GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

BULLETIN 125

QUATERNARY MOLLUSCS OF THE WESTERN PART OF THE EUCLA BASIN

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by

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JUNE 1978

63616/5/78—20BKS.

Issued under the authority of the Hon. A. Mensaros, M.L.A., Minister for Mines

National Library of Australia card number and ISBN 0 7244 7431 5

PREFACE

Extensive collections of Quaternary molluscs have been made from the Eucla Basin in the last twenty five years. When Mr. D. C. Lowry mapped the Western Australian part of the basin in the mid 1960's (the results of which were published in Bulletin 122) there was no detailed knowledge of these faunas. Dr. N. H. Ludbrook, then Senior Palaeontologist with the South Australian Department of Mines, was asked whether she would describe them. The Survey has been fortunate that Dr. Ludbrook agreed to undertake this study and is grateful to the South Australian Department of Mines for facilitating the work both while she was Senior Palaeontologist and latterly while she was Consultant to the Department.

As Dr. Ludbrook points out in the introduction, Pleistocene faunas from southern Australia are almost completely undescribed. This Bulletin is a step towards correcting this situation and provides a sound systematic basis for further work. In parts of Western Australia, Quaternary deposits are economically important for their water potential and their heavy-mineral sands. A knowledge of their faunas will aid considerably in interpreting the stratigraphy of these rocks.

September, 1977.

J. H. LORD,
Director.

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SUMMARY

Molluscs are an important element of the faunas of the limestones of the Eucla Basin. The Roe Calcarenite, deposited on what are now the Roe Plains, contains a very rich assemblage of some 265 species and subspecies, most of which have been collected from caves and from road quarries along the Eyre Highway. These are intertidal, littoral and sublittoral species which accumulated after death near the margin of a shallow sandy indentation of the coastline which formed in the Early Pleistocene south of the Hampton Range.

Two hundred and sixteen of the species or subspecies have been determined specifically and 31 described as new. Systematic description of this fauna is an essential step towards understanding the Quaternary succession in coastal areas of southern Australia.

The fauna contains from 65 to 70 per cent of living species and is regarded as of Early Pleistocene age. It includes a subspecies of the pelagic gastropod *Hartungia dennanti* found also in the lower part of the Bridgewater Formation near Naracoorte, South Australia.

In addition, some 32 species have been identified from unnamed deposits mapped (Lowry, 1970) as Qpo, and 11 from lake and lagoonal deposits (Ql). Twelve of these do not appear to occur in the Roe Calcarenite.

INTRODUCTION

The limestones of the Eucla Basin range in age from Middle Eocene to Pleistocene. Molluscs are an important element of their faunas, none more so than those of the Roe Calcarenite which contains a very rich and well-preserved assemblage. Since the faunas of Pleistocene deposits of southern Australia are almost completely undescribed, systematic description of this fauna is an essential step towards understanding the Quaternary succession not only in the Eucla Basin but also in coastal areas of southern Australia generally.

Quaternary deposits of the Roe Plains were first briefly described by Tate (1879b) who noted a "calciferous sandstone containing the common shells of the present coast" underlying sand drift inside the coastal dunes. He regarded these sandstones and those at Yalata, northwest of Fowler Bay at the eastern end of the Eucla Basin, as recent marine deposits. From then until 1954 when oil exploration companies began reconnaissance surveys of the basin, no systematic collecting from, nor stratigraphic studies of, the limestones of the Bunda Plateau (Tate, 1879b; Lowry, 1970) and the Roe Plains were undertaken.

Cotton (1952) identified 10 species of "subfossil" molluscs collected from lake and lagoonal deposits (Ql of Lowry, 1970) near Israelite Bay.

The first collections now in the Geological Survey of South Australia were made by the writer in company with geologists of Frome Broken Hill Pty. Ltd. in April 1954. Most of this material was from the Nullarbor Limestone of the Bunda Plateau. In the same year Mrs. Judith Lundelius, whose husband Dr. Ernest Lundelius now of the University of Texas, Austin, U.S.A., was collecting vertebrate material principally from Madura Cave, made considerable collections from the Pleistocene Roe Calcarenite at Madura Cave and from roadside excavations on the Eyre Highway. Brief faunal lists of molluscs from the collections were published by Ludbrook (1958a). From this time material was submitted to the Geological Survey of South Australia for study (Ludbrook, 1959c, d, 1960), culminating in a request from the Geological Survey of Western Australia in 1966 that fossil molluscs collected by D. C. Lowry during his mapping programme be identified by the writer. This material had the great advantage of being careful, mostly bulk, sampling of the various limestones mapped in the Eucla Basin in Western Australia. Results of examination of the Tertiary assemblages were issued in a Report of the Geological Survey of South Australia (Ludbrook, 1967b) and incorporated in Lowry (1970) and a list of molluscs common to the Roe Calcarenite and Dry Creek Sands published by Ludbrook (1973).

GEOLOGICAL SETTING

The geology of the western part of the Eucla Basin was described by Lowry (1970), with an accompanying map at a scale of 1:1 000 000, and in the Explanatory Notes to accompany the EUCLA-NOONAERA and MADURA-BURNABBIE 1:250 000 Geological Sheets (Lowry, 1971, 1972).

The Roe Calcarenite (Lowry, 1970, p. 121) is a medium to coarse-grained arenaceous porous shelly calcarenite 1.5 m thick at the type section and on most of the Roe Plains south of the Hampton Range between Twilight Cove in the west and Eucla in the east (Fig. 1.). The maximum recorded thickness is about 7.5 m in Eucla No. 1 Well (Lowry, 1970). The calcarenite often consists almost entirely of the tests of foraminifers, dominated by *Marginopora vertebralis,* forming the matrix and infilling of molluscs such as the *Campanile symbolicum* figured on Plate 11 fig. 14 and by Ludbrook, 1971 (pl. 2, fig. 6). It was described by Ludbrook (1958a, 1958b) as a sandy limestone of Pleistocene age appearing to rest directly on the Eocene Wilson Bluff Limestone as the result of removal by marine erosion of the Nullarbor Limestone south of the

Figure 1. Roe Plains from Eucla Scarp

Hampton Scarp. This is so in Madura No. 1 Well (Ludbrook, 1958b, p. 112) and Exoil Pty. Ltd. Eyre No. 1 Well (Ludbrook, 1960), but in the central and western parts of the Roe Plains, including the type section, it overlies the Abrakurrie Limestone (Lowry, 1970, p. 123).

FOSSIL LOCALITIES

As the Geological Survey of Western Australia was the only source of material clearly located by sample number and grid reference, it was therefore necessary to systematize the methods employed by other collectors. The Eucla Basin is partly in Western Australia and partly in South Australia and the respective state geological surveys have different fossil locality numbering systems. Because of this, two sets of fossil locality numbers are given in the table of localities (Table 1) and on the locality map (Fig. 2).

In the system designed by the Geological Survey of South Australia (see Selby & Day, 1977, for details), each locality is given the number of the 1:100 000 map sheet (Maps of Australia Index, Division of National

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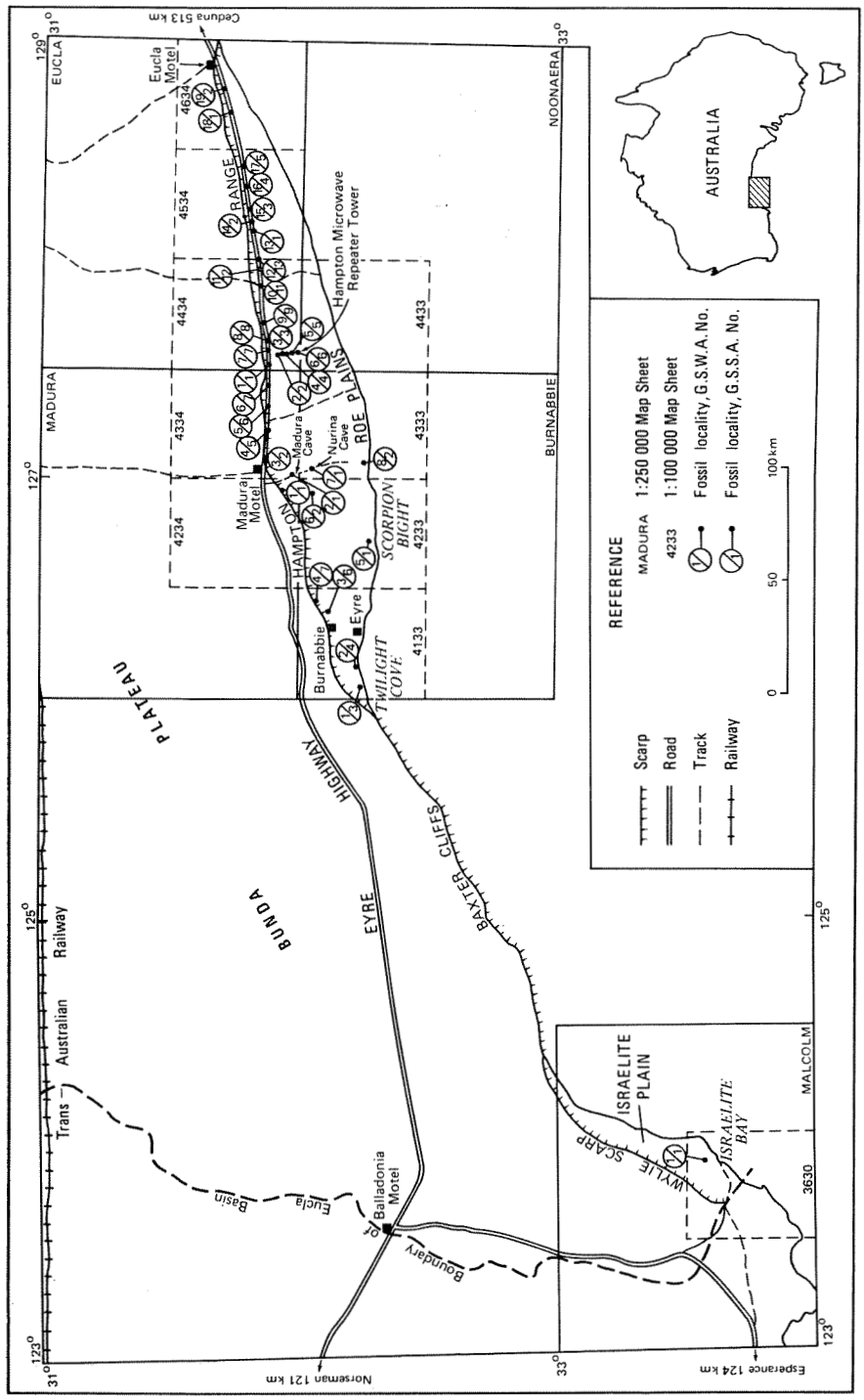


Figure 2. Fossil localities (GSWA 16789)

TABLE 1.—List of fossil localities.

1:250 000 Map Sheet and GSWA Fossil Locality No.	1:100 000 Map Sheet and GSSA Fossil Locality No.	1:250 000 Grid Reference	Latitude South	Longitude East	Locality	Sample No. or Collector	Formation
MALCOLM (MCM)	Malcolm 3630						
MCM 1	3630–FL1	185846	33°36′50″	123°51′49″	Lake, 3 km north of Israelite Bay	GSWA 14365	Quaternary lake and lagoonal deposits (Q1)
MADURA (MDR)	Karulbie 4234						
MDR 1	4234–FL1	494046	31°57′52″	126°55′00″	Water Bore, 10·6 km SW of Madura	GSSA F42/59	Roe Calcarenite
	Madura Pass 4334						
MDR 2	4334–FL1	507043	31°59′31″	127°02′18″	Madura Cave N62	(1) GSWA 5424D	Roe Calcarenite
						GSSA F40/59	Roe Calcarenite
						(2) J. Lundelius	Roe Calcarenite
						(3) B. R. Wilson, G. Zeck, P. Cawthorn	Roe Calcarenite
							Roe Calcarenite
						(4) B. W. Robinson	Roe Calcarenite
MDR 3	4334–FL2	508053	31°54′31″	127°04′00″	4·8 km E of Madura Motel	GSWA 14278	Roe Calcarenite
MDR 4	4334–FL5	534053	31°54′26″	127°16′48″	25 km E of Madura	(1) T. A. Darragh, M. Archer, G. W. Kendrick	Roe Calcarenite
						(2) D. C. Lowry	
MDR 5	4334–FL6	540053	31°54′31″	127°21′12″	32 km E of Madura	(1) B. R. Wilson	Roe Calcarenite
						(2) P. R. Lake	
MDR 6	4334–FL7	548052	31°54′41″	127°25′30″	40 km E of Madura	(1) D. C. & J. Lowry	Roe Calcarenite
						(2) M. Archer, G. W. Kendrick	
						(3) H. P. Salter	

TABLE 1.—*continued.*

1:250 000 Map Sheet and GSWA Fossil Locality No.	1:100 000 Map Sheet and GSSA Fossil Locality No.	1:250 000 Grid Reference	Latitude South	Longitude East	Locality	Sample No. or Collector	Formation
BURNABBIE (BRB)	Burnabbie 4133						
BRB 1	4133–FL3	414012	32°15′00″	126°08′00″	9·6 km E of Twilight Cove	GSWA 5419A	Surface deposit ?Qpo
BRB 2	4133–FL4	415013	32°14′34″	126°08′42″	9·6 km E of Twilight Cove	GSWA 5418	Quaternary surface deposit ?Qpo
BRB 3	4133–FL6	435027	32°07′20″	126°20′24″	Well at Burnabbie....	GSSA F43/59	Roe Calcarenite
BRB 4	4133–FL7	443032	32°05′08″	126°24′30″	21 km NE of Eyre	GSWA 5439	Loose in soil, ?derived from Roe Calcarenite
	Scorpion Bight 4233						
BRB 5	4233–FL1	483006	32°17′34″	126°47′42″	Scorpion Bight	GSWA 5437A	Aeolian sand Qpo
BRB 6	4233–FL2	503040	32°00′31″	126°59′00″	11 km SSW of Madura	B. W. Robinson	Roe Calcarenite
BRB 7	Middini 4333						
	4333–FL1	505041	32°00′31″	127°00′30″	Nurina Cave N46	(a) Surface of doline (b) Underground B. W. Robinson	Roe Calcarenite Type Section
BRB 8	4333–FL2	515008	32°16′33″	127°06′30″	42 km S of Madura	GSSA F41/59	Roe Calcarenite
EUCLA (ECL)	Yalganimirra 4434						
ECL 1	4434–FL1	559052	31°55′00″	127°32′30″	51·5 km E of Madura	(1) A. E. Cockbain, G. W. Kendrick (2) M. & H. P. Salter	Roe Calcarenite

TABLE 1.—*continued.*

1:250 000 Map Sheet and GSWA Fossil Locality No.	1:100 000 Map Sheet and GSSA Fossil Locality No.	1:250 000 Grid Reference	Latitude South	Longitude East	Locality	Sample No. or Collector	Formation
ECL 2	4434–FL2	563048	31°56′23″	127°34′45″	2·9 km N of Hampton Microwave Repeater Tower	T. A. Darragh, M. Archer, G. W. Kendrick	Roe Calcarenite
ECL 3	4434–FL3	563046	31°57′00″	127°34′35″	"near gate to H.M.R.T."	G. Gardner .... (1) A. Jones (2) L. M. Marsh	Roe Calcarenite
ECL 4	4434–FL4	563046	31°57′05″	127°34′45″	1·6 km N of H.M.R.T.	(1) T. .A Darragh, M. Archer, G. W. Kendrick (2) L. M. Marsh	Roe Calcarenite
ECL 5	4434–FL5	563045	31°57′36″	127°34′45″	0·6 km N of H.M.R.T.	T. A. Darragh, M. Archer, G. W. Kendrick	Roe Calcarenite
ECL6	4434–FL6	563045	31°57′57″	127°34′45″	Hampton Microwave Repeater Tower	(1) Darragh, Archer, Kendrick (2) B. J. Smith (3) M. Archer, B. Muir (4) H. & T. Merrifield	Roe Calcarenite
ECL 7	4434–FL7	564053	31°55′00″	127°35′00″	58 km E of Madura	(1) GSWA 5452 (2) J. Lundelius (3) A. E. Cockbain, G. W. Kendrick	Roe Calcarenite
ECL 8	4434–FL 8	567052	31°53′47″	127°35′00″	61 km E of Madura	(1) GSWA 14277 .... (2) T. A. Darragh, M. Archer, G. W. Kendrick	Roe Calcarenite

TABLE 1.—*continued.*

1:250 000 Map Sheet and GSWA Fossil Locality No.	1:100 000 Map Sheet and GSSA Fossil Locality No.	1:250 000 Grid Reference	Latitude South	Longitude East	Locality	Sample No. or Collector	Formation
ECL 9	4434–FL9	575054	31°53′42″	127°41′30″	64 km E of Madura	J. Lundelius	Roe Calcarenite
ECL 10	4434–FL11	592056	31°52′43″	127°51′00″	"near Mundrabilla"	(1) A. J. Carlisle .... (2) M. Archer, B. Muir	Roe Calcarenite
ECL 11	4434–FL12	602057	31°51′46″	127°56′30″	3 km S of Emu Well	M. & H. P. Salter	Roe Calcarenite
ECL 12	4434–FL13	605057	31°51′33″	127°57′00″	88 km W of Eucla Motel	T. A. Darragh, M. Archer, G. W. Kendrick	Roe Calcarenite
	Kathala Pass 4534						
ECL 13	4534–FL1	618059	31°51′20″	128°06′30″	(a) 76·6 and .... (b) 77·7 km W of Eucla Motel	M. & H. P. Salter (a) S side (b) N side of highway	Roe Calcarenite
ECL 14	4534–FL2	626061	31°50′00″	128°11′00″	64 km W of Ecula	(1) GSWA 14257A (2) T. A. Darragh, M. Archer, G. W. Kendrick	Roe Calcarenite
ECL 15	4534–FL3	630061	31°49′34″	128°13′30″	"near Kuthala Pass"	GSWA 3821	Roe Calcarenite
ECL 16	4534–FL4	645063	31°48′51″	128°22′42″	56 km W of Eucla Motel	P. R. Lake	Roe Calcarenite
ECL 17	4534–FL5	648064	31°48′25″	128°24′00″	48 km W of Eucla Motel	T. A. Darragh, M. Archer, G. W. Kendrick	Roe Calcarenite
ECL 18	4634–FL1	162069	31°45′52″	128°42′00″	18 km SW of Eucla	GSWA 14268	Loose in soil
ECL 19	4634–FL2	170074	31°43′12″	128°46′30″	9·6 km W of Eucla	GSWA 14267	Loose in soil

Mapping) followed by its FL (fossil locality) number within the sheet (e.g. 4334-FL7). The reasons for selecting the 1:100 000 scale are given by Selby & Day; they include the fact that it forms an integral part of the 1:250 000 series and that maps based on, for example, the 1:63 360 scale as used by Ludbrook (1966) will not be in common use in the future. The Geological Survey of Western Australia system is similar but is based on the 1:250 000 map sheet; the name of the map sheet is abbreviated as a 3-letter mnemonic and the fossil locality is indicated by a number (e.g. MDR 6).

The Grid References are yard grids based on Series R502 of the Division of National Mapping, but because these are no longer shown on most geological maps including those of Lowry (1970), 1971, 1972), and the Australian Map Grid metric references were not available, the latitudes and longitudes are also given to permit conversion to metric references where necessary.

All Geological Survey of Western Australia samples were collected by D. C. Lowry. The names of the collectors are given for unnumbered samples, mostly in the case of material from the Western Australian Museum where numbers refer to species.

