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SDA TECHNICAL MEMORANDUM SDM 26

PALAEONTOLOGICAL REPORT, VICTORIAN MINES

DEPARTMENT BORE BRANXHOLME-1

by

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Melbourne, August, 1969.

CONTENTS

ENCLOSURES

Summary

Branxholme-1 penetrated a Miocene Heytesbury Group sequence with unusual features, entered middle Palaeocene Gangerrip Group clays and sands at 363', before penetrating 900' + of Albian Eumeralla Formation between approximately 600' and 1497'. The basal transgressive formation of the Heytesbury Group contains a small proportion of deep-water foraminifera, suggesting upwelling of bottom currents against the continental shelf early in the Middle Miocene.

I INTRODUCTION

Branxholme-1 was drilled by the Victorian Mines Department as a water bore, in the north-western part of the Tyrendarra Embayment (Otway Basin), at a location of 37°51'30"S, 141°47'44"E. Total depth was 1510'.

The bore was examined to provide stratigraphic control for a possible future location for an Otway Group test in the Branxholme area.

The sequence drilled comprised Miocene limestones of the Heytesbury Group, then passing through Clifton Formation into two hundred feet of silty clays and argillaceous sands of the Wangerrip Group, before reaching the top of the Eumeralla Formation somewhere between 550' and 600'. Seventeen cores were taken, the first nine at intervals of about 45', the last eight (mainly in the Eumeralla Formation) at variable intervals. Wireline logs were run, but provided only three control points of significance.

The fossiliferous sequence extending from core 2 to core 7 was examined and dated by foraminifera. Cores 8 and 9 were also examined but were barren of fauna. Cores 8, 9, 11, 13, 14, 16 and 17 have been submitted for palynological analysis, and a preliminary note on the determinations by Dr. M. Dettmann, has been included in this report (Chapter 10)

II THE FORAMINIFERAL SEQUENCE

The marine strata lie entirely within the Middle Miocene, with a possibility of highest Lower Miocene at the base of the carbonate transgression.

Due to severe contamination, the cuttings were not examined. A summary of the observations on the cores follows.

Core 1 (38'9"-44'), being a residual sub-basalt soil, was not examined for foraminifera.

Core 2 (80'-83'), a yellow lime grainstone (=limestone), contains a sparse foraminiferal fauna of which the significant components are: Orbulina universa (rare), O. suturalis (common), Globigerinoides bispherica (common), G. glomerosus circularis (common), and G. transitorius-Biorbulina bilobata intermediate forms. (For other species, see distribution chart). The presence of O. universa indicates Zonule D (Middle Miocene), but the great predominance of O. suturalis over O. universa probably indicates a position very low in the zonule.

Core 3 (120'-125'6") is a highly fossiliferous dark grey-brown marl. Significant species include Globigerinoides glomerosus glomerosus and G. glomerosus circularis; Orbulina suturalis and O. universa. The ratio of the former to the latter is about 6:1 in the sample. This, together with the presence of Globigerinoides glomerosus glomerosus, is taken to indicate a position at or very near the Zonule D - E boundary.

Core 4 (165'-170') is a hard yellow bioclastic lime grainstone, which yielded a small fauna, including Globigerinoides glomerosus curvus, G. glomerosus circularis and G. bisphericus. Orbulina suturalis was not found. This fauna indicates Zonule E (Middle Miocene). An interesting point is the presence here of Cassigerinella chipolensis, which was previously thought to be restricted to the Middle Oligocene in Southern Australia (Wade, 1964). It has also been noted in the Miocene in our examination of V.M.D. Codrington-1. (Apthorpe, 1969)

Core 5 (212'-215') is a grey marl with a very rich planktonic fauna. Globigerinoides bisphericus is dominant, with abundant G. trilobus, Globigerina apertura, and a relatively small number of Globigerinoides glomerosus curvus and G. transitorius. The relative proportions of species have changed, with G. bisphericus now dominant, and it is suspected that this fauna is within the lower part of Zonule E.

Core 6 (265-270') is a coarse-grained, bedded, red bioclastic lime grainstone. Much of the fauna is ferruginous-stained, and there is little doubt that it is in palce. An abundant, moderately shallow water fauna is present, with rather sparse planktonics. These include: Globigerinoides trilobus, G. rubra, Globigerina woodi and Globigerinoides glomerosus. The age is therefore still within Zonule E.

Core 7 (314'-319'6") has a lithology virtually identical to core 6. A rich benthonic fauna includes Cibicides perforatus, Cassidulinoides subglobosa, and Sphaeroidina bulloides as the dominant forms. The planktonic fauna is very sparse and rather nondescript. One specimen of Globigerinoides glomerosus may not be in place, due to its yellow clayey coating. The ferruginous stained fauna includes Globoquadrina dehiscens, Globigerinoides trilobus, Globigerina woodi, G. cf. apertura, Globorotalia obesa, Globigerina spp. On the evidence of trilobus and woodi the core is certainly Miocene in age; and if the specimen of glomerosus is in place, it would indicate an age of Zonule E or high in F. Other reasons for believing that this age is oorrect are given in the following.

