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# Pleistocene Macrofossils from CRP-1 Drillhole, Victoria Land Basin, Antarctica

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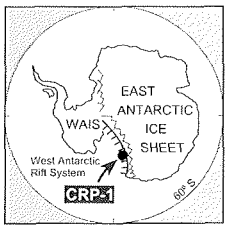
**Abstract** - Macrofossils are a significant component of biogenic carbonate sediments in the Quaternary section of the CRP-1 drillhole, Cape Roberts, Victoria Land Basin. The middle Pleistocene macrofossil assemblages contain more than 60 taxa (probably up to 80) belonging to molluscs (>40), bryozoans (>14), polychaetes (3), octocorals (1), echinoids (1), brachiopods (1), and scalpellid cirripeds (1). Taxa determined at the species level are all known from the present day Ross Sea and permit reconstruction of the palaeoenvironment in some detail. At the time of deposition of the carbonate-rich unit, Roberts Ridge was a bank 100 m deep or more, with a particulate bottom under the influence of weak bottom currents. The CRP-1 assemblages represent the richest and most diverse fossil macrofauna hitherto recorded from the Pleistocene of Antarctica.




## INTRODUCTION

Macrofossils are present, and sometimes abundant, at discrete levels of the Quaternary (middle Pleistocene) part of the CRP-1 drillhole, Cape Roberts, Victoria Land Basin (Cape Roberts Science Team, 1998a). For instance, exceedingly rich and exceptionally well-preserved macrofossil assemblages occur within the carbonate-rich unit between 33.82 and 31.89 metres below sea floor (mbsf), substantially contributing to the composition of biogenic skeletal sediments described by Taviani & Claps (this volume).

Macrofossils recovered below and above the carbonate-rich unit (lithostratigraphic Unit 3.1: Cape Roberts Science Team, 1998b) show advanced levels of abrasion and may represent reworked shallow-marine faunas. Generally, only calcitic fossils were present in these assemblages and are listed below:

1 - 21.54 mbsf: rare bryozoan fragments;
2 - 26.89 mbsf: abundant echinoid spines (?*Sterechinus* sp.), abundant bryozoan fragments, octocorals (?*Primnoisis* sp.), bivalves (*Mysella* sp.), unidentified bivalve fragment, gastropods (Margaritinae sp.), serpulid polychaetes (*Serpula narconensis*);
3 - 26.95 mbsf: echinoid spines (?*Sterechinus* sp.), unidentified bivalve fragments;
4 - 30.11 mbsf: echinoid spines (?*Sterechinus* sp.), one compressed serpulid worm tube, unidentified bivalve (?Pectinidae sp.) fragments;
5 - 32.05 mbsf: unidentified bivalve fragments;
6 - 33.90 mbsf: rare bryozoan fragments.

The carbonate-rich unit yielded an abundant fossil fauna dominated by calcareous micro- (Webb & Strong, this volume) and macrofossils, intermixed with siliceous taxa (diatoms and sponge spicules). The macrofossil fauna is very diverse, containing more than 60 species (possibly as many as 80) of skeletonized invertebrates (Appendix 1). Molluscs dominate over other macroinvertebrates, followed by bryozoans, serpulid and spirorbid polichaetes, octocorals, echinoids, brachiopods and scalpellid cirripeds.

A full systematic account of the whole Pleistocene macrofauna of CRP-1 will require a considerable amount of study and will be the object of a further contribution by the present authors. The primary goal of this paper is to provide an overview of this interesting fossil fauna, which represents a unique record for the Antarctic Quaternary (Fig. 1).

## MACROFOSSILS FROM THE CARBONATE-RICH UNIT (33.82-31.89 MBSF)

### TAPHONOMIC ASPECTS

Calcitic and aragonitic skeletal parts are in places exquisitely preserved. Shells and other skeletal parts may show various degrees of corrosion and even bioerosion at certain intervals. In particular, this fact has been observed in the interval between *c.* 32.80-32.98 mbsf (*cf.* also Taviani & Claps, this volume). Incipient pyritisation of gastropod shells (*e.g. Eatoniella glacialis*) has been observed at 33.01-32.98 mbsf

Intervals intepreted as current-generated may show a considerably higher number of calcitic macrofossils, especially bryozoans and octocorals whilst aragonitic macrofossils are best preserved in muddy layers (Taviani & Claps, this volume). With few exceptions, fossils from the many taphocoenoses that together constitute the bulk of the carbonate-rich unit are either substantially *in situ* or have been moved only a short distance away from their life habitats.

