DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

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AGE AND HABITAT OF A MONOSPECIFIC FORAMINIFERAL FAUNA FROM NEAR-TYPE ETADUNNA FORMATION, LAKE PALANKARINNA, LAKE EYRE BASIN

GEOLOGICAL SURVEY

by

J.M. LINDSAY
BIOSTRATIGRAPHY

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DEPARTMENT OF MINES AND ENERGY
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AGE AND HABITAT OF A MONOSPECIFIC FORAMINIFERAL FAUNA FROM NEAR-TYPE ETADUNNA FORMATION, LAKE PALANKARINNA, LAKE EYRE BASIN.

ABSTRACT

This is a preliminary report of a remarkable population of one species of a marine-type foraminifer from bore-core of near-stratotype Etadunna Formation. The foraminifer, unlike any previously recorded from Etadunna Formation, is identified as Buliminoides sp. cf. B. chattonensis (Finlay), and is compared with three widely-separated Late Oligocene forms (New Zealand, Northern Adelaide Plains, Rhine Graben). These comparisons might suggest some reassessment downwards (at least for the sampled horizon) of the broadly middle Miocene age proposed for Etadunna Formation in more recent years. It is possible that the foraminifer was transported to the Lake Eyre Basin by attachment to birds. Conditions suitable for reproduction and proliferation existed at the time, and salinity may have been within a range of near-marine values, but the monospecific microfauna is not at present taken to be suggestive of a marine ingression.

BOREHOLE: B.M.R. Palankarinna-2 (6540 SW 00010).

LOCATION: Lat. 28°45'50"S, Long. 138°23'48"E. NW side of Lake Palankarinna, 24 km WSW of "Etadunna" H.S. (Fig. 1) .
KOPPERAMANNA 1:250 000 mapsheet, SH 54-1.
Palankarinna 1:100 000 mapsheet, 6540 - II.

SAMPLE DATA:

Sample 6540 RS 00223: 18.85 m., core; off-white fossiliferous dolomicrite (R.A. Callen log).

SUBMITTER: R.A. Callen, Regional Geology Branch, SADME.

METHOD

The sample was disaggregated by a variant of the standard method: prolonged (one week) soaking in a solution of sodium bicarbonate plus a drop or two of detergent, followed by brisk boiling and washing through a very fine mesh sieve. Dried samples were picked at low to medium power, under binocular microscope.

RESULTS

Large numbers of only one species of foraminifera were recovered, together with much rarer valves of apparently three species of ostracods, and a cast of a small gastropod.

The foraminifer can be classified as follows:

Superfamily Buliminacea
Family Turrilinidae
Subfamily Turrilininae
Genus Buliminoides
Buliminoides sp. cf. B. chattonensis (Finlay)

Elongobula chattonensis Finlay, 1939, was put in Buliminoides by Loeblich and Tappan (1964, p. C544, fig. 426/12a-c), and that generic assignment is followed here.

The Etadunna material exhibits a range of sizes, representing a population, from juveniles only 0.1 mm long to adults up to 0.45 mm long. This seems to be close to the length of Buliminoides chattonensis: the holotype (measured from pl. 27, fig. 93, of Finlay, 1939) is 0.47 mm, and the range of lengths for all five (adult) specimens figured by Finlay (loc. cit., figs 92-96) is 0.37 - 0.53 mm, average 0.44 mm. The Etadunna species has a smooth surface, and a high-spired, coiled, subcylindrical form, more or less tapered towards the apical early chambers where the apex is bluntly rounded, not sharply spined as reported for B. chattonensis. The Etadunna species is relatively less slender and generally more tapering than B. chattonensis. The ratio of length to maximum diameter varies from 3.5 to 1.5, with most adults 3.0 - 3.5. The same ratio for the holotype of B. chattonensis (measured from pl. 27, fig. 93, in Finlay, 1939) yields a figure of 4.9, and the range of values

for all five specimens figured by Finlay is 4.8 - 6.3, i.e. distinctly more slender than for the Etadunna species. The number of coils observed in the Etadunna species ranges up to five (up to seven in the figured specimens of B. chattonensis) and the maximum number of chambers per coil is about eight (apparently similar to B. chattonensis: in both species, three or four chambers are visible in a side view of an adult coil). In both species, coils and chambers are flush to slightly inflated: the Etadunna species also displays unevenness and distortion in some cases, "with bulges in odd places", as noted by Finlay for B. chattonensis. The aperture of the Etadunna species is a minute more or less elongate pit in a slight hollow in the obliquely truncate apertural face, hence, so far as can be observed, is generally similar to that of B. chattonensis.

