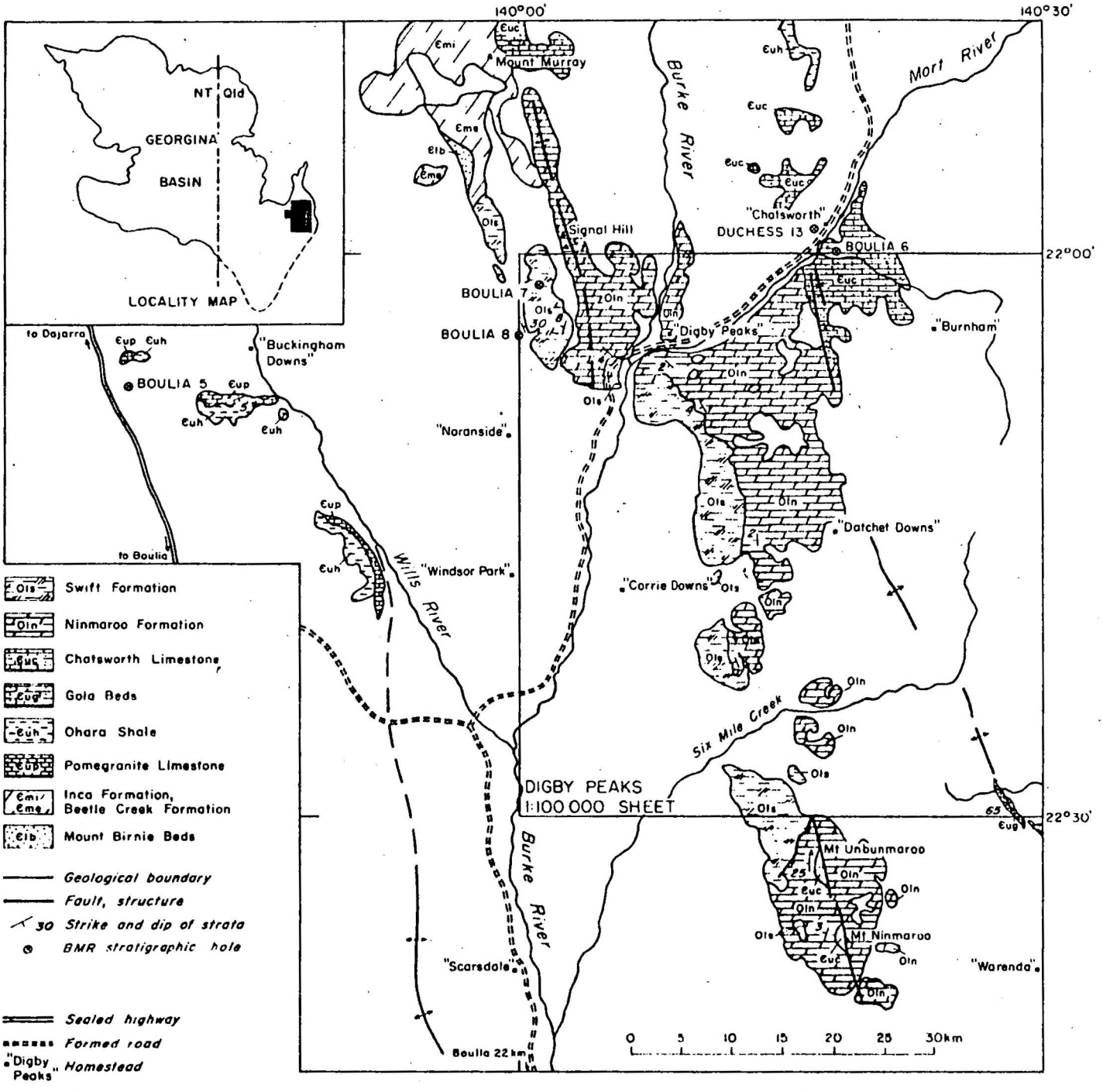


Fig. 1 Burke River Structural Belt, Georgina Basin

The cores are stored at the BMR Core and Cuttings Laboratory, Fyshwick, ACT, and the colour prints and negatives are held by BMR.

PRELIMINARY RESULTS

The detailed lithological logs are shown in Figs. 2-7, and the symbols and abbreviations used on the logs are shown in Tables 1 & 2.

Faunal identifications for Boulia Nos 5, 6 and 9 and Duchess No. 13 are shown in Appendix 1. The geochemical analyses of the cores are shown in Appendix 2, and are discussed with the exception of Boulia No. 9, by Draper (1976). The analyses were done by the Australian Mineral Development Laboratories (AMDEL). Studies of the petrology and depositional environments of the Chatsworth Limestone and Ninmaroo Formation are continuing.

The stratigraphy of each core is discussed below.

(a) BOULIA No. 5

Position;	$139^{\circ}38'$E, $22^{\circ}06'$S (Fig. 1)
Objective:	to examine the relationship between the O'Hara Shale and Pomegranate Limestone.
Drilling:	total depth 100.8 m with continuous coring from 14 m.
Geologists:	field, E.C. Druce; laboratory, J. Kennard.

Boulia No. 5 (Fig. 2a) intersected Palaeozoic limestone beneath 19 m of Cretaceous and younger rocks. The limestone sequence consists of finely laminated silty peloidal grainstone and shaly limestone. It is tentatively placed in the Pomegranate Limestone because of its proximity to outcrop of that unit. However, the sequence is lithologically similar to the Chatsworth Limestone in Boulia No. 6 and Duchess No. 13, a similarity which raises the question of the distinction between the two units. The relationships of the Pomegranate Limestone, O'Hara Shale and Chatsworth Limestone are currently under review.

(b) BOULIA No. 6

Position: 140°18'E, 22°00'S (Fig. 1)
Objective: to examine the Chatsworth Limestone below the type locality.
Drilling: total depth 98.9 m with continuous coring from 12 m.
Geologists: field, E.C. Druce; laboratory, J. Kennard.

Boulia No. 6 (Fig. 3a) intersected 12 m of Cainozoic sediments above the Chatsworth Limestone. The limestone sequence consists of finely laminated silty peloidal grainstone (commonly skeletal), and shaly limestone, together with interbedded sandy ooid-clast skeletal grainstone in the interval 50-55 m, and interlaminated lime mudstone in the interval 55-70 m.

The sequence which crops out in the overlying type locality consists predominantly of sandy peloidal skeletal grainstones, which are devoid of silty and shaly material. Areas of no outcrop, however, are thought to represent silty and shaly limestones similar to those encountered in the drill hole.

(c) BOULIA No. 7

Position: 140°02'E, 22°02'S (Fig. 1)
Objectives: to examine the relationship between the Swift Formation and the Ninmaroo Formation, and to examine the Ninmaroo Formation in an area where it does not crop out.
Drilling: total depth 47.4 m; coring commenced at 4.5 m and recovery was poor due to presence of caverns.
Geologists: field, B. Radke; laboratory, J. Kennard.

Boulia No. 7 (Fig. 4) intersected the Digby Peaks Breccia at 5 m, the Swift Formation at 11 m, and the Ninmaroo Formation at 26 m. It appears that the Digby Peaks Breccia and the Swift Formation represent decalcified and silicified portions of the upper Ninmaroo Formation. The Ninmaroo Formation is calcareous and highly cavernous, and consists of silty peloidal clast grainstone.

(d) BOULIA No. 8

Position: 140°00'E, 22°04'S (Fig. 1)
Objective: to determine the sequence within the Ninmaroo Formation in an area of little outcrop.
Drilling: total depth 67.4 m, with continuous coring from 4 m.
Geologists: field, E.C. Druce; laboratory, J. Kennard, B. Radke.

Boulia No. 8 (Fig. 5) intersected the Ninmaroo Formation at 2 m. The sequence is dolomitic throughout, and consists of very fine to fine dolostone, mudstone, fine grainstone, intraclastic pebbly grainstone, and minor amounts of algal boundstone. The sequence is assigned to the Unbunmaroo Member (Druce et al., in prep.), the basal unit of the Ninmaroo Formation.

(e) BOULIA No. 9

Position: 139°56'E, 22°53'S - Boulia Showground.
Objective: to verify the presence of Ninmaroo Formation in the vicinity of Boulia.
Drilling: total depth 87.7 m with a 2 m bottom-hole core.
Geologists: field, E.C. Druce; laboratory, J. Kennard.

Boulia No. 9 (Fig. 6) intersected 72 m of Cretaceous sandstone and mudstone, and 2 m of dolomite of the Ninmaroo Formation at a depth of 86 m. The dolomite contains rounded pebble-size clasts, one of which is replaced by sphalerite.

(f) DUCHESS No. 13

Position: 140°17'E, 21°58'S (Fig. 1)
Objective: to examine a lower stratigraphic level of the Chatsworth Limestone than that of Boulia No. 6.
Drilling: total depth 84.8 m, with continuous coring from 15.3 m.
Geologists: field, E.C. Druce; laboratory, J. Kennard.

Duchess No. 13 (Fig. 7a) intersected the Chatsworth Limestone beneath 16 m of Cainozoic sediments. The limestone sequence consists of silty peloidal skeletal grainstone (locally oolitic), lime mudstone and shaly limestone. Lithologically the sequence is similar to that in Boulia No. 6, and the palaeontological evidence suggests that the two holes are at the same stratigraphic level (J.H. Shergold, pers. comm., 1977).

REFERENCES

DRAPER, J.J., 1976 - Progress report on Georgina Basin geochemistry - results of 1974 field season. Bureau of Mineral Resources, Australia - Record 1976/57 (unpublished).

DRUCE, E.C., 1974 - Georgina Basin project 1974-1980, a proposal. Bureau of Mineral Resources, Australia - Record 1974/44 (unpublished).

DRUCE, E.C., 1975 - Georgina Basin Project; in GEOLOGICAL BRANCH SUMMARY OF ACTIVITIES 1974. Bureau of Mineral Resources, Australia - report 189, 13-16.

DRUCE, E.C., RADKE, B.M., & SHERGOLD, J.H., in prep. - Upper Cambrian and Ordovician rocks of the Burke River Structural Belt.

DUNHAM, R.J., 1962 - Classification of carbonate rocks according to depositional texture. in: W.E. Ham (Ed.), CLASSIFICATION OF CARBONATE ROCKS. American Association of Petroleum Geologists - Memoir I, 108-21.

OPIK, A.A., 1960 - Cambrian and Ordovician geology (of Queensland). Journal of the Geological Society of Australia, 7, 91-103.

SHERGOLD, J.H., & DRUCE, E.C., in prep. - The Georgina Basin. in: THE LOWER PALAEOZOIC ROCKS OF THE WORLD. Vo. 3, Australasia. Elsevier.

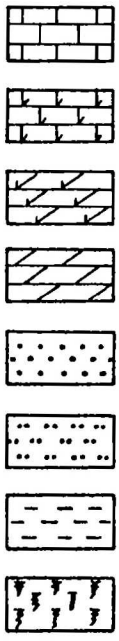
SHERGOLD, J.H., DRUCE, E.C., RADKE, B.M., & DRAPER, J.J., 1976 - Cambrian and Ordovician stratigraphy of the eastern portion of the Georgina Basin, Queensland and eastern Northern Territory. Guidebook, Field Excursion 4C, 25th International Geological Congress, Australia.

SMITH, K.G., 1972 - Stratigraphy of the Georgina Basin. Bureau of Mineral Resources, Australia - Bulletin 111, 156 pp.

