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COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.
BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS.

RECORDS.

1955/87

MICROPALAEONTOLOGY OF THE PLIOCENE DEPOSITS AT PORTLAND
WESTERN VICTORIA.

by

Irene Crespin.

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Records No. 1955/87

During a recent visit to Portland with Dr. N. Boutakoff and Mr. Spencer Jones of the Geological Survey of Victoria, samples were collected systematically at localities along Dutton Way which skirts the eastern shores of Portland Bay and along the foreshore below the Monument on the Kaplanade immediately east of the Portland railway station. Locality 2 on Dutton Way represents the type section for the Maritimo Beds which is the basal unit of the Maritimo Formation and is approximately eight feet thick. These beds overlie the white deposits of the Portland Limestone and are overlain by basalt. The Monument section shows portion of the Maritimo Beds and portion of the topmost unit of the Formation, the Werriko Bed. This section is also overlain by basalt and underlain by Portland Limestone.

(Singleton) At each locality bands of Ostrea sinuata (Lam.) var. glenelegensis are a feature of the deposits and characteristic foraminiferal assemblages are also present. The assemblage found in the Maritimo Beds is dominated by species of Elphidium and "Rotalia" beccarii and affords an interesting palaeoecological study.

The foraminiferal species and their distribution at both localities are given in Table 1. A short description of the samples collected at both localities is given below.

A. Locality 2, Dutton Way. Type section for the Maritimo Beds.

The stratigraphical sequence in the measured section from the Portland Limestone below up to the basalt above is as follows:

Basalt		
1.	Blueish clay	5"
2.	Top <u>Ostrea</u> bed	9"
3.	Sandy clay	1'0"
4.	<u>Ostrea</u> bed	1'6"
5.	Marly sandstone with shells	2'0"
6.	<u>Ostrea</u> bed	1'0"
7.	Blue-grey clay with shells	6"
8.	<u>Ostrea</u> bed	1'0"

Portland Limestone

Sample 8. (Ostrea bed) contains worn and ironstained tests of foraminifera, the most prominent being the littoral to shallow, water temperate genus Elphidium. "Rotalia" beccarii is exceedingly rare.

Sample 7 contains some large tests of Elphidium, but "R." beccarii is very abundant, the fine to medium residue consisting almost entirely of this form.

Sample 6 (Ostrea bed) contains worn and ironstained foraminifera amongst which are large tests of Elphidium with "R." beccarii very rare. Warm water forms such as Amphistegina and Operculina are also present.

Sample 5 contains numerous molluscan shells with Bankivia howitti very common. Elphidium and "R." beccarii are fairly common but the assemblage is represented by numerous small deeper water foraminifera especially lagenidae (Lagena is common) together with miliolidae which are almost completely absent in other samples in the section.

Sample 4 (Ostrea bed) shows a return to shallow water conditions in which Elphidium and "R." beccarii are again well represented.

Sample 3 again shows many tests of Lagena and some rotalines with Elphidium and "R." beccarii equally common.

Sample 2 (Ostrea bed) contains rather poorly preserved fossils. Small mollusca are present as well as bryozoa. Elphidium is represented mainly by a few large tests and "R." beccarii is not so common.

Sample 1 contains abundant "R." beccarii and a few small species of Elphidium. The fine residue consists almost entirely of "R." beccarii.

B. Monument Section in cliff below Esplanade.

Samples from this section represent both the Maritimo Beds and the Werrikoo Beds. The cliff at this point of the foreshore is steep and collecting was difficult.

Sample 1. Base of Maritimo Beds directly over Portland Limestone

"R." beccarii is very abundant but few tests of Elphidium are present.

Sample 2. 10 feet higher in section, at top of Maritimo Beds

Foraminifera are poorly preserved. "R." beccarii is very common and Elphidium is present.

Sample 3. 2 feet higher than sample 2 and base of Werrikoo Beds.

Fragments of Ostrea are abundant. Numerous small foraminifera are present with Elphidium and "R." beccarii not very common.

Sample 4. Near top of Werrikoo, 2 feet below contact with Basalt.