Thus, the Etadunna species compares closely with B. chattonensis in a number of features, but also apparently differs in several respects, e.g. is less slender, more tapering, lacks an apical spine, and may have fewer coils than B. chattonensis. No specimens of B. chattonensis have been available for comparison yet, and in contrast to the abundant Etadunna population (115 specimens picked, hundreds more observed but unpicked) the five adult B. chattonensis figured by Finlay provide an inadequate measure of variability. For the present, there appear to be sufficient similarities to refer the Etadunna population to B. sp. cf. B. chattonensis.

AGE, RANGE, AND OCCURRENCE OF Buliminoides chattonensis AND RELATED FORMS:

B. chattonensis was described by Finlay (1939) from the "Chatton Marine Formation" (Duntroonian Stage), now the Chatton Sand Member of the Gore Lignite Measures (Wood, 1956, 1978), of Southland New Zealand. In published work, the Chatton fauna continues to be dated Duntroonian (Hornibrook, 1961; Wood, 1956, 1978), thus Late Oligocene (Nathan et al., 1986, p. 39). Dr. C.P. Strong (New Zealand Geological Survey, written communication, May 1987) comments that "the species has a reported range of Duntroonian through Waitakian, i.e. upper Oligocene", and is "essentially confined to the Chatton Formation". The Chatton Sand Member represents a fossiliferous,

shallow inner-shelf, marine intercalation in the non-marine Gore Lignite Measures.

At the time of writing, I am not aware of any record of B. chattonensis sensu stricto outside of New Zealand. The only South Australian (or Australian) record of a closely comparable form known to me was noted by me in 1966, as Buliminoides sp. in SADME seismic shothole C. 214, adjacent section 505, Hundred of Dublin, Northern Adelaide Plains, 9 km NW of Dublin, at a depth of 170 feet (52 m) in marine Late Oligocene "Janjukian unit" of Port Willunga Formation (Reference bore 1, appendices 1 and 2, in Lindsay, 1969). The solitary specimen, picked from glauconitic, calcarenitic, quartzose sand, silt and limestone, has a smoothly finished test, a length of 0.51 mm, a length/maximum diameter ratio of 4.6, an apical spine, and up to eight chambers per coil: in these respects the specimen is close to B. chattonensis. However the specimen has only 3 or 4 coils of chambers (?5 to 7 in B. chattonensis), so is only compared with that species, for the present. The accompanying microfauna includes Massilina torquayensis (Chapman), frequent Guembelitria triseriata (Terquem) (but not Chiloguembelina cubensis (Palmer)), and common Amphistegina sp., thus representing the "lower Amphistegina acme", and an earlier, rather than a later, part of the Janjukian Stage, Late Oligocene (Lindsay, 1985, figs 4, 10). It may be significant that this compares closely with the Duntroonian, Late Oligocene, age estimated by authors for the "Chatton Marine Formation".

A more distantly related Buliminoides sp. was recorded by me from SADME STR-2 bore (Lindsay, 1976) 15 km SW of Keith, near the southwestern margin of the Murray Basin, on the Padthaway Ridge. The single specimen, broken both ends but otherwise well preserved, was picked from core of shallow-marine quartzose calcarenite at 75.0 - 75.4 m, in Buccleuch Group reassessed recently as of latest Eocene age. The specimen originally was at least 1.13 mm long, i.e. more than twice the length of adult B. chattonensis, tapers strongly (ratio of length to maximum diameter is 3.5), and has at least six coils of chambers, with up to 10 chambers per coil (up to seven visible from side view) i.e. significantly more than B. chattonensis. Unlike B. chattonensis, the intercameral sutures are distinctly limbate/costate.

The several specimens identified as Elongobula sp. from the Canopus Bore, northern Murray Basin (Ludbrook, 1961, table IX) have been re-examined recently. With the exception of one doubtful fragment, none are Elongobula or Buliminoides. Two specimens are Buliminella, and one other is an unidentifiable broken portion of a Buliminella (or, possibly, Buliminoides) which does not appear to be closely related to Buliminoides sp. cf. B. chattonensis from the Etadunna Formation.