TABLE 1

SYMBOLS USED ON LITHOLOGICAL LOGS

LITHOLOGIES



limestone

dolomitic limestone

calcareous dolostone

dolostone

sandstone

siltstone

shale, mudstone

chert

calcareous

dolomitic

chert nodules

conglomeratic

sandy

silty

shaly, muddy

brecciated

veins

BEDDING

very thick (> 100 cm)

thick (30 - 100 cm)

medium (10 - 30 cm)

thin (1 - 10 cm)

laminated (< 1 cm)

GRAIN TYPES

p peloid

ooid

intraclast

pisolith, oncolite

trilobite

brachiopod

pelecypod, rostroconch

pelmatozoan

sponge spicule

ostracod

algae, stromatolite

skeletal algae

fossil undifferentiated

SEDIMENTARY STRUCTURES

lamination

cross-lamination

cross-bedding

ripple, symmetrical

ripple, asymmetrical

slumped bedding

desiccation cracks

pull apart, syneresis cracks

bioturbation, burrows

SAMPLE TYPE

P► petrographic

G► geochemical

TABLE 2

ABBREVIATIONS USED ON LITHOLOGICAL LOGS

Abbreviations used on the lithological logs and not shown here are taken from the list of standard abbreviations used by BMR

( ) parentheses denote poor, weakly developed, or rare

____ underlining denotes good, well developed, or abundant

CARBONATE ROCKS

Bndst	boundstone
Grnst	grainstone
Mdst	mudstone
Pckst	packstone
Wckst	wackestone

GRAIN TYPES

clast	intraclast
ooid	ooid
pel	peloid
skltl	skeletal

SEDIMENTARY STRUCTURES

bd, bdd	bed (ed)
biotrbtd	bioturbated
bnd, bndd	band (ed)
crk	crack
fnstrt	fenestrate
grdd, grdg	graded (ing)
intbd, intbdd	interbed (ed)
intlamd	interlaminated
lam, lamd	laminae (ed)
stromat	stromatolite
Xbdd	cross-bedded
Xlamd	cross-laminated
Xstrat	cross-stratified

DIAGENETIC FEATURES

bdng	boudinage
clcrt	calcrete
cpctd, cpctn	compacted (tion)
crnltd	crenulated
fiss	fissile
frac	fracture
intxl	intercrystal
por	porosity
py	pyrite
replmnt	replacement
soln	solution
stn, stnd	stain (ed)
styl	stylolite
sut	sutured
vn	vein
xl	crystal

POROSITY SIZE MODIFIERS

lmg	large megapore	(32 - 256 mm)
smg	small megapore	(4 - 32 mm)
lms	large megapore	(0.5 - 4 mm)
sms	small mesopore	(0.06 - 0.5 mm)
mc	micropore	(0.06 mm)

B.M.R. BOULIA No. 5

DEPTH IN METRES	CORE NO.	COLOUR PHOTOGRAPHY	SAMPLES	SEDIMENTARY STRUCTURE	SILICICLASTIC GRAIN SIZE	LITHOLOGY	GRAIN TYPES
0	CUTTINGS					*Soil*	
						v lt gy & lt brn Sltst	
5						*gy orng Sltst*	
						rd brn & gy; orng Sltst	
10						*pl rd & gy orng Sltst*	
						orng pnk Mdst	
15	1			≡		*lamd yel orng & rd orng Mdst*	
	2			≡		*lamd yel orng Mdst; blk oxd lam [Mn?].*	
20	3			≡		*lamd dusky yel, olv gy, gy grn, gy purp v slt Lst; minor lam lt olv gy (slt) Grnst, pel: cpctn bdng*	p
	4		PG	—		*lt gy slt Grnst, pel; coloured lam slt Lst: fiss; weath, Fe stn*	p
				≡		*lamd dusky yel, olv gy, gy grn, gy purp v slt Lst; minor lam lt olv gy (slt) Grnst, pel: weath, Fe stn, cpctn bdng*	p
25	5					*lt gy Lst [re xl Grnst, pel ?]; intlamd coloured v slt Lst [pel Grnst ?], vf re xl; cpctn bdng; f Frac Calc infill.*	p
			PG	≡		*lamd dusky yel, olv gy, gy grn & gy purp v slt Lst; minor lam lt olv gy (slt) Grnst, pel: weath Fe stn; cpctn bdng.*	(p)
	6			≡		*md lt gy & lamd md gy v slt Grnst, pel, Xlamd; rare lam lt gy [olv] Mdst/Wckst: cpctn bdng; Frac, Calc infill.*	p
	7					*md gy & lt olv gy Mdst & Grnst, pel; calc; sh lam: weath; f Frac, Fe stn*	(p)
30	8						
	9		PG	≡		*intlamd md gy & md dk gy slt Grnst, pel & sh lam; num lam & lens lt olv gy Grnst/Pckst ?, pel: cpctn bdng; Styl, vrtl, sut; (Frac), Calc infill; Py*	p
	10			=		*md gy slt Grnst, pel; minor intlamd md gy & dk gy slt & sh Grnst, pel; Diastem ?: cpctn bdng; Styl, flat & vrtl, sut; Py*	p
35	11			≡		*intlamd md gy & md dk gy slt Grnst, pel & sh lam; minor lam lt olv gy Grnst/Pckst ?, pel: cpctn bdng; Py*	p
						lt olv gy Mdst & Grnst, pel; dk gy calc Sh; md gy slt Grnst, pel [poor core recovery – Sh ?]: f(Frac), Calc infill, fiss; Py	p
	12		PG	≡		*intlamd md gy & md dk gy slt Grnst, pel & sh lam; minor lam lt olv gy Grnst/Pckst ?, pel: cpctn bdng; Py*	p
40	13			≡		*lamd lt olv gy Grnst/Pckst, pel & minor Mdst; intlamd md gy & dk md gy slt Grnst, pel & sh lam: f Frac, Calc infill, Py*	p
			PG	⊖		*md lt gy & lt olv gy Wckst/Mdst, biotrbtd; minor tn lam dk gy Sh: Styl, vrtl, sut; f Frac, Calc infill; Py*	p
	14					*intlamd md gy & md dk gy slt Grnst, pel & sh lam; abn lam lt olv gy Pckst/Grnst, pel: cpctn bdng; (Styl) vrtl, sut; Py*	p
			PG	=		*lt olv gy Pckst/Grnst, pel; rare lens Mdst; lamd md gy & md dk gy slt Grnst, pel: cpctn bdng; (Styl) vrtl, sut; f Frac, Calc infill.*	p
45	15			⊖ ≡		*md lt gy & lt olv gy Mdst & Wckst, biotrbtd; intlamd md gy & dk gy slt Grnst, pel: Styl, vrtl, sut; f Frac Calc infill; Py*	(p)
	16		PG	⊖		*intlamd md gy & dk gy slt Grnst, pel; abn lam & bds lt olv gy Pckst/Wckst ?, pel, biotrbtd: cpctn bdng*	p
						2cm bd lt olv gy Grnst, clast [elongate lath], pel	p
				≡		*intlamd md lt gy [olv, grn] slt Grnst, pel & md dk gy sh lam: Py*	⊘ p
	17			≡		*md gy slt Grnst, pel, Xlamd; tn lam md dk gy Sh: Py*	p
50				≡		*intlamd md lt gy [olv, grn] slt Grnst, pel & md dk gy sh lam: Py*	p
	18		PG			*intlamd md lt gy [olv, grn] slt Grnst, pel & sh lam; abn lam [rare towards top] lt olv gy Wckst/Pckst ?, pel: cpctn bdng; fiss; Py*	p
				≡		*intlamd md lt gy [olv, grn] slt Grnst, pel & md dk gy sh lam: Py*	p
	19						
55			PG	≡		*intlamd md lt gy & md dk gy slt Grnst, pel & sh lam, abn lam [rare towards top] lt olv gy Wckst/Pckst, pel: cpctn bdng, fiss; Py*	p
	20					*lt olv gy Mdst; intlamd md lt gy & md dk gy slt Grnst, pel & sh lam: f Frac, Calc infill; Py*	p
			PG	≡ (⊖)		*intlamd md lt gy [olv, grn] slt Grnst, pel, Xlamd, & md dk gy sh lam; loc lam lt olv gy Wckst/Pckst ?, biotrbtd, : (cpctn bdng); Py blebs*	p
	21			≡ ⊖		*intlamd md lt gy & md dk gy slt Grnst, pel & sh lam: abn lam [rare towards top] lt olv gy Pckst/Wckst ?, pel, biotrbtd; rare lam Mdst: cpctn bdng*	(p)
60			PG				
	22			⊖		*lt olv gy Mdst & Wckst, biotrbtd, rare v tn lam blk Sh [carb ?]: Styl, vrtl, sut; f Frac, Calc infill; Py infilling burrows*	(p)
	23			≡		*intlamd md lt gy [olv, grn] slt Grnst, pel & md dk gy sh lam: fiss; Py*	p
			PG				
65	24			≡ ⊖		*intlamd md lt gy & md dk gy slt Grnst, pel & sh lam; abn lam [rare towards top] lt olv gy Pckst/Wckst ?, pel, biotrbtd; rare lam Mdst: cpctn bdng; fiss*	p
				⊖		*lt olv gy Mdst, biotrbtd; lt gy Mdst ? infilling burrows.*	
			PG				
	25					*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam: fiss; Py*	p
			PG	⊖		*intlamd md gy [olv, grn] slt Grnst, pel; abn lam [rare towards top] lt olv gy Wckst/Pckst, biotrbtd: cpctn bdng; Py, infill burrows*	p
70	26			⊖		*md lt gy & lt olv gy [loc mtl] Wckst/Pckst ? pel & Mdst, biotrbtd; rare tn lam gy blk Sh, [carb ?]: Styl, vrtl sut; Frac, Calc infill*	p
			PG			*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam: fiss; Py*	p
	27						
						intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam; lam md lt gy Grnst [Pckst ?], pel: cpctn bdng	
75	28					*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam; abn lam & bds lt olv gy Mdst & Wckst ? [becoming rare towards top]: cpctn bdng; f (Frac) Calc infill; fiss*	p
			PG			*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam: fiss; Py*	p
	29						
			PG	≡		*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam; loc lam lt gy (slt) Grnst, pel & lt olv gy Wckst/Pckst ?: cpctn bdng; fiss; Py*	p
	30						
80							
	31		PG			*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam: fiss; Py*	p
	32			≡ ⊖		*intlamd md gy [oiv, grn] slt Grnst, pel & dk gy sh lam; abn lam [rare towards top] lt olv gy Wckst, pel, biotrbtd: Styl, vrtl, sut; cpctn bdng; Py*	p
85			PG			*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam: fiss; Py*	p
	33					*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam; lam lt olv gy Wckst/Mdst ?: cpctn bdng*	p
	34		PG			*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam: fiss; Py*	p
						intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam; lam lt olv gy Wckst/Mdst ?: cpctn bdng	p
90	35						
			PG			*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam: fiss; Py*	p
	36					*7cm bd lt olv gy Mdst/Wckst ?, nod: soln Brec ?; Frac, Calc infill*	
95	37		PG			*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam; lam lt olv gy Wckst/Mdst ?: cpctn bdng.*	
						intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam: fiss; Py	p
						10 cm bd md gy slt Grnst, pel, clast [at base], Xlamd	p
	38					*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam; lam lt olv gy Wckst/Mdst ?: cpctn bdng; (Styl) vrtl, sut.*	p ⊘
				≡		*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam: fiss; Py bnds*	p
	39		PG	⊖ =		*intlamd md gy [olv, grn] slt Grnst, pel & dk gy sh lam; lam lt olv gy Wckst ? biotrbtd: cpctn bdng; (Styl) vrtl, sut; Py.*	
100				≡ =		*lt gy Wckst ? nod; intnod dk gy sh lam: cpctn; Styl, vrtl, sut*	
T.D. 100·79						*intlamd md gy [olv, grn] slt Grnst, pel, Xlamd & dk gy sh lam; rare lam lt olv gy Wckst/Mdst ?: (Frac), fine; fiss; Py, v rich bnds*	p
						lt gy Wckst ?, nod; intnod dk gy sh lam: cpctn; Styl, vrtl, sut	