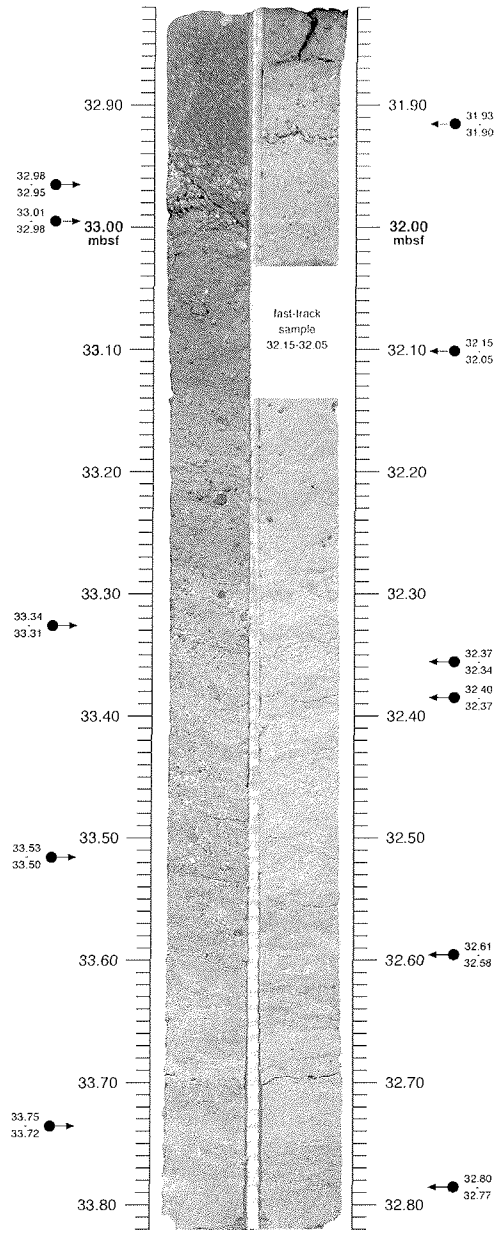



*Fig. 1* – Lithologic log of the carbonate-rich unit in the Quaternary section, showing levels studied for macrofaunal fossil assemblages.

## TAXONOMIC NOTES

*Molluscs*. The mollusc fauna from the carbonate-rich unit comprises at least 40 taxa and probably as many as 50. A preliminary list of molluscan taxa from the carbonate-rich unit has been presented in the Initial Report on CRP-1 (Cape Roberts Science Team, 1998a, p. 56). An updated but still preliminary list of mollusc taxa identified so far in sediment fractions coarser than 500 μm is reported in table 1. Many taxa are represented by juveniles or fragments sometimes difficult to identify. All identified species still live today in the Ross Sea (Dell, 1990). The mollusc fauna is dominated by eatoniellid and buccinid gastropods and phylobryid bivalves. Some of the most significant species are figured in plates 1 to 3.

*Bryozoans*. Bryozoans are the second group in order of importance with at least 14 species identified so far. A preliminary list of bryozoans has been kindly compiled by Dr. Peter Hayward and reported in table 2.

*Annelida*. Polychaete tube worms were found to belong to Serpulidae and Spirorbidae and are listed in table 3. *Paralaeospira* sp. (Plate 3.24) is a taxon very similar to *Paralaeospira* sp. A reported from the Ross Sea below 200 m water depth by Cantone & Sanfilippo (1992).

*Octocorals*. Are represented by 1 species, probably belonging to *?Primnoisis* sp.

*Echinoids*. Probably 1 species (*?Sterechinus* sp.) represented ubiquitously by spines and fragments of test; the spines do not show appreciable differences from those belonging to the living *Sterechinus neumayeri*.

*Brachiopods*. Possibly only 1 species based on small, unidentifiable fragments.

*Scalpellid Cirripeds*. Only 1 very small species represented by a few plates.