The most interesting feature of the core is the occurence in very small numbers of ferruginous-stained specimens of Hastigerinella digitata (Mioc.-Recent); broken chambers of Hastigerinella bermudezi; Polymorphina sororia or P. lactea Brady; aberrant forams with completely

..3

random growth patterns; and an unidentified agglutinated form composed of oriented sponge spicules.

This fauna is significant in that:-

(a) it is the first recorded occurrence known to the author of Hastigerinella in the Otway Basin;

(b) in the tropical planktonic zonation scheme of Bolli and others, H.bermudezi ranges through the Globorotalia barisanensis zone, and possibly slightly above and below it. The Otway Basin equivalents are the lower part of Zonule D and the upper part of Zonule E. Consequently this determination supports a Zonule E age for this core.

(c) Brady's records of H. digitata, P. sororia and P. lactea are virtually all from deep water abyssal deposits. The other forms mentioned above may also provide some evidence of a deep water habitat. To explain their presence here, as a small component of a Cibicides - rich shallow water fauna deposited in a high energy, shallow nearshore environment, one may speculate that deep waters upwelled against the southern Australian continental shelf in the early Middle Miocene, and carried a small part of their fauna onto the shelf, to be deposited with the advancing transgression.

Core 8 (370'-375'6") and Core 9 (425'-430') were both examined and found to be barren of foraminifera.

CONCLUSIONS

1. Branxholme-1, being drilled to the south-east of the Casterton uplift, was situated on a paleo-high for a large part of Upper Cretaceous to Upper Tertiary time. The Upper Cretaceous Sherbrook and Upper Eocene Nirranda Groups are absent, through non-deposition rather than erosion.

This is indicated by facies studies which have indicated the approximate shorelines of both groups. The Sherbrook Group occurs in a Santonian open marine facies at Belfast-4, and in a Santonian restricted marine facies 20 miles to the southwest of Branxholme-1 at Heywood-10. This restricted shallow marine facies is also present in Pretty Hill-1 and Dumeralla-1, forming a linear trend. Further north-west, in Caroline-1 sediments of Santonian age are paralic. (This is within the so-called "Voluta trough", which is discussed in detail elsewhere (Ribis and Apthorpe, 1969)). Thus the Sherbrook Group's most northerly coastline was located somewhat north of Pretty Hill - Dumeralla wells, some 13 miles south of Branxholme-1.

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"Coastal" deposits (i.e. paralic) of the Upper Eocene Nirranda Group are recorded in Heywood-10 and Eumeralla-1. The same formation in Pretty Hill-1 is non-marine. Thus a line drawn through Heywood-10, between Eumeralla-1 and Pretty Hill-1, and probably passing just south of Yangery-1, approximates the Nirranda Group coastline during Zonule K (end Upper Eocene) times.

2. The basal unit of the Upper Tertiary Heytesbury Group, the Clifton Formation, is of unusually young age - Middle Miocene Zonule E, or possibly highest Zonule F (Lower Miocene). This confirms the observation that this transgressive basal unit was highly diachronous, ranging in age from Lower Oligocene Zonule J in the south-west (Voluta-1), through Middle and Upper Oligocene Zonules I-1 and I-2 in the Port Campbell Embayment, to Middle Miocene in this well. The site of Branxholme was therefore structurally a high area throughout at least Oligocene and Lower Miocene time.

3. Although the Clifton Formation is a shallow water deposit, the presence of small quantities of very deep water species may indicate deep water upwelling at the onset of the transgression in this area. D. J. Taylor has in several reports (personal communication) pointed out that Zonule E was a time of marked tectonic disturbance, although this is less pronounced in the Otway than in the Gippsland Basin. Tectonic disturbance appears to be linked with the upwelling of large water masses, which in turn appears to produce the highest number of planktonic species recorded for the Victorian Tertiary.

4. The Clifton Formation of this well may be correlated lithologically, and perhaps chronologically, with the Bochara Limestone, the basal limestone formation in the Muddy Creek sequence outcropping west of Hamilton.

5. Approximately 200 feet of Middle Palaeocene Wangerrip Group clays and dark green argillaceous sandstones are developed in the well. They may be correlated with sediments of the same age in the Casterton area; and also may possibly be correlates of the ferruginous sands and clays underlying the Bochara Limestone (Spencer-Jones, 1965).

Core 10 has not been examined palynologically, but is lithologically very similar to the dated core 9, and is therefore included in the Wangerrip.

IV Summary of Palynological Determination

The determinations, made by Dr. Mary Dettmann, will be reported on in detail at a later stage.