RECORD 1977/19

FIG. 2a

DATE: 29. 1. 76

GEOLOGIST: J. Kennard

MAP SHEET: BOULIA 1:250 000

F 54/A10/88

B.M.R. BOULIA No. 5

DEPTH IN METRES

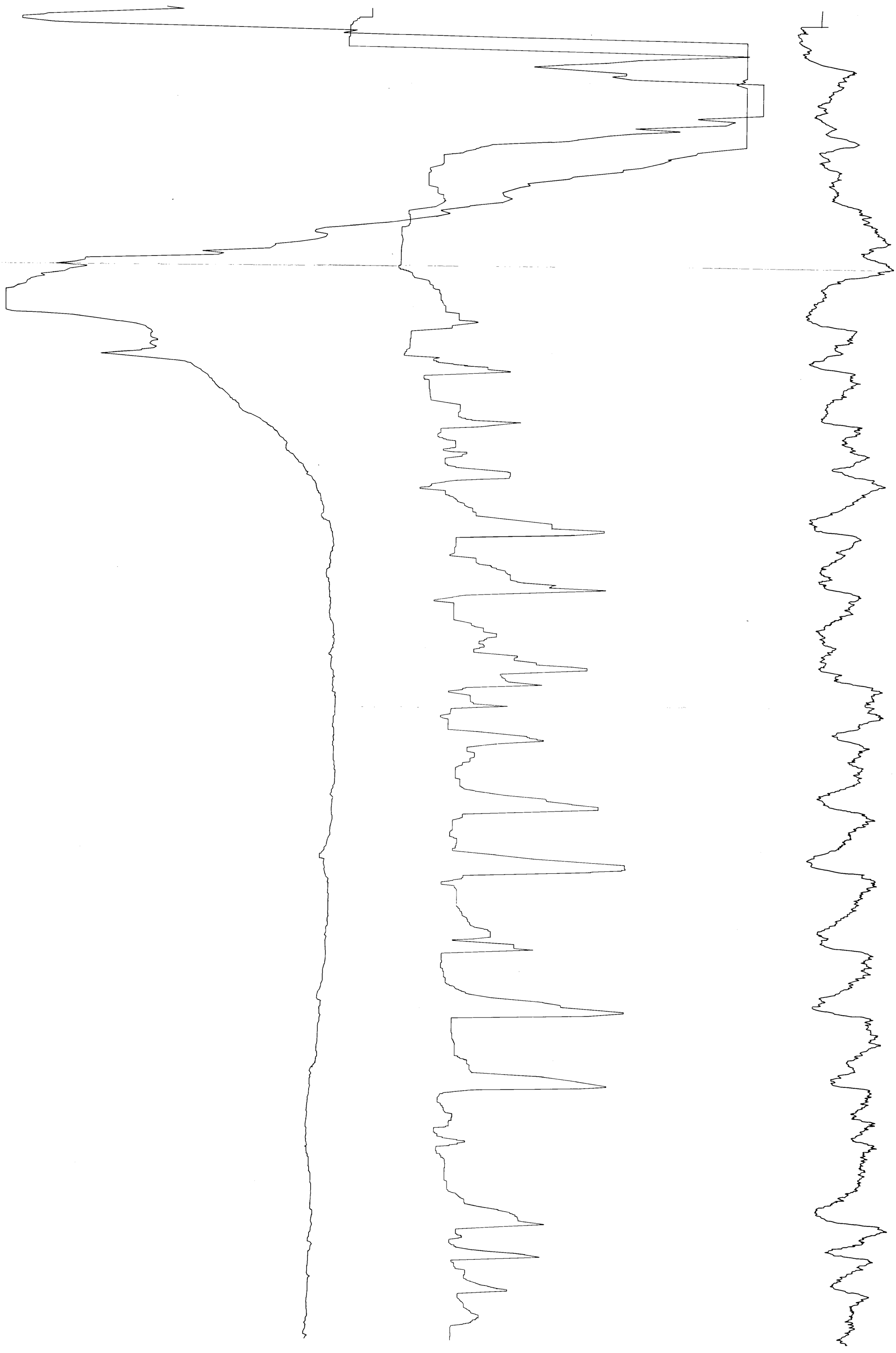
SP 50 mv

RESISTIVITY 100 Ω

GAMMA RAY T = 3 sec.
R = 6 m/minute

0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100

T. D. 100·79



RECORD 1977/19

FIG. 2b

DATE: 2. 8. 74
GEOPHYSICISTS: A. Spence
B Radke

F 54 / A 10 / 102

B.M.R. BOULIA No. 6

DEPTH IN METRES	CORE NO.	COLOUR PHOTOGRAPHY	SAMPLES	SEDIMENTARY STRUCTURE	SILICICLASTIC GRAIN SIZE	LITHOLOGY	GRAIN TYPES
0	CUTTINGS					*Soil, Qtz*	
5							
10						*Sh & calc Sltst*	
15	1			=	c	*gy orng, ang Qtz, slt Mtx*	
	2		PG				
	3						
	4			≡		*intlamd md lt gy slt Grnst, pel [loc Pckst ?]; tn bnds olv gy/gy rd / grn gy / yel brn calc Sh: cpctn bdng; fiss*	p
	5		G				
20	6						
	7		G	≡		*md lt gy slt Grnst, pel; intlamd olv gy sh calc Sltst: (Frac), Calc infill; Py.*	p
	8		PG	≡	θ	*md lt gy v slt Grnst, pel, (skltl), dk gy sh lam; intlamd (slt) Pckst & Wckst ?, pel, biotrbtd; olv gy slt Pckst, skltl at top, pel : cptn bdng; Py.*	p
25	9		Fault	(θ)		*lt olv gy Wckst ?, Pckst ?; lam olv blk calc Sh; p yel brn Mdst, biotrbtd: fault Brec ? at top; soln Brec, Si infill; Styl, flat bnds.*	p
			G				
	10			≡̃ (θ)		*md lt gy slt Grnst, pel, (skltl), loc clasts [irreg] & Pckst ?, (Xlamd), md dk gy lamd sh intervals; minor lam lt olv gy Mdst & Wckst ?, pel, (biotrbtd): cpctn bdng; Py*	p (◠)(⊘)
30			G				
	11			(≡) θ		*lt olv gy Mdst, biotrbtd; md gy slt Grnst, pel; lam olv gy sh Lst: partil re-xl; (Por), loc vug [mg]; Frac, Calc infill; Py*	p
	12		PG				
35							
	13		G	≡	θ	*md dk gy slt Grnst, pel, (skltl), lamd; lt olv gy Mdst (predom at base): (Styl), sut; Py*	p (◠)
	14					*lt olv gy Mdst ? [Wckst ?], f vrtl Cracks, Calc infill, syneresis ?; tn lam olv blk calc Sh: (Styl), sut; fiss*	
			PG				
40	15						
	16		G	≡̃		*md-dk gy slt Grnst, pel, (skltl), (Xlamd), slt bnds; minor lt olv gy Mdst & Wckst, pel, (skltl), biotrbtd, (Xlamd): (Styl) sut; fiss; Py*	p (◠)
45	17		G			*3 cm olv gy slt Grnst, skltl, clast; md gy slt Pckst, skltl, pel: Py;*	p ◠ ⬠ ⊘
	18					*md gy Grnst, clast [lath, subrndd], skltl:*	⊘ ◠
			PG	≡̃		*md gy Grnst, pel, (skltl), (Xlamd); intlamd olv gy sh Grnst, pel: cptn bdng; Styl, bnds; fiss; Py*	p (◠)
	19			θ		*lt olv gy Mdst & Wckst, pel, skltl, biotrbtd; local Grnst, skltl, clast [rndd]: (Styl) tn bnds; fiss*	p ◠ (⊘)
50				≡ θ		*intlamd lt olv gy Mdst & Wckst, pel, biotrbtd, (Xlamd); olv gy sh Grnst, pel, (skltl): fiss, Py*	p ◠
			G	≡̃		*md gy slt Grnst, pel, skltl, Xlamd; intlamd olv blk sh Lst: Styl, flat; cpctn bdng; fiss; Py*	p ◠
	20			≡ vf		*md lt gy sd Grnst, ooid*	⊙
				≡		*md gy Grnst, pel; tn olv blk sh lam; md gy & p yel brn Grnst, clast [lath], skltl: Styl; Si re-pl; Py*	p ◠ ⊘
			P	≡ vf		*md lt gy sd Grnst, coid, clasts:*	⊙ ⊘
				≡		*md gy slt Grnst, pel; tn olv blk sh lam: Styl, sut*	p
	21		PG	≡̃ f		*olv gy & p yel brn sd Grnst, skltl, ooid, clast [md srtd], Xlamd: (Styl), sut, flat*	◠ ⬠ ⊙ ⊘
55	22		G	≡̃ θ		*intlamd lt olv gy Mdst, biotrbtd; md lt gy Grnst ? pel; olv gy sh Grnst, pel, skltl, (Xlamd): cpctn bdng; fiss; Py*	p ◠
			P			*8 cm md lt gy slt Grnst, skltl, Pckst in part: skltl repl by Si*	◠ ⬠
	23		PG				
60	24			= (θ)		*lt olv gy Grnst, pel, skltl; rare p yel brn Mdst, biotrbtd; lam brn blk calc Sh (skltl): vf re-xl; cpctn bdng; fiss; f vrtl Frac, Calc infill; (Py)*	p ◠ (⬠)
						intlamd p yel brn Mdst, biotrbtd; olv gy cl Grnst, pel, skltl, lens Wckst ?, pel; md gy Grnst, pel, ooid, Xlamd: cpctn bdng; vrtl (Frac), Calc infill; fiss; Py	p ◠ ⊙
	25		G	≡ θ			
65	26		G	≡ θ		*intlamd md yel brn Mdst, (skltl), biotrbtd, lamd [algae ?]; olv blk calc Sh; minor md gy Grnst, pel: (Vng), Calc, at base; Styl, bnds & sut; vrtl Frac, Calc infill, in Mdst; Py*	◠ (⟩–) p –◎– ?
	27						
			PG				
70	28						
	29		G				
				θ		*olv gy Mdst ? biotrbt; Grnst, sklt, clast: Py*	◠ ⊘
75	30		G				
	31			≡		*intlamd md gy Grnst ?, pel, (skltl); olv gy Grnst ? Pckst ?, pel; olv blk calc Sh: cpctn bdng; fiss; Py*	p ◠
			PG				
	32						
80	33		G				
	34		G				
85				≡		*intlamd dusky yel brn sh Lst; md gy Grnst ? pel: cpctn bdng, fiss; Py*	p ?
	35			≡		*intlamd olv gy sh Grnst ?, pel; md gy Grnst, pel; cpctn bdng; fiss;*	p
			PG			*Algae Girvanella*	⚡ (◠ ?)
	36						
90	37		G				
	38		G	≡̃		*intlamd (slt)(sh) md gy Grnst, pel, (Xlamd) [1-2 cm sets]; olv blk calc Sh: cpctn bdng; fiss; Py*	p ⬠
95	39		G			*s lens [2 x 3 cm] md gy Grnst, skltl [in situ ?]: Py*	⬠
	40		PG				
T.D. 98·90							