## PALAEOENVIRONMENTAL REMARKS

Macrofaunas represented in the fossil assemblages cored on Roberts Ridge (Cape Roberts Science Team, 1998c) are strongly dominated by vagile and sessile epifauna which include suspension feeders, carnivores (both predators and sponge eaters) and scavengers. These biota are typical of modern shelf/bank environments in Antarctica. Antarctic benthos is typically eurybathic with most taxa distributed over a wide vertical range. Accordingly, a very precise palaeobathymetric assessment may prove challenging and must be derived through the integration of depth records of multiple taxa. By using the bathymetric ranges of extant Ross Sea molluscan species produced by Dell (1990), we can infer depths for CRP-1 very probably exceeding 100 m, possibly in the range of 100-200 m. Polychaete and bryozoan depth-range data do not conflict with such an estimate (Cantone & Sanfilippo, 1992; P. Hayward, writt. com.). Indicators of shallow depths (such as the bivalve *Laternula elliptica* and epyphytic Littorinacean gastropods) are totally absent in the fossil assemblages. *In situ* macrofossils suggest a predominantly calm depositional environment, an inference further supported by the fact that biologic indicators of strong bottom currents (such as, for example, the acorn barnacle *Bathylasma corolliforme*) are totally lacking.

The macrofossil assemblages are quite homogenous throughout Unit 3.1, indicating that the environment remained susbtantially the same throughout the time of deposition of this unit. A brief interruption of this depositional style is marked by the occurrence of ice-discharged coarse debris and pebbles at *c.* 32.98 mbsf (Taviani & Claps, this volume). The temporary availability of hard substrate probably allowed for some attached epifauna (such as the limpet *Iothia coppingeri*) to establish.

By analogy with the distribution of similar modern assemblages in this region, no proximal ice shelf was present, rather conditions were completely open-marine. The macrobenthic assemblages offer no definitive clue as

*Tab. 1* - Preliminary list of mollusca identified in the carbonate-rich unit (33.82-31.89 mbsf). The very high diversity shown by sample 32.15-32.05 mbsf (fast-track) is enhanced by the larger size of this sample; the overall higher diversity between 32.80 and 32.05 mbsf is real, and probably reflects better environmental conditions for biota and/or for the preservation of their calcareous shells.

| SPECIES/SAMPLE | 33.75 33.72 | 33.53 33.50 | 33.34 33.31 | 33.01 32.98 | 32.98 32.95 | 32.80 32.77 | 32.61 32.58 | 32.40 32.37 | 32.37 32.34 | 32.15 32.05 | 31.93 31.90 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BIVALVIA | | | | | | | | | | | |
| *Limopsis* sp. | | | | | | | | | | | ■ |
| *Philobrya sublaevis* Pelseneer | ■ | ■ | | | | | ■ | | | ■ | |
| *Adacnarca limopsoides* (Thiele) | ■ | | ■ | ■ | | | | | | | ■ |
| *Lissarca notorcadensis* Melvill & Standen | ■ | ■ | ■ | | | | ■ | | | | ■ |
| *Adamussium* sp. | | | | | ■ | ■ | ■ | | | ■ | |
| *Mysella* sp. | | | | | | | | | ■ | | |
| *Cyamocardium denticulatum* (Smith) | | ■ | | | | | | | | ■ | |
| *Limatula (Limatula) simillima* Thiele | | | | | | | ■ | | | ■ | |
| *Limatula (Antarctolima) hodgsoni* (Smith) | | | | | | ■ | | | | ■ | |
| *Limatula* sp. | | | | | | ■ | | ■ | ■ | ■ | |
| *Cyclocardia astartoides* (Martens) | ■ | ■ | ■ | | | | | | | ■ | |
| GASTROPODA | | | | | | | | | | | |
| *Anatoma euglypta* (Pelseneer) | | | | | | | | | | ■ | |
| *Trochidae* spp. | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| *Leptocollonia innocens* (Thiele) | | | | ■ | | ■ | | | | ■ | |
| *Lissotesta* cf. *mammillata* (Thiele) | | | | | | | | ■ | | ■ | |
| *Lissotesta* sp. | | | | | | ■ | | ■ | ■ | ■ | |
| *Iothia coppingeri* (Smith) | | | | ■ | | | | | | ■ | |
| *Omalogyra* sp. | | | | | | | ■ | | | | |
| *Eatoniella glacialis* (Smith) | ■ | ■ | | ■ | | ■ | ■ | | | ■ | ■ |
| *Onoba (Ovirissoa) kergueleni* (Smith) | | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | |
| *Onoba gelida* (Smith) | ■ | | | | ■ | ■ | ■ | ■ | ■ | ■ | |
| *Onoba turqueti* (Lamy) | | | | | | ■ | ■ | ■ | ■ | ■ | |
| *Capulus subcompressus* Pelseneer | ■ | | ■ | ■ | | ■ | ■ | | | ■ | ■ |
| *Turritellopsis latior* Thiele | | | | | | ■ | | | | ■ | |
| *Eumetula austrina* (Hedley) | | | | | ■ | ■ | | | | ■ | ■ |
| *Eumetula strebeli* Thiele | | | | | ■ | | ■ | | | ■ | ■ |
| *"Triphora"* sp. | | | | | | ■ | | | | | |
| *Melanella* sp. | | | | | | | | | | ■ | |
| *Prolacuna macmurdensis* (Hedley) | | | | | | | | | | | ■ |
| *Pareuthria innocens* (Smith) | | | | | | | | | ■ | ■ | |
| *Meteuthria cf. rossiana* Dell | | | | | | | | | | ■ | |
| *Prosipho contrarius* Thiele | | | | | | | ■ | | | ■ | |
| *Prosipho cancellatus* Smith | ■ | | | | | | ■ | ■ | ■ | ■ | ■ |
| *Prosipho priestleyi* (Hedley) | | | | | | | | | ■ | ■ | |
| *Prosipho* cf. *mundus* Smith | | | | | | | | ■ | ■ | ■ | |
| *Trophon* sp. | | | | | | | | | | ■ | |
| *Lorabela* cf. *davisii* (Hedley) | | | | | | ■ | | | | | |