Because the Roe Calcarenite is generally obscured under soil or sand cover, collections were originally made from cave entrances, particularly Madura Cave, and shallow roadside pits opened for road construction along the Eyre Highway. Bulk sampling at Nurina Cave, the type section for the Roe Calcarenite (Figure 3) by members of the Western Australian Speleological Group provided an

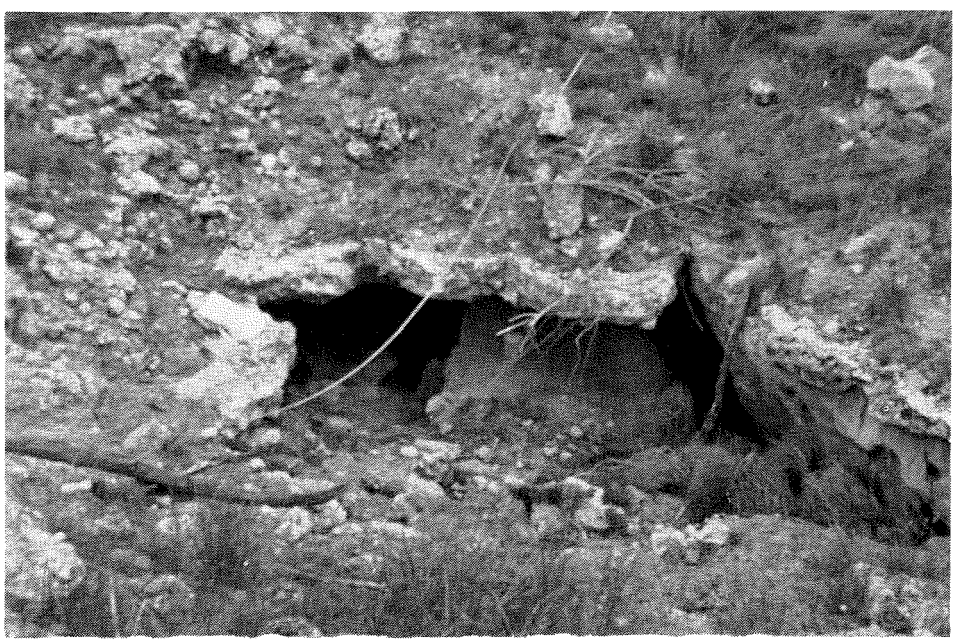


Figure 3. Nurina Cave, N.46, entrance. 1.5 m rubbly Roe Calcarenite overlies Abrakurrie Limestone

invaluable source of small species. The establishment of the East-West Microwave Radio Relay System of the Australian Post Office between Port Pirie in South Australia and Northam in Western Australia (Roberts & Pugh, 1971),

TABLE 2.—Distribution of Bivalvia, Roe Plains and Israelite Plain (GSWA 16794)

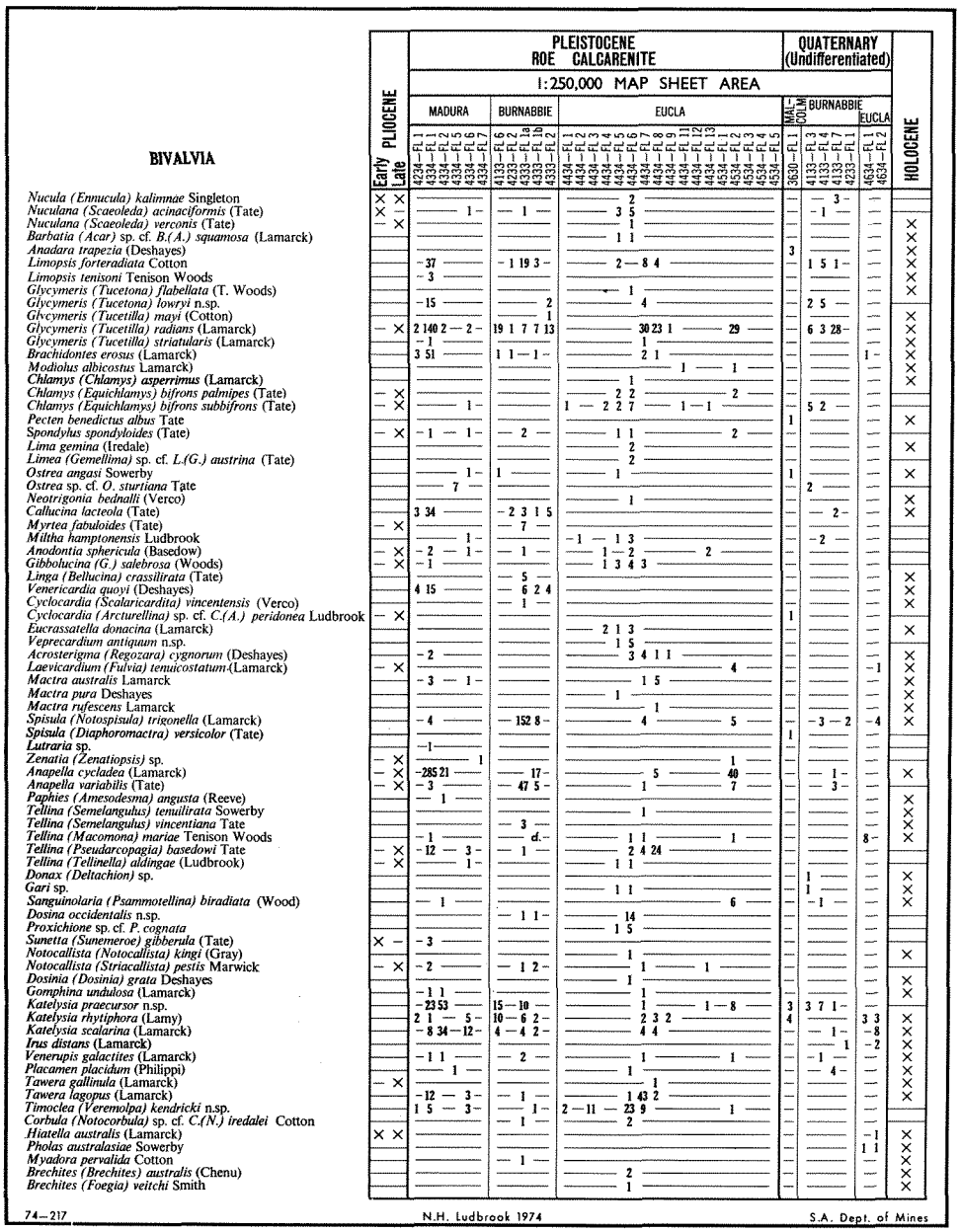
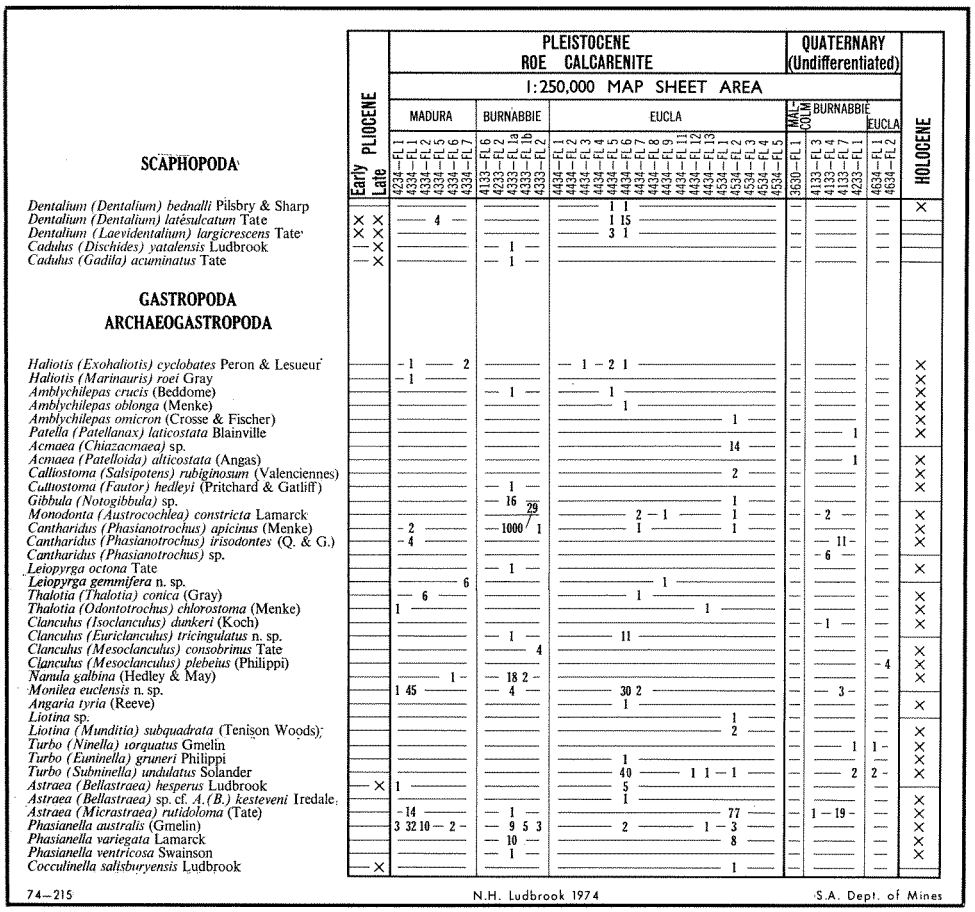


TABLE 3.—Distribution of Scaphopoda and Archaeogastropoda, Roe Plains and Israelite Plain (GSWA 16795)



involving the construction of a Microwave Repeater Tower at Hampton, 50 km east of Madura, was a further stimulus to collecting. Spoil from the foundation holes provided an abundance of well-preserved specimens.

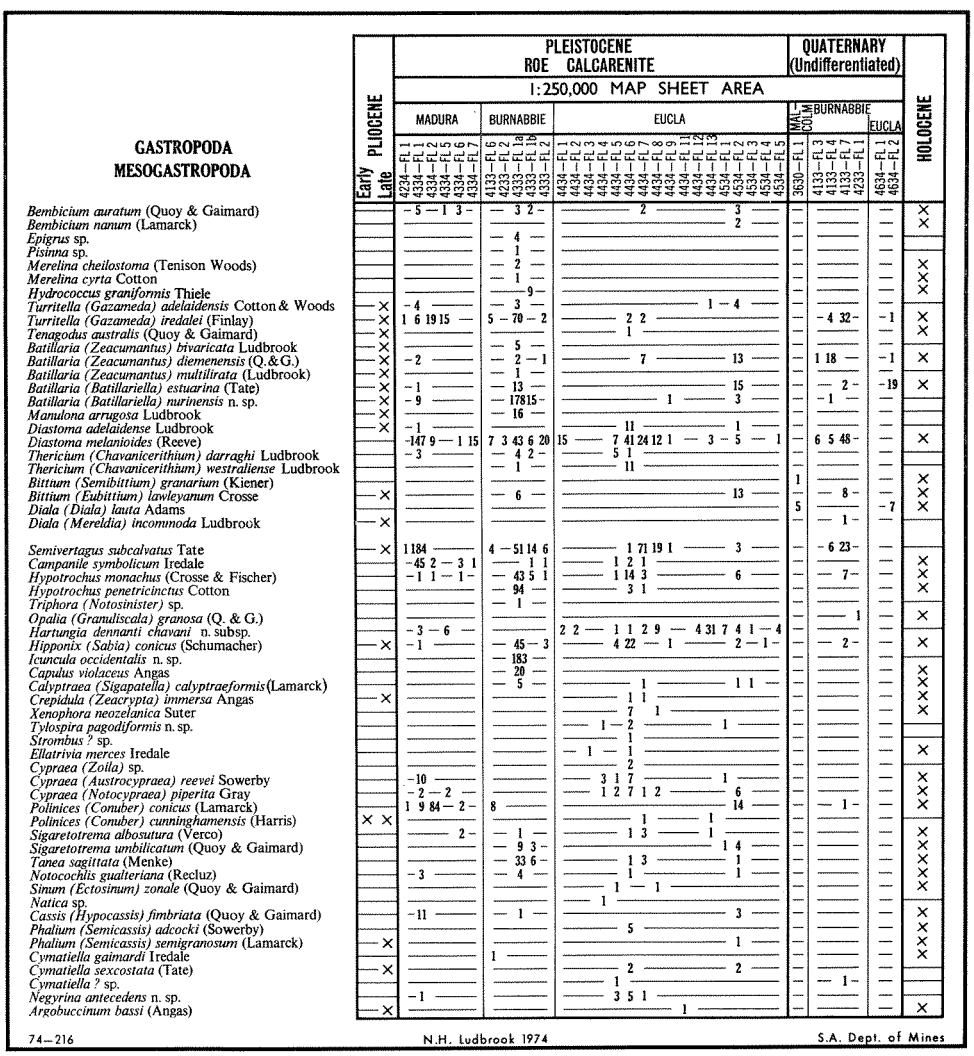
The material studied is in the collections of the Geological Surveys of Western Australia (GSWA) and South Australia (GSSA) and the Western Australian Museum (WAM). Some material is in the National Museum of Victoria (NMV). Other collections to which reference is made are those of the South Australian Museum (SAM), Australian Museum (AM), British Museum (Natural History) (BMNH), Museum National d'Histoire Naturelle, Paris (MNHNP) and Museum d'Histoire Naturelle de Genève (MHNG), Melbourne University Geology Department (MUGD) and the American Museum of Natural History (AMNH). The location of type material is cited where it has been confirmed by the writer or reliably reported. In general it may be stated that the Lamarck types are in either the MNHNP or MHNG, Quoy and

Gaimard and Crosse and Fischer types are also likely to be in Paris, but each needs confirmation. Useful guides to the location of type collections are Sherborn (1940) and Dance (1966).

Unless otherwise stated, descriptions of the species are based on material used in the study. Where published descriptions of material from present seas are considered to be adequate, the species have not been redescribed.

Table 1 includes all localities in the Roe Calcarenite and younger unnamed Quaternary deposits (indicated on Lowry's map as Qpo and Ql) from which material was examined.

TABLE 4.—Distribution of Mesogastropoda, Roe Plains and Israelite Plain (GSWA 16796)



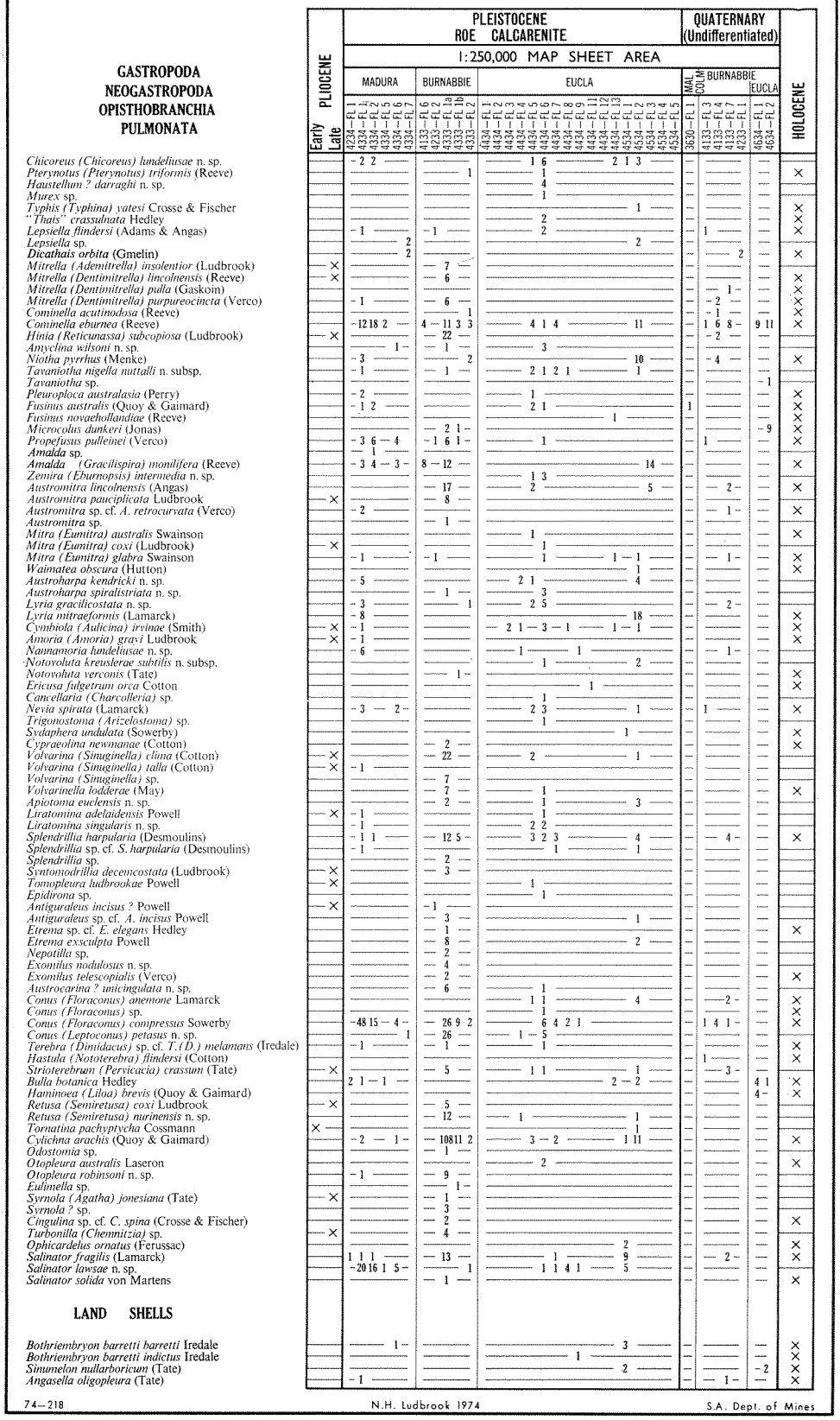


TABLE 5.—Distribution of Neogastropoda, Opisthobranchia, and Pulmonata, Roe Plains and Israelite Plain (GSWA 16797)

Distribution of the molluscs from the Roe Calcarenite and Quaternary deposits is shown on Tables 2 to 5. Under each locality the number of examples of each species is recorded. When it cannot be said with certainty that they occurred *in situ* in the Roe Calcarenite they are recorded under Quaternary, undifferentiated, although it is fairly clear that specimens collected "loose in soil" from localities 4133-FL7, 4634-FL1 and 4634-FL2 are derived from the Calcarenite.

PALAEOECOLOGY OF THE ROE CALCARENITE FAUNA

Any assessment of the palaeoenvironment in which the Roe Calcarenite was deposited is dependent on information on the distribution and ecology of molluscs living now in the Flindersian Province of the southern and southwestern coasts of Australia. Few ecological studies have been made, mostly restricted to Port Phillip Bay (Macpherson, 1966; King, Black & Ducker, 1971; Black, 1971) and the Swan River Estuary (Serventy, 1955; Kendrick, 1960). Otherwise, one has to rely on diversified published data on individual species.

The formidable cliffs of the Great Australian Bight preclude any continuous distribution records within the Bight itself, and most of the information to be gleaned from the literature is the result of local collecting in Spencer Gulf, Gulf St. Vincent, and King George Sound, and dredging by Verco off the southern and southwestern coasts (Verco, 1904-1918, 1911b, 1912b, c; Cotton & Godfrey, 1931-1935, 1938, 1940; Cotton, 1959, 1961). Data provided by Kendrick (1960) for the Peppermint Grove Limestone, Macpherson and Gabriel (1962) and Hodgkin *et al.* (1966) have also been used in citing distributions. Unpublished information on molluscs contained in equivalents of the Glanville Formation and the St. Kilda Formation in South Australia has been incorporated. In the distribution lists under each species, equivalents of the subsurface Glanville Formation of the Adelaide Plains Sub-basin are recorded as Glanville Formation, for which a type surface section has not yet been designated.

As most of the Roe Calcarenite fossil localities are along the Eyre Highway which runs close to the Hampton Range, they must therefore be close to the former shore line. The only sample that might be expected to contain a deeper water fauna is GSSA F41/59 from 4333-FL2, 42 km south of Madura, but its fauna indicates a substrate and water depth similar to those existing at the Eyre Highway localities.

Almost all the living species on which there is information inhabit sandy bottoms and water not more than 60 m deep. Intertidal, littoral, and sublittoral gregarious species such as *Glycymeris (Tucetilla) radians* and *Katelysia scalarina*

are abundant, and species such as *Cominella eburnea* from sandbanks and rock pools in bays and inlets are common and ubiquitous. The faunas recovered from Madura Cave (4334-FL1), Nurina Cave (4333-FL1) (Figure 3) and 4334-FL2 4.8 km east of Madura Motel include gregarious species inhabiting estuaries and mudflats: *Anapella cycladea, Spisula (Notospisula) trigonella* and the pulmonate *Salinator fragilis,* which is common on samphire flats and backwaters. *Ophicardelus ornatus,* usually an inhabitant of mangrove flats, was recovered from 4534-FL2 in a rich and varied littoral assemblage which also included *Salinator fragilis, Anapella cycladea* and *Spisula (Notospisula) trigonella,* as well as four shells of the pelagic janthinid gastropod *Hartungia* sp.

The accumulations at these localities are littoral thanatocoenoses, the autochthonous components of which are the local sublittoral, littoral and mudflat inhabitants. The allochthonous component is small, and, apart from the pelagic *Hartungia* which presumably drifted in or was blown in by on-shore winds—30 specimens having been recovered from locality 4434-FL3—is limited to such species as *Cymbiola (Aulicina) irvinae, Nanula galbina* and *Ericusa fulgetrum orca. Cymbiola (Aulicina) irvinae* is commonly taken in craypots between 18 and 100 m depth (Wilson & Gillett, 1971, p. 130) but it also occurs in the Dry Creek Sands of the St. Vincent Basin; *Nanula galbina* is known only from dredgings between 115 and 240 m, and *Ericusa fulgetrum orca,* known only as a deeper-water (200 m) form of *E. fulgetrum* which itself, however, has a bathymetric range of 0.5 to 200 m.

The land shells in the samples are few and regarded as present day inhabitants and not components of the littoral fauna of the Roe Calcarenite.

During the period of deposition of the Roe Calcarenite the Hampton Range therefore formed the coastline of a shallow sandy indentation with some tidal mudflats.

Compared with the molluscan fauna of the Flindersian Province, the Roe Calcarenite fauna at first glance appears to contain a tropical or subtropical element. Almost all the taxa with this connotation belong to genera surviving from the Tertiary of the Eucla and St. Vincent Basins but almost or entirely absent from the Flindersian Province today. These include species of the genus *Miltha,* represented in the Nullarbor Limestone by *Miltha nullarborensis* and by other species in the Tertiary of southern Australia and the United States, but living now off the coasts of Brazil and Baja California where water temperatures are between 21° and 27° (Ludbrook, 1969), and *Anodontia sphericula,* which is common but small in the Nullarbor Limestone and reaches a great size in the Roe Calcarenite, but has its nearest living relative in *A. philippiana* (Reeve) from North Queensland (Ludbrook, 1969). *Timoclea (Veremolpa) kendricki* has a relative *T. (V.) protomarica* (Cotton) in the Dry Creek Sands of the St. Vincent Basin but living relatives in the Indo-Pacific Region including Geraldton; *Amoria grayi* also provides a link between the Dry Creek Sands and the present day fauna of the Dampierian Province. There are only three species that would appear to be out of their present geographical range: *Angaria tyria*

(Reeve) with no known ancestors and a present distribution from Cockburn Sound to Shark Bay (Wilson & Gillett, 1971), *"Thais" crassulnata* Hedley the southern limit of which appears to be Geraldton, and *Otopleura australis* Laseron, so far recorded only from the Capricorn Group in Queensland. It is regarded as indicative of lowering of temperature that *Cucullaea and Pinctada,* both of which are common in the Dry Creek Sands, are not present in the Roe Calcarenite.

AGE OF THE FAUNAS

On Tables 2 to 5 all the specimens examined from the Roe Plains are recorded, together with some indication of their time range.