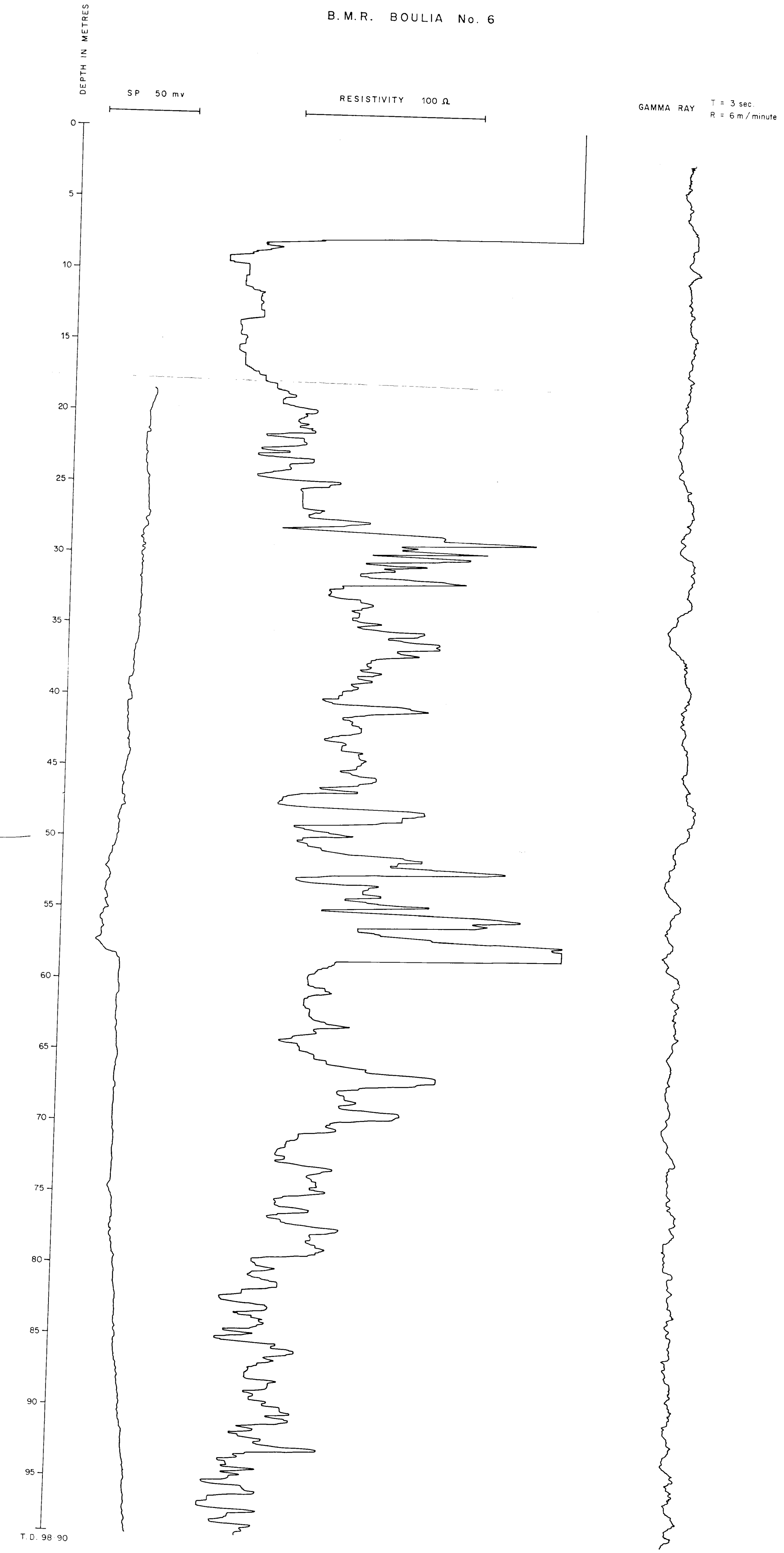
RECORD 1977/19

FIG. 3a

DATE: 25.11.75
GEOLOGIST: J. Kennard
MAP SHEET: BOULIA 1:250000

F 54/A10/84

B.M.R. BOULIA No. 6



RECORD 1977/19

FIG. 3b

DATE: 3. 8. 74

GEOPHYSICIST: A. Spence

F 54 / A 10 / 101

B.M.R. BOULIA No. 7

DEPTH IN METRES	CORE NO.	COLOUR PHOTOGRAPHY	SAMPLES	SEDIMENTARY STRUCTURE / SILICICLASTIC GRAIN SIZE	LITHOLOGY	GRAIN TYPES
0						
5	1		P,G		*wh mass si Brec, Clasts md gy Cht [frgmntd cht Pbl?]; Mtx indd wh slt Clst [Slst?]: Por, vug [mc], frac*	
	2					
	3		G		*dk yel orng & brn Brec [after crbn Brec?]; Clasts md gy Cht & indd wh Clst; Mtx fri Sltst: Por, vug [mc & ms], intprt; Lmn stn*	
10	4					
	5		P,G			
	6			≡	*wh Clst, colour lamd [after Crbn?]; bds & frag? md gy Cht, foss, pel*	(⊘) (p)
	7					
15	8		P,G			
	9		G	≡	*lt gy yel orng Clst, colour lamd c zone mtl brn [after Crbn?]; tn bds dk yel brn si Grnst? [slt pel Grnst?]: Por, vug [mc]; lmn Piso [2mm]*	p?
	10					
	11		G		*wh Clst, chk [after Crbn?], bds md yel brn slt si Grnst? [slt pel Grnst?]: Por, vug [mc]*	p?
20			P,G			
	12			vc	*tn bd vc uncons Sd [aph Cht & Clst grains, rndd, srtd]: Por, intprt*	
	13			≡	*p yel orng & mtl wh Clst, chk [after Crbn?]; bd yel brn si Grnst? clast?: Por, vug [mc]; Frac dk brn Oxd; Mn Dendrites*	⊘?
			P,G			
	14			≡	*intlamd wh & v lt gy olv Clst, chk [after Crbn?]; bds & lens v lt gy aph Cht & si yel gy brn Grnst, skltl (clast): Por, vug [mc+mg], frac; (Mn Dendrites); f Fracs*	◎ (⊘)
25			P,G			
	15		P,G		*basal 10cm – yel gy si Grnst, skltl (clast): Por, vug [ms]*	◎ (⊘)
					Cavern	
					dusky yel & v lt gy Cht, pel or aph, strk of blk Oxd; v lt gy Grnst, pel; olv gy calc Dol:	
					No recovery Numerous minor cavities Lost circulation	
30			CUTTINGS			
35					*Cavern*	
			P,G		*v lt gy Grnst, clast, pel, (skltl)*	⊘ p ◎
	16			≡	*yel gy slt Grnst, pel (skltl), sd at base; slt & sh lam: f partl Dol xl; Por, vug [mg], frac; soln Brec, Calc Ct; Frac, Mn stn & Dendrites & assoc cl gouge.*	p ◎
40						
					No recovery Lost circulation	
45	17				*gy orng fri calc Sltst [soln of v slt pel Grnst?] & cl gouge: Por, frac, instl, vug [mc]; Frac, partl Dol infill, Mn stn, assoc cl gouge*	
	18		G P,G	≡	*gy orng v slt Grnst, pel; lam lt olv brn sh Lst: (Vn), Calc infill; vrtl Frac & hrtl seam of Mn Oxd, Dendrites*	p
T.D. 47·40						

RECORD 1977/19

FIG. 4

DATE: 16.1.76
GEOLOGIST: J. Kennard
MAP SHEET: BOULIA 1:250 000

F 54/A10/90

B.M.R. BOULIA No. 8

DEPTH IN METRES	CORE NO.	COLOUR PHOTOGRAPHY	SAMPLES	SEDIMENTARY STRUCTURE	SILICICLASTIC GRAIN SIZE	LITHOLOGY	GRAIN TYPES
0	CUTTINGS					rd/brn sd Gv (Swift Formation Rub)	
						yel gy [Grnst ?]; gy orng dolLst [Grnst ?]: f xl; blk Oxd [Mn] spots.	
5	1			(≡)(θ)		yel gy Mdst, (biotrbtd), motl c̄ tn lamd bnds: vf xl; tn bnds of soln Brec; Styl, sut, reg - irreg; (Frac).	
	2			≡ (θ)		yel gy Mdst, (biotrbtd); intbdd md pk gy Grnst, f, (slt): f xl; Por, intxl, assoc Mn stn near top; (Styl), sut, reg; (Frac).	
	3			θ			
	4		PG	≡ (θ)		p yel brn Mdst, (biotrbtd); intbdd Grnst ?, slt: vf xl; (Por), vug [styl + frac control]; cpctn Lam c̄ dusky yel Styl [flat, reg, cl Bnds]; (Frac); gy orng Zones c̄ Mn Dentrites at bottom.	
10	5					p yel brn Grnst ?, f, some vc patches: f xl; (Por), intxl + (vug) [frac + Styl control] towards top; cptn nds, dusky yel; Styl, flat, reg; 2 tone.	
	6		PG			p yel brn Grnst, clast [subrndd, 1cm, Grnst ?], (skltl); Por, loc, vug, intxl; Styl.	⊘ ⬠
	7			≡ ≐		p yel brn Grnst, f, (Xstrat) [3 cm sets, low angle]; (Grnst), clast [lath, ang, 1 cm]: f xl; (Por), loc, intxl; Styl, cl, flat, reg; minor Vng, pk Dol infill c̄ assoc ? Calcrete ?	(⊘)
	8		PG			yel gy Grnst, f to vc in Bnds, clast [pel, (ooid)]: cpctd; (Styl), irreg, flat.	⊘
15				(θ)		dusky yel Mdst ? (biotrbtd): vf xl; Styl, vf, tn, flat; Frac.	
				(θ)		yel gy Grnst ? f, (lamd), grdg to intlamd dusky yel Mdst, (biotrbtd): Styl, sut + flat; (Frac).	
				≡ (θ)		dusky yel Mdst, (biotrbtd), intbdd md yel brn Grnst ? : vf - f xl; (Styl), flat, reg; Frac.	
	9		PG			md olv gy Grnst ?: f - m xl; Por, intxl, loc Frac control; styl Base; f (Frac).	
				(≡)(θ)		lt yel gy & dusky yel Mdst; intbdd (Grnst ?), lamd, (biotrbtd): f-vf xl; (Por), frac; soln ? Brec; Styl, flat, reg to irreg.	
				≡		lt gy Grnst, clast [lath, rndd] at base; Mdst (lamd): vf xl; (Styl), reg, sut; (Frac).	⊘ ⌒
20	10		PG	≡ (θ)		md brn gy Mdst ? unit, grdg up to lamd Mdst, (biotrbtd): f xl; (Styl), flat [irreg], sut [reg]; soln brec Bnd; (Frac).	
	11			≡ (θ)		dusky yel Mdst, lamd, algal ? (biotrbtd); intlamd p yel Grnst ? clast [lath, Mdst]: (Por), frac + (vug); Styl, reg, flat + sut; (Frac)	⌒ ⊘
						wh, gy orng Vn, soln clasts; motl Fe/Mn stnd margins, Calc infill.	
			PG	≡ ≐		p & vp yel brn, (Xstrat) [3 cm sets, low angle]: f xl; intxl Por [frac control]; cpctn Lam; Mn Dentrites	
				≡ (θ) ⌐		dusky yel Mdst, (biotrbtd), dessicn crckd; intbdd slt Dol: (Styl), flat; (Frac).	
	12			≡ (θ)		p yel brn Mdst, lamd, (biotrbtd); inbdd Mdst, unif: vf xl; (Frac), Mn stn	
25						wh, gy, orng Vn, soln clasts; motl Fe/Mn stnd margins, Calc infill.	
			PG			p yel brn motl Mdst ?: vf xl; Styl Lam	
	13			≡ (θ)		dusky yel + md yel brn Mdst, lamd; intbdd Grnst, clast [lath, rndd]: f xl; (Por), intxl [frac control]; Styl, flat, reg; loc soln Brec.	⊘
						gy orng + p yel brn Brec, soln clast; f (Frac); Styl, bndd.	
				≡ (θ)		v lt olv gy + md gy Mdst (biotrbtd), lamd; motl lt gy Mdst ? to top: (Por), frac; Styl, bndd.	
	14		PG	≡		lt brn gy Grnst ?, clast [lath, rndd, dol]: f xl; Styl, flat, irreg.	⊘
				≡		lt brn gy: vf xl; (Por) frac; lt olv brn Styl, flat, cl bnds; loc soln Brec; Vn, Calc infill	
30						lt gy vari pk gy Grnst ?, skltl, clast: f - vf xl; (Por), intxl; Styl bnds; Fracs	⊘ (◎)
	15					lt yel brn; intbdd Grnst ?, clast [lath, subrndd]: f xl; Por, intxl + vug [assoc c̄ fracs]; Styl cl bnds; Frac	(⊘)
			PG	≡ θ		lt brn gy intbdd dusky yel Mdst ? biotrbtd: f xl; Styl, flat bnds, stylo - brec c̄ Si at top.	
	16		PG	≡ θ		lt olv gy; p yel brn intbdd Mdst ? biotrbtd; intbdd lt brn gy Grnst. ?: vf xl; (Por) loc, intxl [styl control]; Styl bnds, flat; Frac at base	
				θ		dk yel brn biotrbtd Mdst ? tn md yel orng lam: vf xl; Styl, flat, irreg, intconn; (Frac)	
35				θ		motl, biotrbtd; Styl, sut.	
				≡		dusky yel, lt olv gy motl Mdst ?; intbndd Grnst ? [Xlamd]: vf xl; Styl; Frac.	
	17					pk + dk yel brn Grnst, clast [rndd, vari]: vf xl; Por, vug [ms, styl control]: Styl, sut.	⊘
			PG	≡		md yel brn, dusky yel vari; tn intbdd Mdst; (Grnst), clast [lath]; v tn cl Lam: vf xl; Styl, tn bnds, flat [emphasize Lam]; Frac.	(⊘)
	18			↔		gy orng + yel gy [motl] Mdst; algal ? [fnstrt]: vf xl; (Styl): Frac	⌒ ?
40	19		PG	≡ (θ)		lt yel brn Mdst ? (biotrbtd). intbdd vf xl; Por, vn [por Calc, Mn infill]; Styl, flat; Frac.	
				≡ (θ)		lt yel brn, intbdd dusky yel: f - vf xl; (Por), loc soln of vugs, frac; Styl, flat, tn bnds; Frac.	
				(θ)		lt yel brn motl: f xl; Por, vug, intxl; Styl, flat; (Frac).	
						lt brn gy, motl orng Bndst, algal: f - c xl; Por, intxl [frac control], vug; Si	⌒
				≡		lt olv gy Mdst ? : f xl; (Por) inxl; (Styl), flat.	
	20			≡		lt brn gy, p yel brn: f xl; (Por) frac; Styl Lam; Vug, Si infill; (Frac)	
			PG			lt brn gy Grnst ? clast: f xl; (Por), frac, vug [ms, intconn]; Styl, intconn; Frac	⊘
	21			(≡)		p rd; intbdd tn cl Lam: f xl, (Styl).	
45	22			(≡)		p yel brn: f xl. Intbdd lt brn gy Grnst ? clast: f xl; Styl, flat; Frac	⊘
			PG	(≡)(θ)		gy orng Mdst, biotrbtd; intbdd Mdst, lamd, algal; intbdd Grnst, clast: vf xl; Frac	⌒ ⊘
	23			(≡)		p yel brn Bndst, algal at base; overlying Grnst ?: f xl; (Por), vug, fr; Styl, flat + sut; (Frac)	⌒
				≡ (θ)		p yel brn Mdst, lamd [algal ?]; intbdd lt olv gy Grnst, biotrbtd in lower section: f - vf xl; (Styl); (Frac).	⌒ ?
			PG				
				≡		p yel brn Grnst ? clast [rndd, laths]: f xl; Por, intxl [assoc c̄ styl, frac]; Frac. Intbdd dusky yel Mdst ? cracks [synaeresis]	⊘
50	24					vf xl.	
				≡		p yel brn Mdst ?, lamd; intlamd Grnst ? (clast): f - vf xl; patchy Por, frac, vug, in dk yel bnds; (Frac)	(⊘)
	25		PG	≡ (θ)		dusky yel Mdst ? cracks [synaeresis]: vf xl; Por, frac; Styl lam, flat; (Frac)	
				(≡)		p yel brn; v tn cl Lam: f - vf xl; (Por), loc vug [intconn, ms], frac; loc cpctn bnd; Brec [tn bnds of soln and frac]; Frac.	
55	26			(≡)		p yel brn: vf xl; Por, vug [loc calc infill], intxl; (Styl), flat + sut; Frac.	
			PG	(≡)		lt brn gy: vf xl; Por, intxl; Styl, flat + sut; dusky yel cpctn bnds; (Frac).	
				(≡)(θ)		p yel brn: vf xl; (Por), vug [ms, intconn, some infilled]; cpctn bnds [unif].	
	27			↔		dk yel brn: vf xl; Vug, ms, Dol infill. pk gy bnds, clasts [evaps ?]	
			PG	(≡)(θ)		lt yel brn: vf xl; dusky yel cpctn Lam [unif]; (Frac).	
	28					dusky gy Grnst, clast [yel rndd laths]: f xl; Por, vug at top; Frac.	⊘
						lt yel brn: vf xl; Vng, hrtl, gy orng pk Dol + clear Calc infill; Por, vug.	
60				θ		yel gy motl, biotrbtdt: vf xl; Por, loc, vug [ms, intconn]; Styl, flat to sut.	
	29			≡		dk yel brn / dusky brn, vari; vf lam: vf xl; Styl, irreg; Vug, irreg.	
			PG	≡ (θ)		pk gy + dusky yel bnds: vf xl; Styl.	
						lt yel brn slt: vf xl; Por, intxl [irreg], vug [irreg, partil infill]; Frac.	
	30					pk gy / lt olv gy motl, vari: vf xl; Vug, irreg, Calc infil; Styl lam; Frac.	
				(≡)		lt olv gy, lamd: vf xl; Styl, flat, reg: Frac.	
	31		PG		vf	lt yel brn sd Grnst ?, skltl [complete geopetal]: vf xl; Styl lam, tn yel gy; Frac	▽ or ♉
				θ		dusky yel, motl, slt: vf xl; (Styl).	
65				≡		v lt brn, cracks [synaeresis]: vf xl; (fnstrl Vug); Styl lam + yel gy cpctn Bnds	
	32			⌀(≡)		md lt gy, (lamd): vf xl; irreg tn yel gy lam cpctd Dol; Por, frac; Styl; Frac.	⌒ ?
			PG	⌀(≡)		md lt gy: vf xl; tn yel gy lam of cpctd Dol; Styl; (Frac)	