Numerous small foraminifera are present with larger tests chalky and broken. "R." beccarii is absent and only a few tests of Elphidium are present.

Notes on the foraminiferal assemblages

Two assemblages of foraminifera have been recognised in the samples from Dutton Way and Monument sections. One is characteristic of the Maritimo Beds at the base of the Maritimo Formation and the other of the Werrikoo Beds at the top of the Formation.

The Maritimo assemblage consists almost entirely of species described from Recent seas and it is dominated by tests of "R." beccarii (Linne) and species of Elphidium and related genera. The only forms described from Pliocene deposits in southern Australia are Pseudopolymorphina howchini (Cushman & Ozawa) (1930) from the Lower Pliocene (Kallimann) at McDonald's, Hamilton, Victoria. Nonion victoriense Cushman (1936) from Lake Bunga, eastern Victoria. Elphidium pseudonodosum (Cushman) (1936) from Forayth's, near Hamilton, and Elphidium adalaidense Howchin and Parr (1938) from the Metropolitan Abattoirs Bore, Adelaide. As well as the moderately

large species of Elphidium and allied genera such as Parrellina, E. crispum (Linne), E. eraticulatum (F.&M.), Parrellina verriculata (Brady) and P. imperatrix (Brady), several species of small Recent species of Elphidium are recorded. These include E. advenum (Cushman), E. articulatum (d'Orb.), E. argenteum Parr, E. simplex Cushman, E. sculpturatum Cushman and a probable new species. In Sample 5 in the Dutton Way section, numerous species of the Lagenidae were determined and these include species described by Parr (1950) such as Pissurina bassensis and P. earlandi.

Planctonic foraminifera are represented in nearly all samples from Dutton Way and include such forms as Globigerina bulloides d'Orb., Globigerinoides trilobus (d'Orb.), G. ruber (d'Orb.), Orbulina universa d'Orb., Globobulimina crassa (d'Orb) and G. menardii (d'Orb).

The Werrikoo Beds which occur at the top of the Maritimo Formation and which were sampled in the Monument section contain an assemblage somewhat different from that in the Maritimo Beds. "R." beccarii is not common and although several species of Elphidium are represented individual tests are not numerous. Furthermore, the species Rotorbinella cycloclypeus (Howchin and Parr, 1938) described from the Lower Pliocene beds in the Cowandilla Bore, South Australia, is present in some abundance. It is absent from the Maritimo Beds.

According to Phleger (1954) the abundance of "R." beccarii and species of Elphidium and related forms indicate off-shore conditions and the almost complete absence of arenaceous foraminifera in the assemblage "open-gulf" conditions. Phleger (p.608) states that "these groups seem to be able to withstand considerable ranges in salinity and perhaps in other ecologic factors as well. It appears, however, that their basic ecological adjustment is to the open-gulf water mass". The presence of abundant remains of Ostrea at various horizons together with Elphidium and "R." beccarii suggests that there was "a mud-marsh shore-line directly open to attack by open-gulf waves.

Bandy (1954) suggests that chlorinity seems to play an important part in determining the distribution of "R." beccarii and Elphidium. "R." beccarii appears to be most limited to brackish water whereas Elphidium thrives in water of both low and normal chlorinity. That there was a certain amount of warmth is indicated by the presence of Amphistegina and Operculina in some samples.

The age of the beds of the Maritimo Formation is considered to be Upper Pliocene. Singleton (1941) placed the beds of the "Werrikooian Stage" of western Victoria in the uppermost Pliocene when he described Ostrea sinuata var. glenelgensis which is abundant in the Portland beds. The majority of species of foraminifera have been described from the Pleistocene and Recent deposits. No species have been described from beds older than Lower Pliocene. None of the species described by Collins (1953) from the Pleistocene of Port Fairy were recognised but many species listed by him from those deposits have been recorded.

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DISTRIBUTION OF FORAMINIFERA IN THE MARITIMO FORMATION.