Roe Calcarenite Fauna

Analysis of the vertical distribution in time of the 217 species identified from the Roe Calcarenite is as follows:

Stratigraphic range	Number of species	per cent	gastro-pods	per cent
?Miocene to Holocene	1	0·5	....	....
Late Pliocene to Holocene	19	8·8	14	9·5
Early Pleistocene to Holocene	120	55·3	80	54·4
Early Pliocene to Late Pleistocene	1	0·5	....	....
Early to Late Pleistocene	3	1·4	....	....
Miocene to Early Pleistocene	4	1·8	2	1·4
Early Pliocene to Early Pleistocene	6	2·8	3	2·0
Late Pliocene to Early Pleistocene (including one unnamed)	35	16·0	23	15·7
Early Pleistocene (Roe Calcarenite only)	28	12·9	25	17·0
Total species	217	100·0	147	100·0
Species still living	140	65	94	64

Species not included above	
(1) related to or possibly conspecific with living species	18
(2) related to Tertiary species	4
(3) not identified	21
(4) doubtfully coming from Roe Calcarenite	5
Maximum possible species so far collected from Roe Calcarenite	265
Maximum possible living species including (1), (3), (4)	184
Maximum possible percentage of living species as known from present evidence	70

The percentage of living species in the Roe Calcarenite therefore appears to lie, on present evidence, between 65 and 70 per cent. These figures are not incompatible with those of 66 and 73 per cent for the Early Pleistocene Older and Newer Red Crag respectively (Boswell, 1931, p. 88; Oakley, 1969, p. 39). Of the gastropods, between 64 and 72 per cent are living as compared with from 47 to 60 in the Red Crag (Boswell, 1952, p. 306). Boswell (1952, p. 311) advocated placing the Pliocene-Pleistocene boundary at the base of the Red Crag, in which he was supported independently by Lagaaij (1952, p. 206, 207) who correlated the Waltonian (Red Crag) with the Lower Amstelian and Calabrian. In the regional scale recommended by the Stratigraphy Committee of the Geological Society of London (1969, p. 152, 156) the Waltonian constitutes the earliest of the Pleistocene stages, but the Committee emphasized (p. 152, item 14.2.3) that the base of the Calabrian in Italy was accepted for the time being as the base of the Pleistocene. Oakley (1969, p. 39) tentatively correlated the Red Crags with the pre-Gunz (Donau) glaciation, but Hays and Berggren (1971, p. 686, 687) placed the Calabrian in the pre-glacial Pleistocene before the Donau, with a time-span from 1.85 to 1.1 million years B.P.

There are at present no firm data for faunal correlation between the Pleistocene formations of Europe and those of southern Australia, but the summary presented above is regarded as relevant to any discussion of the Late Pliocene-Pleistocene sequence in southern Australia. At the more local level, Ludbrook (1963, figs. 1, 4, p. 14) equated an upper member of the Dry Creek Sands, restricted to the subsurface of the Lockleys area west of Adelaide, with the Calabrian stage. This member has yet to be defined and its fauna studied to establish its relationships with the Roe Calcarenite or the upper part of the Hallett Cove Sandstone. The possible lateral equivalence of the unit at Lockleys with his Carisbrooke Sand was noted but not resolved by Lindsay (1969, p. 41).

The Roe Calcarenite has 16 per cent of its species in common with the Dry Creek Sands from which 10 per cent of living species was reported (Ludbrook, 1954), a figure now regarded as too low in the light of further material available from subsequent drilling. It has 11 per cent in common with the Glanville or Peppermint Grove Formations.

The Roe Calcarenite carries a subspecies of *Hartungia dennanti* identical with one from the Bridgewater Formation on the Kanawinka Scarp 1.6 km southeast of Naracoorte, South Australia. This permits correlation with the lower part of the Bridgewater Formation, the detailed stratigraphy and correlation of which is still imperfectly known. Boutakoff (1963, p. 56) considered that the calcarenite dunes of the Bridgewater Formation spanned the whole Pleistocene Epoch, a view supported by Kenley (1971, p. 135). The fauna also shows elements in common with those of the "limestone facies" of the Whalers Bluff Formation of Western Victoria, from which molluscs were determined by A. N. Carter from localities 1.6 and 3.6 km downstream from Killara Bridge (Kenley, 1971, p. 130, 152).

From its percentage of living species and analogy with the Waltonian; its common component with the Hallett Cove Sandstone and the Dry Creek Sands, which carry a lower percentage of living species; from the fact that most of the warm-water component of the Dry Creek Sands fauna, including species of *Miltha, Anodontia, Timoclea (Veremolpa), Antigona (Proxichione), Thericium (Chavanicerithium), Trunculariopsis, Amoria* and *Cymbiola (Aulicina),* became extinct in southern Australia before or during the deposition of the formation; and from its correlation with units believed from their stratigraphic position to be of Early Pleistocene age; the age of the Roe Calcarenite is considered to be Early Pleistocene.

Other Faunas

Apart from Roe Calcarenite sites, material was collected from 7 other localities:

(1) "loose in soil" from 4133-FL7 (35 species), 4634-FL1 (9 species), 4634-FL2 (17 species). Those from 4133-FL7, 21 km east of Eyre, are consistent with and are presumed to have been derived from the Roe Calcarenite. Those from 4634-FL1, 18 km southwest of Eucla and 4634-FL2, 9.6 km west of Eucla contain more than 50 per cent of species not occurring or rare in the Roe Calcarenite. In all probability they have not been derived from the Roe Calcarenite and are either post-Roe Calcarenite or of Late Pleistocene or Holocene age.

(2) from coastal dunes (Qpo) locality 4233-FL1, 5.2 m above low water, a few individuals of eight species— *Notospisula trigonella, Irus distans, Patella (Patellanax) laticostata, Acmaea (Patelloida) alticostata, Turbo (Subninella) undulatus, Opalia (Granuliscala) granosa* and *Dicathais orbita.* Five of these species inhabit the littoral zone of rocky platforms or reefs and have been transported. The assemblage is not regarded as indigenous and may be of Holocene age.

(3) "Quaternary deposits on surface" 3-6 m above sea level, localities 4133-FL3 and 4133-FL4, 9.6 km east of Twilight Cove. The locality is mapped as coastal dunes (Qpo) but the faunas are consistent with the Roe Calcarenite and the site appears to need further examination.

(4) Fine soft incoherent sand, locality 3630-FL1, lake near Israelite Bay. Lake and lagoonal deposits (Ql). This appears to be the same material as that identified by Cotton (1952). It contains *Anadara trapezia* but not *Marginopora vertebralis.* The record of *Anadara trapezia* living at Albany (Kendrick and Wilson, 1959) and the absence of *Marginopora vertebralis* precludes the possibility of this material being correlated with the Late Pleistocene Glanville Formation. It seems most readily to be correlated with the Holocene St. Kilda Formation (see Fig. 4) as Cotton implied in referring to a "Mid-Recent emergence about 4 000 years ago". Cotton's correlations and his conclusions regarding the height of the lagoonal deposits

above sea level are considerably confused between what are now recognized as equivalents of the Glanville and St. Kilda Formations, as Lowry (1970, p. 128) appreciated.

The assemblage includes littoral inhabitants of sandy mud and sand such as *Katelysia rhytiphora* and also *Spisula (Diaphoromactra) versicolor* which elsewhere occurs only abundantly in Lake MacDonnell, now cut off from the sea by dunes.

Cotton (1952) identified 10 species of "subfossil" molluscs collected from lake and lagoonal deposits near Israelite Bay. All of the specimens in the South Australian Museum have been re-examined and the following nomenclatural revisions and interpretations of their source are here placed on record: SAM P8174, P8175 from "the bed of a small creek running into a salt lake about 33 miles east of the old Thomas River homestead". These are species presumably living in one of the modern lagoons (Lowry, 1970, p. 128).

P8174. *Coxiella striatula* Menke. Identified by Cotton as *Coxiella cf. confusa.* In matrix of fine sand, salt and carbonaceous matter; 12 specimens, several of which have a high smooth protoconch of 3 smooth whorls, faintly striate on the third whorl.

P8175. *Coxiella glauerti* Macpherson. Identified by Cotton as *Coxiella striatula.* In matrix of fine sand and silt, carbonaceous matter.

SAM P8179, P8180, P8181, P8183-P8188 from marginal salt lagoon deposit "between Port Malcolm and Israelite Bay". These extensive old lagoons were described by Lowry (1970, p. 128). The assemblage appears to be of Holocene age, and suggests a possible equivalence with that of the St. Kilda Formation.

P8179. *Katelysia scalarina* (Lamarck) 4 specimens
P8180. *Laevicardium (Fulvia) tenuicostatum* (Lamarck) 1 right valve
P8181. *Anadara trapezia* (Deshayes) 2 left valves
P8183. *Cominella eburnea* Reeve 6 specimens
P8184. *Niotha pyrrhus* (Menke) 4 specimens
P8185. *Polinices conicus* (Lamarck)
P8186. *Parcanassa pauperata* (Lamarck)
P8187. *Cominella lineolata* (Lamarck)
P8188. *Akera bicincta* Quoy & Gaimard

Cotton also recorded *Ostrea angasi* Sowerby (as *Ostrea sinuata*), which was not seen.

Summary

Figure 4 is a generalized correlation table for the Miocene to Holocene formations of the Eucla Basin and sedimentary basins of southern Australia in which their equivalents occur. The last column records radiometric dates determined for fossil molluscs of some of the Quaternary formations and for the Newer Volcanics of Victoria.

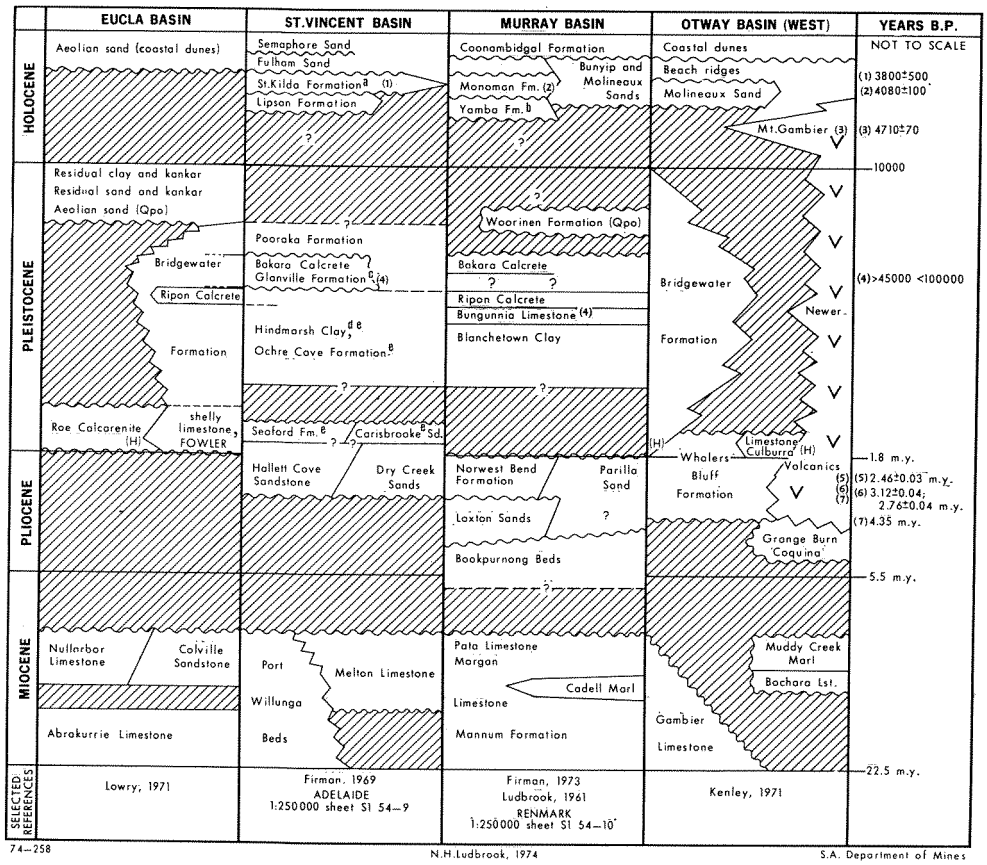


Figure 4. Generalized correlation table for Miocene to Holocene formations in the Eucla, St. Vincent, Murray and Western Otway Basins. (GSWA 16790)

a. "Marine sands and clays of Osborne high sea level" (Aitchison, Sprigg & Cochrane, 1954, p. 19).

b. The relationship of this and other gypsum levels to that of Wopfner & Twidale, 1967, which they regarded as of Late Pleistocene age, does not appear to have been established.

c. "*Anadara* high sea level" of Aitchison, Sprigg & Cochrane, 1954.

d. "Mammaliferous Drift" of Tate, 1890; "Mottled terrestrial clays etc." of Aitchison, Sprigg & Cochrane, 1954.

e. The relationships between these formations (Firman, 1967; Ward, 1966; Lindsay, 1969) need elucidation as some duplication of nomenclature is possible.

H. Contains *Hartungia dennanti chavani*.

(1) La Jolla Radiocarbon Laboratory.

(2) Gakushuin University, Tokyo.

(3) D.S.I.R. Research Laboratory, Wellington, N.Z. (Gill, 1955).

(4) La Jolla Radiocarbon Laboratory, with the comment "The samples whose ages are given as 45 000 years are not completely inactive, but the levels of activity are too low to yield meaningful ages. However, these samples are tens of thousands rather than hundreds of thousands of years old".

(5) Dartmoor (Aziz-ur-Rahman & McDougall, 1972).

(6) Portland Quarries (Aziz-ur-Rahman & McDougall, 1972).

(7) Grange Burn (Turnbull et al., 1965).

63616—(3)

No attempt has been made to subdivide the Pleistocene, which presents the same problems in Australia as elsewhere—that it was in general a period of denudation and erosion rather than one of sedimentation (Oakley, 1969). From the radiometric dates it is possible, however, to place the units containing the marine faunas into some chronostratigraphic perspective.

Whether one accepts the "long chronology" of most Quaternary specialists (Berggren, 1972), or the "short chronology" of Emiliani (1961) or the threefold subdivision of Zeuner (1959), the Glanville Formation (with *Anadara trapezia*) and the Bungunnia Limestone are of Late Pleistocene age. Accepting the base of the Pleistocene at the base of the Calabrian Stage at 1.8 million years (Berggren, 1969, 1972) or "close to 2.0 million years" (McDougall & Stipp, 1968), the Newer Volcanics in the Portland area are of Late Pliocene age. However, the relationship of the dated samples to the Werrikoo Member of the Whalers Bluff Formation is not yet clearly established (Aziz-ur-Rahman & McDougall, 1972), so that a Late Pliocene age for the Werrikooian is likely but not yet proven.

Inserted in proof: Since the above was submitted for publication Singleton McDougall & Mallett (1976) have published an important paper presenting biostratigraphic and radiometric data from which the relationships of the Pliocene and Pleistocene formations of western Victoria may be deduced. Some modification of the generalized correlation chart, Figure 4, involving the separation of the Werrikoo Limestone, which straddles the Pliocene-Pleistocene boundary, from the Pliocene Whalers Bluff Formation is necessary as a result.

ACKNOWLEDGEMENTS

This study is the result of cooperation between the Geological Surveys of Western Australia and South Australia, and the courtesy of the Geological Survey of Western Australia in submitting the fossil molluscs collected by D. C. Lowry during his mapping programme is gratefully acknowledged. The quality and volume of material examined have been greatly enhanced and augmented by the generosity of the Western Australian Museum in making their large collection of molluscs from the Roe Calcarenite available. To the Director of the Geological Survey of Western Australia and the Director of the Western Australian Museum grateful acknowledgement is made. The work was carried out in the Department of Mines, South Australia, and the writer is most grateful to the Director of Mines for permitting this to be done after her retirement while retained as a Consultant to the Department.

Special thanks are given to Mr. D. C. Lowry who collected and prepared the samples and provided accurate locality data, and to Mrs. Judith Lundelius of Austin, Texas, for presenting material to the Geological Survey of South Australia Palaeontological Collection. To Mr. G. W. Kendrick of the Western Australian Museum, who not only sorted and prepared the specimens lent by the Museum, but generously responded to many queries on the material while the work was in progress, the writer is extremely grateful.

For permitting examination of material in their custody thanks are expressed to the Director, South Australian Museum, and Dr. Helene Laws formerly Curator of Marine Invertebrates; to the Director, National Museum of Victoria, and Mr. T. A. Darragh; to the Director, The Australian Museum and Dr. W. F. Ponder; and to the Director, British Museum (Natural History) and Dr. J. D. Taylor and Mr. C. P. Nuttall.

With the exception of those acknowledged in the explanations to the plates, photographs were taken by the author. For providing assistance with photography and for developing and printing the author is greatly indebted to Mr. W. K. Harris and Mr. J. M. Lindsay of the Palaeontology Section, Geological Survey Branch, South Australian Department of Mines, and Mr. J. K. Warner and Miss Elizabeth Murphy of the Publicity Branch, South Australian Premier's Department. Dr. R. Wernli of the Service de la Carte géologique, Rabat, Morocco, kindly supplied the photographs of the holotype of *Acrybia (Hartungia) chouberti* Chavan. The photograph of Nurina Cave was taken by Mr. J. A. Gilchrist.

Plans and tables were prepared in the Survey and Drafting Branch, South Australian Department of Mines, and thanks are expressed to Mr. B. S. Glasgow, Chief Survey Draftsman, for his cooperation.

Mrs. I. E. C. Ashton, Miss F. de Angeli and Miss N. Stoyanoff were responsible for typing the manuscript.

SYSTEMATIC DESCRIPTIONS

Phylum	MOLLUSCA
Class	BIVALVIA
Subclass	PALAEOTAXODONTA
Order	NUCULOIDA
Superfamily	NUCULACEA
Family	NUCULIDAE
Genus	**Nucula** Lamarck, 1799
Subgenus	**Ennucula** Iredale, 1931

Nucula (Ennucula) kalimnae Singleton

Plate 5, fig. 4

1932 *Nucula kalimnae* Singleton: p. 292, pl. 24, figs. 7-9

1955 *Nucula (Ennucula) kalimnae;* Ludbrook: p. 18, pl. 1, figs. 1, 2 (synonymy)

Type material: Holotype and paratypes, MUGD 1312-4, from Jemmy's Point, Lakes Entrance, Victoria; Jemmy's Point Formation, Kalimnan, Early Pliocene.

Material: The species is represented on the Roe Plains by five specimens from two localities: G.S.W.A. F6940 (1-3) (4133-FL7); WAM 69.342, 69.460 (4434-FL6).

Distribution: Jemmy's Point Formation, Grange Burn Coquina, Whalers Bluff Formation, Dry Creek Sands, Roe Calcarenite; Early Pliocene to Early Pleistocene.

Superfamily	NUCULANACEA
Family	NUCULANIDAE
Genus	**Nuculana** Link, 1807
Subgenus	**Scaeoleda** Iredale, 1929

Nuculana (Scaeoleda) acinaciformis (Tate)

Plate 1, figs. 3, 4

1886b *Leda acinaciformis* Tate: p. 130, pl. 5, figs. 6a, 6b

1961 *Nuculana (Scaeoleda) acinaciformis;* Ludbrook: p. 59, pl. 2, figs. 7, 8 (synonymy)

Type material: Holotype SAM Tate Coll. T. 1033, from Muddy Creek, Hamilton, Victoria; ?Grange Burn Coquina, Early Pliocene.

Material: The species, redescribed by Ludbrook in 1961, is represented in the Roe Calcarenite by 11 specimens from 5 localities: WAM 61.41 (4334-FL6); 69.344(5) (4434-FL6); 66.376 (4333-FL1); 69.534 (pair), 69.535 (2) (4434-FL5); GSWA F7164 (4133-FL7).

Distribution: Grange Burn Coquina, Roe Calcarenite, coastal dunes (Qpo); Early Pliocene, Pleistocene.

Nuculana (Scaeoleda) verconis (Tate)

Plate 1, figs. 1, 2

1891 *Leda verconis* Tate p. 264, pl. 11, fig. 4
1938 *Scaeoleda verconis;* Cotton & Godfrey: p. 45, fig. 20
1955 *Nuculana (Scaeoleda) verconis;* Ludbrook: p. 21, pl. 1, fig. 7
1961 *Scaeoleda verconis;* Cotton: p. 38, fig. 18.

Type material: Holotype SAM D11340 Yankalilla Bay.

Material WAM 69.343 (4434-FL6).

Description: Shell solid, subovate, umbo centrally situated, lunule narrow and well-defined, anterior dorsal margin convex, posterior side shortly rostrate, anterior side rounded, posterior keel curved and rounded, margining the flattened posterior-dorsal area. Surface ornamented with about 30 concentric overlapping lirae; hinge roundly angled and divided by the triangular resilifer, the anterior side slightly convex with 12 chevron-shaped and 5 immature teeth, the posterior side concave, the teeth broken or obscured by matrix in the Roe Calcarenite specimen but apparently about 9 in number, chevron-shaped.

Dimensions: Length 14, height 9 mm.

Remarks: The Roe Calcarenite specimen WAM 69.343 (4434-FL6) is considerably larger than the living examples; with one exception, the species appears to be rare, and known over its stratigraphic range from a few specimens only; it is common in Cockburn Sound, Western Australia.

Distribution: Dry Creek Sands, Roe Calcarenite, present seas (South Australia and Cockburn Sound, Western Australia); Late Pliocene to Early Pleistocene, Holocene.

Subclass	PTERIOMORPHIA
Order	ARCOIDA
Superfamily	ARCACEA
Family	ARCIDAE
Subfamily	ARCINAE
Genus	**Barbatia** Gray, 1842
Subgenus	**Acar** Gray, 1857

Barbatia (Acar) sp. cf. **B.(A.) squamosa** (Lamarck)

Plate 1, figs. 5, 6

cf. 1819 *Arca squamosa* Lamarck: p. 45

Material: WAM 69.361 (4434-FL5) and 70.1 (4434-FL6).

Remarks: The two specimens lack the tegulate sculpture said to be characteristic of *B.(A.) squamosa.* The sculpture consists of fine radiating ribs crossed by concentric growth lines and folds. Length 30, height 17 mm.

Distribution: Roe Calcarenite; Early Pleistocene.

Subfamily ANADARINAE
Genus **Anadara** Gray, 1847

Anadara trapezia (Deshayes)

1839 *Arca trapezia* Deshayes: p. 358
1840 *Arca trapezia* Deshayes: pl. 21
1887b *Barbatia trapezia* (Deshayes) Tate: p. 102 (synonymy and discussion)
1904 *Barbatia trapezia;* Pritchard & Gatliff: p. 242 (synonymy)
1904 *Arca lischkei* Dunker; Hedley: p. 203, pl. 9, figs. 29-34 (synonymy and discussion)
1917 *Arca trapezia;* Hedley: p. M5 (synonymy)
1921 *Arca trapezia;* May: p. 8 (synonymy)
1923 *Arca trapezia;* May: pl. 2, fig. 4
1938 *Anadara trapezia* (Deshayes) Cotton & Godfrey: p. 49, fig. 27
1958 *Anadara trapezia;* May revised Macpherson: pl. 2, fig. 4
1961 *Anadara trapezia;* Cotton: p. 44, fig. 25
1962 *Anadara trapezia;* Macpherson & Gabriel: p. 274, fig. 313
1966 *Anadara trapezia;* Macpherson: p. 228

Material: Three specimens GSWA F7037, locality 3630-FL1, lake near Israelite Bay in fine soft sand, and 2 specimens SAM P8181 between Port Malcolm and Israelite Bay, Pleistocene to Holocene lake and lagoonal deposits (Ql).