T.D. 67·40

RECORD 1977/19

FIG. 5

DATE: 18.11.75

GEOLOGISTS: B. Radke
J. Kennard

MAP SHEET: BOULIA 1: 250 000

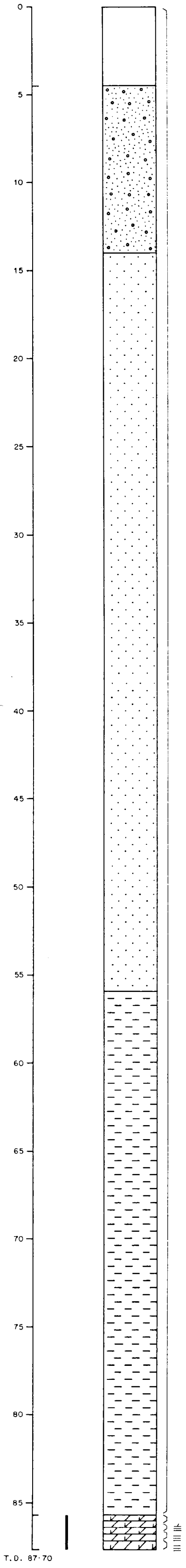
F 54 /A 10/91

B.M.R. BOULIA No. 9

DEPTH IN METRES | CORE NO. | COLOUR PHOTOGRAPHY | SAMPLES | SEDIMENTARY STRUCTUR | SILICICLASTIC GRAIN SIZ

LITHOLOGY

GRAIN TYPES



Soil, Gvl

Sd, Gvl

Sst

Drillers Report — cuttings unavavailable

Mdst

motl p yel brn/gy & olv gy Grnst ? : f-vf xl; Por, vug [ms], intxl; Styl, bnds, irreg; Py
lt gy Grnst, skltl, Xlomd; lt gy Grnst, clast [rndd, (repld by Sphal)], skltl: f xl; Por, vugs [ms], intxl; Styl bnds, irreg Py
md olv gy Grnst ? [clasts ?, skltl ?]: f-vf xl; Por, intxl, (frac); Py
lt brn olv gy & olv gy, lamd; lt gy Grnst ? intlamd brn olv gy, olv blk sh: f-vf xl; Por, intxl; Styl bnds, irreg; cpctn bdng.

RECORD 1977/19

FIG. 6

DATE: 21.12.75
GEOLOGISTS: J. Kennard
MAP SHEET: BOULIA 1:250000

B.M.R. DUCHESS No. 13

DEPTH IN METRES | CORE NO. | COLOUR PHOTOGRAPHY | SAMPLES | SEDIMENTARY STRUCTURE | SILICICLASTIC GRAIN SIZE | LITHOLOGY | GRAIN TYPES

0					c	*rd uncons Sd*	
5							
10	1				vc	*brn/rd uncons Sd*	
						Pbl, uncons	
15	2					*No recovery*	
	3					*pbl Grnl, uncons*	
	4						
20	5		G ►	≡	vf	*lt olv gy slt(sd) Grnst ?, pel; intlamd dusky yel calc Sh: partil vf re-xl; (Por) frac; Frac, Fe & Mn; yel orng weath [Fe]*	p
	6					*No recovery*	
	7						
	8					*yel gy sli dol Grnst, pel, [loc slt]: (Por), vug [ms], frac; Frac, Si & Mn partil infill. Cavern/Frac infill of lt olv brn Dol, Grnst, clast [lath & eqnt, subrndd]: Por, vug [ms], (frac); Frac, Si infill; Lmn after Slpd*	p ⊘ ⬠ ◎ (◠)
25	9		G ►		vf	*basal 2cm – lt gy sd Grnst, skltl, oncolite, (clast) [olv Clst]: Weath*	
	10			≡		*lt gy slt Grnst, pel; minor lam lt olv gy Mdst; tn lamd lt gy olv calc Sh [yel orng weath]: (Styl), sut; conf tn Calc Vns; Frac; fiss*	p
	11		G,P ►	≡		*olv lt gy pel Grnst/Pckst ?; lam lt olv brn calc Sh; basal 1cm md gy Grnst/Pckst, skltl, clast, (ooid); vf re-xl; (Frac), Fe stain.*	◠ ⊘ (⊙)
30	12		G ►	≡ (⊖)		*lt gy slt Grnst, pel [loc skltl, pel]; minor lam lt olv gy Mdst, (biotrbtd); lam lt gy olv calc slt Sh [yel orng weath]: (Por) frac; conf tn Calc (Vns), Frac; fiss.*	p ◠ ⬠
	13					*abund dk yel orng calc slt Sh, intlamd Grnst, pel, skltl.*	
35	14		G,P ►	≙		*olv lt gy loc slt Grnst, pel, (Xlamd); p olv calc Sh: (Por) frac; Frac, Fe stain; yel orng Weath.*	p
	15		G ►	≡ (⊖)		*lt gy slt Grnst, pel [loc yel orng weath]; lam & tn bds olv dusky yel Mdst/Wckst, pel, biotrbtd: Por, frac; Styl, flat & sut; cpctn bdng; conf tn Calc Vns; Frac, irreg & flat hrtl [Fe stain]*	p
40	16			≡		*basal 8cm lt olv gy slt Pckst, skltl; Mdst & Grnst [pel] Lam: Por, frac, (vug); Frac, Fe stain lt olv gy Grnst/Pckst, pel; lam olv gy sh Lst: (Por) frac; (Frac), Fe stain*	◠ (⬠) p p
	17		G,P ►				
45	18		G ►	≡ ⊖		*olv md lt gy slt Grnst, pel, (skltl) (loc clast), Xlamd; loc Grnst/Pckst, skltl, pel, clast, ooid ?; minor lam Mdst, biotrbtd; olv gy sh (slt) Grnst, pel: (Por) frac; styl, flat & sut; cpctn bdng; conf tn Calc Vns, Fe stain; (Frac), Fe stain; Py*	p ◠ ⬠ ⊘ (⊙)
				▽			
	19		G ►			*basal 1cm Pckst, skltl, pel, ooid, clast*	◠ ⬠ p ⊙ ⊘
50	20		G,P ►	≙		*olv md lt gy Grnst [& Pckst], pel, Xlamd; minor Grnst & Pckst, skltl, loc clast [rndd lath]; lam dk olv gy sh Lst: vf re-xl in parts; Styl, flat; cpctn bdng; Py*	p ◠ ⬠ ⊘
	21			≡ ⊖		*Pckst & Grnst, skltl, ooid, pel* / *lt gy olv Grnst, clast [lath, subrndd], (skltl), pel* / *lt gy olv minor Pckst ? [pel] grdg to Wckst [pel] & Mdst, lamd; lam dk olv gy sh Lst: cpctn bdng*	◠ ⬠ ⊙ p ⊘ (◠) (⬠) p
55	22		G,P ►	≡ ⊖		*lt olv gy Grnst/Pckst, pel, & Mdst, biotrbtd; lamd olv gy slt Grnst, pel (skltl): cpctn bdng; Styl, flat; Py* / *md gy Grnst/Pckst, skltl, ooid, geopetal Mud: Calc Ct* / *md gy slt Grnst, pel, (loc skltl); minor lam olv blk sh Lst: cpctn bdng; (Vg) & irreg (Frac), Calc infill* / *brn md gy Grnst, clast [lath & sph, rndd], skltl: soln Brec; Frac, Calc infill* / *lt olv gy Grnst/Pckst, skltl, pel; bnds lt olv gy Mdst, biotrbtd: Py*	p (◠) ◠ ⊙ ⬠ p (◠) ⊘ ◠ ⬠ ◠ ⬠ p
	23		G ►				
60	24			(≡) ⊖ (ω)		*lt olv gy Mdst ?, biotrbdt; lam & bds md gy Grnst, pel, (loc ooid), Xlamd; olv gy slt Grnst, pel, (skltl): cptn bdng; Py*	p (◠) (⬠)
			G ►			*basal 50cm mtl Grnst/Pckst ?, biotrbtd, & Mdst; slt Grnst, pel, (skltl); tn Grnst skltl: extrm cpctn bdng, Py*	p ◠
65	25			≡ ⊖		*intlamd gy p yel brn Pckst ?, pel, & Mdst, biotrbtd; minor lam md gy Grnst, pel, skltl; dusky yel brn slt calc Sh; fiss; Py*	p ◠
	26		G ►				
						md lt gy Grnst/Pckst, skltl, pel, (clast ?), geopetal Mud: Calc Ct; Py	p ◠ (⊘) (◎)
70	27		G,P ►				
	28			≙ ⊖		*lt olv gy [brn] Grnst/Pckst ?, pel & Mdst, biotrbtd; md gy slt Grnst, pel (skltl), Xlamd; olv gy slt sh Grnst, pel, skltl: cptn bdng; (Frac) Calc infill; (Py)*	p (◠)
			G ►				
75	29						
			G ►				
80	30			≙ ⊖		*lt olv gy (brn) Pckst ?/Grnst ? pel, (skltl) (Xlamd) c Mdst bnds, biotrbtd; lam & bds md gy (slt) Grnst, pel; dusky yel brn calc slt Sh; loc md gy Grnst/Pckst, skltl, pel, ooids? cpctn bdng; Frac, Calc infill; (Py)*	p ◠ (⬠) (⊙?)
	31		G ►				
			G ►			*olv gy Grnst/Pckst, clast [lath, subrndd], skltl, ooid; olv gy Grnst, pel: Vg, Calc & Si infill; Si replc of skltl; (Py)*	⊘ ◠ ⬠ ⊙ ◎
	32		G ►	≡		*md dk gy Grnst, pel, (skltl), loc slt, (Xlamd); p yel brn – olv gy (sh) Grnst, pel; dusky yel brn calc Sh; loc dk gy Grnst/Pckst, skltl, clast [irreg]: cpctn bdng; fiss; (Py)*	p ◠ ⊘ ◠ ⬠ ◎