*Tab. 2* - Preliminary list of Bryozoa identified in the carbonate-rich unit (courtesy of Dr. Peter Hayward).

| SPECIES/SAMPLE | 33.75 33.72 | 33.53 33.50 | 33.34 33.31 | 33.01 32.98 | 32.98 32.95 | 32.80 32.77 | 32.61 32.58 | 32.40 32.37 | 32.37 32.34 | 32.15 32.05 | 31.93 31.90 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lageneschara lyrulata* (Calvet) | ■ | | ■ | | | | | ■ | | | |
| *Swanomia brevimandibulata* (Moyano) | ■ | | | | | | | | | | ■ |
| *Swanomia membranacea* (Thornely) | | | | | | ■ | | | | | ■ |
| *Swanomia* sp. | | | | | | ■ | | ■ | | | ■ |
| *Paracellaria wandeli* (Calvet) | ■ | ■ | ■ | ■ | | | ■ | ■ | | | |
| Lichenoporidae sp. | | | | | ■ | | | | | | ■ |
| Tubuliporidae sp. | | | | | | | | | ■ | ■ | ■ |
| *Cellaria aurorae* Livingstone | | ■ | | | ■ | | | | ■ | ■ | |
| *Polirhabdotos inclusum* (Waters) | ■ | | | | | | ■ | | ■ | | ■ |
| *Hornera* sp. | ■ | | ■ | ■ | ■ | | ■ | | | | ■ |
| *Cellarinella margueritae* Rogick | | | | | | | | | | | ■ |
| *Cellarinella* sp. | ■ | | ■ | | | ■ | ■ | | ■ | ■ | ■ |
| *?Cellarinelloides crassus* Moyano | | | | ■ | | | | | | | |
| *?Trypticocirrus* sp. | | ■ | | | | | | | | ■ | |

*Tab. 3* - Polychaetes (Serpulidae and Spirorbidae) identified in the carbonate-rich unit.

| SPECIES/SAMPLE | 33.75 33.72 | 33.53 33.50 | 33.34 33.31 | 33.01 32.98 | 32.98 32.95 | 32.80 32.77 | 32.61 32.58 | 32.40 32.37 | 32.37 32.34 | 32.15 32.05 | 31.93 31.90 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Serpula narconensis* Baird | ■ | | ■ | | | | | | ■ | | |
| *Paralaeospira* sp. | ■ | | | ■ | | | | ■ | ■ | ■ | |
| *Spirorbis* sp. | | | | | | | ■ | | ■ | | ■ |