Remarks: The living species is gregarious in estuaries and soft mud flats of eastern Australia from Moreton Bay to Bass Strait. In southern Australia it was extremely abundant in the Late Pleistocene, and in association with *Marginopora vertebralis* characterises the fauna of the Glanville Formation and its equivalents ("*Anadara* high sea level" of Aitchison, Sprigg and Cochrane, 1954). After the deposition of the Glanville Formation both *Anadara trapezia* and *Marginopora vertebralis* became rare or extinct in southern Australia where *Anadara trapezia* is found living at a very few localities: Western Port Bay, Port Albert, Port Phillip (Macpherson & Gabriel, 1962), Victoria; and Oyster Harbour, Albany, Western Australia (Kendrick and Wilson, 1959).

Distribution: Glanville Formation, Peppermint Grove Limestone, margins of present seas; Late Pleistocene to Holocene.

Superfamily LIMOPSACEA
Family LIMOPSIDAE
Genus **Limopsis** Sassi, 1827

Limopsis forteradiata Cotton

Plate 1, figs. 7, 8

1930 *Limopsis tenisoni forteradiatus* Cotton: p. 231
1938 *Limopsis forteradiata;* Cotton & Godfrey: p. 53, fig. 32
1961 *Limopsis forteradiata;* Cotton: p. 49, fig. 30

Type material: Holotype SAM D10125 from dredgings derived from Glanville Formation, Port Adelaide River.

Material: The species is abundant in the Roe Calcarenite, being represented by 85 specimens from 8 localities: WAM 65.720 (4434-FL1); 66.378 (19), 66.527 (3) (4333-FL1); 66.590 (4233-FL2); 66.600 (3) (4334-FL1); 69.360 (2) (4434-FL5); GSWA F6919 (4133-FL7); F7005 (5); F7006 (3) (4434-FL7); F7058 (5) (4133-FL4); F7073 (2) (4334-FL1); F7100 (4) (4434-FL8); F7111 (4133-FL3); F7125 (8); GSSA M1317, M1318, M2546 (18) (4334-FLI).

Description: Shell triangularly orbicular, subequilateral, of moderate size; umbo central, small, acute, slightly incurved, dorsal margin short, slightly curved; anterior, posterior and ventral margins gently curved; hinge line arched, with about 12 posterior and 9 anterior teeth; ligamental area short, ligament pit large and triangular; ornament of conspicuous primary radial riblets varying considerably in number but usually from 20 to 25, with finer secondary riblets between, crossed by numerous very fine closely and evenly set concentric lirae. Anterior adductor high, small, roundly quadrate; posterior adductor below the hinge line ovate; both adductors set behind more or less conspicuous ridges extending from under the umbo to the pallial line, which is entire.

Dimensions: F7058 (1) length 16.5, height 16.5 mm; M2546 (1) length 17, height 17.5 mm, inflation (2 valves) 10 mm.

Distribution: Roe Calcarenite, Glanville Formation, present seas (Gulf St. Vincent to Bunbury); Pleistocene to Holocene.

Limopsis tenisoni Tenison Woods

1877 *Limopsis cancellata* Tenison Woods: p. 156 (not Reeve)
1878a *Limopsis tenisoni* Tenison Woods: p. 56
1887b *Limopsis belcheri* Tate: p. 104 (not Adams & Reeve)
1904 *Limopsis tenisoni;* Pritchard & Gatliff: p. 245 (synonymy)
1921 *Limopsis tenisoni;* May: p. 84 (synonymy)
1923 *Limopsis tenisoni;* May: pl. 1, fig. 2
1938 *Limopsis tenisoni;* Cotton & Godfrey: p. 52, fig. 31
1958 *Limopsis tenisoni;* May revised Macpherson: pl. 1, fig. 12
1961 *Limopsis tenisoni;* Cotton: p. 48, fig. 29
1962 *Limopsis tenisoni;* Macpherson & Gabriel: p. 281, fig. 321

Type material: Hypotype (May) SAM May Coll. 12.

Material: The species is represented by three calcreted specimens GSWA F6902 from the Roe Calcarenite of Madura Cave (4334-FL1).

Distribution: Roe Calcarenite, present seas (Victoria to southwestern Australia); Early Pleistocene, Holocene.

Family GLYCYMERIDIDAE
Subfamily GLYCYMERIDINAE
Genus **Glycymeris** da Costa, 1778
Subgenus **Tucetona** Iredale, 1931

Glycymeris (Tucetona) flabellata (Tenison Woods)

Plate 1, figs. 15, 16

1878b *Pectunculus flabellatus* Tenison Woods: p. 61, 62
1887b *Pectunculus flabellatus;* Tate: p. 103 (synonymy)
1904 *Glycimeris flabellata* (Tenison Woods) Pritchard & Gatliff: p. 242 (synonymy)
1921 *Glycymeris flabellatus* (Tenison Woods) May: p. 8 (synonymy)
1923 *Glycymeris flabellata;* May: pl. 2, fig. 6
1925 *Glycymeris flabellata;* Chapman & Singleton: p. 45, pl. 3, figs. 29, 30
1938 *Glycymeris flabellata;* Cotton & Godfrey: p. 62, fig. 44
1958 *Tucetona flabellatus* (Tenison Woods) May revised Macpherson: pl. 2, fig. 6
1961 *Glycymeris flabellata;* Cotton: p. 58, fig. 42
1962 *Tucetona flabellatus;* Macpherson & Gabriel: p. 280, fig. 319

Type locality: "Northeast Tasmania"

Type material: Neotype (Chapman & Singleton, 1925) NMV F671; hypotype (May) SAM May Coll. 21.

Material: The species is represented in the Roe Calcarenite by a single specimen WAM 71.317 (4434-FL6).

Distribution: Whalers Bluff Formation, Roe Calcarenite, and present seas (uncommon, southern Australia, New South Wales to Great Australian Bight); Early Pleistocene, Holocene.

Glycymeris (Tucetona) lowryi n.sp.

Plate 1, figs. 11-14

Type material: Holotype GSWA F7056(1) from locality 4133-FL4, Kanidal Beach, 10 km east of Twilight Cove, Grid Reference BURNABBIE 415013, 32° 14′ 34″S, 126° 08′ 43″E; in Quaternary aeolian sand (Qpo); figured paratype GSWA F7056(2) (4133-FL4); unfigured paratypes GSWA F7008(4) (4434-FL7); F7056(5) (4133-FL4); F7110(2) (4133-FL3); GSSA M1321(2) (4333-FL2); M3213, M3281(9); WAM 62.29(5) (4334-FL1).

Description: Shell of medium size, subcircular in outline, depressed, slightly longer than high; umbo central, very slightly opisthogyrous, ligamental area small, with 4 or 5 widely diverging striae on each side; hingeline long and arcuate, with from 11 to 14 slightly uncinate teeth in each series; anterior adductor subrhomboidal, posterior adductor subquadrate with a ridge on the anterior side; inner margin slightly flattened with from 15 to 26, usually 19, intercostal denticulations. Surface ornamented with from 27 to 33, 29 in the holotype and paratype, radial ribs approximately equal to the interspaces, rounded, crossed by frequent concentric growth lamellae.

Dimensions: Holotype GSWA F7056(1) length 27, height 24.5 mm; paratype GSWA F7056(2) length 25.5, height 23 mm.

Remarks: The species is very close to the Miocene *G.(T.) gunyoungensis* Chapman & Singleton from which it differs in general shape and in the hinge region. The hinge is relatively longer and the hinge margin curved. The species is named for Mr. D. C. Lowry who collected much of the material used in this study.

Distribution: Roe Calcarenite and dunes (Qpo) of the Roe Plains; Pleistocene.

Subgenus **Tucetilla** Iredale, 1939

Glycymeris (Tucetilla) mayi (Cotton)

Plate 1, figs. 9, 10

1947c *Tucetilla mayi* Cotton: p. 659, pl. 20, figs. 18, 19
1961 *Glycymeris mayi* (Cotton) Cotton: p. 62, fig. 47

Type material: Holotype SAM D13046 Beachport, South Australia; paratype, SAM May Coll. 24.

Material: The species is represented by a single specimen GSSA M2553 from 4333-FL2.

Description: Shell suborbicular, inflated, rather small, slightly produced posteriorly, ornamented with about 20 primary riblets and numerous finer secondary riblets on the anterior and posterior areas and intercalating between the primary riblets, crossed by numerous fine concentric growth threads. Hinge line gently arcuate, moderately broad in the fossil but narrow in the living shell, with about 10 teeth on each side; inner ventral margin with about 50 fine denticles.

Dimensions: Height 16, length 18, inflation (one valve) 5.5 mm.

Remarks: In Cape Pillar specimens in the May Collection the area within the pallial line is radially striate and the adductor scars long and subtriangular, extending from below the umbo.

Distribution: Roe Calcarenite, present seas southern Australia; Early Pleistocene, Holocene.

Glycymeris (Tucetilla) radians (Lamarck)

Plate 1, fig. 19

1819 *Pectunculus radians* Lamarck: p. 54
1887b *Pectunculus radians;* Tate: p. 103
1904 *Glycimeris radians* (Lamarck) Pritchard & Gatliff: p. 243 (synonymy)
1916 *Glycymeris radians* (Lamarck) Hedley: p. 154 (synonymy)
1921 *Glycymeris radians;* May: p. 9
1923 *Glycymeris radians;* May: pl. 2, fig. 7
1938 *Glycymeris radians;* Cotton & Godfrey: p. 64, fig. 45
1958 *Glycymeris radians;* May revised Macpherson: pl. 2, fig. 7
1961 *Glycymeris radians;* Cotton: p. 60, fig. 43
1962 *Tucetilla radians* (Lamarck) Macpherson & Gabriel: p. 280, fig. 318

Type material: The holotype (both valves) in the MNHNP, height 24, length 30 mm, and 2 complete specimens labelled "var.b", height 29, length 35 mm. Seen by N. H. Ludbrook 3 March, 1952.

Type Locality: "Australia".

Material: Three hundred and thirteen specimens from 15 localities on the Roe Plains: GSSA M1305(19) (4133-FL6); M1319(12) (4333-FL2); M1320(3), M2555(84) (4334-FL1); M2577(16) (4434-FL7); GSWA F6873(14) (4434-FL7); F6895(2) (4334-FL2); F6918(28) (4133-FL7); F6983 (4534-FL2); F7057(3) (4133-FL4); F7096(23) (4434-FL8); F7109(6) (4133-FL3); F7123(40) (4334-FL1); WAM 61.34(2) (4334-FL6); 65.670(5) (4434-FL1); 66.377, 66.379(5), 66.380, 66.528(3), 66.529(4) (4333-FL1); 66.598(5), 66.599(2) (4334-FL1); 69.586 (4534-FL2).

Description: Shell of medium size, somewhat obliquely ovate, produced posteriorly; ornament somewhat variable, but in general consisting in the median part of the shell between the umbo and the ventral margin of about 30 fine radial ribs, flatly rounded and broader than the interspaces, both ribs and interspaces surmounted with very fine radial threads from 6 to 8 on each rib; the radial sculpture is usually obsolete in both the posterior and anterior areas where it consists of irregularly alternating fine and very fine threads, the number of which varies but which is usually about 20, radial ornament crossed by fine concentric growth striae imbricating near the ventral margin. Ligamental area wide and low, with 5 to 6 diverging striae; hinge of medium width, arcuate, with from 14 to 18 teeth in the posterior series and 12 to 14 in the anterior, somewhat encroaching on the ligamental area. Posterior adductor subovate, anterior adductor triangularly ovate; inner ventral margin with from 25 to 30 denticles.

The living shell is coloured cream to yellowish brown, with concentric swirls of brown from the posterior and anterior areas towards the median part. Interior more or less stained with purplish brown.

Dimensions: GSSA M1303(a) length 31, height 29, inflation (2 valves) 18 mm; (b) length 29, height 25 mm.

Distribution: Dry Creek Sands, Roe Calcarenite, present seas; Late Pliocene, Early Pleistocene, Holocene.

Glycymeris (Tucetilla) striatularis (Lamarck)

Plate 1, figs. 17, 18

1819 *Pectunculus striatularis* Lamarck: p. 52
1843 *Pectunculus obliquus* Reeve: pl. 6, fig. 33
1901 *Glycymeris striatularis* (Lamarck) Tate & May: p. 437
1904 *Glycimeris striatularis* (Lamarck) Pritchard & Gatliff: p. 244 (synonymy)
1906 *Glycimeris striatularis;* Pritchard & Gatliff: p. 68
1916 *Glycymeris striatularis;* Hedley: p. 155

1921 *Glycymeris striatularis;* May: p. 9 (synonymy)
1923 *Glycymeris striatularis;* May: pl. 2, fig. 8
1938 *Glycymeris striatularis;* Cotton & Godfrey: p. 64, fig. 46
1958 *Glycymeris striatularis;* May revised Macpherson: pl. 2, fig. 8
1961 *Glycymeris striatularis;* Cotton: p. 60, fig. 44

Type material: The type specimens in the MNHNP are 1 complete specimen height 34, length 39 mm and 1 valve of a younger shell, both rather worn, white outside with remnants of the epidermis, splashed with brown inside. Seen by N. H. Ludbrook 3 March, 1952. Type locality King George Sound.

Material: 2 specimens GSSA M1323 (4434-FL1), GSWA F7007 (4434-FL7).

Remarks: These are two worn specimens ornamented with fine radiating flattish ribs with linear interspaces.

Distribution: Roe Calcarenite, present seas (New South Wales to Geraldton, Western Australia); Early Pleistocene, Holocene.

Order MYTILOIDA
Superfamily MYTILACEA
Family MYTILIDAE
Subfamily MYTILINAE
Genus **Brachidontes** Swainson, 1840

Brachidontes erosus (Lamarck)

Plate 1, fig. 25

1819 *Mytilus erosus* Lamarck: p. 120
1906 *Mytilus erosus;* Pritchard & Gatliff: p. 69
1916 *Brachyodontes erosus* (Lamarck) Hedley: p. 158
1921 *Brachyodontes erosus;* May: p. 12 (synonymy)
1923 *Brachyodontes erosus;* May: pl. 4, fig. 4
1938 *Brachyodontes erosus;* Cotton & Godfrey: p. 118, fig. 108
1956 *Mytilus erosus;* Laseron: p. 265
1958 *Hormomya erosus* (Lamarck) May revised Macpherson: pl. 4, fig. 4
1961 *Austromytilus erosus* (Lamarck) Cotton: p. 126, fig. 112
1962 *Hormomya erosus;* Macpherson & Gabriel: p. 289, fig. 330

Type material: The type specimens in the MNHNP were seen by N. H. Ludbrook on 3 March, 1952. They are on two tablets, one with a large single specimen 2 valves, length 70, height 22, thickness (both valves) 35 mm here designated as lectotype, the other with two specimens one of medium size length 56, height 23 mm, the other small. Type locality Kangaroo Island, South Australia.

Material: 61 specimens GSSA M1310 (4133-FL6); M1311 (4234-FL1); M1312, M2557(37) (4334-FL1); M2579(4), GSWA F7009(2) (4434-FL7); F7102 (4434-FL8); F7112 (4133-FL3); F7121 (4634-FL1); WAM 62.22(6), 65.671 (4334-FL1); 66.530 (4333-FL1b); 66.601, 66.603 (4334-FL1).

Description: Shell elongate, of medium size and somewhat variable in shape, solid, mytiliform, slightly inflated anteriorly; umbo terminal, rather low, prosogyrate; anterior dorsal margin short, curving gently to the nearly straight and long anterior margin. Posterior dorsal margin straight, dorsal angle broad. Hinge very short, usually without teeth but sometimes with several tooth-like crenulations extending on to the external surface of the shell beneath the umbo. Behind the ligament on the posterior dorsal margin there are numerous tooth-like crenulations independent of the external ornament; crenulations corresponding to the external ornament are developed on the posterior, ventral and anterior margins where they become obsolete. Anterior adductor scar elongate-ovate, raised and calloused, placed beneath the umbo at the anterior border; posterior adductor heart-shaped, with a long posterior retractor fastened to its dorsal side.

Surface ornament of about 20 ribs on the posterior side of the umbonal-ventral ridge, bifurcating towards the ventral margin; numerous fine riblets on the anterior side of the ridge.

Dimensions: Lectotype length (oblique) 70, height 22 mm; GSSA M1312A length 48, height 18 mm.

Remarks: Laseron (1956, p. 265) makes the following comment on the generic location of the species: "In *Brachyodontes* . . . there are no cardinal teeth, but a row of small pseudo-teeth on the margin above the ligamental groove posterior to the umbo. The southern and western species *M. erosus* Lamarck has a hinge much nearer to this type . . . Cotton and Godfrey (1938) placed the three species *rostratus, erosus* and *hirsutus* all under *Brachyodontes* but here they are considered as generically separate, not only from *Brachyodontes* but from each other." Cotton (1961, p. 125) quotes Laseron's note and at the same time transfer *M. erosus* to *Austromytilus* of which *M. rostratus* Dunker is the type species.

Distribution: Roe Calcarenite, present seas (southern Australia); Early Pleistocene, Holocene).

Subfamily MODIOLINAE
Genus **Modiolus** Lamarck, 1799

Modiolus albicostus Lamarck

Plate 1, fig. 24

1819 *Modiola albicosta* Lamarck: p. 111
1887b *Modiola albicosta;* Tate: p. 105
1904 *Modiola albicosta;* Pritchard & Gatliff: p. 250 (synonymy)
1916 *Modiola albicosta;* Hedley: p. 159
1921 *Modiolus albicostus;* May: p. 12
1923 *Modiolus albicostus;* May: pl. 4, fig. 6
1924 *Modiolus delinificus* Iredale: p. 196 (nom. nud.)
1938 *Modiolus albicostus;* Cotton & Godfrey: p. 113, fig. 100
1958 *Modiolus albicostus;* May revised Macpherson: pl. 4, fig. 6
1961 *Modiolus albicostus;* Cotton: p. 119, fig. 104

Type material: Lamarck's types are in the Natural History Museums of Paris and Geneva, seen by N. H. Ludbrook on 3 and 5 March, 1952. Those in Paris consist of (1) 8 complete specimens and one unpaired valve in various stages of growth. White internally on the anterior side, purple on the posterior; largest specimen length 75 height 40 mm; (2) 3 large specimens labelled "var en *spatula*" and 2 juveniles of the same variety, all except one specimen collected from Timor by Péron and Lesueur, the middle and largest on tablet (2) marked "type Lamarck", covered with epidermis, height 65, length 38 mm. All of these specimens are from Timor. Those in Geneva are *Modiola albicosta* No. 3. Two examples (4 valves) labelled in Lamarck's handwriting; one specimen figured Delessert (1841) length 71, height 30, length of hinge 33 mm, covered with epidermis which is dark brown in the narrow posterior area light brown elsewhere; umbo-ventral ridge dark brown with a pink-coloured radial stripe.

Material: The species is represented in the Roe Calcarenite by two specimens, WAM 69.376 (length 89, height 50, length of hinge 40 mm) from 4534-FL2, and 70.41 (4434-FL11).

Distribution: Roe Calcarenite, present seas (New South Wales to Western Australia); Early Pleistocene, Holocene.

Order	PTERIOIDA
Suborder	PTERIINA
Superfamily	PECTINACEA
Family	PECTINIDAE
Genus	**Chlamys** Roeding, 1798
Subgenus	**Chlamys** s.s.

Chlamys (Chlamys) asperrimus (Lamarck)

Plate 2, figs. 1, 2.

1819 *Pecten asperrimus* Lamarck: p. 174
1887b *Pecten asperrimus;* Tate: p. 108
1904 *Chlamys asperrimus* (Lamarck) Pritchard & Gatliff: p. 264 (synonymy)
1916 *Pecten asperrimus;* Hedley: p. 157
1921 *Chlamys asperrimus;* May: p. 10 (synonymy)
1923 *Chlamys asperrimus;* May: pl. 3, fig. 7
1930 *Chlamys asperrimus asperrimus;* Gatliff & Singleton: p. 73; pl. 2, figs. 1, 2, 4; pl. 3, fig. 5; pl. 4, figs. 11, 12 (synonymy)
1938 *Mimachlamys asperrimus* (Lamarck) Cotton & Godfrey: p. 110, fig. 86
1958 *Chlamys asperrimus;* May revised Macpherson: pl. 3, fig. 7
1961 *Mimachlamys asperrimus;* Cotton: p. 105, fig. 90
1962 *Chlamys asperrimus;* Macpherson & Gabriel: p. 303, fig. 344
1966 *Chlamys asperrimus;* Macpherson: p. 232

Type material: Lamarck's types are in the Natural History Museums of Paris and Geneva, seen by N. H. Ludbrook on 3 and 5 March, 1952. Those in Paris

consist of 6 specimens on a tablet: one large example at the top, height 100, length 86 mm; 1 pair height 75, length 74 mm; 2 pairs, 1 height 57, length 46 mm; 2 valves on either side height 40, length 38 mm, from Australia. Those in Geneva consist of 6 young specimens, the largest measuring height 45, length 40 mm; all dark red except the smaller which is orange-red. Label in Lamarck's handwriting "No. 43".

Material: The species is represented by a pair WAM 69.461, height 47, width 46 mm from 4434-FL6.

Distribution: Roe Calcarenite, present seas (southern Australia); Early Pleistocene, Holocene.