Apart from B. chattonensis, the only form illustrated in the "Catalogue of Foraminifera" (Ellis and Messina, 1940 et seq.) to which the Etadunna species shows any resemblance, is that named Bulimina acicula Andreae, 1884 (a junior homonym of Bulimina acicula Costa, 1856), later illustrated by Cushman (1933, 1947) as Turrilina acicula (Andreae), then Turrilina andreaei Cushman. In this case, the resemblance is rather close, Andreae's species being similar in length (0.45 - 0.50 mm), shape (tapering, elongate-coiled; ratio of length/max. diam. = 3.2), number of coils (about six in adult), number of chambers per coil (up to about eight; up to five visible in side view), surface features (smooth finish, chambers may be slightly inflated, spiral and intercameral sutures flush to slightly incised), and in the lack of an apical spine. There is some difference in the aperture, but the overall impression is of a form closely similar to the Etadunna species. Andreae's species was described from the Upper Oligocene "Cyrenenmergel" (Cyrena marls) of Unter-Elsass (Alsace, now eastern France) in the Rhine Graben. The Cyrena marls (Cyrena, a bivalve mollusc) comprise the uppermost phase of an Oligocene marine transgression (facies marginal-marine to brackish) into the Rhine Graben (Mainz Basin, Plain of Alsace: Gignoux, 1955, pp. 498-499; Doebl and Malz, 1962). Doebl and Malz (p. 383) correlate the Cyrena marls with lower Chattian Stage, Late Oligocene.

IMPLICATIONS FOR AGE AND DEPOSITIONAL ENVIRONMENT OF ETADUNNA FORMATION

From the accounts given above, it is noteworthy that the three foraminiferal records most comparable with the Etadunna species (Chatton, Southland N.Z.; Dublin area, Northern Adelaide Plains; Cyrena marls, Rhine Graben) have the following in common:

1. All are of Late Oligocene age.
2. All are from trangressive, marginal-marine sands and clays, with more or less restricted oceanic access.

Implications for the dating of Etadunna Formation cannot be pressed at this preliminary stage and with these few scattered comparisons, but the Late Oligocene foraminiferal associations of the horizon presently sampled in Palankarinna 2 bore might suggest some reassessment downwards (at least for that horizon) of the broadly middle Miocene age proposed in more recent years (Callen and Tedford, 1976; Woodburne et al., 1985).

The following matters are relevant to discussion of the depositional environment of at least this horizon of Etadunna Formation:

1. The abundant, size-graded population of Buliminoides sp. cf. B. chattonensis represents a living and reproducing community, not merely a few temporary survivors.
2. A monospecific assemblage such as this, with its extreme minimum value for the Fisher Diversity Index (α is very much less than 1), could indicate various kinds of marginal-marine marsh or lagoon environment ranging from hyposaline to hypersaline, but Buliminoides is not recorded from these (Murray, 1973). Other more expected faunal elements in such marginal environments, such as Ammonia, elphidiids, and agglutinated forms, are not present in the Etadunna sample. Any genera of the Subfamily Turrilininae, e.g. Turrilina, Buliminoides, Buliminella, which are recorded as environmental indicators (usually Buliminella, as B. elegantissima) point to some degree of marineness, in agreement with the three comparative records discussed

above. However, the expected diversity and nature of even a marginal-marine assemblage is lacking in the Etadunna sample.

3. The abundant population of Buliminoides sp. cf. B. chattonensis from BMR Palankarinna 2 at 18.85 m, is very different in numbers and nature from the few depauperate foraminifera (Elphidium; Triloculina and other Miliolidae) recorded by Ludbrook (1963, p. 77) from buff dolomitic silt comprising the basal half-metre of Etadunna Formation in SADME Lake Eyre bore 20 (43.6 - 44.2 m).

4. The ostracods present in the Etadunna sample indicate a "non-marine" environment (Jin-Song Bao, previously Petroleum Exploration Brigades, China Ministry of Geology, personal communication, May 1987).

5. Ludbrook (1965) concluded "that foraminifera can be carried hundreds of miles from the sea by wind or by birds and that they will survive for a short time if the salinity of the water into which they are introduced is favourable". It is possible, but perplexing, that Buliminoides sp. cf. B. chattonensis was introduced alone into the Lake Eyre Basin by some such means. If so, it is apparent that conditions, at least at one horizon, were suitable for reproduction and proliferation, not just for survival. For Buliminoides, this may imply a salinity within a range of normal-marine to marginal-marine values. The Buliminoides-ostracod microfauna is even more monotonous than that reported by Wang and Lin (1974) from central China - interpreted by them as a Palaeogene brackish-water assemblage of transitional (marine-continental) facies with some marine connection inland. They recorded mainly species of Discorbis, together with examples of an agglutinated form Reophax? in association with some non-marine euryhaline (salinity-tolerant) ostracods. The Etadunna microfauna is not at present taken to be suggestive of a marine ingression into the inland Lake Eyre Basin.