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Core 8	370'-375'6"	Triorites edwardsii zone	M. Palaeocene
Core 9	425'-430'	" "	" "
Core 11	602'-605'	??Coptospora paradoxa zone	definite Lower Cretaceous
Core 13	785'-790'6"	Coptospora paradoxa zone	(Albian)
Core 14	880'-885'3"	" "	" "
Core 16	1282'6"-1287'	" "	" "
Core 17	1492'-1497'6"	" "	" "

V REFERENCES

Spencer - Jones, D. 1965 : Marginal Tertiary Deposits of the Tyrendarra Embayment. Vic. Mines Dept., unpublished report no. 1965/31.

Wade, M. 1964 : Micropaleontology 10(3), Table 1.

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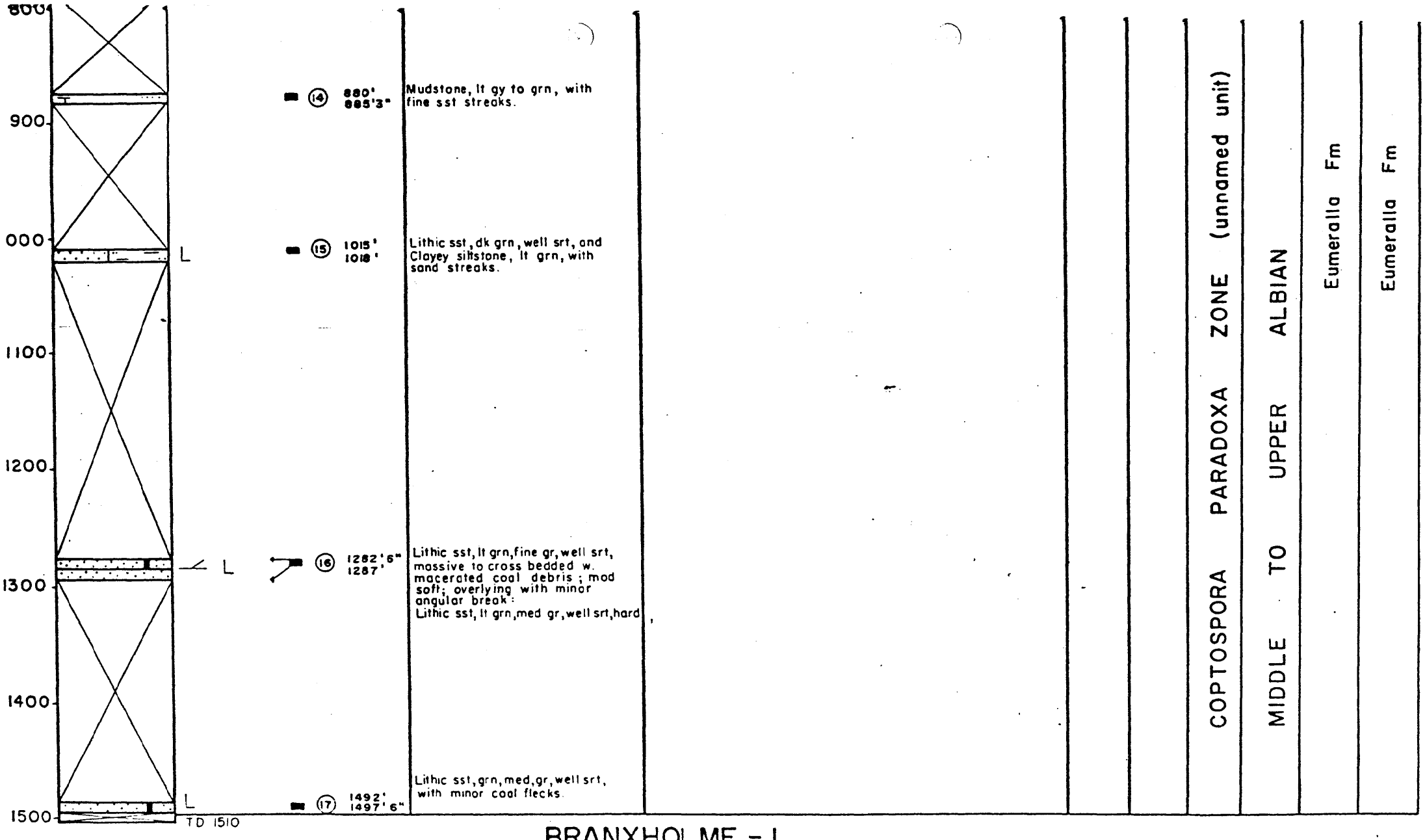
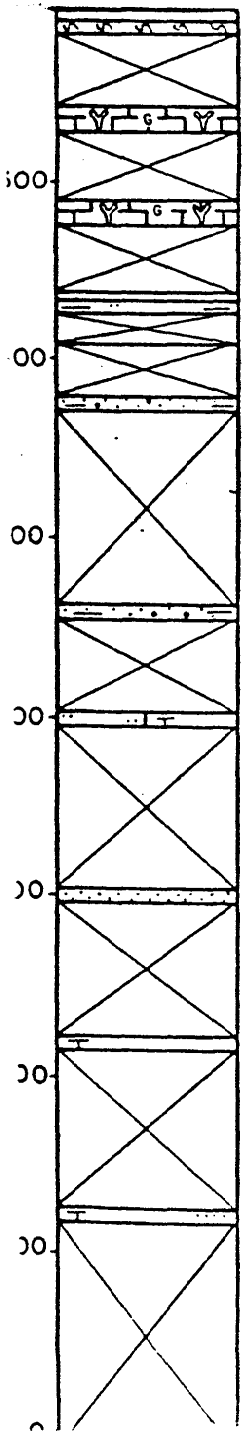
Apthorpe, M. C. 1969 : Palaeontological report, V.M.D. Codrington-1. S.D.A. Technical Memorandum SDM 27.