Dutton Way Section Monument Section

Foraminifera	8	7	6	5	4	3	2	1	1	2	3	4
<i>Psammophax consociata</i> Rhumbler	-	-	-	F	-	-	-	-	-	-	-	-
<i>Gaudryina</i> sp.	-	-	-	F	-	-	-	-	-	-	-	-
<i>Textularia</i> cf. <i>sagittula</i> Deffr.	-	-	F	-	F	-	f	-	-	F	F	F
<i>Textularia abbreviata</i> d'Orb.	-	-	F	-	-	-	-	-	-	-	-	-
<i>Pyrgo bulloides</i> (d'Orb.)	-	-	-	F	-	-	-	-	-	-	-	-
<i>Quinqueloculina disparilis</i> d'Orb.	-	-	-	f	-	-	-	-	-	-	-	-
<i>Triloculina tricarinata</i> d'Orb.	-	-	-	F	-	-	-	-	-	-	-	-
<i>Triloculina</i> cf. <i>oblonga</i> (Montagu)	-	-	-	F	-	-	F	-	-	-	-	-
<i>Triloculina</i> sp.	-	-	-	-	-	-	F	-	-	F	-	-
<i>Sigmollina australis</i> (Parr).	-	-	-	F	-	-	-	-	-	-	-	-
<i>Sigmollina schlumbergeri</i> (Brady)	F	-	-	F	-	-	-	-	-	-	-	-
<i>Cornuspira crassisepta</i> Brady	-	-	-	F	-	-	-	-	-	-	-	-
<i>Bolivina hassensis</i> Parr	-	-	-	-	-	-	-	F	-	-	-	-
<i>Bolivina alata</i> (Seq.)	-	-	-	-	-	-	-	F	-	-	-	-
<i>Bolivina amygdalaeformis</i> Brady	-	-	F	-	-	-	-	-	-	-	-	-
<i>Bolivina pseudoplicata</i> Heron-Allen & Earland	-	-	-	F	-	F	F	-	-	-	-	-
<i>Bolivina robusta</i> Brady	-	-	F	-	-	-	-	-	-	-	-	-
<i>Bolivina</i> cf. <i>spathulata</i> (Williamson)	F	-	-	-	-	-	-	-	-	-	-	-
<i>Bolivina tortuosa</i> Brady	-	-	-	F	-	-	-	-	-	-	-	-
<i>Bolivina dilatata</i> Reuss	F	-	-	-	-	-	-	-	-	-	-	-
<i>Bolivina compacta</i> Sidebottom	-	-	-	-	-	-	-	-	-	F	-	-
<i>Bolivina</i> sp.	-	-	-	-	-	-	-	-	-	-	-	F
<i>Bulimina aculeata</i> d'Orb. var.	-	-	-	-	-	-	F	F	-	-	F	-
<i>Bulimina elegans</i> d'Orb.	-	-	F	-	-	-	-	-	-	F	-	-
<i>Bulimina marginata</i> d'Orb.	-	-	F	-	-	-	-	-	-	-	-	-
<i>Bulimina</i> cf. <i>pupoides</i> d'Orb.	-	-	F	-	-	-	-	-	-	F	-	-
<i>Bulimina</i> sp. aff. <i>elongata</i> d'Orb.	-	-	-	-	-	-	-	-	-	F	-	-
<i>Rectobolivina bifrons</i> Brady var. <i>striatula</i> Cushman	-	-	F	f	F	F	f	-	-	-	F	F
<i>Cassidulina subglobosa</i> d'Orb.	f	-	F	F	f	f	f	-	-	-	F	-
<i>Cassidulina laevigata</i> d'Orb.	F	-	-	-	-	-	-	-	-	-	-	F
<i>Cassidulina pacifica</i> Cushman	-	-	-	-	-	F	-	-	-	-	-	-
<i>Ceratobulimina</i> sp.	-	-	-	-	-	F	-	-	-	-	-	-
<i>Lagena laevis</i> (Montagu)	-	-	f	f	f	f	-	-	-	-	F	-
<i>Lagena implicata</i> Cushman & McCulloch	-	-	-	-	f	-	-	-	-	-	-	-
<i>Lagena perlucida</i> (Montagu)	-	-	-	F	-	F	-	-	-	-	-	-
<i>Lagena lineata</i> (Williamson)	-	-	-	F	-	F	-	-	-	-	F	-
<i>Lagena apiculata</i> (Reuss)	-	-	-	F	-	F	-	-	-	-	-	-
<i>Lagena striata</i> (d'Orb.)	-	-	-	f	f	f	f	-	-	-	F	-