6. Following this preliminary investigation, further samples from this and perhaps other bores should be examined to determine if the same or different foraminifera are present at various levels within Etadunna Formation, to help to further determine age and environment of deposition.

J.M. Lindsay

21/7/87

J.M. LINDSAY
Principal Geologist
Biostratigraphy Branch

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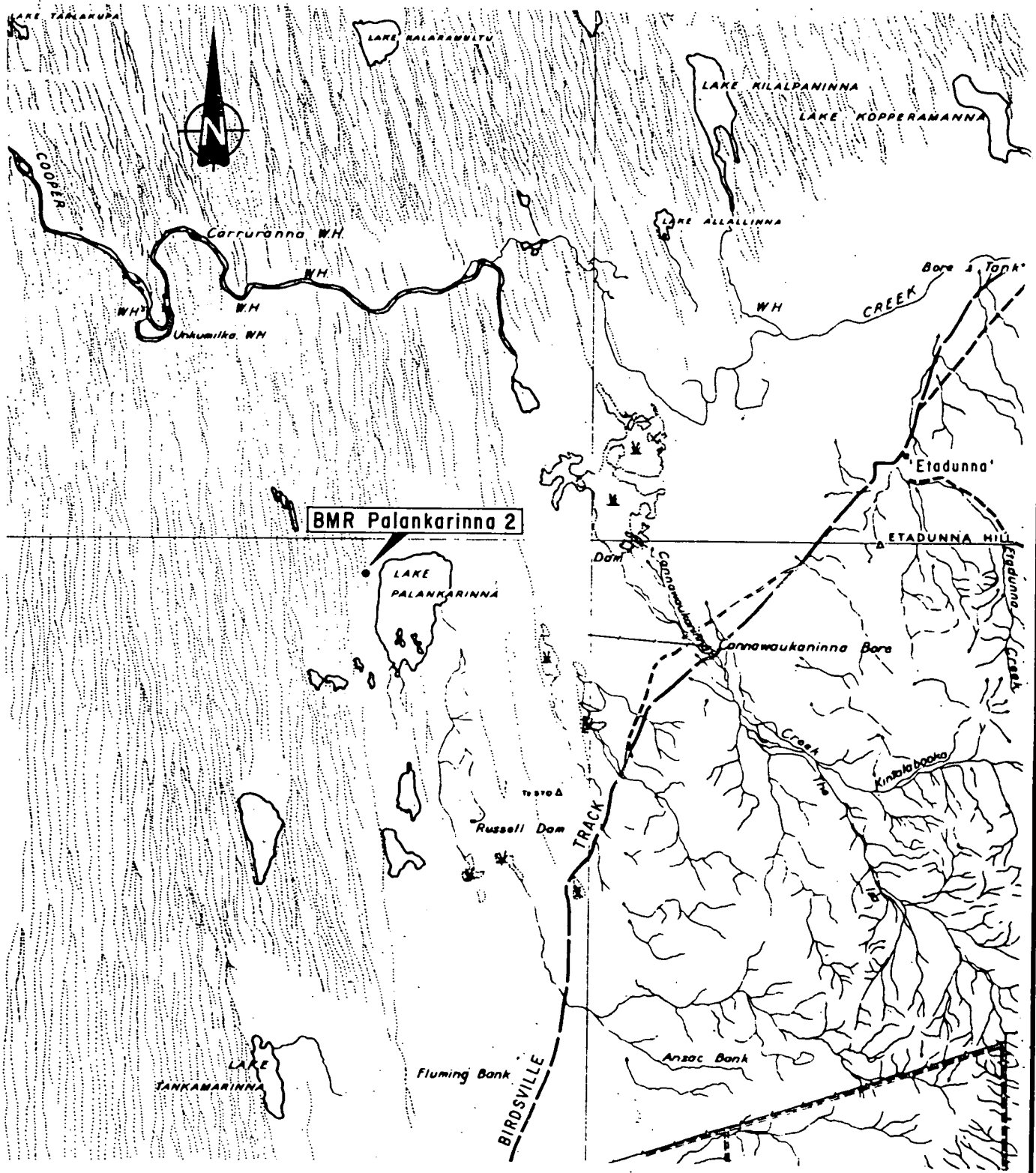

FIG.....1

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED J.M.L.	C.D.O. 24·8·87 DATE
BMR PALANKARINNA 2 BORE LAKE EYRE BASIN, S.A.	DRAWN R.H.	SCALE AS SHOWN
LOCALITY PLAN	DATE JULY 1987	PLAN NUMBER S19358
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