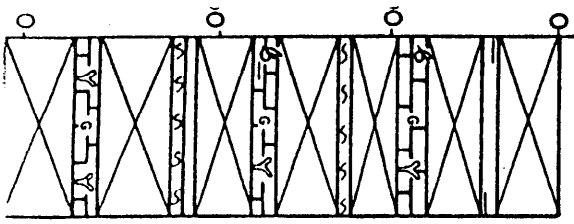
BRANXHOLME - 1

Core log and foraminiferal distribution chart

S.D.M. 26
Encl. 1
Drg. N° 3360.



⑦	314' 319'6"	As above	E or F	10 or 9		MIDDLE OR LOWER MIOCENE	Clifton	Bochara
⑧	370' 375'6"	Silty clay, dk brn-grn to dk grn, soft glauc (?), silty, ferrug grains.	NFF					
⑨	425' 430'	Argill sst, dk grn, poorly srt, minor crs grains, mod soft.	NFF		TRIORITES EDWARDSII	MIDDLE PALEOCENE	Wangerrip Gp. (undiff.)	Pebble Point Fm.
⑩	540' 545'	Argill sst, dk grn, mod soft, occas pebbly.						
⑪	602' 605'	Grn siltstone and gy claystone, mod hard to mod soft, patchy						
⑫	700' 704'6"	Lithic sst, gy grn, med to fine gr, well srt, mod soft, massive.						
⑬	785' 790'6"	Mudstone, med to lt gy, mod hard, massive						
⑭	880' 885'3"	Mudstone, lt gy to grn, with fine sst streaks.			named unit)		Fm	Fm



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FORMATION CHANGES INDICATED ON LOGS

CORED INTERVALS

① 38'9" 44' ② 80' 83' ③ 120' 125'6" ④ 165' 170' ⑤ 212' 215' ⑥ 265' 270'

LITHOLOGY

Soil, dk brn, clayey, ferrug, semi-consol.

Biocl limegrainstone, yellow, foss, bry, porous, fri.

Marl, dk gy-brn, soft, foss, bry

Biocl.lime grainstone, crm-yellow, hard, clayey, ruggy in part.

Marl, med gy, soft, sticky, foss, bry massive.

Lime grainstone, red, ferrug, crs gr, mod hd, friable, foss-bryozoa, bedded

DISTRIBUTION OF SELECTED FORAMINIFERA

PLANKTONICS
Globorotalia barisanensis
Orbulina universa
Orbulina suturalis
Globigerinoides transitorius – Biorbulina bilobata
Globigerinoides glomerosus circularis
Globigerinoides bisphericus
Globigerinoides trilobus
Globigerina woodi
Globoguadrina dehiscens
Biorbulina bilobata
Globigerinoides glomerosus glomerosus
Globigerinoides rubra
Globigerina apertura
G. bulloides
G. cf. concinna (Wade)
Globigerinoides glomerosus curvus
Cassigerinella chipolensis
Globigerinoides trilobus immaturus
Globorotalia obesa
Globigerinoides transitorius
Globorotalia obesa
Globigerina cf. eyapertura (?)
Hastigerinella digitata
H. bermudezi

BENTHONICS

Astrononion centroplax
Carpenteria rotaliformis
Sphaeroidina bulloides
Polymorphina lactea /P. sororia

ZONULE (TAYLOR)	D	D	E (low) E (basal)
CARTER'S FAUNAL UNIT EQUIVALENTS	11	11	10 10 10 10?
PALYNOLOGICAL ZONE			
AGE	MIDDLE MIOCENE		
FORMATION	Fm	Heytesbury Gp (undiff)	
TENTATIVE CORRELATIONS	o Ls.	Muddy Creek Marl.	