ROWANS - 1

PE990143

6.4 Paleontological Report

6.4.1 Introduction

Cutting samples from Rowans -1 were examined at 100 foot intervals from 220' to 5200'. Eight sidewall cores from the Upper Cretaceous and two from the Lower Cretaceous were examined, but all were barren of microfauna.

The foraminiferal zonation used is that of Taylor for the Gippsland, Bass and Otway Basins, modified by later drilling results of Shell Development (Aust.) Ltd. Enclosure 8 outlines this zonation and presents comparisons with zonations of other areas.

Cuttings from the carbonates of the Tertiary Heytesbury and Nirranda Groups were severely caved, and no accurate definition of zonule boundaries was possible. Cuttings in the Wangerrip Group were predominantly sandy or coaly, and no precisely dateable mocrofaunas were found. The Upper Cretaceous Sherbrook Group was also predominantly sandy, but contained two marine shaley intervals which could be dated. Sidewall cores shot in these intervals were unfossiliferous, which suggests that the Cretaceous faunas occur discontinuously through the marine intervals.

6.4.2 The Foraminiferal Sequence

6.4.2.1 Miocene 220 - approx. 1400 ft.

Zonule D: 220 - 700 ft. (Middle Miocene)

The occurrence in this interval of Orbulina universa, O. suturalis, and rare Globigerinoides glomerous circularis, in the absence of older species of the Orbulina bioseries, defines zonule D.

Zonule E: 700 - 1000 ft. (Middle Miocene)

The highest occurrence of Globigerinoides glomerosus at 700 ft. defines the top of this zonule. At 790 ft. the earlier form Globigerinoides glomerosus curvus is also present. Small specimens referable to Globigerinoides cf. bisphericus are rare at 890 and 950 ft., but true G. bisphericus is absent.

Zonules F and G: 1000 - 1200 ft. approximately (Lower Miocene).

The limits of these zonules, defined as they are on the downhole disappearance of certain species, cannot be accurately defined on cuttings because of the extremely heavy caving. Globigerinoides bisphericus is present below 1000 ft., defining the top of Zonule F. Below 1100 ft. Globigerinoides trilobus is very abundant, and this may indicate that the sequence is within zonule G at around this depth.

Zonule H: approx. 1200 - approx. 1400 ft. (Lower Miocene)

Globigerina woodi is moderately abundant in samples in this interval, but the fauna appears to be largely masked by caving. Evidence for the presence of the zonule is largely negative: it is placed above the highest occurrence of Zonule I species, and below the abundant G. trilobus faunas of Zonule G.

6.4.2.2 Middle to Upper Oligocene. Approx. 1400 - 1960 ft.

Zonule I: ?1400 - ?1960 ft.

The top of this zonule is difficult to determine, because specimens of Globigerina euapertura, the index species, appear to lose their distinctive identity near the top of their range. Below 1600 ft. however, G. euapertura is definitely present. Also occurring are rare Globorotalia opima, G. nana, and abundant specimens referable to the Globigerina apertura group. Specimens referred to Globigerina angiporoides are present throughout Zonule I and into Zonule H; in the higher samples they are joined by rare Globigerina linaperta. The presence of these Lower Oligecene and Upper Eocene forms is attributed to reworking of the underlying Nirranda Group. Some slight support for this explanation lies in the presence of the older species G. linaperta only in the higher samples; erosion of Nirranda Group sediments would remove and redeposit progressively older faunas with the passage of time. It is uncertain how long this reworking continued; a search for reworked specimens was not made in the well above approximately 1200 ft.

The age of the Clifton Formation is believed to be zonule I (middle to upper Oligocene), based on the presence of abundant Globigerina euapertura directly above the formation, and the presence of very rare specimens of G. euapertura preserved in the red colour of the Clifton lithology, which have caved into the Narrawaturk Marl directly below. No specimens of Globigerina angiporoides were observed in the Clifton Formation, although the lithology is hardly a favourable one for their preservation.

6.4.2.3 Lower Oligecene and Upper Eocene: 1970 - 2100 ft.

Zonules J and K

Dating of the Nirranda Group proved difficult, as severe caving from the Heytesbury Group obscured most of the in situ fauna. Less than 5% of the fauna are estimated to be in place. Two cutting samples eventually were dated. Sample 1970-80 close to the top of the Narrawaturk Marl, contained sufficient fauna to assign it to probable zonule J (Lower Oligecene). Species present include Globigerina angiporoides (very rare), Globigerina euapertura (common), Globorotalia cf. ampliapertura (v. rare), Globigerina ouachitaensis, Spirillina medioscabra, and Spirillina decorata. Globorotalia increbescens is present as a single specimen at 1990'. Sample 2090-2100' from near the base of the Narrawaturk, is assigned to high in zonule K (Upper Eocene) on the basis of the presence of Globigerina linaperta. Other rare species include G. angiporoides, G. ouachitaensis, G. ampliapertura, Cibicides pseudoconvexus and Cerobertina kakahoica. Of five other samples examined between these two, all were so heavily contaminated that no definite zonule determination could be made. It was therefore not possible to fix the position of the Oligocene - Eocene boundary, which lies between 1980' and 2090'.