T.D. 84·80

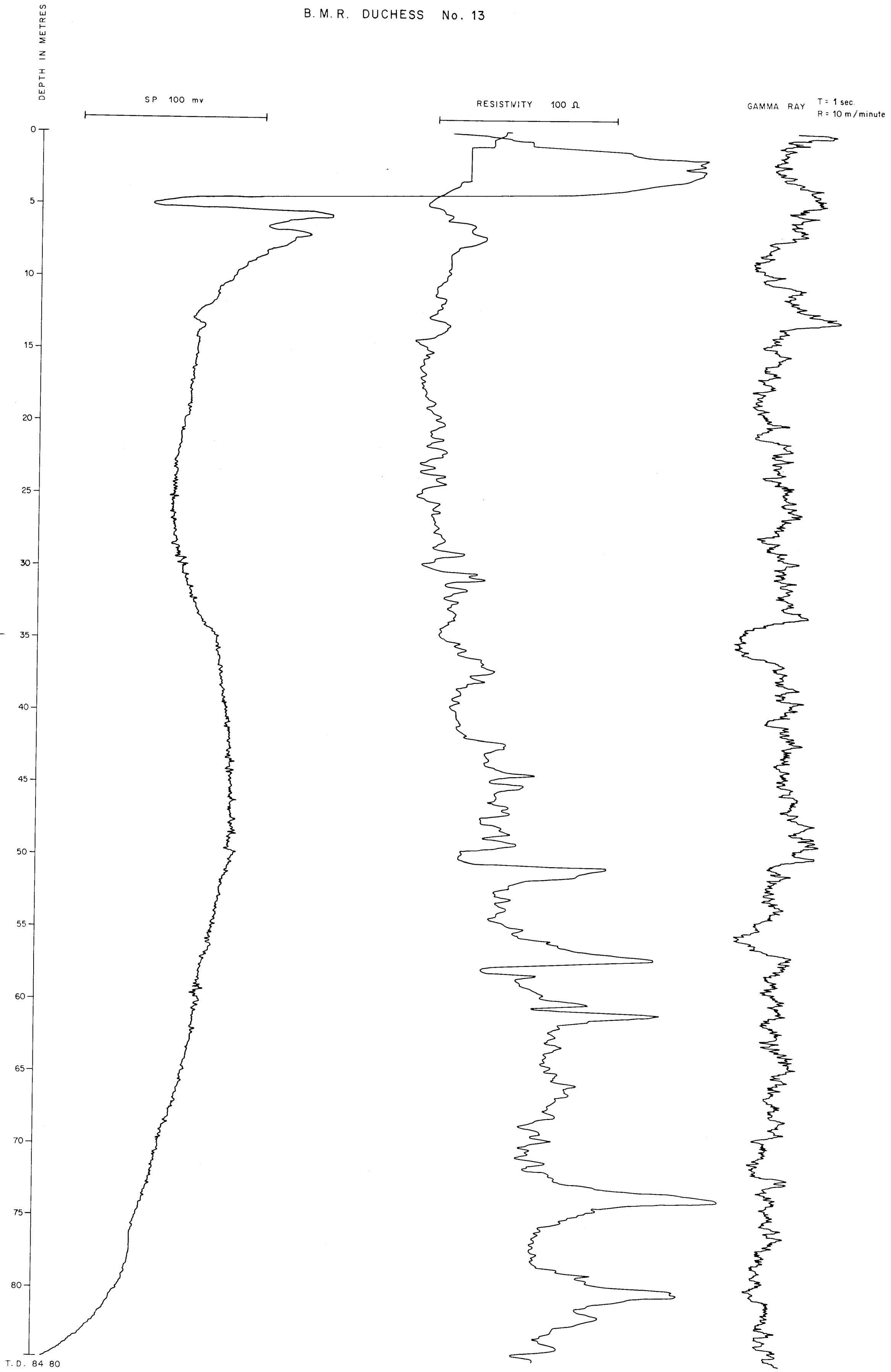
RECORD 1977/19

FIG. 7a

DATE: 5. 1. 76
GEOLOGIST: J. Kennard
MAP SHEET: DUCHESS 1:250000

F 54/A10/93

B. M. R. DUCHESS No. 13



RECORD 1977/9

FIG. 7b

DATE: 1. 8. 74
GEOPHYSICIST: A. Spence

F 54/A 10/100

APPENDIX 1

PALAEONTOLOGICAL DETERMINATIONS

by J.H. SHERGOLD

BMR Boulia No. 5
BMR Boulia No. 6
BMR Boulia No. 9
BMR Duchess No. 13.

Note: Many of the taxa determined are new species or genera, and are nomina nuda until the publication of a bulletin describing the trilobite faunas of the Chatsworth Limestone (Shergold, in prep.).

BMR Boulia No. 5

Core interval (metres)	Determinations
14.00 - 15.50	
15.50 - 17.00	
17.00 - 18.65	phyllocarid? undet.
18.65 - 20.65	
20.65 - 22.25	inarticulate brachiopod undet.
22.25 - 23.20	
23.20 - 23.70	
23.70 - 25.20	
25.20 - 26.20	
26.20 - 27.25	
27.25 - 27.75	
27.75 - 28.75	
28.75 - 29.15	
29.15 - 30.74	
30.74 - 32.25	
32.25 - 32.54	
32.54 - 33.74	inarticulate brachiopod undet.
33.74 - 34.54	
34.54 - 35.25	
35.25 - 36.75	
36.75 - 37.09	
37.09 - 38.34	
38.34 - 39.09	
39.09 - 39.84	
39.84 - 41.39	inarticulate brachiopoda undet. cranidium (granulose) undet. cranidium (nepeiiform) undet. librigena undet. chitinous tube undet.
41.39 - 41.64	

41.64 - 42.89	inarticulate brachiopod indet.
42.89 - 44.14	
44.14 - 44.39	inarticulate brachiopod undet.
44.39 - 45.92	
45.92 - 46.19	
46.19 - 47.44	
47.44 - 48.19	
48.19 - 48.94	
48.94 - 50.44	
50.44 - 50.74	
50.74 - 51.74	
51.74 - 52.74	
52.74 - 53.24	
53.24 - 54.79	
54.79 - 55.29	
55.29 - 56.29	
56.29 - 57.29	
57.29 - 57.79	
57.79 - 59.84	organic films
59.84 - 60.84	
60.84 - 61.88	
61.88 - 62.38	
62.38 - 63.89	organic films
63.89 - 65.39	
65.39 - 66.39	
66.39 - 66.89	
66.89 - 68.39	
68.39 - 68.94	
68.94 - 69.94	
69.94 - 70.94	inarticulate brachiopod undet.

70.94 - 71.44	
71.44 - 72.94	
72.94 - 73.49	
73.49 - 74.49	
74.49 - 75.49	
75.49 - 75.99	
75.99 - 77.49	
77.49 - 78.04	
78.04 - 79.04	
79.04 - 80.54	
80.54 - 82.04	
82.04 - 82.59	
82.59 - 83.34	
83.34 - 84.59	
84.59 - 84.84	
84.84 - 86.34	
86.34 - 87.14	
87.14 - 87.89	
87.89 - 89.14	
89.14 - 89.39	
89.39 - 90.89	
90.89 - 91.69	
91.69 - 92.19	
92.19 - 93.69	
93.69 - 94.19	inarticulate brachiopods undet.
94.19 - 95.19	
95.19 - 96.24	inarticulate brachiopods undet.
96.24 - 96.74	
96.74 - 98.24	
98.24 - 99.14	
99.14 - 100.79	

BMR Boulia No. 6

Core interval (metres)	Determinations
12.00 - 12.30	
12.30 - 13.80	inarticulate brachiopod undet. librigena undet. trilobite fragments indet.
13.80 - 14.00	inarticulate brachiopod fragments trilobite fragments indet.
14.00 - 14.75	inarticulate brachiopod fragments Neoagnostus felix sp. nov.
14.75 - 15.30	inarticulate brachiopod undet. trilobite fragments undet.
15.30 - 16.80	inarticulate brachiopod undet. trilobite fragments indet.
16.80 - 17.15	inarticulate brachiopod indet. trilobite fragment undet.
17.15 - 18.40	inarticulate brachiopoda undet. trilobite indet.
18.40 - 18.55	inarticulate brachiopod undet. Wentsuia iota sp. nov. mansuyiinid? indet.
18.55 - 19.80	inarticulate brachiopod undet.
19.80 - 21.05	inarticulate brachiopod undet. librigena undet. Wentsuia iota sp. nov. trilobite gen nov.?
21.05 - 22.55	inarticulate brachiopoda undet.
22.55 - 23.10	inarticulate brachiopod undet. problematicum (calcareous tube) Atopasaphus? sp. undet.
23.10 - 24.10	inarticulate brachiopoda undet. trilobite librigena indet.
24.10 - 25.10	Haniwoides sp. indet.
25.10 - 25.92	inarticulate brachiopod undet. trilobite fragment indet.
25.92 - 26.75	
26.75 - 27.50	inarticulate brachiopod undet. Neoagnostus greeni sp. nov. Pseudagnostus mortensis sp. nov. Taenicephalites plerus sp. nov.
27.50 - 29.00	

29.00 - 29.75	inarticulate brachiopod undet.
29.75 - 30.50	inarticulate brachiopod undet.
30.50 - 32.00	inarticulate brachiopoda undet. agnostid indet.
32.00 - 32.20	inarticulate brachiopod undet. Taenicephalites? sp. (meraspid) protaspid indet.
32.20 - 33.45	inarticulate brachiopod undet Taenicephalites plerus sp. nov. hypostoma indet. protaspid indet.
33.45 - 34.75	
34.75 - 35.00	inarticulate brachiopod undet. Neoagnostus? sp. indet. Wentsuia iota sp. nov.
35.00 - 36.50	inarticulate brachiopoda undet. Wentsuia iota sp. nov.
36.50 - 36.75	inarticulate brachiopoda undet. Neoagnostus sp. aff. N. greeni sp. nov. Taenicephalites? sp. (meraspid) agnostid indet.
36.75 - 38.00	inarticulate brachiopoda undet.
38.00 - 39.30	inarticulate brachiopod undet. dendroid graptolite fragments undet. ostracode undet. Maladioidella? sp. undet. Pseudagnostus sp. indet. Wentsuia iota sp. nov.
39.30 - 39.55	
39.55 - 41.05	inarticulate brachiopod undet. dendroid graptolite fragments undet.
41.05 - 41.30	inarticulate brachiopod undet. librigena indet.
41.30 - 42.55	inarticulate brachiopoda undet. bradoriid aff. Bradoria sp. Haniwoides varia sp. nov. Pseudagnostus sp. aff. P. tricanthus sp. n Taenicephalites plerus sp. nov. Wentsuia sp. undet. pygidium indet.
42.55 - 43.85	inarticulate brachiopod undet. ostracode indet. Paichiashania prima sp. nov. Pseudagnostus aulax sp. nov. Wentsuia iota sp. nov. librigena indet.

43.85 - 45.35	inarticulate brachiopoda undet. Neoagnostus felix sp. nov. Pseudagnostus apsis sp. nov. Taenicephalites? sp. undet. Wentsuia iota sp. nov. agnostid indet.
45.35 - 45.85	inarticulate brachiopoda indet. agnostid indet.
45.85 - 46.85	ostracode indet. Haniwoides? sp. indet. Maladioidella doylei sp. nov. agnostid indet. ceratopygid gen. et sp. indet.
46.85 - 47.85	inarticulate brachiopoda undet. Haniwoides? sp. indet. Taenicephalites plerus sp. nov. ptychoparioid cranidium indet.
47.85 - 48.35	inarticulate brachiopod undet. ostracode indet. Maladioidella sp. indet. Wentsuia iota sp. nov. ceratopygid indet. hypostome indet.
48.35 - 49.85	inarticulate brachiopoda undet. ostracode undet. Maladioidella doylei sp. nov. Wentsuia iota sp. nov. pygidium indet. agnostid indet.
49.85 - 50.40	trilobite fragments indet.
50.40 - 51.40	inarticulate brachiopoda undet. ptychoparioid librigena undet. Peichiashania? sp. indet. Wentsuia? sp. indet. protaspis indet. ostracoda undet.
51.40 - 52.90	inarticulate brachiopoda undet. Maladioidella doylei sp. nov. Wentsuia iota sp. nov. meraspid cranidium undet. librigena undet. ostracoda undet. minute coiled tube (mollusc?)
52.90 - 53.46	inarticulate brachiopod undet. Wentsuia? sp. indet. ptychoparioid librigena indet. ostracoda undet.
53.46 - 54.65	inarticulate brachiopoda undet. ostracoda undet. pseudagnostid indet.
54.65 - 54.80	inarticulate brachiopod undet. Taenicephalites plerus sp. nov.

54.80 - 56.05	inarticulate brachiopoda undet. dendroid graptolite fragments undet.
56.05 - 57.55	Haniwoides? sp. indet. librigena undet. trilobite fragments indet.
57.55 - 57.80	
57.80 - 59.05	inarticulate brachiopoda undet. brachiopod, trilobite and pelmatozoan debris Cermatops? gen. nov. sp. indet.
59.05 - 59.30	inarticulate brachiopod undet. Wentsuia? sp. indet.
59.30 - 60.55	dendroid graptolite fragments undet. trilobite fragments indet.
60.55 - 62.05	trilobite fragments undet. ostracode undet.
62.05 - 62.30	
62.30 - 63.55	inarticulate brachiopod undet. trilobite fragments indet.
63.55 - 63.90	
63.90 - 64.90	
64.90 - 66.40	
66.40 - 66.90	
66.90 - 67.90	
67.90 - 68.45	
68.45 - 69.45	
69.45 - 70.95	inarticulate brachiopod fragment undet. meraspid cranidia undet. Neoagnostus aulax sp. nov.
70.95 - 71.45	inarticulate brachiopod undet. librigena undet. meraspid cranidium undet. Wentsuia iota sp. nov.
71.45 - 72.45	inarticulate brachiopod undet. Haniwoides? sp. indet. Homagnostus? sp. indet. Peichiashania? sp. undet. Pseudagnostus tricanthus sp. nov. P. mortensis sp. nov. Wentsuia iota sp. nov.
72.70 - 73.00	inarticulate brachiopod undet. Haniwoides varia sp. nov. Pseudagnostus mortensis sp. nov.

73.00 - 74.00	inarticulate brachiopod undet. Haniwoides varia sp. nov. Neoagnostus sp. undet. Wentsuia iota sp. nov. hypostoma undet. early meraspid cranidium undet.
74.00 - 75.50	inarticulate brachiopod undet. Haniwoides varia sp. nov. Maladioidella doylei sp. nov. Neoagnostus greeni sp. nov. Taenicephalites plerus sp. nov. Wentsuia iota sp. nov. ptychoparioid pygidium undet.
75.50 - 76.00	inarticulate brachiopod undet. Wentsuia iota sp. nov.
76.00 - 77.00	inarticulate brachiopod undet. Haniwoides varia sp. nov. Wentsuia iota sp. nov. agnostid fragments undet. hypostoma undet.
77.00 - 77.55	inarticulate brachiopod undet. Haniwoides varia sp. nov. Neoagnostus felix sp. nov. pseudagnostid indet.
77.55 - 78.35	inarticulate brachiopod undet. Haniwoides varia sp. nov. Neoagnostus greeni sp. nov. N. felix sp. nov. Taenicephalites plerus sp. nov.
78.35 - 80.05	inarticulate brachiopoda undet. Haniwoides varia sp. nov. Taenicephalites plerus sp. nov. Wentsuia iota sp. nov. agnostid undet. pygidium undet.
80.05 - 81.55	inarticulate brachiopod undet. Cermatops gen. nov. sp. undet. Haniwoides varia sp. nov. Maladioidella doylei sp. nov. Taenicephalites plerus sp. nov. early meraspid indet. pseudagnostid undet. ptychoparioid librigena undet.
82.20 - 83.00	inarticulate brachiopoda undet. Haniwoides varia sp. nov. Neoagnostus aulax? sp. nov. Neoagnostus sp. undet. Pseudagnostus sp. undet. Taenicephalites plerus agnostid undet. meraspid cranidia undet.