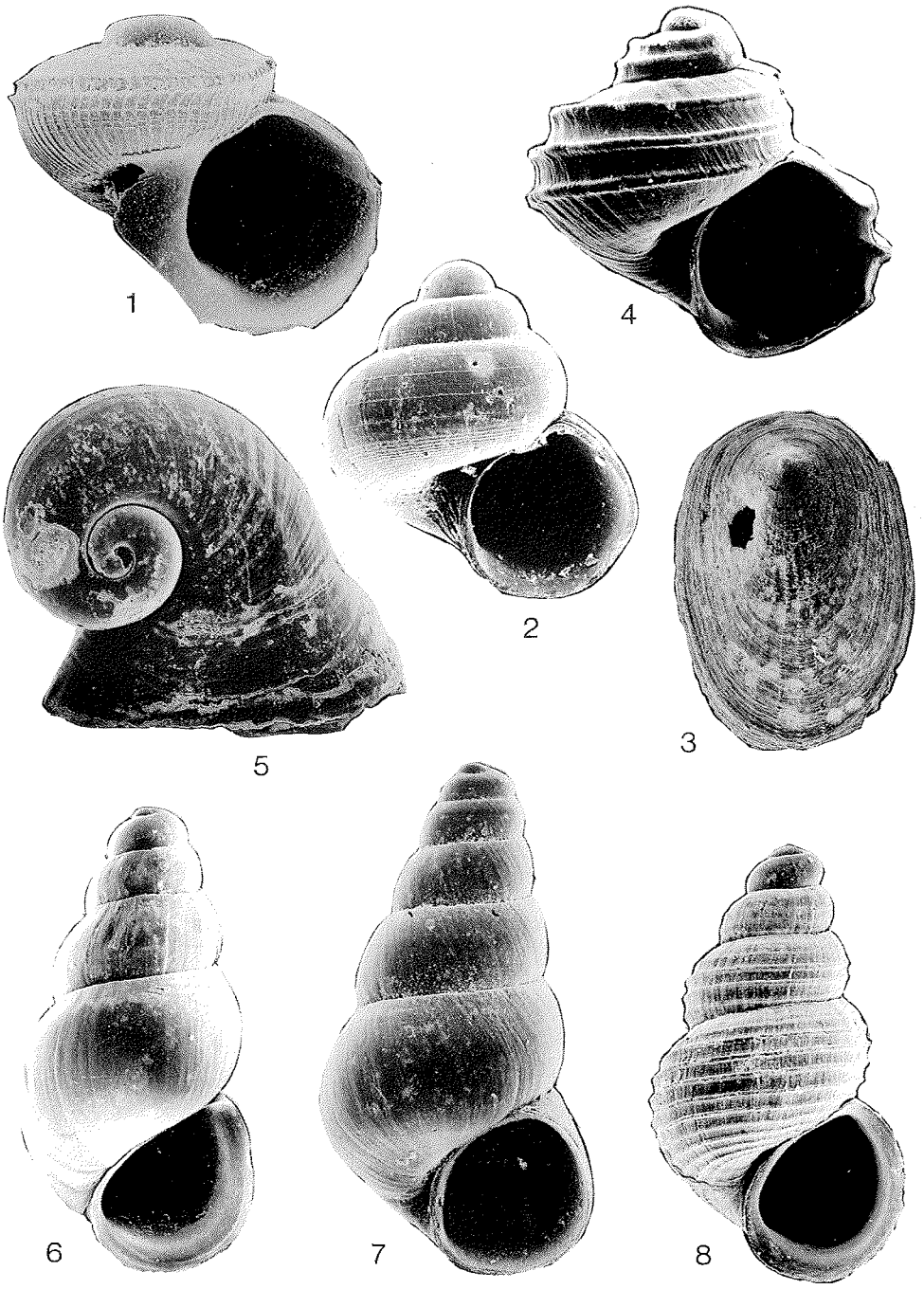



*Plate 1* - Pleistocene gastropods from the carbonate-rich unit. *1) Anatoma euglypta* (Pelseneer, 1903); 32.15-32.05 mbsf; 0.6 x 0.7 mm. *2) Lissotesta* cf. *mammillata* (Thiele, 1912); 32.40-32.37 mbsf; 1.7 x 1.4 mm. *3) Iothia coppingeri* (Smith, 1881); 33.01-32.98 mbsf; 4.3 x 3.0 mm. *4) Prolacuna macmurdensis* (Hedley, 1911); 31.93-31.90 mbsf; 2.2 x 2.5 mm. *5) Capulus subcompressus* Pelseneer, 1903; 32.61-32.58 mbsf; 2.4 x 2.5 mm. *6) Onoba (Ovirissoa) kergueleni* (Smith, 1875); 32.37-32.34 mbsf; 3.3 x 1.6 mm. *7) Eatoniella glacialis* (Smith, 1907); 32.15-32.05 mbsf; 2.3 x 1.1. mm. *8) Onoba gelida* (Smith, 1907); 32.37-32.34 mbsf; 3.1 x 1.75 mm.