<i>Lagena</i> sp. 1	-	-	-	-	F	F	-	-	-	-	-	-
<i>Lagena</i> sp. 2	-	-	-	F	-	-	-	-	-	-	-	-
<i>Lagena sulcata</i> (W. & J.)	-	-	F	-	-	F	-	-	-	-	-	-
<i>Lagena sulcata</i> var. <i>laevicostata</i> Cush. & Gray	-	-	-	-	-	F	-	-	-	-	-	-
<i>Lagena semistriata</i> Williamson	-	-	-	-	F	-	-	-	-	-	-	-
<i>Lagena distoma</i> Parker & Jones	-	-	-	-	F	-	-	-	-	-	-	-
<i>Lagena distoma-margaritifera</i> P. & J. var. <i>victoriensis</i> Parr	-	-	-	F	-	-	-	-	-	-	F	-
<i>Lagena flexa</i> Cushman & Gray	-	-	-	F	-	-	-	-	-	-	-	-
<i>Lagena</i> aff. <i>plumigera</i> Brady	-	-	-	F	-	-	-	-	-	-	-	-
<i>Lagena tenuis</i> (Born.) var. <i>ornata</i> Reuss	-	-	-	-	-	-	-	-	-	-	F	-
<i>Fissurina orbignyana</i> Seq.	-	-	-	-	-	-	F	-	-	-	-	-
<i>Fissurina</i> cf. <i>fissicarinata</i> Parr	-	-	-	-	-	-	F	-	-	-	-	-
<i>Fissurina earlandi</i> Parr	-	-	-	F	F	f	-	-	-	-	-	-
<i>Fissurina hassensis</i> Parr	-	-	-	-	-	-	F	-	-	-	-	-
<i>Fissurina</i> cf. <i>collinsi</i> Parr	-	-	-	F	-	-	-	-	-	-	-	-
<i>Parafissurina quadrata</i> Parr	-	-	-	-	-	-	F	-	-	-	-	-
<i>Oolina pseudocatenuolata</i> (Chapman & Parr)	-	-	-	-	-	-	F	-	-	-	-	-
<i>Oolina costata</i> (Williamson)	-	-	-	-	-	-	F	-	-	-	-	-
<i>Oolina acuticosta</i> (Reuss)	-	-	-	-	-	-	F	-	-	-	-	-
<i>Oolina tasmanica</i> Parr	-	-	-	-	-	-	-	-	-	-	F	-
<i>Dentalina mitsu</i> Hada	-	-	-	-	-	-	-	-	-	-	F	-
<i>Vaginulina vertebralis</i> Parr	F	-	-	-	-	F	-	-	-	-	-	-
<i>Nodosaria radialis</i> Linne	-	-	-	-	F	-	F	-	-	-	-	-
<i>Uvigerina hispida</i> Schwager	-	-	-	-	-	-	F	-	-	-	-	-
<i>Uvigerina pisces</i> d'Orb.	-	-	-	F	-	-	-	-	-	-	F	-
<i>Uvigerina hassensis</i> Parr	-	-	-	-	F	-	F	-	-	-	-	-
<i>Ammonia</i> cf. <i>saxatilis</i> Cushman var. <i>bradyana</i> Cushman	-	-	F	-	-	-	-	-	-	-	-	-
<i>Ammonia scalaris</i> (Natsch).	-	-	-	-	-	-	F	-	-	-	-	-
<i>Lenticulina tasmanica</i> Parr	-	-	-	-	-	-	F	-	-	-	-	-
<i>Lenticulina reticulata</i> (Lam.)	-	-	F	-	-	-	-	-	-	-	-	-
<i>Guttulina irregularis</i> (d'Orb.)	-	-	-	-	-	-	F	-	-	-	-	F
<i>Guttulina vabei</i> Cushman & Ozawa	-	-	-	-	-	-	F	-	-	-	-	-
<i>Guttulina problema</i> d'Orb.	F	-	-	f	-	-	-	-	-	-	F	F
<i>Guttulina lactea</i> (W. & J.)	-	-	F	-	-	-	-	-	-	-	-	F
<i>Guttulina yamazaki</i> Cushman & Ozawa	-	-	-	-	-	-	-	-	-	-	-	F
<i>Guttulina</i> aff. <i>guttiformis</i> (Terquem).	-	-	-	-	-	-	-	-	-	-	-	F
<i>Guttulina regina</i> (Brady, Parker & Jones)	-	-	-	-	-	-	-	-	-	-	-	F