83.00 - 84.50	Haniwoides varia sp. nov. Wentsuia iota sp. nov. ceratopygid meraspid cranidium indet. hypostoma indet. pseudagnostid indet.
84.50 - 85.25	inarticulate brachiopod undet. Wentsuia iota sp. nov.
85.25 - 86.00	inarticulate brachiopoda undet. Cermatops gen. nov. sp. undet. Haniwoides varia sp. nov. Wentsuia iota sp. nov. agnostid pygidium undet.
86.00 - 86.65	inarticulate brachiopod undet. agnostid fragment indet. ceratopygid librigena undet.
86.65 - 89.65	
87.65 - 89.15	
89.15 - 89.65	
89.65 - 90.65	inarticulate brachiopod fragments indet.
90.65 - 91.35	inarticulate brachiopod undet.
91.35 - 92.10	inarticulate brachiopod fragments indet.
92.10 - 93.60	inarticulate brachiopod fragments indet.
93.60 - 94.35	trilobite fragment undet.
94.35 - 95.10	
95.10 - 95.90	
95.90 - 96.40	inarticulate brachiopod fragments indet. ostracode undet. meraspid cranidium undet.
96.40 - 97.90	probable organic films
97.90 - 98.90	inarticulate brachiopod fragments indet. Wentsuia iota sp. nov. ptychoparioid librigena undet. probable organic films

BMR Boulia No. 9

Limestone below Mesozoic in the bottom core interval 85.70 - 87.70 m yielded only fragments of inarticulate brachiopods.

BMR Duchess No. 13

Core interval (metres)	Determinations
15.27 - 16.27	
16.27 - 16.47	
16.47 - 17.22	inarticulate brachiopod undet. Atopasaphus cf. stenocanthus Shergold, 1975 Cermatops gen. nov. sp. undet.
17.22 - 18.30	inarticulate brachiopod undet. trilobita undet.
18.30 - 18.80	inarticulate brachiopod undet.
18.80 - 20.23	inarticulate brachiopoda undet. Wentsuia iota? sp. nov.
20.23 - 21.36	inarticulate brachiopod undet.
21.36 - 21.61	
21.61 - 21.81	
22.20 - 23.00	
23.00 - 23.50	
23.50 - 24.50	inarticulate brachiopoda undet.
24.50 - 25.00	inarticulate brachiopod undet. Pseudagnostus aulax sp. nov. Wentsuia iota sp. nov.
25.00 - 26.50	inarticulate brachiopod undet.
26.50 - 27.40	inarticulate brachiopod undet.
27.40 - 27.90	
27.90 - 29.40	inarticulate brachiopoda undet. trilobite fragments undet.
29.40 - 30.40	inarticulate brachiopod undet.
30.40 - 30.90	
30.90 - 32.40	Taenicephalites plerus sp. nov. Cermatops? gen. nov. sp. undet.
32.40 - 32.90	inarticulate brachiopod undet.
32.90 - 33.90	inarticulate brachiopod undet.
33.90 - 34.73	
34.73 - 35.50	

35.50 - 36.70	inarticulate brachiopod undet. Haniwoides varia sp. nov. Lorrettina depressa sp. nov. pseudagnostid indet.
36.70 - 36.95	
36.95 - 37.95	
37.95 - 38.45	inarticulate brachiopod undet.
38.45 - 39.95	inarticulate brachiopod undet. Taenicephalites? sp. indet. ceratopygid undet. pseudagnostid undet. trilobite fragments undet.
39.95 - 40.90	inarticulate brachiopoda undet.
40.90 - 41.40	
41.40 - 42.90	inarticulate brachiopod undet. Cermatops gen. nov. sp. undet. Homagnostus? sp. indet. Pseudagnostus parvus sp. nov. Taenicephalites plerus sp. nov.
42.90 - 43.90	
43.90 - 44.40	Pseudagnostus aulax sp. nov.
44.40 - 45.90	inarticulate brachiopod undet. Atopasaphus sp. undet. Taenicephalites plerus sp. nov.
45.90 - 46.90	Taenicephalites plerus? sp. nov.
46.90 - 47.40	trilobite fragments indet.
47.40 - 48.90	ostracode undet.
48.90 - 49.50	Neoagnostus sp. indet.
49.50 - 50.50	inarticulate brachiopod undet. Taenicephalites plerus sp. nov. ostracoda undet. protaspis undet.
50.50 - 52.00	inarticulate brachiopod undet. ostracoda undet. agnostid indet.
52.00 - 52.50	inarticulate brachiopoda undet. Maladioidella doylei sp. nov. trilobite fragments undet.
52.50 - 53.50	inarticulate brachiopoda undet. Maladioidella doylei sp. nov. Taenicephalites plerus sp. nov. Wentsuia iota sp. nov. trilobite fragments undet.

53.50 - 55.00	inarticulate brachiopod undet. agnostid indet.
55.00 - 55.50	inarticulate brachiopod undet.
55.50 - 56.43	inarticulate brachiopoda undet. Haniwoides varia sp. nov. ostracoda undet. pelecypod? undet.
56.43 - 57.53	inarticulate brachiopod undet. Cermatops gen. nov. sp. undet. Haniwoides varia sp. nov. Wentsuia iota sp. nov. ostracoda undet. olenacean? pygidium undet. hypostoma undet.
57.50 - 57.75	
57.75 - 59.25	inarticulate brachiopoda undet. Rhaptagnostus macrambitus? sp. nov. trilobite fragments undet. dendroid graptolite fragments undet.
59.25 - 60.50	Neoagnostus sp. indet. Wentsuia iota sp. nov
60.50 - 60.75	inarticulate brachiopod undet.
60.75 - 62.25	inarticulate brachiopoda undet. Rhaptagnostus macrambitus sp. nov. pseudagnostid undet. librigena undet. ostracoda undet.
62.25 - 62.60	
62.60 - 63.60	inarticulate brachiopod undet.
63.60 - 65.10	inarticulate brachiopod undet. Haniwoides varia sp. nov.
65.10 - 65.60	inarticulate brachiopod undet.
65.60 - 66.60	inarticulate brachiopod undet.
66.60 - 68.10	inarticulate brachiopoda undet. Schizambon sp. undet. Haniwoides varia sp. nov. Pseudagnostus aff. mortensis sp. nov. Wentsuia iota sp. nov. geragnostoid undet.
68.20 - 69.45	inarticulate brachiopoda undet. Pseudagnostus parvus? sp. nov. Taeniocephalites plerus sp. nov. agnostid fragments undet. Pelagiella? sp. undet. ostracode sp. undet.
69.45 - 70.60	inarticulate brachiopod undet. Neoagnostus aff. greeni sp. nov.

70.60 - 71.10	inarticulate brachiopod undet. trilobite fragments undet.
71.10 - 72.60	inarticulate brachiopoda undet. Taenicephalites plerus sp. nov. trilobite fragments undet.
72.60 - 72.80	agnostid meraspid cephalon undet.
72.80 - 74.05	inarticulate brachiopod undet.
74.05 - 75.55	inarticulate brachiopoda undet. trilobite fragments undet.
75.55 - 75.80	inarticulate brachiopod undet. meraspid pygidium undet. (ceratopygid?)
75.80 - 77.05	inarticulate brachiopod undet. librigenal fragment undet.
77.05 - 77.30	inarticulate brachiopod fragment indet. Neoagnostus aff. greeni sp. nov.
78.05 - 78.30	meraspid cranidium undet.
78.55 - 78.80	
79.05 - 79.30	Neoagnostus greeni sp. nov.
79.55 - 79.80	inarticulate brachiopod undet.
80.30 - 80.55	inarticulate brachiopod undet. Maladioidella doylei sp. nov. Wentsuia iota sp. nov.
80.80 - 81.05	Wentsuia iota sp. nov. meraspid cranidium undet.
81.05 - 81.30	inarticulate brachiopod undet. cranidium undet.
81.55 - 81.80	
81.80 - 82.05	Maladioidella? sp. indet.
82.30 - 82.55	Haniwoides varia sp. nov. Wentsuia iota sp. nov.
82.55 - 82.80	inarticulate brachiopod undet. Peichiashania prima sp. nov. Taenicephalites plerus sp. nov. Wentsuia iota sp. nov.
82.80 - 83.05	inarticulate brachiopod undet. Haniwoides varia sp. nov. Taenicephalites plerus sp. nov.
83.05 - 83.30	inarticulate brachiopod undet. Maladioidella doylei sp. nov. Wentsuia iota sp. nov.

83.30 - 83.55	trilobite fragments undet.
83.55 - 83.80	*Maladioidella doylei* sp. nov.
83.80 - 84.05	librigena undet. meraspid cranidium undet.
84.05 - 84.30	*Connagnostus* cf. *aversus* sp. nov. *Haniwoides varia* sp. nov. *Maladioidella doylei* sp. nov.
84.30 - 84.55	*Maladioidella doylei* sp. nov. *Neoagnostus* sp. undet.
84.55 - 84.80	*Haniwoides*? sp. indet. *Maladioidella doylei* sp. nov. olenid? undet. pseudagnostid undet.

APPENDIX 2

GEOCHEMICAL RESULTS

SAMPLE No.	STRAT. HOLE	DEPTH (m)	Ca	Mg	Insol	Sr	Fe	Mn	P	Cu	Pb	Zn	Ba	F	Org C
74715001	BOULIA No. 6	14.0	26.4	0.25	31.7	0,063	0.26	0,017	160	12	5	54	820	0.03	0.12
2		18.0	29.0	0.37	22.6	0.086	0.29	0,015	130	8	5	32	260	0.025	0.11
3		21.0	30.3	0.91	18.5	0.10	0.25	0,014	110	8	10	27	180	0.025	0.10
4		24.0	27.7	0.49	25.7	0.054	0.16	0,018	680	8	15	18	160	0.05	0.09
5		27.0	33.9	0.34	12.6	0,19	0,12	0,016	60	4	5	6	70	0.045	0.10
6		30.0	23.3	0.36	38,9	0.054	0,12	0,017	250	5	5	16	200	0.06	0.06
7		33.0	32.2	1.30	13,2	0.095	0,14	0,013	90	4	5	15	60	0.06	0.11
8		36.0	23.7	0.37	34,4	0.056	0,13	0,018	250	8	10	12	200	0.05	0.07
9		39.0	23.1	0.42	36,6	0.052	0.10	0,017	200	8	10	14	130	0.035	0.06
10		42.0	22.9	1.11	35.5	0.077	0.19	0,018	270	9	10	19	200	0.06	0.10
1		45.0	19.9	0.79	43,2	0,042	0,23	0,020	390	8	10	15	220	0.05	0.10
2		47.8	33.9	1.74	6.65	0,093	0,34	0,024	90	8	5	33	50	0.015	0.06
3		51.0	31.7	1.39	12,7	0,10	0,21	0,015	340	9	10	32	60	0.04	0.14
4		54.0	32.8	1.27	12,6	0.14	0,18	0,018	150	5	10	8	60	0.015	0.15
5		57.0	22.9	1.03	34,6	0,091	0,12	0,015	270	11	10	24	170	0,14	0,13
6		59.8	25.1	0.96	34,6	0.15	0,13	0,014	280	14	5	21	150	0,12	0,17
7		63.0	22,5	1,61	33,2	0,090	0,12	0,017	280	11	5	20	170	0,17	0,13
8		66.0	28.4	1,16	21,4	0,18	0,12	0,017	200	11	10	23	120	0,11	0,17
9		69.0	29,7	1,06	20,0	0,19	0,16	0,015	180	11	10	18	140	0,06	0,19

