71/77

Hydrogeology

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

Pal. Rept. 9/71

GEOLOGICAL SURVEY

Palaeontology Section

OBSERVATION BORE NO. 1, HUNDRED TOWNSEND, SECTION 125: MICROPALAEONTOLOGY AND STRATIGRAPHY

BRIAN McGOWRAN
Senior Palaeontologist

Rept.Bk.No. 71/77
G.S. No. 4654
D.M. No. 1016/1/69

12th May, 1971.

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CONTENTS

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ABSTRACT

The section is analysed on lithological and microfaunal criteria as: Recent-Pleistocene (0-55 ft.); Oligocene, Gambier Limestone (55-70 ft.); Eocene, Lacepede Formation plus Kongorong Sand (70-?150ft.); Eocene, Knight Formation (?150-240ft. T.D.).

The Gambier/Lacepede = Oligocene/Eocene contact is probably disconformable on biostratigraphic evidence. The planktonic foraminiferal sequence in the Lacepede Formation is studied in some detail, including selection of important biostratigraphic datums. The base of the marine section includes a sporadic ingression preceding the main transgression. The Kongorong Sand perhaps should be reduced in status to a member of the Lacepede Formation.

INTRODUCTION

Observation Bore No. 1 was drilled by cable tool in Co. Robe, Hd. Townsend, Section 125, between 17.2.70 and 3.4.70. Total Depth is 240 ft. and R.L. (Ground) 65.29 ft.

Sludge samples submitted for palaeontological examination were washed and examined by standard micropalaeontological methods. The present report is the outcome of this study. The bore was logged by Mr. H. Floegel, and his lithological column is the basis of the litho- and biostratigraphical analysis dis-

cussed below and summarized on Fig. 1.

Although no cores were taken, the interval representing the Lacepede Formation is of particular interest and is accorded the most detailed attention here.

PLEISTOCENE - RECENT (0-55ft.)

Small gastropods and charophyte oogonia occur in the grey, calcareous "soil" (0-1 ft.).

The next 23 feet consists of calcarenite, calcisiltite and marl, light-coloured, in part well cemented. Down to 15.5. ft. microfaunas are poor, with gastropods, thin-shelled ostracodes, and rare foraminifera (Ammonia, cf. Melonis). Anomalinoides, Cibicides, Globigerina are present, but reworked. The first Ammonia beccarii (common) and Elphidium (common) in some numbers appear downhole at 15.5 ft. The unit is distinct from the underlying unit, but it has not been identified formation-wise.

From 24 to 55 feet the sediment is a loose grey sand, quartzose, with rounded bioclastic skeletal carbonate grains and often abundant calcareous microfossils. There are variations in lithological aspect governed by the amount of coarser shell fragments, mostly mollusca.

The benthonic foraminiferal fauna is dominated by Ammonia beccarii, Elphidium cf. crassatum, Discorbis including D. dimidiatus, and miliolids. Also present are Vagocibicides maoria, Peneroplis pertusus, Discorbinella biconcava, Sigmoilopsis lapidigera, Bolivinids, Uvigerinids, and others.

Planktonics, represented by worn specimens presumed to be reworked from the Miocene part of the Gambier Limestone, include

Globigerinoides, Turborotalia and Globoquadrina dehiscens. However, in the lower part of the unit (40-55 ft.), there are planktonics which appear not to have suffered recycling. This group includes Globorotalia crassula conomiozea/viola, G. inflata, G. crassaformis, G. cf. praemenardii, Globigerina bulloides s.l. and G. woodi cf. decoraperta. A specimen of Globorotalia truncatulinoides occurs as a downhole contaminant in the Eocene (143 ft.).

The lithology of the interval between 24 and 55 feet, together with its indigenous microfaunal content and the recycled elements, indicate marine, neritic, shallow, rather high energy conditions of deposition. In terms of identified rock units (Firman 1967, 1969) the interval appears to belong to the Coomandook Formation, with the possibility remaining that it could include the "coquina and calcarenite at base of Bridgewater Formation". Indeed, it is not clear how an aeolianite is to be distinguished from a neritic-to-littoral sand in sludges where sedimentary structures have been destroyed. The interval is taken to be of Pleistocene age (Firman places the Coomandook Formation in the Lower Pleistocene on superpositional grounds) although biostratigraphic evidence is lacking.