Subgenus **Equichlamys** Iredale, 1924

Chlamys (Equichlamys) bifrons palmipes (Tate)

Plate 2, fig. 5

1886b *Pecten palmipes* Tate: p. 105, pl. 5, fig. 4; pl. 7, figs. 4a-b
1959 *Chlamys (Equichlamys) palmipes* (Tate) Ludbrook: p. 225, pl. 1, figs. 3-6

Type material: The types of *C. (E.) bifrons* (Lamarck) were seen by Ludbrook in Paris and Geneva in March, 1952. The types of *Pecten palmipes* Tate are in the South Australian Museum, Tate Collection T932, from Edithburg, South Australia; Hallett Cove Sandstone, Late Pliocene.

Material: 6 specimens WAM 69.660 (4534-FL2), 69.661; 70.1087(2) (4434-FL6); 70.1123(2) (4434-FL5).

Remarks: An *Equichlamys* with 9 to 10 elevated broad ribs on each valve; ribs surmounted by very fine threads, interspaces shagreened. The Roe Plains specimens come close to those described as *C. (E.) palmipes* from the Norwest Bend Formation at Tailem Bend. The lectotype and paratype from Edithburg have fewer ribs than the Tailem Bend and Roe Plains examples.

Tate (1886, p. 105) and Ludbrook (1959, p. 224) both remarked on the difficulty in separating Tate's species *C. (E.) consobrinus, C. (E.) palmipes,* and *C. (E.) subbifrons* from the living *C. (E.) bifrons* (Lamarck). Like the Pecten groups described by Fleming (1957), they all belong to a single polytypic species and the fossils formerly described as species are here given subspecific rank. In the subspecies *C. (E.) bifrons palmipes* the ribs are very elevated and narrower than the interspaces; the radial riblets are weak.

Distribution: Hallett Cove Sandstone and Norwest Bend Formation, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Chlamys (Equichlamys) bifrons subbifrons (Tate)

Plate 2, Figs. 6, 7

1882 *Pecten subbifrons* Tate: p. 44
1886b *Pecten subbifrons* Tate: p. 104, pl. 3, fig. 2
1959 *Chlamys (Equichlamys) subbifrons* (Tate) Ludbrook: p. 224, pl. 1, fig. 1

Type material: The types of *Pecten subbifrons* are in the South Australian Museum Tate Collection T959; they came from the old Government House Quarry, City of Adelaide; Hallett Cove Sandstone.

Material: 22 specimens GSWA F7053(2) (4133-FL4); F7106(4); F7107 (4133-FL3); WAM 61.35 (4434-FL6); 69.462(2) (4434-FL6); 70.1085-6 (4434-FL5); 70.1098, 70.1099 (4434-FL4); 70.1100(2), 70.1124(2) (4434-FL6); 70.1143 (4434-FL11); 70.2153 (4434-FL1).

Description: Shell solid, triangularly orbicular, slightly convex, subequilateral, subequivalve, left valve tending to be flattened near the umbo, both dorsal margins slightly concave; ornamented with from 10 to 12 (usually 12) broad radial ribs, those in the middle of the shell raised, those on the anterior and posterior flattened, both ribs and interspaces surmounted each by about 5 radial riblets, those on the ribs usually of about equal strength to those in the interspaces; some shagreen ornament between the riblets, but its absence is due to abrasion of the fossils. Ears subequal, each with from 8 to 12 radial threads.

Dimensions: Roe Calcarenite specimen WAM 69.462a length 62, height 62, inflation (2 valves) 20 mm.

Remarks: The subspecies is retained for examples with from 10 to 12 primary ribs.

Distribution: Hallett Cove Sandstone, Norwest Bend Formation, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Genus **Pecten** Mueller, 1776

Pecten benedictus albus Tate

1887d *Pecten fumatus* var. *albus* Tate: p. 115
1904 *Pecten medius;* Pritchard & Gatliff: p. 261 (synonymy)
1921 *Pecten medius;* May: p. 10 (synonymy)
1923 *Pecten medius;* May: pl. 3, fig. 5
1938 *Notovola alba* (Tate) Cotton & Godfrey: p. 92, fig. 78
1957 *Pecten benedictus albus;* Fleming: p. 33, pl. 2, fig. 1 (synonymy)
1961 *Notovola alba;* Cotton: p. 96, fig. 81
1962 *Pecten alba;* Macpherson & Gabriel p. 300, fig. 341
1966 *Pecten alba;* Macpherson: p. 231

Type material: Holotype SAM D8920; hypotype NZGS W767.

Material: One complete specimen GSWA 7151 collected from locality 3630-FL1 in soft incoherent sand (Ql).

Distribution: Present seas (Western Port, Victoria to Shark Bay, Western Australia); Holocene.

Family SPONDYLIDAE
Genus **Spondylus** Linnaeus, 1758

Spondylus spondyloides (Tate)

Plate 2, figs. 3, 4

1882 *Pecten spondyloides* Tate: p. 44
1955 *Spondylus spondyloides* (Tate) Ludbrook: p. 34, pl. 2, fig. 1 (synonymy)
1959b *Spondylus spondyloides;* Ludbrook: p. 226, pl. 2, fig. 1

Type material: Syntypes SAM Tate Collection T956, 948 from Aldinga Bay, South Australia, Hallett Cove Sandstone, (Late Pliocene); hypotype SAM Tate Collection F15470.

Material: Eight specimens GSSA M2563 (4334-FL1); WAM 61.30 (4334-FL6); 66.381 (4333-FL1); 69.346 (4434-FL6); 69.362 (4434-FL5); 69.370 (4534-FL2).

Description: Shell thick, solid, subequilateral, slightly produced posteriorly, inflated, with 7 to 9 primary ribs, between each pair of which there are two or three secondary ribs of variable width and a variable number of tertiary ribs, all more or less spiny.

Dimensions: 69.356 (pair) length 87, height 89, inflation 59 mm; 69.362 (pair) length 75, height 79, inflation 43 mm.

Distribution: Hallett Cove Sandstone, Norwest Bend Formation, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Superfamily LIMACEA
Family LIMIDAE
Genus **Lima** Bruguière, 1797

Lima gemina (Iredale)

Plate 1, figs. 22, 23

1929a *Austrolima nimbifer gemina* Iredale: p. 165
1938 *Austrolima gemina;* Cotton & Godfrey: p. 105, fig. 91
1961 *Austrolima gemina;* Cotton: p. 110, fig. 195

Type material: None has been designated. Type locality: "South Australia".

Material: Two specimens WAM 70.4, 71.318 (4434-FL6).

Description: The Pleistocene shell is obliquely trigonal-ovate, inequilateral, moderately convex; umbo subcentral, small, prosogyrous, distant; hinge area large, triangular, elongate, with a long triangular ligament pit; ears small, unequal, each with an inconspicuous tooth; anterior margin nearly straight, posterior convex.

Surface ornamented with about 40 strong scaly ribs broader than the interspaces.

Dimensions: WAM 70.4 length 40, height 49.5, inflation (one valve) 13.5 mm.

Distribution: Roe Calcarenite, present seas ("Beachport to Fremantle to 27 m" (Cotton & Godfrey, 1938)); Early Pleistocene, Holocene.

Genus **Limea** Bronn, 1831
Subgenus **Gemellima,** Iredale, 1929

Limea (Gemellima) sp. cf. **L. (G.) austrina** Tate

Plate 9, figs. 19-22

cf. 1887b *Limea austrina* Tate: p. 73, 109, pl. 4, fig. 7

Material: Two specimens WAM 69.463 (4434-FL6).

Description: Shell tumid, subovate, equilateral, solid, with about 24 nodulose radial ribs with narrow deep interspaces; umbos prominent, incurved, hinge straight of medium length, high, with a broad triangular ligament pit on either side of which there are one or two obscure denticulations. Inner margin thick, crenulated corresponding to the external ribs, interior of shell radially furrowed. Length 9, height 10 mm.

Remarks: The species differs from *L. (G.) austrina* in the greater number of ribs and in the stronger crenulations of the inner margin dorsally. It is somewhat broader than *L. (G.) austrina.*

Distribution: Roe Calcarenite; Early Pleistocene.

Suborder OSTREINA
Superfamily OSTREACEA
Family OSTREIDAE
Genus **Ostrea** Linnaeus, 1758

Ostrea angasi Sowerby

1871 *Ostrea angassi* Sowerby: pl. 13, fig. 28
1887b *Ostrea angasi* Sowerby emend. Tate: p. 110
1904 *Ostrea angasi;* Pritchard & Gatliff: p. 266 (synonymy)
1916 *Ostrea angasi;* Hedley: p. 156 (synonymy)
1938 *Ostrea sinuata;* Cotton & Godfrey: p. 86, fig. 73 (not Lamarck 1819)
1954 *Ostrea angasi;* Thomson: p. 143 (synonymy)
1958 *Ostrea angasi;* May revised Macpherson: pl. 3, fig. 2
1961 *Ostrea sinuata;* Cotton: p. 86, fig. 73
1962 *Ostrea angasi;* Macpherson & Gabriel: p. 311, fig. 353
1966 *Ostrea angasi;* Macpherson: p. 232

Material: GSSA M1307 (4133-FL6); GSWA F7149 (3630-FL1); WAM 61.32 (4334-FL6); 69.536 (4434-FL5).

63616—(4)

Remarks: The species, known as the mud oyster, Port Lincoln oyster, or Stewart Island oyster, was described by Thomson who did not separate the Australian oyster from the New Zealand species. It is close to the Pliocene species *O. arenicola* Tate.

Distribution: Roe Calcarenite, Glanville Formation, "old beach deposit of Port Phillip", present seas (southern Australia and New Zealand); Early Pleistocene to Holocene.

Ostrea sp. cf. **O. sturtiana** Tate

cf.1886b *Ostrea sturtiana* Tate: p. 97, pl. 6, fig. 1

Material: Nine valves WAM 69.380 (a-g) (4334-FL5); GSWA F7105 (1-2) (4133-FL3).

Description: An elongate subtrigonal *Ostrea,* moderately thick, lower valve shallow to moderately deep, radially irregularly ribbed and wrinkled, margins relatively smooth; upper valve nearly flat with irregular growth lamellae; hinge moderate to narrowly triangular, only moderately channelled in the middle. Muscle impression large, reniform.

Dimensions: WAM 69.380b, c length 64, height 88, muscle length 24, height 22 mm.

Remarks: The species is similar in shape to the Pliocene *O. sturtiana* but is less wrinkled and none of the specimens is as thick as is usual with *O. sturtiana.* It has a conspicuously large muscle scar.

Distribution: Roe Calcarenite; Early Pleistocene.

Order TRIGONIOIDA
Superfamily TRIGONIACEA
Family TRIGONIIDAE
Genus **Neotrigonia** Cossmann, 1912

Neotrigonia bednalli (Verco)

Plate 1, figs. 20, 21

1907b *Trigonia margaritacea* Lamarck var. *bednalli* Verco: p. 224, pl. 28, figs. 1, 2, 3
1938 *Neotrigonia bednalli* (Verco) Cotton & Godfrey: p. 90, fig. 77
1961 *Neotrigonia bednalli;* Cotton: p. 93, fig. 79

Type material: Holotype SAM D13056 from Gulf St. Vincent, 27-36 m.

Remarks: The Pleistocene specimen WAM 69.464 (4434-FL6) is a juvenile with 20 ribs carrying plate-like tubercles. Length 16, height 16 mm.

Distribution: Roe Calcarenite, present seas (Beachport to King George Sound); Early Pleistocene, Holocene.

Subclass HETERODONTA
Order VENEROIDA
Superfamily LUCINACEA
Family LUCINIDAE
Subfamily LUCININAE
Genus **Callucina** Dall, 1901

Callucina lacteola (Tate)

Plate 3, figs. 2-5

1856 *Lucina lactea* A. Adams: p. 225 (not Lamarck, 1818)
1897 *Lucina lacteola* Tate: p. 48 new name for *Lucina lactea* Adams, not Lamarck
1916 *Loripes lacteola* (Tate) Herdley: p. 161 (synonymy)
1921 *Codakia lacteola* (Tate) May: p. 18 (synonymy)
1923 *Codakia lacteola;* May: pl. 7, fig. 16
1938 *Codokia lacteola*; Cotton & Godfrey: p. 206, fig. 219
1958 *Callucina lacteola;* May revised Macpherson: pl. 7, fig. 16
1961 *Codokia lacteola;* Cotton: p. 219, fig. 226

Type material: Holotype of *Lucina lactea* Adams, BM(NH), Cuming Collection.

Material: Lucina lacteola Tate SAM D12958 from Swan River, Western Australia; 50 specimens GSSA M1313 (4234-FL1); M1314 (4333-FL2); M2536(17) (4434-FL1); GSWA F6938(2) (4133-FL7); F7074(2), F7135(3), WAM 62.31, 65.673 (4334-FL1); 66.386(3), 66.532 (pair) (4333-FL1); 66.592(2) (4233-FL2); 66.602(10) (4334-FL1).

Description: Shell sub-orbicular, solid, fairly thick, moderately convex, ornamented with fairly regular thin concentric lamellae, about 1 mm apart, interspaces finely radially striated. Umbos slightly to the anterior, prosogyrous, dorsal margin nearly straight, ventral margin well rounded. Hinge with a very weak AI and 3b in the right valve; 4b and 2 in the left valve. Posterior adductor oval, anterior adductor broad, moderately long and confluent with the pallial line for part of its length; a fairly large conspicuous pedal retractor scar above and separated from the anterior adductor. Inner margin thick, finely crenulated.

Dimensions: WAM 66.532 length 22, height 21, inflation 14 mm.

Distribution: Roe Calcarenite, present seas (Tasmania, South Australia and south Western Australia); Early Pleistocene, Holocene.

Genus **Myrtea** Turton, 1822

Myrtea fabuloides (Tate)

Plate 9, fig. 18

1886b *Lucina fabuloides* Tate: p 1.12, fig. 5
1887c *Lucina fabuloides* Tate: p. 145
1955 *Myrtea fabuloides* (Tate) Ludbrook: p. 46, pl. 2, fig. 16

Type material: Holotype and paratypes SAM Tate Collection T 1111 from Blanche Point, Aldinga Bay, South Australia: Hallett Cove Sandstone (Late Pliocene); hypotype SAM Tate Collection F15491.

Material: Seven small valves WAM 66.388 (4333-FL1).

Distribution: Hallett Cove Sandstone, Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Subfamily MILTHINAE

Genus **Miltha** H. & A. Adams, 1857

Miltha hamptonensis Ludbrook

Plate 3, figs. 1, 10

1969 *Miltha hamptonensis* Ludbrook: p. 60, pl. 3, figs. 1-3, pl. 4, figs. 1, 2

Type material: Holotype WAM 69.334 from locality 4434-FL6, Hampton Microwave Repeater Tower.

Material: WAM 61.33, 69.334 (4334-FL6); 69.468 (4434-FL6); 69.537 (4434-FL5); 69.62 (4434-FL2); 70.6(2) (4434-FL2); GSWA F7052 (4133-FL4).

Distribution: Roe Calcarenite and coastal dunes (Qpo); Pleistocene.

Genus **Anodontia** Link, 1807

Anodontia sphericula (Basedow)

Plate 5, fig. 1

1902 *Meretrix sphericula* Basedow: p. 131, pl. 2, fig. 2
1959b *Anodontia sphericula* (Basedow) Ludbrook: p. 227, pl. 3, figs. 1-3, pl. 5, figs. 1-4
1973 *Anodontia sphericula;* Ludbrook: pl. 26, fig. 65

Type Material: SAM Neotype P12658 from Edithburg, South Australia, Hallett Cove Sandstone; Late Pliocene; hypotypes P12659, F15471.

Material: WAM 61.243 (4334-FL1); 61.37 (4334-FL6); 66.384 (4333-FL1); 69.465, 69.466 (4434-FL6); 69.574 (4434-FL4); 69.624(2) (4434-FL13); GSSA M2559 (4334-FL1).

Remarks: The species attains its greatest size in the Roe Calcarenite, the magnificent specimen 69.466 having dimensions length 105, height 95, inflation (both valves) 79 mm.

Distribution: Nullarbor Limestone, Melton Limestone, Dry Creek Sands; Hallett Cove Sandstone, Roe Calcarenite; Miocene, Late Pliocene to Early Pleistocene.

Genus **Gibbolucina** Cossmann, 1904
Subgenus **Gibbolucina** s.s.

Gibbolucina (Gibbolucina) salebrosa (Woods)

Plate 3, figs. 6-9

1931 *Codakia salebrosa* N. H. Woods: p. 149, pl. 8, figs. 4,5
1947c *Epicodakia salebrosa* (Woods) Cotton: p. 663
1955 *Eomiltha (Gibbolucina) salebrosa* (Woods) Ludbrook: p. 48, pl. 6, fig. 3

Type material: Holotype SAM F15493 Tate Collection from Abattoirs Bore No. 1, Adelaide, section 97, hundred of Yatala, 98-152 m, Dry Creek Sands, Late Pliocene.

Material: GSSA M3212 (4434-FL7); GSWA F6876 (4334-FL2); F6880 (4434-FL7); WAM 65.676 (4334-FL1); 69.348 (4434-FL6); 69.364(2), 69.365 (4434-FL5); 69.375 (4434-FL4); 70.3(a-c) (4434-FL6).

Description: Shell fairly thick, rough, inequilateral, equivalve, irregularly compressed, commonly thickening with age, ornamented with irregular growth lamellae and numerous fine concentric growth striae; lunule depressed, obliterating the anterior hinge, ligament deeply set, nymph stout, long; hinge edentulous. Area inside the pallial line roughened and thickened, anterior scar long, dorsally confluent with the pallial line, diverging ventrally subparallel to the pallial line, posterior adductor scar long, oval; margin smooth.

Dimensions: WAM 69.364, length 26, height 24 mm.

Remarks: The species is a *Gibbolucina* rather than an *Eomiltha* which has now been classified as a subgenus of *Gibbolucina* (Chavan, 1969: p. 502), not the reverse as used by Ludbrook (1955).

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Genus **Linga** de Gregorio, 1884
Subgenus **Bellucina** Dall, 1901

Linga (Bellucina) crassilirata (Tate)

1887a *Lucina crassilirata* Tate: p. 67, pl. 4, fig. 2
1938 *Codokia crassilirata* (Tate) Cotton & Godfrey: p. 206, fig. 218
1961 *Codokia crassilirata;* Cotton: p. 219, fig. 225

Type material: Holotype SAM D12957 from Streaky Bay, South Australia.

Material: The Roe Calcarenite specimens consist of five juveniles WAM 66.387 from Nurina Cave (4333-FL1), corresponding exactly to specimens in a series from Wallaroo, South Australia.

Distribution: Roe Calcarenite, present seas (Gulf St. Vincent to St. Francis Island (Cotton & Godfrey, 1938)); Early Pleistocene, Holocene.

Superfamily CARDITACEA
Family CARDITIDAE
Subfamily CARDITINAE
Genus **Venericardia** Lamarck, 1801

Venericardia quoyi (Deshayes)

Plate 3, fig. 14

1833 *Cardita australis* Quoy & Gaimard: pl. 80, fig. 4 (not Lamarck)
1852 *Cardita quoyi* Deshayes: p. 103
1904 *Cardita quoyi;* Pritchard & Gatliff: p. 232 (synonymy)
1962 *Venericardia quoyi* (Deshayes) Macpherson & Gabriel: p. 317, fig. 358

Material: Thirty-one specimens GSSA M1304(4) (4234-FL1); M1316(4) (4333-FL2); M2533(6), GSWA F7064(2), F7131(3), WAM 65.672(4), (4334-FL1); 66.383(6), 66.531(2), (4333-FL1).

Description: Shell of moderate size, solid, thick, convex, oblong-ovate, rounded anteriorly, truncated posteriorly; umbo high, incurved, prosogyrous. Surface ornamented with 22 radial ribs wider than the deep interspaces and surmounted by prominent tubercles. Hinge moderately broad with 4b, 2, and a very weak AII in the left valve, a very weak AI, 3a, and a strong triangular 3b in the right valve. Anterior adductor reniform, above which and just under the hinge is a fairly deep pedal retractor pit; posterior adductor roundly triangular.

Dimensions: WAM 66.383 length 28, height 26; 66.351 length 24, height 22 mm.

Distribution: Roe Calcarenite, present seas (Victoria to Western Australia); Early Pleistocene, Holocene.

Subfamily CARDITAMERINAE
Genus **Cyclocardia** Conrad, 1867
Subgenus **Scalaricardita** Sacco, 1899

Cyclocardia (Scalaricardita) vincentensis (Verco)

1908b *Carditella vincentensis* Verco: p. 354, pl. 16, figs. 20, 21
1938 *Carditella vincentensis;* Cotton & Godfrey: p. 190, fig. 197
1961 *Carditella vincentensis;* Cotton: p. 201, fig. 203

Type material: Holotype SAM D12921, from Gulf St. Vincent, 41 m.

Material: A single right valve WAM 66.389 (4333-FL1)

Distribution: Roe Calcarenite, present seas (Backstairs Passage, South Australia, to Bunbury, Western Australia); Early Pleistocene, Holocene.

Subgenus **Arcturellina** Chavan, 1952

Cyclocardia (Arcturellina) sp. cf. **C. (A.) peridonea** Ludbrook

cf. 1955 *Cyclocardia (Arcturellina) peridonea* Ludbrook: p. 44, pl. 2, fig. 7

Material: A single valve GSWA F7180 from locality 3630-FL1, in Quaternary soft incoherent sand (Ql).

Distribution: Dry Creek Sands, lake and lagoonal deposits (Ql); Late Pliocene, ?Holocene.

Family CRASSATELLIDAE
Subfamily CRASSATELLINAE
Genus **Eucrassatella** Iredale, 1924

Eucrassatella donacina (Lamarck)

Plate 3, figs. 15, 16

1818 *Crassatella donacina* Lamarck: p. 481
1924 *Eucrassatella kingicola* (Lamarck) Iredale: p. 203
1936 *Eucrassatella kingicola verconis* Iredale: p. 271
1938 *Eucrassatella verconis;* Cotton & Godfrey: p. 164, fig. 164
1961 *Eucrassatella verconis;* Cotton: p. 174, fig. 170
1964 *Eucrassatella donacina* (Lamarck) Darragh: p. 4, pl. 1, fig. 4; pl. 2, fig. 5 (synonymy)

Type Material: Holotype MNHNP from Shark Bay, Western Australia; not seen by Ludbrook 1952; type of *Eucrassatella kingicola verconis* AM C1412.