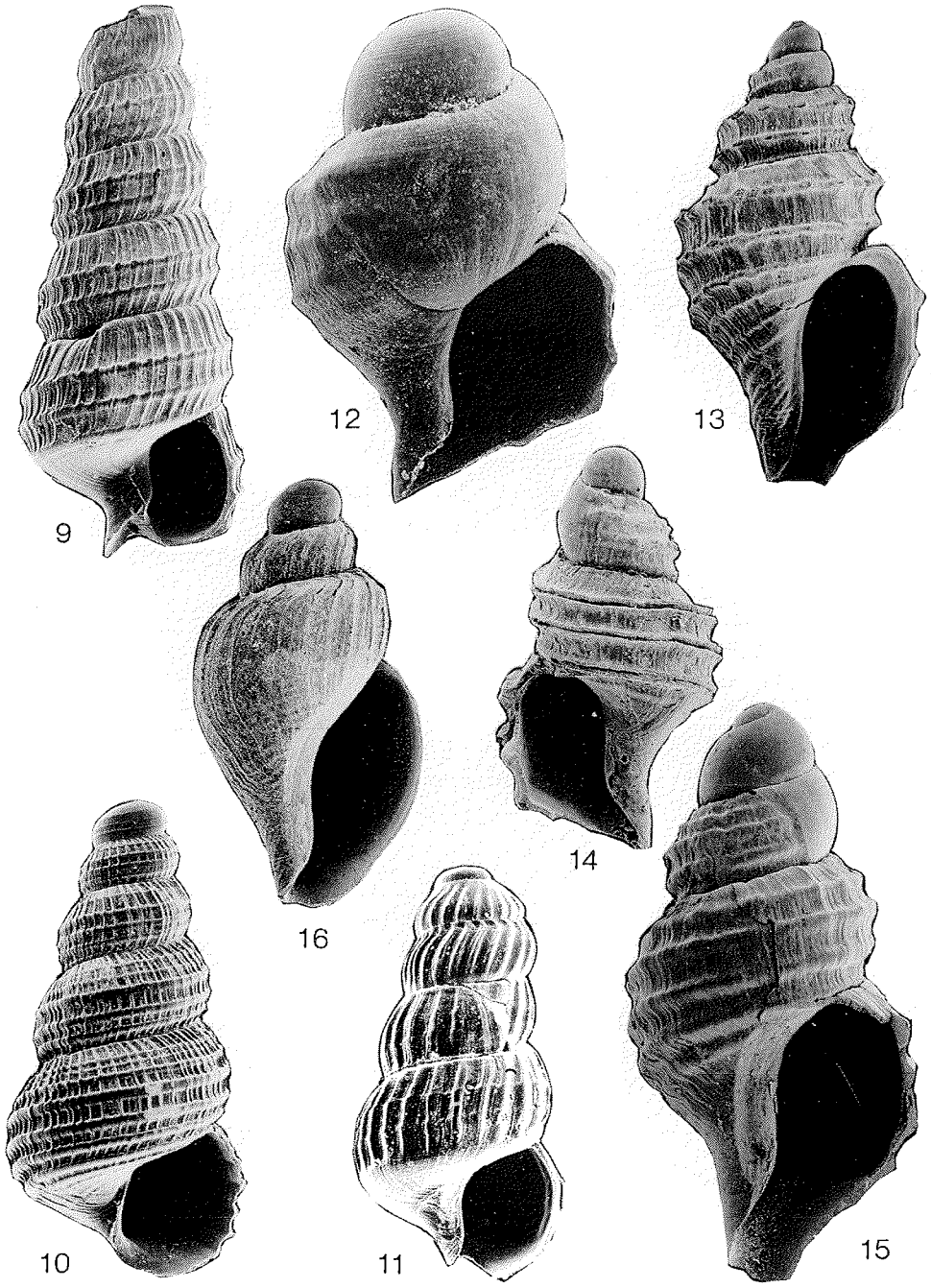



*Plate 2* - Pleistocene gastropods from the carbonate-rich unit. *9) Eumetula austrina* (Hedley, 1911); 31.93-31.90 mbsf; 3.8 x 2.1 mm. *10) Turritellopsis latior* Thiele; 32.80-32.77 mbsf; 3.0 x 1.5 mm. *11) Eumetula strebeli* Thiele, 1912; 32.61-32.58 mbsf; 4.0 x 2.0 mm. *12) Prosipho cancellatus* Smith, 1915, juvenile shell; 32.15-32.05 mbsf; 1.7 x 1.2 mm. *13) Prosipho cancellatus* Smith, 1915; 32.61-32.58 mbsf; 6.0 x 3.1 mm. *14) Prosipho contrarius* Thiele, 1912; 32.61-32.58 mbsf; 2.5 x 1.4 mm. *15) Prosipho* cf. *cancellatus* Smith, 1915; 32.40-32.37 mbsf; 3.3 x 2.2 mm. *16) Lorabela* cf. *davisii* (Hedley, 1916); 32.80-32.77 mbsf; 5.3 x 2.7 mm.