GAMBIER LIMESTONE (55-70 ft.)

Abundant bryozoal fragments in light grey-cream calcarenite mark the top of preserved Gambier Limestone. An admixture of "Pleistocene" microfossil elements and megafossil fragments with typically Oligocene microfauna and bryozoa occurs in the sludge sample from 54-62 ft. The contact was observed at

55 ft. and the mixing is taken to indicate sampling across it, rather than wholesale recycling of Gambier sediment.

The benthonic foraminiferal assemblage includes Victoriella conoidea, Carpentaria rotaliformis, Stomatorbina concentrica, Gyroidinoides zelandica, Elphidium howchini, Bolivinopsis cubensis, Cibicides, Eponides, Cassidulina, etc.

Planktonic species include Globigerina cf. angiporoides, G. labiacrassata, G. cf. brevis, G. cf. ampliapertura, G. cf. praesepis, G. praebulloides s.l., Globorotalia (Turborotalia) opima nana, G. (T.) cf. siakensis. This assemblage identifies the Globigerina angiporoides zone, of early Oligocene age (Ludbrook and Lindsay 1969). Although the uppermost Eocene Subbotina linaperta zone has not been identified (see below) the preserved interval of Gambier Limestone is close to the base of the formation. A mere 15 feet in thickness indicates almost total stripping by erosion prior to "Pleistocene" deposition.

LACEPEDE FORMATION plus KONGORONG SAND (70-?150 ft.)

There is a striking contact at 70 ft., where the characteristic Gambier Limestone facies gives way downhole to a calcisiltite and marl with coarse bryozoal fragments and quartz sand, all of which tends to be iron-stained, and polished brown grains and pellets which may be limonite. A sludge sample from 65-70 ft. contains a mixture of lithologies; it is clear that the contact logged at 70 ft. by Floegel is the Gambier Limestone/ Lacepede Formation contact. This sample contains, in the contrasting preservations, Victoriella and Globigerapsis index. Victoriella ranges upwards from the Globigerina angiporoides zone in the Lower Oligocene (Ludbrook 1967), whereas G. index occurs

only in the Eocene "Turborotalia" aculeata and older zones. The contact of disjunct species would suggest that the Gambier/Lacepede and Oligocene/Eocene contact is disconformable, with a small but discernable period of time unrepresented (Subbotina linaperta zone and part of G. angiporoides zone).

The interval 70-80 ft. contains a characteristic benthonic foraminiferal assemblage including Karreria pseudoconvexa, Alabamina aff. westraliensis, Pseudopolymorphina sp.

The interval 80-128 ft. is also typical of the Lacepede Formation lithologically, but distinguishable from the overlying bed in being of green-brown sandy marl with abundant glauconite pellets and a richer microfauna.

The distribution chart of planktonic species (fig.2) includes several of the more important biostratigraphic horizons. That the tops of Globigerapsis index and "Turborotalia" aculeata are noncongruent probably is not significant in this upper facies. The interval from top G. index to top Truncorotaloides primitiva defines the "Turborotalia" aculeata zone, and although Hantkenina was not found the top of Truncorotaloides collactea is consistent with previous records (Ludbrook and Lindsay 1969).

Benthonic species include particularly the aragonitic-calcareous group which characterize the more glauconitic lithologies of the Eocene in southern Australia: Hoeglundina elegans, Cerobertina kakahoica, Lamarckina airensis.

The brown, glauconitic and pyritic clay between 128 and 138 feet is almost unfossiliferous, whereas sludges from 140 to 150 (?) feet carry a second, and distinct, rich foraminiferal assemblage (fig.2). The presence of Truncorotaloides primitiva

marks the Globigerapsis index zone (Ludbrook and Lindsay 1969). "Truncorotaloides collactea group B", as designated herein, includes the typical morphotype found in the section above ("group A") together with a wider range in form. The other variants, considered to be intergradational with collactea s.s., include 3-chambered forms ("pseudotopilensis", approaching but distinct from T. primitiva), and truncate forms ("rotundimarginata, spinuloinflata). The group as a whole is likely to embrace the assemblage of acarininid planktonics, each designated nomenclaturally, found within the Globigerapsis index zone in New Zealand (Jenkins 1971). These records (see also McGowran & Lindsay 1969 on the same horizon in the Eucla Basin) would appear to constitute an "ingression" reflecting shortlived, favourable environmental conditions over the region as a whole. It probably has an oceanclimatic basis and is likely to be synchronous, thus having important regional correlational value.