Material: WAM 69.347 (4434-FL6); 69.363 (4434-FL5); 69.374, 69.573 (4434-FL4); 70.24a,b (4434-FL6).

Description: (after Darragh, 1964, and modified for the Pleistocene shell): Shell wedge-shaped, slightly produced posteriorly. Umbos prominent, prosogyrous, in the fossil specimens with weak concentric ribs, the rest of the shell smooth but for concentric growth striae. Only moderately thick and not heavy.

Dimensions: WAM 69.347 (pair) length 77, height 61, inflation 27 mm.

Distribution: Roe Calcarenite, present seas (Gulf St. Vincent to Shark Bay); Early Pleistocene, Holocene.

Superfamily CARDIACEA
Family CARDIIDAE
Subfamily CARDIINAE
Genus **Veprecardium** Iredale, 1929

Veprecardium antiquum n. sp.

Plate 4, figs. 1-3

Type material: Holotype WAM 69.351a, from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E, Roe Calcarenite, Early Pleistocene; figured paratype WAM 69.366 (4434-FL6); unfigured paratypes WAM 69.351b-d (4434-FL6).

Material: WAM 69.350, 69.351a-d (4434-FL6); 69.366 (4434-FL5) (all pairs).

Description: Shell large, roundly subquadrate, hinge long, tumid, subequilateral, umbos central, inflated, almost in contact, incurved, prosogyrous, both lunule and escutcheon poorly defined; ornamented with from 40 to 43 flat ribs with vertical sides and linear interspaces; each rib is ornamented in the centre with loosely cemented pustules which are easily rubbed off, and on one or both sides with very fine regular oblique tubercles. Hinge fairly long, slightly curved; in the right valve a short triangular anterior cardinal above the short wedge-shaped posterior cardinal; anterior and posterior laterals short, triangular; left valve with an elevated posterior cardinal and triangular anterior cardinal, anterior and posterior laterals.

Dimensions: Holotype WAM 69.351a length 54, height 51, inflation 38 mm; paratype 69.366 length 57, height 51, inflation 40 mm.

Remarks: Veprecardium antiquum differs from the type species *V. pulchricostatum* Iredale in the following respects: it is roundly subquadrate, with the length greater than the height in the ratio 1.06:1.00. *V. pulchricostatum* is subcircular to subovate, higher than long, the length:height ratio being 0.94:1.00. There are 40 to 43 flat, fairly broad ribs in *V. antiquum,* 38 to 40 elevated narrow ribs in *V. pulchricostatum.*

Distribution: Roe Calcarenite; Early Pleistocene.

Subfamily TRACHYCARDIINAE
Genus **Acrosterigma** Dall, 1900
Subgenus **Regozara** Iredale, 1936

Acrosterigma (Regozara) cygnorum (Deshayes)

Plate 4, fig. 4

1855 *Cardium cygnorum* Deshayes: p. 331
1887b *Cardium cygnorum;* Tate: p. 95
1903 *Cardium cygnorum;* Pritchard & Gatliff: p. 135 (synonymy)
1916 *Cardium cygnorum;* Hedley: p. 162
1917 *Cardium cygnorum;* Hedley: p. 686, pl. 52, fig. 41 (synonymy)
1921 *Cardium cygnorum;* May: p. 21 (synonymy)
1923 *Cardium cygnorum;* May: pl. 9, fig. 13
1938 *Cardium cygnorum;* Cotton & Godfrey: p. 226, fig. 250
1958 *Regozara cygnora* (Deshayes) May revised Macpherson: pl. 9, fig. 13
1961 *Vasticardium cygnorum* (Deshayes) Cotton: p. 240, fig. 257
1962 *Regozara cygnora*; Macpherson & Gabriel: p. 337, fig. 385

Type material: Holotype BMNH 1971.23/1; paratypes 1971.23/2, 1971.23/3.

Material: WAM 69.349a, b (4434-FL6); 69.378 (4434-FL8); 70.5 (4434-FL6); GSSA M2540 (4334-FL1); GSWA F6877 (4434-FL7).

Remarks: The Roe Calcarenite specimens have from 38 to 43 ribs, the posterior 8 with scales in the interspaces, the rest ornamented with chevron-shaped ridges and with deep narrow interspaces.

Dimensions: WAM 70.5 (pair) length 45, height 52, inflation 33 mm.

Distribution: Roe Calcarenite, present seas (New South Wales and southern Australia to southwestern Australia); Early Pleistocene, Holocene.

Genus **Laevicardium** Swainson, 1840
Subgenus **Fulvia** Gray, 1853

Laevicardium (Fulvia) tenuicostatum (Lamarck)

Plate 4, fig. 5

1819 *Cardium tenuicostatum* Lamarck: p. 5
1825 *Cardium racketti* Donovan: p. 4, pl. 124
1841 *Cardium tenuicostatum;* Delessert: pl. 11, fig. 6
1887b *Cardium tenuicostatum;* Tate: p. 95
1903b *Cardium tenuicostatum;* Pritchard & Gatliff: p. 136
1916 *Cardium tenuicostatum;* Hedley: p. 163 (synonymy)
1917 *Cardium racketti;* Hedley: p. 685 (synonymy and discussion)
1921 *Cardium racketti;* May: p. 22
1923 *Cardium racketti;* May: pl. 9, fig. 15
1955 *Fulvia tenuicostata* (Lamarck) Ludbrook: p. 62, pl. 4, fig. 13 (synonymy and discussion)
1958 *Fulvia tenuicostata;* May revised Macpherson: pl. 9, fig. 15
1961 *Fulvia racketti* (Donovan) Cotton: p. 241, fig. 256
1962 *Fulvia tenuicostata;* Macpherson & Gabriel: p. 337, fig. 386

Type material: The types were seen by Ludbrook in Paris, 3 March, 1952; the type tablet has the holotype (figured Delessert, 1841), and two paratypes. The holotype has 46 ribs faintly crenulated by growth striae but otherwise smooth. The anterior side is gently rounded, the posterior somewhat produced.

Dimensions: length 51, height 50 mm. Type locality: Timor (Péron & Lesueur).

Material: GSWA F6981(3) (4534-FL2); F7140 (4634-FL2); WAM 69.587 (4534-FL2).

Distribution: Dry Creek Sands, Roe Calcarenite, Glanville Formation, present seas (Australia generally; Indo-Pacific); Late Pliocene to Holocene.

Superfamily MACTRACEA
Family MACTRIDAE
Subfamily MACTRINAE
Genus **Mactra** Linnaeus, 1767

Mactra australis Lamarck

Plate 4, fig. 6

1818 *Mactra australis* Lamarck: p. 475
1916 *Mactra australis;* Hedley: p. 168 (synonymy)
1921 *Mactra australis;* May: p. 26

1923 *Mactra australis;* May: pl. 11, fig. 12
1938 *Mactra australis;* Cotton & Godfrey: p. 272, fig. 309
1958 *Mactra australis;* May revised Macpherson: pl. 11, fig. 12
1961 *Mactra australis;* Cotton: p. 290, fig. 318
1962 *Mactra australis;* Macpherson & Gabriel: p. 364, fig. 424

Material: GSSA M1293, M2561(2) (4334-FL1); GSWA F6878 (4434-FL7); F7097(5) (4434-FL8); WAM 61.40 (4334-FL6).

Distribution: Roe Calcarenite, present seas (southern Australia); Early Pleistocene, Holocene.

Mactra pura Deshayes

Plate 4, figs. 7, 8

1853 *Mactra pura* Deshayes: p. 15
1887b *Mactra pura;* Tate: p. 83
1903 *Mactra pura;* Pritchard & Gatliff: p. 105 (synonymy)
1916 *Mactra pura;* Hedley: p. 169
1921 *Mactra pura:* May: p. 26 (synonymy)
1923 *Mactra pura;* May: pl. 11, fig. 16
1938 *Mactra pura;* Cotton & Godfrey: p. 272, fig. 308
1958 *Mactra pura;* May revised Macpherson: pl. 11, fig. 16
1961 *Mactra pura;* Cotton: p. 289, fig. 317
1962 *Mactra pura;* Macpherson & Gabriel: p. 364, fig. 425

Material: The species is represented by a pair of valves WAM 69.538 from locality 4434-FL5.

Distribution: Roe Calcarenite, Peppermint Grove Limestone, present seas (Tasmania to Geraldton, Western Australia); Early Pleistocene to Holocene.

Mactra rufescens Lamarck

Plate 4, figs. 11, 12

1818 *Mactra rufescens* Lamarck: p. 476
1887b *Mactra rufescens;* Tate: p. 83
1903b *Mactra rufescens;* Pritchard & Gatliff: p. 106 (synonymy)
1916 *Mactra rufescens;* Hedley: p. 168
1921 *Mactra rufescens;* May: p. 26 (synonymy)
1923 *Mactra rufescens;* May: pl. 11, fig. 17
1938 *Mactra rufescens;* Cotton & Godfrey: p. 273, fig. 310
1958 *Mactra rufescens;* May revised Macpherson: pl. 11, fig. 17
1961 *Mactra rufescens;* Cotton: p. 290, fig. 319
1962 *Mactra rufescens;* Macpherson & Gabriel: p. 364, fig. 423

Type material: Holotype from Shark Bay, Western Australia in the MNHNP where it was seen 3 March, 1952. It is a large specimen, length 55, height 43 mm, cream coloured, yellow near the umbo.

Material: The species is represented by a single valve WAM 69.379 from locality 4434-FL8.

Distribution: Roe Calcarenite, present seas (southern Australia from southern New South Wales to Shark Bay, Western Australia); Early Pleistocene, Holocene.

Genus **Spisula** Gray, 1837
Subgenus **Notospisula** Iredale, 1930

Spisula (Notospisula) trigonella (Lamarck)

Plate 4, fig. 9

1818 *Mactra trigonella* Lamarck: p. 479
1853 *Gnathodon parvum* Petit: p. 358, pl. 13, figs. 9, 10
1854 *Mactra rostrata* Reeve: pl. 19, fig. 104 (not Spengler, 1802, nor Philippi, 1846)
1854 *Mactra corbuloides* Deshayes: p. 63
1867 *Spisula cretacea* Angas: p. 909, pl. 44, fig. 6
1867 *Spisula producta* Angas: p. 909, pl. 44, fig. 7
1871 *Mactra fluviatilis* Angas: p. 20, fig. 31
1902 *Spisula parva* (Petit) Hedley: p. 707, pl. 34, figs. 2, 3 (synonymy)
1903b *Spisula parva;* Pritchard & Gatliff: p. 108 (synonymy)
1914 *Mactra trigonella;* Lamy: p. 245
1916 *Mactra trigonella;* Hedley: p. 169
1921 *Spisula trigonella* (Lamarck) May: p. 26 (synonymy)
1923 *Spisula trigonella;* May: pl. 12, fig. 1
1930 *Notospisula trigonella* (Lamarck) Iredale: p. 400
1930 *Notospisula parvum* (Petit) Iredale: p. 400, 407
1930 *Notospisula cretacea* (Angas) Iredale: p. 400
1930 *Notospisula fluviatilis* (Angas) Iredale: p. 400
1938 *Notospisula trigonella;* Cotton & Godfrey: p. 275, fig. 276
1958 *Notospisula trigonella;* May revised Macpherson: p. 12, fig. 1
1966 *Notospisula trigonella;* Macpherson: p. 235
1968 *Notospisula trigonella;* Wilson & Kendrick: p. 25, pl. 2 (discussion and synonymy)

Type material: From Shark Bay, Western Australia, in the MNHNP where it was seen on 3 March, 1952. There are three specimens, the largest length 25, height 18 mm. The label carries the locality "Baie des Chiens marins".

Material: 183 specimens GSSA M3277(4) (4334-FL1); GSWA F6989(2) (4233-FL1); F7020(4) (4434-FL7); F7150(5) (4534-FL2); F7165(3) (4133-FL4); WAM 66.401(2), 66.402(150), 66.537(6), 66.539(2) (4333-FL1).

Description: Shell varying in shape, triangularly ovate, the anterior margin rounded, the posterior broadly angled and produced to a varying degree, equivalve, concentrically striate or lirate. Hinge narrow; left valve with lamellar cardinals 2b and 2a joined at an angle high under the umbo in front of the deep triangular resilium which usually cuts through the dorsal margin under the umbo, high lamellar LAII and LPII finely ridged on both sides; right valve with small lamellar cardinals 3a flush with the dorsal margin and a narrow 3b at an angle

to it, LAI and LAIII and LPI and LPIII ridged only on the sides of the pits between them for the reception of the left laterals. Both adductor scars ovate, pallial sinus about as deep as the width of the posterior adductor, narrowly rounded, area between the pallial line and the margin weakly crenately ridged.

Dimensions: GSWA F6989(1) length 24, height 19 mm.

Remarks: Pritchard & Gatliff (1903, p. 109) and Wilson & Kendrick (1968) have observed the habit of this species of apparently dying out and then reappearing in great numbers from Port Melbourne to the Yarra mouth and in the Swan Estuary. Its abundance in Nurina Cave sample 66.402 suggests that this was the case also in the Pleistocene.

Distribution: Dry Creek Sands (Upper Member), Roe Calcarenite, Glanville Formation, present seas (Australia generally); Late Pliocene or Early Pleistocene to Holocene.

Subgenus **Diaphoromactra** Iredale, 1930

Spisula (Diaphoromactra) versicolor (Tate)

Fig. 5

1887a *Hemimactra versicolor* Tate: p. 64
1887a *Mactra versicolor* Tate: p. 74, pl. 4, fig. 12a, b
1887b *Mactra (Hemimactra) versicolor* Tate: p. 84
1930 *Diaphoromactra versicolor* (Tate) Iredale: p. 400
1938 *Diaphoromactra versicolor;* Cotton & Godfrey: p. 274, fig. 313
1961 *Diaphoromactra versicolor;* Cotton: p. 292, fig. 322

Type material: Holotype SAM D12854 Lake MacDonnell, South Australia.

Material: GSWA F7182 (3630-FL1); topotypes GSSA.

Description (from a series of topotypes): Shell small, thin but solid, inequilateral, moderately produced posteriorly with a relatively flattened posterior-dorsal area; rounded anteriorly, ventral margin rounded, dorsal margin roundly angulate, umbos smooth, prosogyrous, slightly incurved, surface sculptured with fine microscopic concentric striae. Hinge of moderate width; left valve with strong laterals LAII and LPII, cardinals a bifid 2 and very small 4b; right valve with usually a weak LAI and LAIII and LPI and LPIII, but varying in strength, cardinals 3a and 3b fused at the dorsal end, partly joined to LAIII; the laterals are microscopically striate on the dorsal side, but the striations vary in strength and may be obsolete. Pallial sinus broad, shallow.

Dimensions: (holotype) length 12.5, height 9.5 mm.

Remarks: Tate (1887a, p. 64) recognized the resemblance of this species to *Mactra fluviatilis* Angas (=*Mactra trigonella* Lamarck), but considered the dentition to be very different and placed *versicolor* in *Hemimactra* to which it is also related. The hinge has never been fully described or figured, and since

Iredale (1930, p. 400) erected the genus *Diaphoromactra* to accommodate *Hemimactra versicolor* and, at the same time, *Notospisula* for *Gnathodon parvum* Petit (= *Mactra trigonella* Lamarck) its relationhip with *Spisula* has become obscured.

Juveniles of *Spisula (Notospisula) trigonella* (Lamarck) are readily confused with *Diaphoromactra* and, indeed, have been so recorded (Ludbrook, 1963, p. 13, fig. 4). It is doubtful whether *Notospisula* and *Diaphoromactra* should be separated even subgenerically; in *Notospisula* the shell is thicker and the dentition more robust, but the essential elements, including some striation of the laterals in *Diaphoromactra,* are the same in both subgenera. As *S. (D.) versicolor* does not occur in the Roe Calcarenite, and its known occurrence in the area studied is limited to locality 3630-FL1, a marginal lake near Israelite Bay, more critical appraisal of *Diaphoromactra* is beyond the scope of the present study.

Distribution: Marginal marine lakes, Lake MacDonnell (South Australia) and lake near Israelite Bay; Holocene.

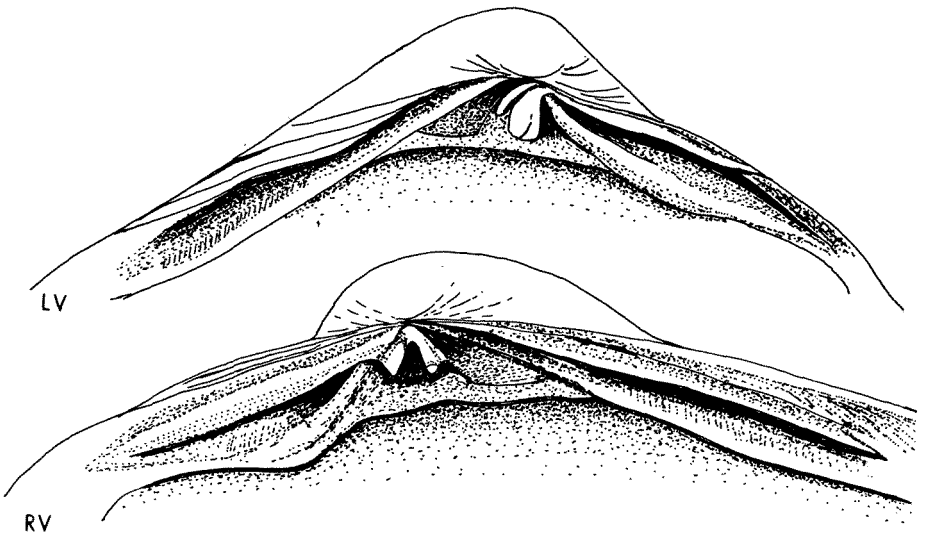


Figure 5. Hinge of *Spisula (Diaphoromactra) versicolor* **(X8) (GSWA 16791)**

Subfamily LUTRARIINAE
Genus **Lutraria** Lamarck, 1799

Lutraria sp.

Material: An external mould in calcarenite GSSA F196/54 from locality 4334-FL1 (Roe Calcarenite).

Subfamily ZENATIINAE
Genus **Zenatia** Gray, 1853
Subgenus **Zenatiopsis** Tate, 1879

Zenatia (Zenatiopsis) sp.

Plate 4, fig. 10

1931 *Zenatiopsis angustata;* Woods: p. 151 (not Tate)
1955 *Zenatiopsis angustata;* Ludbrook: p. 77 (in part)
1963 *Zenatiopsis angustata;* Gill & Darragh: p. 182 (in part)
1971 *Zenatiopsis ultima;* Darragh & Kendrick: p. 90 (in part)

Material: Two specimens WAM 69.372 (4534-FL2); 69.649 (4334-FL7).

Description: Shell small for the genus, but relatively solid, dorsal margin straight, ventral margin straight to convex, the shell being widest at about the middle, anterior margin roundly arcuate. Lunule sometimes present, encroaching on the hinge area, hinge plate rather narrow, in the left valve 2a and 2b high and lamellar, slightly curved, vertex directed anteriorly, AII high and parallel to 2a, 4b weak; 3a and 3b slightly curved, vertex under umbo and anterior to it. Internal ridge high, rather narrow, bordering the adductor scar generally, length varies. Ridge just in front of 2a and 4II in the left valve and in front of 3a in the right valve; ridge passes under the hinge plate which is in contact with it only at its dorsal end where it may appear as a thickening of the shell wall; it does not have the hook-like support for the anterior end of the hinge plate as in other species of *Zenatiopsis*.

Dimensions: (WAM 69.372, posterior end broken) height 15, umbo-anterior margin 6 mm; (of 12 measured specimens) maximum length 60, maximum height 23, umbo-anterior margin 9 mm, ratio height:umbo-anterior margin 1:0.5.

Remarks: The differences between *Zenatiopsis ultima* and *Z. (Z.)* sp. are tabulated below.

Zenatiopsis ultima (measurements given by Darragh & Kendrick, 1971) (mm)		*Zenatia (Zenatiopsis)* sp. (measurements on 12 specimens) (mm)	
Maximum length	103	Maximum length (est.)	60
Maximum height (H)	39	Maximum height (H)	23
Maximum umbo-anterior margin (UA)	17	Maximum umbo-anterior margin (UA)	9
Ratio H:UA	1:0.42	Ratio H:UA	1:0.5
Widest at anterior end on umbo-ventral line		Widest about middle of shell	
Ventral margin straight to concave		Ventral margin straight to convex	
Anterior margin squarely rounded, descending almost vertically as in *Z. phorca*		Anterior margin roundly arcuate	

Lunule encroaching on hinge area	Lunule sometimes encroaching on hinge area
Teeth not described in detail, but appear to be 2a and 2b, with vertex directed posteriorly	2a and 2b high and lamellar, slightly curved, vertex directed anteriorly, AII high and parallel to 2a, 4b weak; 3a and 3b slightly curved, vertex under umbo and anterior to it
Internal ridge prominent, thick, flattened, in dorsal half of valve	Internal ridge high, rather narrow, bordering anterior adductor scar generally, length varies
Internal ridge between 2a and 2b in the left valve and between 3a and 3b in the right valve	Ridge just in front of 2a under AII in left valve and in front of 3a in right valve
Hinge plate supported by ridge which curves around muscle scar dorsally	Ridge passes under hinge plate which is only in contact with it at its dorsal end where it may appear as a thickening of the shell wall; it does not have the hook-like support for the anterior end of the hinge plate as in other species of *Zenatiopsis,* and in this respect it provides a link between *Zenatia* and *Zenatiopsis.*

Distribution: Dry Creek Sands, Roe Calcarenite and Quaternary of Perth Basin; Late Pliocene to Early Pleistocene.