* Dutton Way samples 8 - 1 in upward sequence
Monument Section samples 1 - 4 in upward sequence.

Foraminifera

8.7.6.5.4.3.2.1.

1.2.3.4

<i>Globulina gibba</i> d'Orb	- - F - - - -	- - - -
<i>Pseudonolymorphina howchini</i> Cush. & Ozawa	- - F - - f - -	- - - F
<i>Pyralina fusiformis</i> (Roemer)	- - F - - - -	- - - -
<i>Sigmoidella elegantissima</i> (Parker & Jones)	f r f r r - r -	- - - F
<i>Sigmoidella kagaensis</i> Cushman & Ozawa	- f r - - - -	- - - -
<i>Sigmomorphina</i> cf. <i>flintii</i> (Cushman)	r - - - - -	- - - -
<i>Sigmomorphina williamsoni</i> (Terquem)	- - - F - - -	- - - -
<i>Planulara</i> sp	- - - - - -	- - F -
<i>Globigerina bulloides</i> d'Orb	f - r f - - r -	- - F F
<i>Globigerina</i> sp. nov. (= <i>C. suberretacea</i> Chap)	- - - - - r -	- - - -
<i>Globigerina sacculifera</i> Brady	- - - - - -	- - F -
<i>Globigerinoides ruber</i> (d'Orb.)	r - - - r r - -	- - F -
<i>Globigerinoides trilobus</i> (d'Orb.)	f - f f f f f -	- f f f
<i>Orbulina universa</i> d'Orb	- - - - - r -	- - - -
<i>Globorotalia crassa</i> (d'Orb)	- - r r r r r -	- r - -
<i>Globorotalia menardii</i> (d'Orb.)	r - r r r r - -	- r - -
<i>Pullenia quinqueloba</i> Parker & Jones	- - - - - -	- - F -
<i>Discorbinella biconcava</i> (Parker & Jones)	- - r - r r r -	- - - -
<i>Discorbis bartheloti</i> (d'Orb.)	- - - - - r -	- - - -
<i>Discorbis collinsi</i> Parr	- f f r - - -	- - - -
<i>Discorbis australis</i> Parr	- - r r - - -	- f c r
<i>Discorbis margaritifera</i> (H.-A. & E.)	r - - - - -	- - - -
<i>Discorbis patelliformis</i> (Brady)	- - - F - - -	- - - F
<i>Discorbis patelliformis</i> (Brady)	XXXXXXXXXXXXXXXX	XXXXXXXX
<i>Discorbis turbo</i> (d'Orb.)	- - - - - r -	- - F -
<i>Discorbis globularis</i> (d'Orb.) cf. var. <i>angelica</i> Cushman	- - F - - - -	- - - -
<i>Discorbis dimidiatus</i> (P. & J.) var. <i>acervulinoides</i> Parr	- - - - - r -	- - - -
<i>Discorbis</i> sp. 1	- - - - - r -	- - - -
<i>Dvocybicoides biserialis</i> Cushman & Valentine	- - - - - -	- - f -
<i>Dvocybicoides laevis</i> Parr	- - - - - -	- - f -
<i>Vavocibicoides</i> sp. aff. <i>V. maoria</i> Finlay	- - - - - -	- - - F
<i>Cypsinella globula</i> Reuss	- - - - - r -	- - - -
<i>Anomalina ammonoides</i> (Reuss)	- - r - - - -	- - - -
<i>Anomalina glabrata</i> Cushman	- - - - - -	- - F -
<i>Anomalina nonionoides</i> Parr	- - r - - - -	- - F -
<i>Heronallenia translucens</i> Parr	- - - - - r -	- - - -
<i>Heronallenia lingulata</i> (B. & H.)	- - r - - - -	- - - -
<i>Cibicides lobatulus</i> (W. & J.)	f - r - f f f -	- f f f