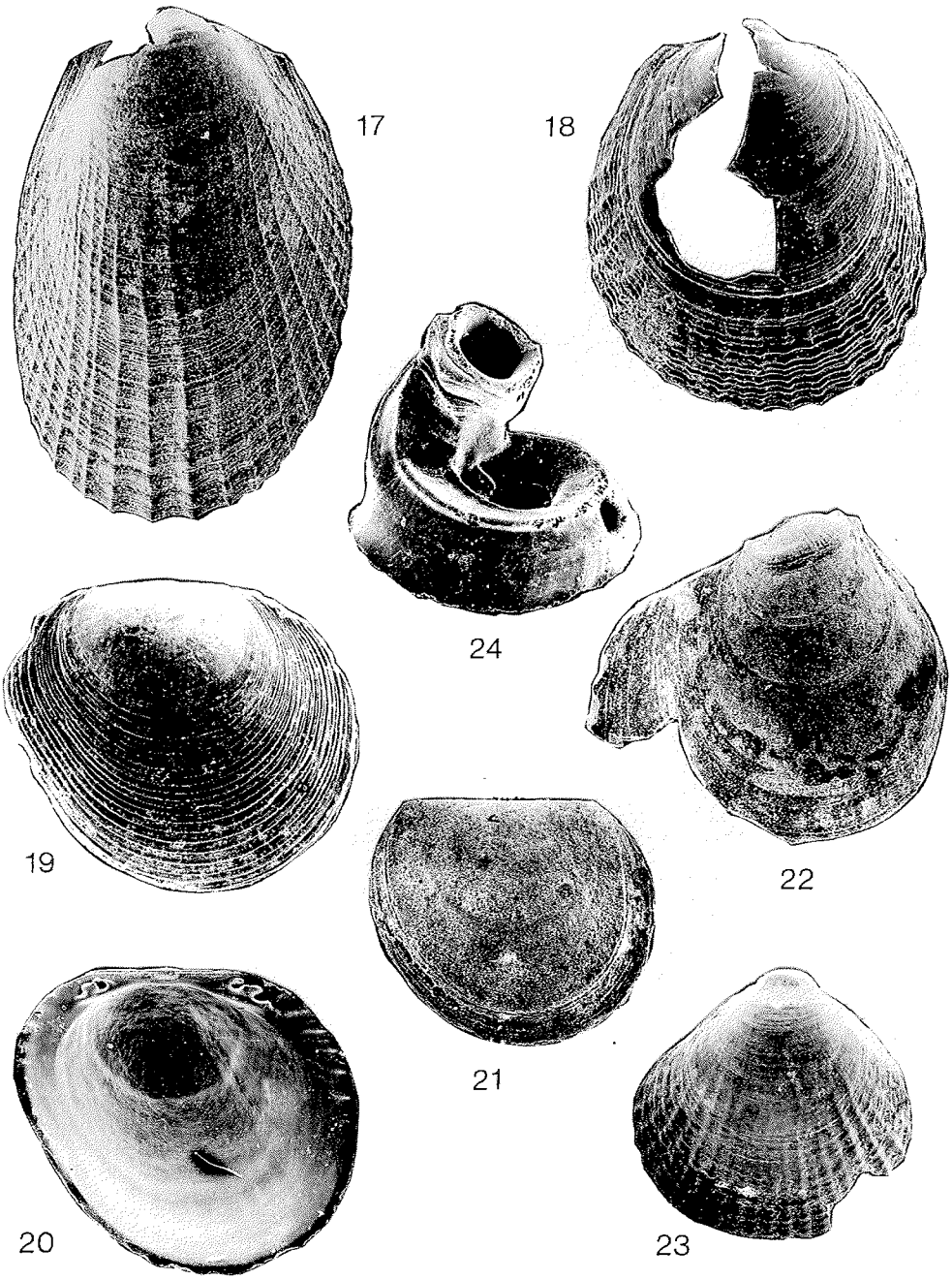



*Plate 3* - Pleistocene bivalves and polychaetes from the carbonate-rich unit. *17) Limatula simillima* Thiele, 1912; 32.15-32.05 mbsf; 1.5 x 0.9 mm. *18) Limatula* cf. *hodgsoni* (Smith, 1907); 32.80-32.77; 1.2 x 1.0 mm. *19) Lissarca notorcadensis* Melvill & Standen, 1907, external view of a left valve; 32.61-32.58 mbsf; 1.9 x 2.1 mm. *20) Lissarca notorcadensis* Melvill & Standen, 1907, internal view of a right valve; 33.34-33.31 mbsf; 1.8 x 2.0 mm. *21) Lissarca notorcadensis* Melvill & Standen, 1907, jnvenile shell; 33.34-33.31 mbsf; 1.1 x 1.2 mm. *22) Phylobria sublaevis* (Pelseneer, 1903); 32.58 mbsf; 2.1 x 2.3 nm. *23) Cyclocardia astartoides* (Martens, 1878), juvenile shell; 33.34-33.31 mbsf; 1.3 x 1.2 mm. *24) Paralaeospira* sp.; 32.37-32.34 mbsf; 2.1 x 2.0 mm.

to the presence/absence of seasonal sea-ice, which per se does not seem to be a factor constraining these communities. Today, these communities are living in near-zero temperatures under seasonal sea-ice.

## AGE

Based on taxonomic comparisons at the species-level of the cored macrofossil assemblages with present-day Ross Sea living communities, the age of the carbonate-rich unit is generically estimated to be Pleistocene. However, it must be mentioned that the true time-distribution of these taxa is virtually unknown.

## ACKNOWLEDGEMENTS

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*Appendix 1* - Species list mentioned in the text.