Family MESODESMATIDAE
Genus **Anapella** Dall, 1895

Anapella cycladea (Lamarck)

Plate 3, figs. 11, 12

1818 *Crassatella cycladea* Lamarck: p. 483
1818 *Crassatella cuneata* Lamarck: p. 483
1843 *Mesodesma triquetrum* Hanley: p. 101
1853 *Anapa smithii* Gray: p. 44
1876 *Anapa tasmanica* Tenison Woods: p. 160
1897 *Anapella cuneata* (Lamarck) Tate: p. 46
1903b *Anapella cuneata;* Pritchard & Gatliff: p. 112 (synonymy)
1921 *Anapella cuneata;* May: p. 26 (synonymy)
1923 *Anapella cycladea* (Lamarck) May: pl. 12, fig. 2
1938 *Anapella pinguis* (Crosse & Fischer) Cotton & Godfrey: p. 276, fig. 315
1958 *Anapella cycladea;* May revised Macpherson: pl. 12, fig. 2
1961 *Anapella pinguis;* Cotton: p. 294, fig. 324
1962 *Anapella cycladea;* Macpherson & Gabriel: p. 359, fig. 416

Material: 369 specimens GSSA M1308(7), M2558(194) (4334-FL1); GSWA F6889(20), F6946(1) (4133-FL7); F6956(40) (4534-FL2); F7061(5) (4334-FL1); F7093(1) (4334-FL2); F7122(56) (4334-FL1); F7153(5) (4434-FL8); WAM 62.30(1) (4333-FL1); 65.680(5) (4334-FL1); 66.399(17) (4333-FL1); 66.605(10), 66.606(8) (4334-FL1).

Description: Shell thick, solid, ovate-trigonal, inflated, anterior margin rounded, posterior produced and roundly angulate, posterior dorsal area flattened above a rounded keel; left valve with a high prominent 2, partially overhanging the resilium, smooth LAII and high thick more or less triangular LPII; right valve with a very weak and prong-like 3a and 3b in front of the deep resilium and tending to be encroached upon by the submarginal ligament, LAIII and LPIII weak or obsolete, LAI and LPI more or less triangular, microscopically pitted. Anterior adductor scar broadly reniform, posterior adductor broadly oval, striated, with a small pedal retractor scar confluent with it under the hinge, pallial line punctate, pallial sinus very slight, shallow, more or less delimited by an angle in the pallial line; area inside the pallial line smooth and shining. Living shell a dirty white to greyish colour, light brown on the posterior area, epidermis brown.

Dimensions: Large specimen (Outer Harbor, South Australia, topotype of *A. pinguis)* length 30, height 26 mm; GSSA M2558a length 24, height 22 mm.

Distribution: Dry Creek Sands, Roe Calcarenite, Glanville Formation, St. Kilda Formation, present seas (Victoria, Tasmania, South Australia and south-western Australia); Late Pliocene to Holocene.

Anapella variabilis (Tate)

Plate 3, fig. 13

1887c *Anapa variabilis* Tate: p. 172, pl. 17, figs. 5a-b
1959b *Anapella variabilis* (Tate) Ludbrook: p. 230, pl. 4, figs. 5, 6

Type material: SAM Tate Collection T1209 from Blanche Point, Aldinga Bay, South Australia; Hallett Cove Sandstone (Late Pliocene).

Material: Sixty-six specimens GSWA F6930(3) (4133-FL7); F6979(8) (4534-FL2); WAM 62.26(3) (4334-FL1); 66.400(47), 66.538(5) (4333-FL1).

Remarks: The species is readily distinguishable from *A. cycladea* by its more oval shape, deep tumid valve, and inflated high umbo. It lacks the posterior carination of *A. cycladea,* the hinge is narrower, and the resilifer cuts through the dorsal margin to the umbo.

Dimensions: (GSWA F6930) length 22, height 18 mm.

Distribution: Hallett Cove Sandstone, Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Genus **Paphies** Lesson, 1831
Subgenus **Amesodesma** Iredale, 1930

Paphies (Amesodesma) angusta (Reeve)

1854 *Mesodesma angusta* Reeve: pl. 1, fig. 3
1921 *Amphidesma angusta* (Reeve) May: p. 27 (synonymy)
1923 *Amphidesma angusta;* May: pl. 12, fig. 4
1938 *Amphidesma angusta;* Cotton & Godfrey: p. 279, fig. 319
1958 *Mesodesma angusta;* May revised Macpherson: pl. 12, fig. 4
1961 *Amphidesma angusta;* Cotton: p. 297, fig. 328
1962 *Donacilla angusta* (Reeve) Macpherson & Gabriel: p. 360, fig. 418
1971 *Paphies (Amesodesma) angusta* (Reeve) Beu: p. 119

Material: A single valve, GSWA F6896 (4334-FL2), the interior of which is obscured by matrix, is possibly this species.

Distribution: Roe Calcarenite, present seas (sandy beaches between tidemarks from New South Wales to Western Australia); Early Pleistocene, Holocene.

Superfamily TELLINACEA
Family TELLINIDAE
Subfamily TELLININAE
Genus **Tellina** Linnaeus, 1758
Subgenus **Semelangulus** Iredale, 1924

Tellina (Semelangulus) tenuilirata Sowerby

1867 *Tellina tenuilirata* Sowerby: pl. 39, fig. 219
1867 *Tellina semitorta* Sowerby: pl. 39, fig. 221
1887b *Tellina tenuilirata;* Tate: p. 88
1903b *Tellina tenuilirata;* Pritchard & Gatliff: p. 116
1924 *Semelangulus tenuiliratus* (Sowerby) Iredale: p. 212
1938 *Semelangulus tenuiliratus;* Cotton & Godfrey: p. 254, fig. 286
1961 *Semelangulus tenuiliratus;* Cotton: p. 271, fig. 295
1962 *Semelangulus tenuiliratus;* Iredale & McMichael: p. 24

Material: The species is represented by a single left valve GSWA F7087 (4434-FL7).

Distribution: Roe Calcarenite, present seas (South Australia, Victoria and New South Wales); Early Pleistocene, Holocene.

Tellina (Semelangulus) vincentiana Tate

1891 *Tellina vincentiana* Tate: p. 262, pl. 11, fig. 10
1938 *Semelangulus vincentianus* (Tate) Cotton & Godfrey: p. 255, fig. 288
1961 *Semelangulus vincentianus;* Cotton: p. 272, fig. 297

Type material: Holotype SAM D12685 from Gulf St. Vincent 31-33 m.

Material: Three fragments only, WAM 66.406, from Nurina Cave (4333-FL1).

Distribution: Roe Calcarenite, present seas (Gulf St. Vincent and St. Francis Island); Early Pleistocene, Holocene.

63616—(5)

Subgenus **Pseudarcopagia** Bertin, 1878

Tellina (Pseudarcopagia) basedowi Tate

Plate 5, figs. 2, 5

1901 *Tellina basedowi* Tate, in Basedow: p. 148, pl. 3
1959b *Macoma basedowi* (Tate) Ludbrook: p. 229, pl. 4, figs. 3, 4

Type material: Neotype selected Ludbrook (1959b) SAM Tate Collection F15469 from Giles Point, Yorke Peninsula, South Australia, Hallett Cove Sandstone, Late Pliocene.

Material: GSSA M1300, M2565(3), (4334-FL1); M2570(3), GSWA F6872 (4434-FL7); F7095(24) (4434-FL8); F7124 (4334-FL1); WAM 61.38 (4334-FL6); 62.21(3), 65.675, 65.681(4) (4334-FL1); 66.404 (4333-FL1); 69.356, 69.357 (4434-FL6).

Description: Shell large, triangularly suborbicular, subequivalve and subequilateral, rather thin but solid, only slightly convex, with a shallow posterior flexure; ornamented with thin raised concentric lamellae about 1 mm apart separated by flat interspaces and curving sharply upwards over the posterior flexure; crossed by fine radial striae. Umbo small, subcentral, hingeline angulate, narrow, with two small cardinal teeth in each valve, the posterior in the right valve and the anterior in the left valve bifid, all are easily broken off; a weak posterior and a weak anterior lateral in each valve. Ligament long, strong, deeply sunken. Posterior adductor roundly quadrate, anterior adductor subpyriform; pallial sinus large and irregular in shape.

Dimensions: Hypotype WAM 69.356 length 89, height 78, inflation (both valves) 31 mm. The Giles Point neotype (Ludbrook, 1959b) and topotypes seem to be juveniles. From the dimensions given by Tate (1901), the holotype (whereabouts uncertain), is more inflated than the other specimens measured.

Distribution: Hallett Cove Sandstone, Norwest Bend Formation, and Roe Calcarenite; the species is best developed in the Roe Calcarenite; Late Pliocene to Early Pleistocene.

Subgenus **Tellinella** Moerch, 1853

Tellina (Tellinella) aldingae (Ludbrook)

Plate 6, figs. 1, 6

1887c *Tellina lata* Tate: p. 164 (not Quoy & Gaimard)
1959b *Laciolina aldingae* Ludbrook: p. 229, pl. 2, fig. 4 (new name for *Tellina lata* Tate not Quoy & Gaimard)

Type material: Holotype SAM Tate Collection T1210 from Aldinga Bay, South Australia; Hallett Cove Sandstone, Late Pliocene.

Material: WAM 61.31 (4334-FL6); 69.358 (pair) (4434-FL6); 69.368 (pair) (4434-FL5).

Description: Shell large, solid, triangularly oval, only slightly convex, produced, rostrate and strongly flexed posteriorly, rounded anteriorly; strongly ornamented with concentric lamellae narrower than the interspaces and 1.5 to 2.0 mm apart on the main part of the shell, becoming irregular and flexing upwards over the rostrum; umbo subcentral, small, opisthogyrous. Hinge arched, narrow, with a small grooved median cardinal and one weak grooved posterior cardinal in each valve. Anterior adductor subpyriform, posterior adductor somewhat irregular, pallial sinus large, subovate, extending nearly two-thirds up the height of the shell and about two-thirds across the length of the shell; inner margin flat, simple.

Dimensions: WAM 69.358 length 123, height 84, inflation (pair) 37 mm.

Distribution: Hallett Cove Sandstone, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Subgenus **Macomona** Finlay, 1927

Tellina (Macomona) mariae Tenison Woods

Plate 6, fig. 2

1876 *Tellina mariae* Tenison Woods: p. 162
1887b *Tellina mariae;* Tate: p. 89
1901 *Macoma mariae* (Tenison Woods) Tate & May: p. 426
1903b *Macoma mariae;* Pritchard & Gatliff: p. 118 (synonymy)
1921 *Macoma mariae;* May: p. 25
1923 *Tellina mariae;* May: pl. 11, fig. 5
1938 *Macoma modestina* Cotton & Godfrey: p. 257, fig. 290 (not Tate, 1891)
1958 *Homalina mariae* (Tenison Woods) May revised Macpherson: pl. 11, fig. 5
1961 *Macomona mariae* (Tenison Woods) Cotton: p. 273, fig. 299
1962 *Homalina mariae;* Macpherson & Gabriel: p. 377, fig. 441
1975 *Tellina (Macomona) mariae;* Ponder: p. 114, text fig. 2

Material: GSWA F6892 (4434-FL7); F7075 (4334-FL1); F7119(8) (4634-FL1); WAM 66.405(cf.) (4333-FL1); 70.128 (pair) (4434-FL6).

Distribution: Roe Calcarenite, Glanville Formation, St. Kilda Formation, present seas (southern Australia); Early Pleistocene to Holocene.

Family DONACIDAE
Genus **Donax** Linnaeus, 1758
Subgenus **Deltachion** Iredale, 1930

Donax (Deltachion) sp. cf. **D. (D.) electilis** (Iredale)

cf. 1930 *Deltachion electilis* Iredale: p. 399, pl. 62, fig. 7
1930 *Deltachion brazieri* Iredale: p. 399, pl. 62, fig. 8 (not Smith, 1891)

Material: A single specimen GSWA F7104 (4133-FL3).

Remarks: The specimen is immature, dimensions length 14, height 9.5 mm, with rather weak ornament, the inner ventral margin strongly finely denticulate. It appears to be an elongate form of *D. (D.) electilis* figured by Iredale as *D. brazieri.*

Distribution: Roe Calcarenite; Early Pleistocene.

Family PSAMMOBIIDAE
Subfamily PSAMMOBIINAE
Genus **Gari** Schumacher, 1817

Gari sp.

Plate 6, figs. 4, 5

Material: 3 pairs WAM 69.359 (4434-FL6); 69.369 (4434-FL5); 69.377 (4434-FL13).

Description: Shell thin, elongate-ovate, slightly convex, rounded anteriorly, narrowly truncated posteriorly; umbo small, median, prosogyrous; surface ornamented with fine concentric imbricating threads reflected over the umbo-posterior ridge. Hinge with a short posterior and long anterior cardinal in the right valve, a grooved anterior and short posterior cardinal in the left valve. Pallial sinus large, extending about half way up the shell and more than two-thirds of the way across, confluent with the pallial line; anterior adductor reniform, posterior adductor subquadrate. Length 36, height 19, inflation 10 mm.

Remarks: This species is possibly *Gari livida* (Lamarck), the types of which were seen by Ludbrook in Paris on 3 March, 1952. The type series consists of one complete specimen length 28, height 14 mm and a single valve. The type locality of *Psammobia livida* Lamarck (1818, p. 515) is Shark Bay, Western Australia, not southern Tasmania as given by Cotton & Godfrey (1938, p. 262) and Cotton (1961, p. 279). Specific identification and distribution of the species is deferred until authentic material from Shark Bay can be compared with the species occurring in southern Australia and with the Roe Calcarenite material.

Subfamily SANGUINOLARIINAE
Genus **Sanguinolaria** Lamarck, 1799
Subgenus **Psammotellina** Fischer, 1880

Sanguinolaria (Psammotellina) biradiata (Wood)

Plate 5, fig. 3; Plate 8, figs. 2, 4, 6

1815 *Solen biradiata* Wood: p. 135, pl. 33, fig. 1
1857 *Soletellina biradiata* (Wood) Reeve: pl. 1, fig. 2
1887b *Soletellina biradiata;* Tate: p. 87
1903b *Soletellina biradiata;* Pritchard & Gatliff: p. 114 (synonymy)
1921 *Soletellina biradiata;* May: p. 25 (synonymy)
1923 *Soletellina biradiata;* May: pl. 11, fig. 11

1938 *Soletellina biradiata;* Cotton & Godfrey: p. 265, fig. 301
1958 *Soletellina biradiata;* May revised Macpherson: pl. 11, fig. 11
1961 *Flavomala biradiata* (Wood) Cotton: p. 281, fig. 282
1962 *Soletellina biradiata;* Macpherson & Gabriel: p. 371, fig. 433
1966 *Soletellina biradiata;* Macpherson: p. 236

Material: Eight specimens GSWA F6890 (4334-FL2); F6957(5) (4535-FL2); F7039 (4133-FL4); WAM 69.373 (4534-FL2).

Distribution: Roe Calcarenite, Glanville Formation, Peppermint Grove Limestone, St. Kilda Formation, present seas (common in sand at or above low tide mark from Cockburn Sound to New South Wales); Early Pleistocene to Holocene.

Superfamily VENERACEA
Family VENERIDAE
Subfamily VENERINAE
Genus **Dosina** Gray, 1835

Dosina occidentalis n. sp.

Plate 6, figs. 7-10

Type material: Holotype WAM 69.352 from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″S, 127° 34′ 45″E; Roe Calcarenite, Early Pleistocene; paratypes, 4 paired valves and 11 single valves WAM 66.392, 66.533 (4333-FL1); 70.1101, 70.1102, 70.1126, 70.1127, NMV P27257 (1 pair and 6 valves) (4434-FL6).

Description: Shell of moderate size for the genus, roundly ovate, inflated, umbos prominent, situated at the anterior one-quarter, posterior dorsal margin gently curved, anterior, posterior and ventral margins roundly curved. Escutcheon fairly broadly lanceolate, smooth but for growth lines and bounded by a ridge; lunule broadly heart-shaped, striated, bounded by an incised line. Sculpture of about 20 lamellae 2.5 mm apart on the adult part of the shell and 12 small lamellae on the juvenile, interspaces with from 8 to 10 fine concentric striae crossed by fine radial striae. Hinge sinuous, of moderate width; left valve with a weak tubercle-like anterior lateral (LAII), a strong curved anterior cardinal (2a), strong grooved median cardinal (2b), and a long laminar posterior cardinal (4b) separated from the nymph by a shallow groove; right valve with a short anterior cardinal (3a), high grooved median cardinal (1), and long grooved posterior cardinal (3b). Anterior adductor scar reniform, posterior scar large, broadly reniform. Pallial sinus small, sharply angular, directed towards the umbo. Inner margin finely denticulate.

Dimensions: Holotype WAM 69.352 length 34.4, height 32.9, inflation (two valves) 24 mm.

Remarks: The shell is higher in relation to its length than the Eocene *D. multilamellata* (Tate), and more regularly ornamented.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Proxichione** Iredale, 1929

Proxichione sp. cf. **P. cognata** (Pritchard)

Plate 8, figs. 1, 3, 5, 7

cf. 1903 *Chione cognata* Pritchard: p. 101, pl. 12, fig. 5

Material: WAM 69.467a, b (pair); NMV 27255, 27256, 27259 (right valves) (4434-FL6) and 27258 (left valve) (4434-FL5).

Description: Shell large, elongate-oval, umbos high, prosogyrous, posterior and anterior margins rounded, dorsal and ventral margins gently arcuate; surface ornamented with numerous high thin concentric lamellae, about 2 mm apart in the adult part of the shell, between which there are fine radial threads 1 mm apart 40 mm from the umbo, which are interrupted by, but usually continue on to, the lamellae, particularly in the earlier part of the shell. Hinge relatively narrow; right valve with a small socket for the reception of LAII, 3a high, fairly narrowly triangular and grooved, 3b long, triangular, deeply grooved; left valve LAII weak, 2a high, narrow, triangular, 2b broad and deeply grooved, 4b weak, long, narrow, close to and nearly parallel to the nymph. Anterior adductor subovate, posterior adductor larger than anterior and slightly irregular, pedal retractor high under the umbo and separated by callus from the anterior adductor. Pallial sinus fairly large and roundly triangular; there is a line of pits within the pallial line about 5 mm from it; ventral margin finely denticulate.

Dimensions: 69.476b length (estimated) 90, height 69, inflation 48 mm.

Remarks: Compared with *P. cognata* (Pritchard) from the Dry Creek Sands this species is more elongate, and the pallial sinus is larger. The spacing of the concentric ornament is about the same as in *P. cognata* but the radial threads are more widely separated. Darragh (1965, p. 165) has shown the diagnostic features which separate *Proxichione* from *Antigona* and *Periglypta* with which it has been synonymized.

Distribution: Roe Calcarenite; Early Pleistocene.

Subfamily SUNETTINAE

Genus **Sunetta** Link, 1807

Subgenus **Sunemeroe** Iredale, 1930

Sunetta (Sunemeroe) gibberula (Tate)

Plate 6, fig. 11

1887c *Meroe gibberula* Tate: p. 162, pl. 15, figs. 4a, b

Type material: SAM Tate Collection T1158A-J from Muddy Creek, Victoria, Grange Burn Coquina, Early Pliocene.

Material: Three specimens from Madura Cave (4334-FL1) GSWA F7134 and GSSA M2549.

Description: Shell thick, solid subovate, inequilateral, equivalve, slightly convex, the greatest convexity just behind the umbo; umbo acute, small, prosogyrous, situated somewhat to the anterior; anterior side slighly produced and fairly sharply rounded, posterior side truncated and broadly rounded; dorsal margin broadly angulate at 125°, ventral margin rounded, finely crenulated within. Hinge fairly broad, with three divergent cardinals, the posterior cardinal long, lamellar, grooved and bordering the nymph; median cardinal short, bevelled, triangular; anterior cardinal short, lamellar; anterior lateral pit deep. Left valve with long, thin, grooved posterior cardinal, short bevelled median cardinal and thin lamellar anterior cardinal, a high lamellar anterior lateral. Escutcheon deep, broad; lunule small, lanceolate. Adductor scars subovate, pallial sinus sharply rounded, fairly deep.

Dimensions: F7134(1) length 15.5, height 12.5 mm.

Distribution: Grange Burn Coquina and Roe Calcarenite; Early Pliocene and Early Pleistocene.

Subfamily PITARINAE
Genus **Notocallista** Iredale, 1924
Subgenus **Notocallista** *s.s.*

Notocallista (Notocallista) kingi (Gray)

Plate 7, figs. 1, 2

1827 *Cytherea kingi* Gray: p. 476
1903b *Meretrix kingi* (Gray) Pritchard & Gatliff: p. 130 (synonymy)
1921 *Macrocallista kingi* (Gray) May: p. 299 (synonymy)
1923 *Macrocallista kingi;* May: pl. 10, fig. 3
1924 *Notocallista kingi* (Gray) Iredale: p. 210 (synonymy)
1938 *Paradione kingi* (Gray) Cotton & Godfrey: p. 233, fig. 257
1958 *Notocallista kingi;* May revised Macpherson: pl. 10, fig. 3
1961 *Notocallista kingi;* Cotton: p. 247, fig. 264
1962 *Notocallista kingi;* Macpherson & Gabriel: p. 343, fig. 393
1966 *Notocallista kingi;* Macpherson: p. 233

Material: A single valve WAM 69.354 from locality 4434-FL6, Hampton Microwave Repeater Tower.

Distribution: Roe Calcarenite, present seas (southern Australia); Early Pleistocene, Holocene.

Subgenus **Striacallista** Marwick, 1938

Notocallista (Striacallista) pestis Marwick

Plate 7, figs. 3, 4

1938 *Notocallista (Striacallista) pestis* Marwick: p. 73, pl. 13, figs. 3, 4
1955 *Notocallista (Striacallista) pestis;* Ludbrook: p. 65, pl. 5, fig. 3

Type material: Holotype, Auckland Museum, from Abattoirs Bore No. 1, hundred of Yatala, section 97, Adelaide, 98.45-152 m, Dry Creek Sands, Late Pliocene; hypotype, SAM Tate Collection.

Material: Seven specimens GSWA F6894 (4434-FL7); WAM 65.677 (4334-FL1); 66.394, 66.535 (4333-FL1); 69.625 (4434-FL13).

Description: (mainly after Marwick, 1938). Shell about average size for the subgenus, suboval to subtrigonal, narrowed posteriorly, beaks moderately conspicuous, rather narrow. Surface shining, posterior and anterior parts bearing concentric grooves and ridges about 4 per mm, but these are very irregular and die out over the middle of the shell. Ligament shallow, its walls low. Hinge: left valve with lamellar anterior cardinal joined above to lamellar median cardinal, posterior cardinal short, lamellar and joined to the nymph, anterior lateral short, high, pointed; right valve with anterior and median cardinals semilunar, high, and of equal strength, their inner margins parallel and vertical, posterior cardinal long, narrow, grooved; upper anterior lateral parallel to lunular margin, lower short, fairly high and pointed.