SAMPLE No.	STRAT. HOLE	DEPTH (m)	Ca	Mg	Insol	Sr	Fe	Mn	P	Cu	Pb	Zn	V	Ba	F	Org C
4715020	BOULIA No. 6	71.9	26.4	0.25	31.7	0.063	0.26	0.017	180	10	5	31		140	0.03	0.12
1		75.0	26.3	1.44	25.6	0.13	0.45	0.019	160	12	5	54		170	0.035	0.22
2		77.8	25.8	1.89	25.1	0.13	0.55	0.021	220	10	5	30		180	0.03	0.20
3		81.0	31.7	1.39	12.7	0.10	0.21	0.015	110	8	10	27		240	0.04	0.14
4		84.0	32.8	1.22	12.6	0.14	0.18	0.018	680	8	15	18		1400	0.015	0.15
5		87.15	26.7	1.35	25.1	0.12	0.62	0.022	210	9	5	33		170	0.04	0.16
6		90.0	26.7	0.79	26.9	0.11	0.63	0.022	210	11	10	34		220	0.05	0.17
7		93.0	25.2	1.11	26.8	0.33	0.63	0.018	250	3	5	7		220	0.065	0.18
8		96.0	24.5	0.75	32.5	0.10	0.51	0.017	180	15	5	47		200	0.06	0.15
9		98.7	23.1	0.42	36.6	0.052	0.10	0.017	180	8	5	26		140	0.035	0.06
30	BOULIA No. 8	7.0	17.4	8.95	24.5	0.005	0.47	0.050	350	7	10	16		200	0.03	0.06
1		10.05	19.2	10.2	12.6	0.004	0.60	0.073	140	4	10	17		100	0.035	0.06
2		13.7	14.0	7.30	36.2	0.004	0.51	0.063	160	2	10	8		240	0.035	0.03
3		16.6	21.8	11.8	1.95	0.003	0.60	0.094	210	2	5	8		210	0.025	0.06
4		19.1	22.0	11.3	4.30	0.005	0.66	0.11	60	2	5	12		40	0.035	0.04
5		22.95	11.4	6.35	44.4	0.003	0.53	0.082	360	4	5	14		480	0.035	0.04
6		25.5	19.7	10.1	10.6	0.005	0.56	0.075	200	4	10	40		80	0.035	0.01
7		28.1	17.9	9.00	22.5	0.005	0.37	0.094	90	4	5	15		240	0.035	0.03
8		31.2	21.2	10.7	8.90	0.003	0.44	0.034	90	2	5	10		70	0.03	0.03

SAMPLE No.	STRAT. HOLE	DEPTH (m)	Ca	Mg	Insol	Sr	Fe	Mn	P	Cu	Pb	Zn	V	Ba	F	Org C
74715039	BOULIA No. 8	34.0	21.4	10.9	6.40	0.005	0.46	0,055	80	3	5	8		50	0.03	0.05
40		37.0	14.9	7.90	33.3	0.003	0.48	0,087	180	6	5	12		300	0.035	0.04
1		40.0	19.6	10.2	12.7	0.004	0.61	0,10	90	4	10	7		70	0.03	0.04
2		43.3	18.8	9.65	15.1	0.003	0.72	0,11	70	4	5	12		100	0.031	0.03
3		46.8	18.4	9.65	17.3	0.003	0.54	0,074	60	4	10	12		170	0.025	0.04
4		49.0	17.9	9.65	17.3	0.003	0.47	0,10	170	8	10	16		100	0.03	0.04
5		52.25	19.7	10,2	12.1	0.004	0.48	0,042	70	9	5	15		480	0.03	0.04
6		55.75	19.3	9.50	16.3	0.005	0.65	0,13	200	4	10	40		110	0.035	0.03
7		58.75	19.0	9.80	15.6	0.005	0.50	0,067	170	4	10	12		70	0.025	0.05
8		61.5	20.4	10.5	9.50	0.005	0.68	0,14	50	4	10	13		50	0.03	0.06
9		64.0	20.5	10.7	8.40	0.003	0,77	0,045	50	3	5	5		50	0.035	0.04
50		67.0	20.0	10.8	7.20	0.004	0,36	0,046	60	6	5	8		30	0.025	0.05
1	BOULIA No. 5	22.0	20.4	0.37	43.1	0.052	0,066	0,013	260	14	5	36		1300	0.075	0.06
2		26.2	19.7	0.69	41.6	0.063	0.073	0,014	260	16	10	41		240	0.09	0.08
3		31.25	22.8	1.09	34.4	0.087	0,19	0,023	240	13	5	19		240	0.065	0.15
4		37.25	19.1	1.09	42.8	0.065	0.16	0,017	220	16	5	28		220	0.135	0.21
5		41.25	20.0	1.10	39.4	0.079	0,18	0,016	280	18	5	28		240	0.085	0.18
6		43.90	29.6	1.03	19.0	0.12	0,19	0,018	140	12	5	15		420	0.08	0.10

SAMPLE No.	STRAT. HOLE	DEPTH (m)	Ca	Mg	Insol	Sr	Fe	Mn	P	Cu	Pb	Zn	V	Ba	F	Org C
74715057	BOULIA No. 5	47.0	28.4	1.28	20.1	0.10	0.15	0.020	160	10	10	18		220	0.055	0.14
8		51.5	25.0	0.53	30.7	0.10	0.15	0.025	230	13	10	26		380	0.055	0.19
9		54.0	22.3	1.13	35.4	0.084	0.20	0.024	240	18	10	34		700	0.06	0.15
60		57.0	18.0	1.56	44.1	0.072	0.24	0.023	295	34	5	78		540	0.10	0.21
1		60.0	16.9	0.98	48.5	0.076	0.16	0.014	250	15	10	35		260	0.085	0.38
2		63.25	20.9	1.62	37.9	0.075	0.21	0.021	270	23	5	38		360	0.10	0.19
3A		66.40	20.5	1.22	40.3	0.089	0.25	0.025	240	21	5	50		480	0.07	0.22
4		69.3	23.1	1.44	33.1	0.080	0.18	0.018	870	14	5	20		190	0.125	0.19
5		72.5	16.8	1.85	47.2	0.070	0.27	0.025	380	21	5	41		260	0.08	0.21
6		75.75	17.5	1.43	46.6	0.068	0.25	0.025	280	18	5	37		300	0.065	0.25
7		77.90	21.3	1.23	36.3	0.082	0.24	0.033	260	16	5	20		320	0.045	0.16
8		81.0	LISTED NOT REC -		LISTED NOT REC -		LISTED NOT REC -		LISTED NOT REC -							
9		85.0	15.7	0.69	53.5	0.077	0.25	0.020	310	18	15	47		620	0.08	0.38
70		88.0	18.7	1.44	43.8	0.065	0.27	0.023	330	40	10	120		580	0.075	0.18
1		91.0	23.1	1.36	33.7	0.080	0.24	0.026	270	56	5	100		400	0.06	0.17
2		95.0	19.3	1.31	42.7	0.059	0.26	0.024	340	19	10	32		260	0.08	0.12
3		99.5	23.3	0.87	35.9	0.067	0.19	0.030	270	9	10	25		140	0.03	0.07
4	DUCHESS No. 13	20.0	32.3	0.18	16.6	0.033	0.10	0.036	110	6	5	16		140	0.02	0.06

SAMPLE No.	STRAT. HOLE	DEPTH (m)	Ca	Mg	Insol	Sr	Fe	Mn	P	Cu	Pb	Zn	V	Ba	F	Org C
4715075	DUCHESS No. 13	24.8	27.1	0.21	26.5	0.043	0.069	0.018	170	3	5	9		120	0.015	0.06
6		28.5	23.5	0.18	36.3	0.034	0.068	0.018	840	4	10	17		360	0.035	0.05
7		32.2	19.9	0.23	41.7	0.042	0.083	0.018	310	8	5	12		220	0.06	0.03
8		34.5	33.3	0.34	14.3	0.070	0.068	0.015	90	5	5	13		90	0.035	0.04
9		37.6	23.1	0.28	37.2	0.047	0.11	0.018	290	7	5	14		220	0.075	0.08
80		41.8	22.5	0.71	36.3	0.056	0.15	0.019	230	6	5	11		180	0.045	0.08
1		44.8	22.5	0.70	36.6	0.061	0.20	0.020	300	90	15	24		220	0.07	0.12
2		49.2	29.7	0.79	18.4	0.078	0.26	0.017	180	6	5	18		220	0.03	0.08
3		52.0	32.0	1.06	12.3	0.11	0.20	0.013	120	5	5	11		190	0.03	0.07
4		55.8	28.7	0.47	19.3	0.051	0.11	0.018	710	7	10	11		110	0.045	0.10
5		58.7	22.2	1.16	35.2	0.072	0.16	0.017	270	6	5	18		240	0.13	0.10
6		63.3	25.8	0.81	26.6	0.10	0.20	0.016	220	6	5	12		300	0.14	0.14
7		66.35	27.4	0.81	24.1	0.21	0.17	0.013	250	9	5	30		140	0.12	0.19
8		69.45	21.8	1.00	36.5	0.088	0.13	0.017	260	10	10	22		220	0.15	0.12
9		72.35	24.5	1.62	34.5	0.13	0.17	0.020	310	11	10	23		170	0.20	0.5
90		75.30	27.7	1.28	21.2	0.17	0.14	0.015	200	12	5	24		100	0.11	0.18
1		78.20	25.1	1.26	27.3	0.17	0.18	0.016	200	12	5	28		140	0.15	0.21
2		81.05	25.1	1.89	26.6	0.16	0.22	0.018	210	15	5	27		200	0.11	0.20
3		84.60	31.0	1.47	14.3	0.16	0.26	0.014	210	15	5	110		340	0.055	0.25

SAMPLE No.	STRAT. HOLE	DEPTH (m)	Ca	Mg	Insol	Sr	Fe	Mn	P	Cu	Pb	Zn	V	Ba	F	Org C
74715094	BOULIA No. 7	5.0	0.04	0.18	95.8	0.001	0.006	0.001	270	4	45	58		260	0.005	0.04
5		8.6	0.05	0.025	91.7	0.001	0.036	0.007	580	45	85	2250		380	0.005	0.06
6		11.0	0.05	0.026	95.6	0.001	0.044	0.003	470	10	35	670		90	0.005	0.06
7		14.9	27.4	0.81	24.1	0.21	0.17	0.013	530	12	30	860		280	0.12	0.19
8		15.7	0.06	0.039	95.7	0.001	0.010	0.001	270	6	5	120		170	0.005	0.06
9		19.3	0.05	0.028	95.9	0.001	0.014	0.001	410	2	5	60		150	0.005	0.04
100		20.0	0.03	0.014	96.8	0.001	0.21	0.001	90	8	5	17		230	0.005	0.05
1		23.3	0.16	0.11	91.5	0.001	0.077	0.003	710	4	30	260		330	0.025	0.05
2		24.9	0.04	0.014	97.0	0.001	0.077	0.001	20	1	5	10		40	0.005	0.04
3		25.1	0.07	0.034	94.6	0.001	0.037	0.001	70	1	5	56		30	0.01	0.03
4		38.4	30.9	0.34	19.8	0.03	0.043	0.015	190	4	5	34		170	0.02	0.07
5		46.65	15.1	0.15	56.5	0.013	0.034	0.012	470	1	10	13		530	0.015	0.04
74715106		47.0	17.0	0.16	52.6	0.016	0.035	0.012	490	1	10	11		500	0.015	0.05

SAMPLE No.	STRAT. HOLE	DEPTH (m)	Ca	Mg	Insol	Sr	Fe	Mn	P	Cu	Pb	Zn	V	Ba	F	Org C
74715232	BOULIA No. 9	85.7-85.8	19.9	11.3	10.8	0.003	0.15	0.032	100	9	4	13		80	0.010	0.15
3		85.8-85.9	19.3	10.9	14.3	0.003	0.15	0.032	130	5	6	18		100	0.010	0.11
4		85.9-86.0	18.9	10,8	13,1	0.003	0.18	0.033	400	6	10	18		70	0.016	0.06
5		86.0-86.1	18.5	10.5	16.6	0.003	0.21	0.031	680	8	34	17		110	0.022	0.08
6		86.1-86.23	18.0	10.4	17.5	0.003	0.22	0.030	640	6	20	14		130	0.022	0.11
7		86.23-86.33	17.5	10.1	21.2	0.003	0.16	0.028	640	4	8	40		170	0.022	0.05
8		86.33-86.43	17.4	9.75	21.6	0.003	0.16	0,027	720	3	14	21		180	0.022	0.06
9		86.43-86.53	15.2	8.4	32.3	0.003	0.26	0.026	1140	3	32	21		300	0.035	0.08
40		86.53-86.63	15.5	8.95	29.2	0.003	0.16	0.027	500	3	14	30		280	0.018	0.04
1		86.63-86.73	12.8	7.35	41.6	0.002	0.18	0.023	570	5	22	32		380	0.018	0.10
2		86.73-86.88	10.7	6.4	49.9	0.002	0.18	0.019	340	4	26	29		460	0.014	0.09
3		86.88-86.98	11.8	7.15	45.6	0.002	0.16	0.021	350	4	24	23		440	0.014	0.04
4		86.98-87.08	11.7	7.6	46.0	0.002	0.15	0.020	320	4	20	31		440	0.012	0.05
5		87.08-87.20	12.9	7.25	41.6	0.002	0.18	0.022	290	4	24	23		380	0.014	0.07
6		87.20-87.29	13.8	7.8	35.9	0.003	0.20	0.023	300	5	26	16		340	0.014	0.10
7		87.44-87.5	17.2	9.6	23.1	0.003	0.17	0,027	130	4	14	19		170	0.010	0.07
8		87.5-87.6	17.3	10.0	20.7	0.003	0.17	0.028	100	2	12	10		160	0.010	0.07
9		87.6-87.7	17.2	9.6	22.7	0.003	0.18	0.029	100	3	8	23		180	0.008	0.07