Mollusca
*Phylobria sublaevis* (Pelseneer, 1903)
*Lissarca notorcadensis* Melvill & Standen, 1907
*Adacnarca limopsoides* (Thiele, 1912)
*Cyamiocardium denticulatum* (Smith, 1907)
*Limatula simillima* Thiele, 1912
*Limatula* cf. *hodgsoni* (Smith, 1907)
*Cyclocardia astartoides* (Martens, 1878)
*Anatoma euglypta* (Pelseneer, 1903)
*Leptocollonia innocens* (Thiele, 1912)
*Lissotesta* cf. *mammillata* (Thiele, 1912)
*Iothia coppingeri* (Smith, 1881)
*Eatoniella glacialis* (Smith, 1907)
*Onoba (Ovirissoa) kergueleni* (Smith, 1875)
*Onoba gelida* (Smith, 1907)
*Capulus subcompressus* Pelseneer, 1903
*Turritellopsis latior* Thiele, 1912
*Eumetula austrina* (Hedley, 1911)
*Eumetula strebeli* Thiele, 1912
*Prolacuna macmurdensis* (Hedley, 1911)
*Paraeuthria innocens* (Smith, 1907)
*Meteuthria* cf. *rossiana* Dell, 1990
*Prosipho contrarius* Thiele, 1912
*Prosipho priestleyi* (Hedley, 1911)
*Prosipho cancellatus* Smith, 1915
*Prosipho* cf. *mundus* Smith, 1915
*Lorabela* cf. *davisii* (Hedley, 1916)

Annelida
*Serpula narconensis* Baird, 1865

Bryozoa
*Lageneschara lyrulata* Baild, 1865
*Swanonia brevimandibulata* (Moyano, 1969)
*Swanomia membranacea* (Thornely, 1924)
*Paracellaria wandeli* (Calvet, 1909)
*Cellaria aurorae* Livingstone, 1928
*Polirhabtos inclusum* (Waters, 1904)
*Cellarinella margueritae* Rogick, 1956
?*Cellarinelloides crassus* Moyano, 1970