The Kongorong Sand is characterized in the type description (Ludbrook 1971) as "brownish quartz grit with angular to subangular grains stained and coated with limonite", "........poorly fossiliferous, with shark teeth", and as providing an "unsuitable environment" for planktonic foraminifera; no mention is made of fine-grained matrix. Harris (1971), however, has described the unit as "a brown to yellow-brown limonitic stained quartz grit with a carbonaceous clay matrix", and this agrees with lithological logging of the Mt. Salt structure holes by J.M. Lindsay (pers. comm.). The interval below 138 ft. in the present section was logged by Floegel as a sandy and gritty clay. The typical brown quartz sand of the Kongorong is prominent, as is a microfauna the important elements of which are not downhole contaminants (fig.2).

Thus, the type description of the Kongorong Sand would seem to represent a clean-washed extreme variant among the range of lithologies. Also, the characteristic brown sand component is found in the upper ten feet of the Lacepede Formation in the present section. For these reasons it is suggested that the Kongorong Sand should be regarded as a member of the Lacepede Formation.

It is interesting that the interval 140-150 ft., with a good planktonic fauna of the Truncorotaloides primitiva zone, is separated from the sediments above 130 ft., with rich planktonic assemblages of the "Turborotalia" aculeata zone and rich benthonic assemblages, by an almost barren section of fine-grained sediment. This is a clear indication that the major Eocene transgression began rather sporadically. Among various patterns of Tertiary transgression distinguished by Taylor (1967) this situation appears to fit best the pattern of ingressions preceding a transgression.

KNIGHT FORMATION (?150-240 ft.)

The coarse fraction of a sludge sample from 147.5-152.5 ft. includes a mixture of limonite-stained quartz, clear quartz, glauconite pellets and pyrite. Cyclammina is present. At 152.5-155 ft. clear quartz sand and quartz pebbles dominate. These samples are a sampling mixture of Kongorong Sand and Knight Formation (sensu Harris 1971; Tartwaup Formation of Ludbrook 1971). The contact is placed tentatively at 150 ft.

11 samples searched for foraminifera yielded nothing. The sands were logged by Floegel as varyingly clayey and carbonaceous (fig.1), but the Burrungule Member appears to be not well developed.

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BM:CMH
12.5.1971

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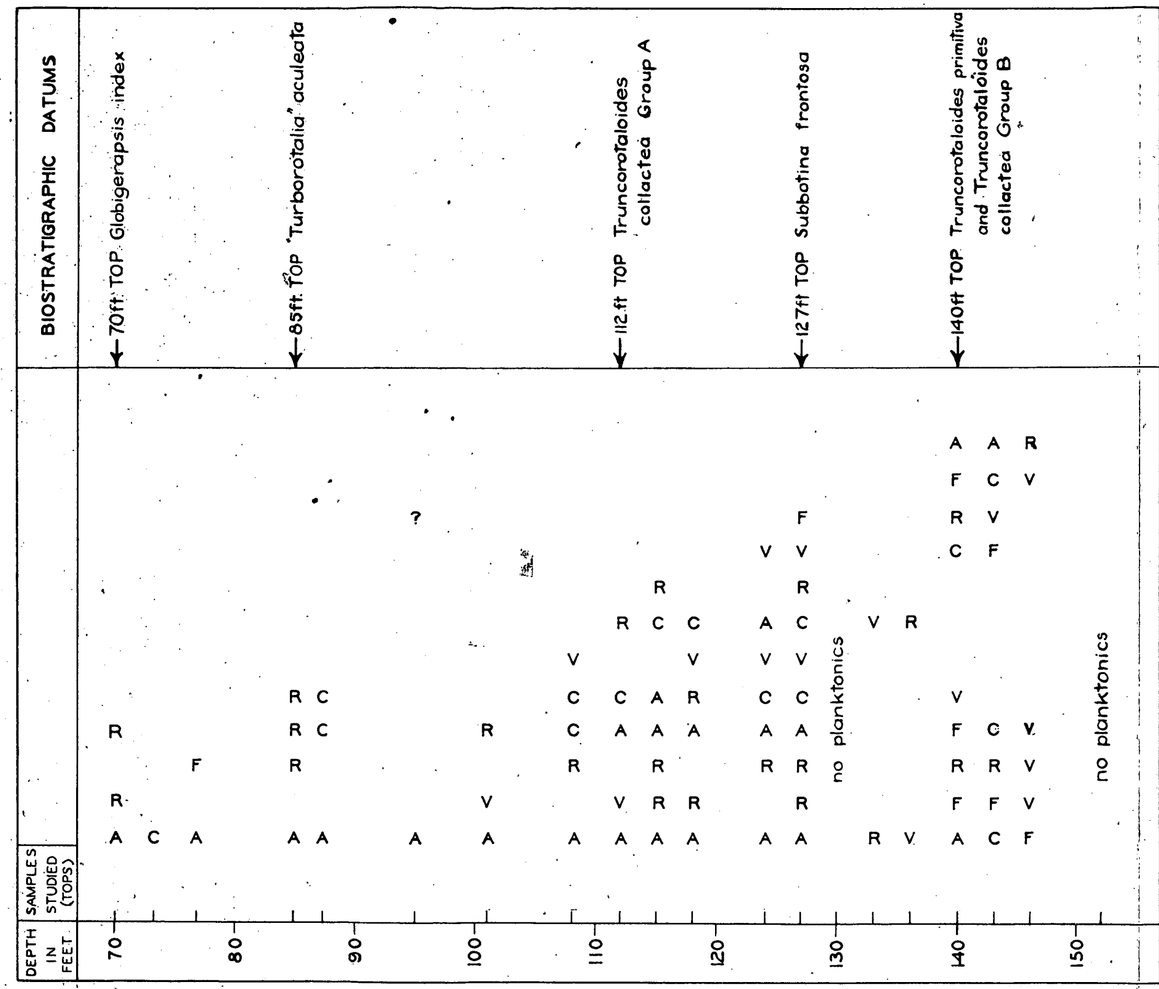
IM-2.70 A1811