<i>Cibicides refulgens</i> (Montfort)	- - r f f - - -	- - - -
<i>Cibicides ungerianus</i> (d'Orb.)	- - r - f - f -	- - F F
<i>Cibicides mundulus</i> (Brady, Parker & Jones)	r - - - - -	- - - -
<i>Cibicides</i> sp. 1 (aff. <i>C. umbonifer</i> Parr)	f f f f f c - -	- - - -
<i>Cibicides subhaudingeri</i> Parr	- - - - - -	- - f -
<i>Siphonina reticulata</i> (Cz.)	- - - - - r -	- - F -
<i>Patellina corrugata</i> Williamson	- - - r r r - -	- - - -
<i>Alabamina tuberculata</i> (B. & W.)	- - - F - - -	- - - -
<i>Planulina wuellerstorfi</i> (Schwager)	- - - F - - -	- - F -
<i>Planulina</i> sp. aff. <i>P. ariminensis</i> (d'Orb.)	- - - - - -	- - F -
<i>Gyrogonia soldanii</i> (d'Orb.)	- - r r - - -	- - F -
<i>Enonides</i> sp. 1	- - r - - r -	- - - -
<i>Notorotalia clathrata</i> (Brady)	f f r r r f f -	- - f f
<i>Rotalia beccarii</i> (Linne)	f a f c a c f a	c a - -
<i>Stomatorbina concentrica</i> (Parker & Jones)	r - - - - -	- - - -
<i>Spirillina denticulogranelata</i> Chapman	- - r - - - -	- - - -
<i>Rotorbinella cycloclypeus</i> (Howchin & Parr)	- - - - - -	- - c f
<i>Calcarina calcar</i> (d'Orb.)	- - - - - -	- - f -
<i>Elphidium articulatum</i> (d'Orb.)	- - f - - - f -	f - - -
<i>Elphidium argenteum</i> Parr	- f - c f f r r	- - - -
<i>Elphidium crispum</i> (Linne)	- r r r r r f -	- f f f
<i>Elphidium adelaidense</i> Howchin & Parr	- - f f f - - -	- - f f
<i>Elphidium advenum</i> (Cushman)	- - f f - - - -	- - - -
<i>Elphidium advenum</i> var. <i>margaritaceum</i> Cushman	- - r - - - -	- - - -
<i>Elphidium pseudonodosum</i> Cushman	f f f f r - f -	- - - -
<i>Elphidium simplex</i> Cushman	- c - - f - - f	c f - -
<i>Elphidium sculpturatum</i> Cushman	r - r - - - -	- - - -
<i>Elphidium rotatum</i> Howchin & Parr	r - f r - - -	- - - f
<i>Elphidium macellum</i> (F. & M.)	- - - c - f f -	- f f r
<i>Elphidium</i> sp. 1	- - - f c - - -	- - f r
<i>Parrellina verriculata</i> (Brady)	r - r - r r - -	- r - -
<i>Parrellina imperatrix</i> (Brady)	f f f f f f f -	- - f -
<i>Polystomellina australis</i> (Cushman)	- - - - - r -	- - F F
<i>Astrononion australe</i> Cushman	r - r - - - r -	- - F -
<i>Astrononion</i> sp. nov	- - - - - r -	- - - -
<i>Nonion depressulum</i> (W & J.)	- - - - - r -	- - - -
<i>Nonion</i> cf. <i>nicobarensis</i> (Schw.)	- - - - - r -	- - - -
<i>Nonion victoriensis</i> Cushman	- - - - - -	- - F -
<i>Amphistegina</i> cf. <i>lessonii</i> d'Orb.	- - r r - - -	- - - -
<i>Operculina</i> cf. <i>ammonoides</i> (Gron.)	- - r f - - -	- - - -
<i>Operculina</i> sp.	r - - - - -	- r r r