6.4.2.4 Undated: 2100' - 3000'

Only caved faunas from the Heytesbury Group were seen in this interval, which comprises the coarse sands of the Mepunga Formation and the sands and silts of the top of the Wangerrip Group.

6.4.2.5 ?Lower Tertiary: 3090' - 3130'

A sparse arenaceous paralic fauna composed of Haplophragmoides complanata and Ammodiscus parri is suggestive of a Lower Tertiary age, by comparison with other wells in the Otway Basin.

6.4.2.6 Undated: 3180' - 4380'

This predominantly sand interval was barren of in situ foraminifera.

6.4.2.7 Upper Cretaceous: 4440' - 5070'

Upper Cretaceous foraminifera occur in two thin intervals which are separated by a thick unfossiliferous sand.

Zonule XA: 4370' - 4480' approx. (Santonian - Campanian approximately)

A sparse, entirely arenaceous fauna, dominated by Haplophragmoides spp., occurs in this interval. Species present include Marssonella oxycona, Hyperammina elongata, Trochammina sp. -14, and Ammobaculites subcretacea. The occurrence of Textularia semicomplanata at 4440' - 50' defines the interval as zonule XA.

6.4.2.8 Undated: 4480' - 5020'

Unfossiliferous sand covers this interval.

Zonule XB: 5020' - 5150' (Turonian)

Sparse faunas dominated by Haplophragmoides spp. are undateable, with the exception of a much richer arenaceous fauna at 5140-50'. At this depth the presence of Textularia trilobita defines the zonule XB. Other species here include Dorothia filiformis and D. cf. filiformis, Ammobaculites goodlandensis, and questionable Colomia austrotrochus.

6.4.2.9 Undated: 5160' - 5350'

No in situ foraminifera were found in cuttings or sidewall cores over this interval (lower Flaxmans Fm. - Waarre Fm. - top Otway Gp.) The deeper part of the Otway Group intersected in the well was not checked for foraminifera.

6.4.3 Depositional Environments of the Sequence, and Notes on Correlation

6.4.3.1 Upper Cretaceous

Both marine intervals (XB and XA) contain an entirely arenaceous fauna, indicating severely restricted marine conditions. The water depth was probably shallow, and water circulation was poor.

The presence of marine shale of XB (Turonian) age in this well indicates a correlation of the Belfast Formation here with the lower part of the Belfast Formation in the Flaxmans -1 well and the Port Campbell wells. It also implies that Rowans -1 occupied a depositional low during the Turonian, whereas surrounding wells such as Laang -1, Mepunga -7 and Nirranda -3 occupied higher structural positions at this time. The depositinally low position of this well might have some bearing on the quality of the Waarre Formation as a potential reservoir rock.

The fauna of zonule XA is considerably less rich than that of the Port Campbell area, which is the opposite of what might be expected in a well in a depositional low which had received Turonian marine sediments. Therefore it seems probable that some structural re-adjustment of the Rowans area occurred between the Turonian and Senonian, and that the rise of the area more than compensated for the relatively higher sea level of the Senonian Transgression.

6.4.3.2 Lower Tertiary

Apart from a short paralic interval near the base, the entire Wangerrip appears to be barren of microfauna, rich in coaly fragments, and is therefore interpreted as non-marine. The paralic interval at 3100' may perhaps be correlated with the Rivernook Member, as that is the most widespread of the Lower Terriary marine incursions, but there is no direct palaeontological evidence for such a correlation.

6.4.3.3 Upper Eocene and Lower Oligocene

Due to the heavy caving, the depositional environment of the Narrawaturk Marl is impossible to assess. All that can be said is that it is marine, probably open marine.

6.4.3.4 Middle to Upper Oligecene and Miocene

The Clifton Formation contains a moderately abundant microfauna, not suggestive of very shallow depth. This may lend some support to the recently advanced hypothesis of Carter and Landis (1972) that the disconformity underlying the Clifton Formation represents a period of submarine erosion, not subaerial exposure. The Clifton Formation is then seen as being deposited during the period of slowing down of the erosive currents, which may explain why it contains an abundant foraminiferal and bryozoal fauna in a high energy lithological framework. Obviously much further work will be necessary before this hypothesis can be accepted, but the old picture of the Clifton Formation as the shallow water base of the Heytesbury transgression, advancing over an exposed land surface, seems to require modification.

The succeeding marls and limestones of the Heytesbury Group contain a fully open marine microfauna rich in planktonics, and as elsewhere in the Otway Basin a middle to outer neritic carbonate shelf environment seems indicated.

6.4.4 Reference

Carter, R.M. and Landis, C.A. Nature Physical Science, vol. 237, May 1, 1972.