DEPTH IN FEET	GRAPHIC LOG	DESCRIPTION	FORMATION	AGE
1		Soil		RECENT TO PLEISTOCENE
		Calcarenite and calcisiltite, light coloured. Ammonia and Elphidium in lower part; reworked microfossils.		
24		Grey quartz sand, abundant rounded bioclastic carbonate grains and calcareous microfossils; reworked Gambier Limestone.	COOMANDOOK FORMATION	
55		DISCONFORMITY		
		Bryozoal calcarenite and calcisiltite with Victoriella.	GAMBIER LIMESTONE	OLIGOCENE
70		?DISCONFORMITY		
		Bryozoal calcisiltite and marl, iron-stained, with iron-stained quartz sand and polished "limonite" grains.	LACEPEDE FORMATION	UPPER EOCENE
80		Marl, glauconitic (pelletal), sandy, fossiliferous, green-brown.		MIDDLE
128		Clay, brown, with pyrite nodules, sand, glauconite pellets.		
138		Clay, brown, with pyrite, weathered glauconite pellets, abundant iron-stained quartz sand.	KONGORONG SAND	
150		?DISCONFORMITY		
		Sand, varyingly gritty, clayey, carbonaceous, pyritic.	KNIGHT FORMATION	? LOWER EOCENE
240		Total depth 240 feet.		

Lithology based mostly on logging by H.Floegel.

PALAEONTOLOGY SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA
Compiled: B.McGOWRAN	OBSERVATION BORE No 1
Drn. J.M.B. | Ckd. L.V.W.	SEC. 125 HD. TOWNSEND
	STRATIGRAPHY
	Scale: 1 inch = 20 feet
	Date: 13 May 1971
	Drg. No. 71-414
	ke3

FIG. 1.



LEGEND

V	very rare	1 - 2	specimens
R	rare	3 - 5	"
F	frequent	6 - 10	"
C	common	11 - 25	"
A	abundant	25 +	"

FIG.2.

PALAEONTOLOGY SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: 1 inch = 10 feet
Compiled: B.M°GOWRAN	OBSERVATION BORE Nº 1 SEC. 125 HD. TOWNSEND PLANKTONIC FORAMINIFERAL DISTRIBUTION AND BIOSTRATIGRAPHIC HORIZONS IN THE LACEPEDE FORMATION	Date: 13 May 1971
Drn. J.M.B. | Ckd.		Drg. No. 71-415 Ke3

1M—2,70 A1811