Dimensions: WAM 69.625 length 36, height 24 mm; GSWA F6894 length 28, height 20.3 mm.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Subfamily DOSINIINAE
Genus **Dosinia** Scopoli, 1777
Subgenus **Dosinia** s.s.

Dosinia (Dosinia) grata Deshayes

Plate 7, figs. 5, 6, 8, 9

1853 *Dosinia grata* Deshayes: p. 8
1863 *Dosinia diana* Adams & Angas: p. 424, pl. 5, fig. 15
1887b *Dosinia grata;* Tate: p. 93 (synonymy)
1917 *Dosinia grata;* Gatliff & Gabriel: p. 28, pl. 3
1921 *Dosinia grata;* May: p. 22 (synonymy)
1923 *Dosinia grata;* May: pl. 9, fig. 17
1938 *Dosinia diana;* Cotton & Godfrey: p. 231, fig. 255
1958 *Dosinia grata;* May revised Macpherson: pl. 9, fig. 17
1961 *Dosinia diana;* Cotton: p. 247, fig. 262
1962 *Dosinia grata;* Macpherson & Gabriel: p. 340, fig. 388

Material: A pair of valves WAM 71.316 (4434-FL6).

Description: Shell fairly large, suborbicular, inequilateral, thin, fragile, medially convex, umbo moderately swollen, prosogyrous, situated near the anterior one-third, dorsal margin slightly curved, ventral and anterior margins roundly curved, posterior margin slightly produced; lunule elongate-cordiform, fairly deep, escutcheon long, wide, bounded by a ridge in the left valve, ligament narrow, surface ornamented with fine, thin, erect lamellae, about 130 on each valve; hinge narrow, left valve with a weak AII, long erect 4b, erect triangular divergent 2b and 2a; right valve with a weak AI and pit for the reception of

the left AII, high triangular parallel 3a and 1 and a long bifid 3b. Posterior adductor oval, anterior adductor lenticular, pallial sinus triangular, large, extending across the shell to below the umbo.

Dimensions: WAM 71.316 length 46, height 42.6, inflation (both valves) 25 mm.

Remarks: This is a rare shell.

Distribution: Roe Calcarenite, present seas (Tasmania, Victoria, South Australia); Early Pleistocene, Holocene.

Subfamily TAPETINAE
Genus **Gomphina** Moerch, 1853

Gomphina undulosa (Lamarck)

Plate 6, fig. 3

1818 *Venus undulosa* Lamarck: p. 606
1887b *Chione undulosa* (Lamarck) Tate: p. 93
1903 *Chione undulosa;* Pritchard & Gatliff: p. 128 (synonymy)
1916 *Gomphina undulosa* (Lamarck) Hedley: p. 166 (synonymy)
1921 *Gomphina undulosa;* May: p. 23 (synonymy)
1923 *Gomphina undulosa;* May: pl. 10, fig. 12
1938 *Gomphina undulosa;* Cotton & Godfrey: p. 244, fig. 272
1958 *Gomphina undulosa;* May revised Macpherson: pl. 10, fig. 12
1961 *Gomphina undulosa;* Cotton: p. 259, fig. 280
1962 *Gomphina undulosa;* Macpherson & Gabriel: p. 351, fig. 404

Type material: Holotype MNHNP from King George Sound, Western Australia.

Material: Three specimens GSWA F6883 (4334-FL2); F7166 (4434-FL7); GSSA M3283 (4334-FL1).

Description: Shell trigonal, narrowly rounded anteriorly, produced and roundly angled posteriorly, lunule long, shallowly impressed and feebly margined; ligament external, short; hinge plate short, broad, triangular, with diverging long 4b, subequal and strong 2b and 2a in the left valve, 3a 1, and a long 3b in the right valve; dorsal margin grooved; ventral margin smooth. Adductor scars subovate, pallial sinus rounded, moderately deep. The living shell is ornamented with a variable pattern of undulating brown lines.

Dimensions: GSSA M3283 length 24, height 20 mm; average specimen length 32, height 26 mm.

Remarks: The holotype, seen by Ludbrook, 3 March, 1952, is a single specimen height 25 length 28 mm, white, with angularly undulating concentric markings of light brown colour. The Roe Calcarenite specimens are either worn or juvenile and the description is given of specimens in the South Australian Museum D14349 from Leighton, Western Australia.

Distribution: Roe Calcarenite, Peppermint Grove Limestone, present seas (southern Australia); Early Pleistocene to Holocene.

Genus **Katelysia** Roemer, 1857

Katelysia praecursor n.sp.

Plate 7, figs. 11-16

Type material: Holotype GSWA F7054 from locality 4133-FL4, Kanidal Beach, 10 km east of Twilight Cove, Grid Reference BURNABBIE 415013, 32° 14′ 34″ S, 126° 08′ 42″ E; in Quaternary aeolian sand; figured paratype WAM 69.371 (4534-FL2); unfigured paratypes GSWA F6886(2), F6888(51), F6904(2) (4334-FL2); F6928 (4133-FL7); F6986(8) (4534-FL2); F7038(3) (3630-FL1); F7054(7) (4133-FL4); F7108(3) (4133-FL3); F7129(5), GSSA M2562(13) (4334-FL1); M3187(15) (4133-FL6); M3190 (4434-FL7); WAM 62.27(3) (4334-FL1); 66.395(10) (4333-FL1); 66.604(2) (4334-FL1); 70.1093 (4434-FL13).

Description: Shell subtrigonal to trigonal-ovate, solid, thick, equivalve, inequilateral; umbos small, prosogyrous, incurved, sculptured with concentric threads, situated between one-sixth and one-fifth from the anterior, dorsal margin angulate, concave anteriorly, nearly straight posteriorly; anterior margin rounded, posterior somewhat produced. Surface ornamented from the umbo to the ventral margin with concentric growth ridges which are raised, retroflexed and become lamellar towards the anterior; between the ridges there are numerous, crowded, thin concentric lirae. Hinge short and wide with three long straight divergent cardinal teeth; ligament external, lunule lanceolate, escutcheon poorly defined, fairly wide. Pallial sinus of moderate size, a rounded arch, adductor scars and pallial line well-defined; inner margin smooth. Colour pattern apparently of fine radial lines.

Dimensions: Holotype GSWA F7054 length 42, height 33, inflation (both valves) 20 mm.

Remarks: K. praecursor comes closest to *K. scalarina* var. *aphrodinoides* Lamarck (See Fischer-Piette and Métivier, 1971), from which it is readily distinguished by its trigonal-ovate shape, short and wide hinge, and surface sculpture of prominent well-spaced concentric growth ridges. The name *praecursor* is given because this species seems to be an early form of *Katelysia* not persisting to the present.

Distribution: Roe Calcarenite, Glanville Formation, and unnamed surface deposit (Qpo); Pleistocene.

Katelysia rhytiphora (Lamy)

Plate 7, fig. 7

1818 *Venus corrugata* Lamarck: p. 594 (not Gmelin)
1855 *Venus strigosa* Lamarck; Sowerby: p. 736, pl. 162, fig. 222-223
1903b *Chione strigosa:* Pritchard & Gatliff: p. 126, pl. 15 figs. 4-6
1921 *Marcia corrugata* (Lamarck) May: p. 23 (synonymy)
1923 *Marcia corrugata;* May pl. 10, fig. 13

1935 *Marcia (Katelysia) rhytiphora* Lamy: p. 358 (new name for *Venus corrugata* Lamarck not Chemnitz nor Gmelin)
1938 *Katelysia corrugata* (Lamarck) Cotton & Godfrey: p. 241, fig. 269
1958 *Katelysia rhytiphora* (Lamy) May revised Macpherson: pl. 10, fig. 13
1961 *Katelysia corrugata;* Cotton: p. 257, fig. 277
1962 *Katelysia rhytiphora;* Macpherson & Gabriel: p. 354, fig. 407
1964 *Katelysia rhytiphora;* Nielsen: p. 233
1966 *Katelysia rhytiphora;* Macpherson: p. 234
1971 *Katelysia rhytiphora;* Fischer-Piette & Métivier: p. 69, pl. 14, figs. 12-15

Material: Forty-three specimens GSWA F7035(3) (3630-FL1); F7045(2) (4133-FL3); F7098(3) (4434-FL8); F7116(3) (4634-FL1); F7132(3) (4634-FL2); F7152 (3630-FL1); GSSA M1301(2) (4234-FL1); M2515(2) (4434-FL9); M2573(2) (4434-FL7); M3188(10) (4133-FL6); WAM 61.39(5) (4434-FL6); 65.678 (4334-FL1); 66.397(6), 66.536(2) (4333-FL1).

Description: (from beach specimens Henley Beach, South Australia). Shell ovate, solid, fairly thick, equivalve, inequilateral; umbos small, smooth, prosogyrous, situated a little more than one-fourth from the anterior; dorsal margin roundly angulate, concave anteriorly, convex posteriorly; both anterior and posterior margins fairly sharply curving to the rounded ventral margin. Surface ornamented with somewhat irregular bifurcating more or less rounded concentric ridges, wider than the interspaces, crossed by fine radial striae; colour cream to greyish white usually flecked with light brown chevron-shaped colour patterns, interior yellow, the adductor scars and ligamental areas stained deep purple. Hinge of moderate width with three straight divergent cardinals the posterior of which is longer and narrower than the others which are more or less grooved; ligament external, long and narrow, lunule lanceolate, escutcheon long and of moderate width. Pallial sinus small, inner margin smooth but for slight roughening by the fine radial striae.

Distribution: Roe Calcarenite, Glanville Formation, St. Kilda Formation, Peppermint Grove Limestone, present seas (southern Australia from Victoria to Albany); Early Pleistocene to Holocene.

Katelysia scalarina (Lamarck)

Plate 7, fig. 10

1818 *Venus scalarina* Lamarck: p. 599
1841 *Venus scalarina;* Delessert: pl. 10, fig. 12
1887b *Chione scalarina* (Lamarck) Tate: p. 92
1903b *Chione scalarina;* Pritchard & Gatliff: p. 127 (synonymy)
1921 *Marcia scalarina* (Lamarck) May: p. 24 (synonymy)
1923 *Marcia scalarina;* May: pl. 10, fig. 5
1938 *Katelysia scalarina* (Lamarck) Cotton & Godfrey: p. 242, fig. 270
1958 *Katelysia scalarina;* Macpherson & Gabriel: p. 352, fig. 406
1964 *Katelysia scalarina;* Nielsen: p. 196, 222
1966 *Katelysia scalarina;* Macpherson: p. 234
1971 *Katelysia scalarina;* Fischer-Piette & Métivier: p. 65, pl. 13, figs. 16, 17

Type material: According to Fischer-Piette & Métivier (1971, p. 66) the type figured by Delessert (1841, pl. 10, fig. 12) is in the MNHG.

Material: Eighty-one specimens GSWA F6879(4) (4434-FL7); F6887(33), F6910 (4334-FL2); F6947 (4133-FL7); F7010(8) (4634-FL2); F7101(4) (4434-FL8); F7155(2) (4334-FL1); GSSA M1306(4) (4133-FL6); M1309(2), M3189(10) (4334-FL7); WAM 61.39(12) (4334-FL6); 62.25(2), 62.28(2) (4334-FL1); 66.396(4), 66.536(2) (4333-FL1).

Description: (beach material, Henley Beach, South Australia). Shell subovate, moderately solid, equivalve, inequilateral; umbos small, smooth, prosogyrous, situated at the anterior one-fourth, dorsal margin angulate, short, nearly straight anteriorly, straight to slightly convex posteriorly and roundly curving to the ventral margin. Surface ornamented with rounded concentric lamellae, slightly recurved, about equal to the interspaces and usually about 1 mm apart; colour white, creamy white or greyish white, dotted with light brown or grey, interior white inside, purple outside the pallial line. Hinge of moderate width, with three straight divergent cardinals; ligament long and narrow, escutcheon narrow and not well defined. Pallial sinus of medium size, internal margin smooth.

Dimensions: GSWA F6910 length 43, height 30 mm.

Distribution: Roe Calcarenite, Glanville Formation, Peppermint Grove Limestone, present seas (southern Australia from Victoria to Cape Leeuwin); Early Pleistocene to Holocene.

Genus **Venerupis** Lamarck, 1818

Venerupis galactites (Lamarck)

Plate 9, figs. 3, 4

1818 *Venus galactites* Lamarck: p. 599
1852 *Tapes galactites* (Lamarck) Sowerby: p. 695, pl. 151, fig. 132
1887b *Tapes galactites;* Tate: p. 91
1903b *Tapes galactites;* Pritchard & Gatliff: p. 134 (synonymy)
1916 *Paphia galactites* (Lamarck) May: p. 24 (synonymy)
1921 *Venerupis galactites* (Lamarck) May: p. 24 (synonymy)
1923 *Venerupis galactites;* May: pl. 11, fig. 1
1938 *Venerupis galactites;* Cotton & Godfrey: p. 248, fig. 275
1958 *Pullastra galactites* (Lamarck) May revised Macpherson: pl. 11, fig. 1
1961 *Venerupis galactites;* Cotton: p. 263, fig. 283
1962 *Pullastra galactites;* Macpherson & Gabriel: p. 356, fig. 413
1966 *Pullastra galactites;* Macpherson: p. 234
1971 *Venerupis galactites;* Fischer-Piette & Métivier: p. 10 (synonymy)

Type material: Seen in MNHNP Paris 3 March, 1952, 1 large left valve, King George Sound, and one complete specimen, "Nlle Hollande. Péron et Lesueur".

Material: Seven specimens GSWA F6893 (4334-FL2); F7055 (4133-FL4); GSSA M2543 (4334-FL1); M3191 (4434-FL7); WAM 66.398(2) (4333-FL1); 69.662 (4534-FL2).

Description: Shell fairly large, solid, oblong, inequilateral, moderately inflated; umbos small, nearly flat, prosogyrous, situated at the anterior one-fifth of the shell, anterior margin rounded, posterior dorsal margin nearly straight, posterior margin truncated and descending obliquely to the ventral margin, a low umbo-ventral ridge separates a triangular posterior area from the rest of the shell. Escutcheon long and narrow, lunule absent. Surface ornamented with thin, low concentric lamellae less than 1 mm apart, between which are fine thin radial threads, about 3 per mm, which do not cross the concentrics. Inner margin smooth, adductor scars oval, pallial sinus conspicuous, roundly triangular. Hinge short, narrow, with 3 small cardinal teeth in each valve, the anterior two shorter and bifid.

Dimensions: Syntype MNHNP length 60 height 34 mm, GSWA F7055 length 43, height 29 mm.

Remarks: The Roe Plains specimens are more coarsely ornamented than typical *V. galactites,* and the radial threads occur between and do not cross the concentric lamellae.

Distribution: Roe Calcarenite, present seas (Victoria to Western Australia, littoral, gravelly sand); Early Pleistocene, Holocene.

Genus **Irus** Oken, 1815

Irus distans (Lamarck)

Plate 9, figs. 1, 2

1818 *Venerupis distans* Lamarck: p. 507
1818 *Venerupis carditoides* Lamarck: p. 508
1901 *Venerupis carditoides;* Tate & May: p. 429
1901 *Venerupis exotica;* Tate & May: p. 430 (not Lamarck)
1916 *Venerupis carditoides;* Hedley: p. 17
1921 *Venerupis exotica;* May: p. 24
1922 *Venerupis carditoides;* Lamy: p. 295, pl. 3, figs. 3, 4
1922 *Venerupis distans* (?); Lamy: p. 296-7, pl. 3, figs. 5, 6
1923 *Venerupis exotica;* May: pl. 10, fig. 18
1938 *Venerupis exotica;* Cotton & Godfrey: p. 246, fig. 274
1971 *Irus carditoides* (Lamarck) Fischer-Piette & Métivier: p. 84 (extensive synonymy)

Type material: According to Lamy (1922, p. 296) the holotypes of both *Venerupis distans* and *V. carditoides* are in the MNHNP (Types Lamarckiens).

Type locality: (of V. distans) "Iles St. Pierre et St. Francois Péron" (Nuyts Archipelago, South Australia).

Material: A single valve GSWA F6994 (4233-FL1).

Remarks: Lamy (1922) figured the types of *V. carditoides* (pl. 3, figs. 3, 4), *V. distans* (pl. 3, figs. 5, 6) and *V. exotica* (pl. 3, figs. 7, 8) and expressed the opinion (p. 296) that what Australian authors had been describing and figuring under the name *Venerupis exotica* might in fact be *V. carditoides, V. distans*

being a small deformed example of *V. carditoides.* Although the original label of Péron and Lesueur with their name *"Cardium subimbricatum"* for the shell subsequently described by Lamarck as *Venerupis distans* is missing, Lamy's figures leave no doubt of the identity of the Australian species. These are confirmed by Fischer-Piette and Métivier (1971) from whose extensive synonymy the more significant references are included above. Neither Lamy nor Fischer-Piette and Métivier, however, acknowledge the fact that although *V. distans* is a juvenile of *V. carditoides* the name is available under the International Code of Zoological Nomenclature (Article 17(4)). The name *V. distans* has page priority over *V. carditoides* and is considered the correct name for the species. Lamarck (1818, p. 507) noted the relationship between *V. distans* and other species, including *V. exotica,* and the genus *Irus* in which it is placed by Fischer-Piette and Métivier.

Distribution: Coastal dunes (Qpo) and present seas (southern Australia); Pleistocene and Holocene.

Subfamily CHIONINAE
Genus **Placamen** Iredale, 1925

Placamen placidum (Philippi)

Plate 9, figs. 5, 6

1844 *Venus placida* Phillippi. p. 128, pl. 2, fig. 2
1902 *Chione placida* (Philippi) Hedley: p. 322
1903b *Chione placida;* Pritchard & Gatliff: p. 128 (synonymy)
1921 *Clausinella placida* (Philippi) May: p. 23 (synonymy)
1923 *Clausinella placida;* May: pl. 10, fig. 9
1925 *Placamen placidum* (Philippi) Iredale: p. 248, 255
1938 *Placamen placidum;* Cotton & Godfrey: p. 238, fig. 263
1958 *Placamen placidum;* May revised Macpherson: pl. 10, fig. 9
1961 *Placamen placidum;* Cotton: p. 253, fig. 270
1962 *Placamen placidum;* Macpherson & Gabriel: p. 348, fig. 401

Material: Six specimens GSWA F6927(1-4) (4133-FL7); WAM 69.353 (4434-FL6); 69.637 (4334-FL5).

Description: Shell ovately subtrigonal, solid, moderately inflated in the middle of the shell and flattening towards the umbo and ventral margin; umbos smooth, small, incurved, prosogyrous, situated at the anterior one-fifth of he shell; anterior margin concave, posterior convex; surface ornamented with from 10 to 18 high concentric lamellae, conspicuously recurved and tending to be frilled posteriorly. Escutcheon long and smooth, lunule small, heart-shaped, deeply impressed. Adductor scars large, subovate, pallial line and sinus not well preserved, inner ventral margin very finely denticulate. Hinge wide, short, with three cardinals.

Dimensions: WAM 69.353 length 26.4, height 25.5 mm.

Remarks: The specimens come within the range of *P. placidum,* but also are related to a species from the Adelaide Plains Basin close to *P. subroboratum.*

Distribution: Roe Calcarenite, present seas (New South Wales, Victoria, Tasmania and South Australia); Early Pleistocene, Holocene.

Genus **Tawera** Marwick, 1927

Tawera gallinula (Lamarck)

1818 *Venus gallinula* Lamarck. p. 592
1887b *Chione gallinula* (Lamarck) Tate: p. 91 (in part)
1903b *Chione gallinula;* Pritchard & Gatliff: p. 123 (synonymy)
1916 *Chione gallinula;* Hedley: p. 165 (synonymy)
1921 *Antigona gallinula* (Lamarck) May: p. 23 (synonymy)
1923 *Antigona gallinula;* May: pl. 10, fig. 5
1938 *Tawera gallinula* (Lamarck) Cotton & Godfrey: p. 240, fig. 266 (not fig. 265)
1955 *Tawera gallinula;* Ludbrook: p. 68, pl. 3, fig. 20 (synonymy)
1958 *Tawera gallinula;* May revised Macpherson: pl. 10, fig. 5
1961 *Tawera gallinula;* Cotton: p. 255, fig. 274
1962 *Tawera gallinula;* Macpherson & Gabriel: p. 347, fig. 398

Type material: MNHNP 2 tablets, one with 2 adult specimens length 35, height 28 mm, the other with juveniles, seen 3 March, 1952, from King Island, Tasmania.

Material: The species is represented by a single specimen GSWA F7099 (4434-FL8).

Distribution: Dry Creek Sands, Roe Calcarenite, present seas (southern Australia); Late Pliocene to Early Pleistocene, Holocene.

Tawera lagopus (Lamarck)

Plate 9, figs. 7, 8

1818 *Venus lagopus* Lamarck: p. 59
1887b *Chione gallinula* (Lamarck) Tate: p. 91 (in part)
1903 *Chione lagopus* (Lamarck) Hedley: p. 596
1903b *Chione lagopus;* Pritchard & Gatliff: p. 124 (synonymy)
1916 *Chione lagopus;* Hedley: p. 165
1921 *Antigona lagopus* (Lamarck) May: p. 23 (synonymy)
1923 *Antigona lagopus;* May: pl. 10, fig. 6
1938 *Tawera lagopus* (Lamarck) Cotton & Godfrey: p. 240, fig. 265 (not fig. 266)
1958 *Tawera lagopus;* May revised Macpherson: pl. 10, fig. 6
1961 *Tawera lagopus;* Cotton: p. 255, fig. 273
1962 *Tawera lagopus;* Macpherson & Gabriel: p. 347, fig. 399

Type material: MNHNP, seen 3 March, 1952, it consists of 1 tablet with 1 adult length 35, height 27 mm and 1 faded juvenile, from King George Sound, Western Australia.

Material: Sixty-two specimens GSWA F6874(19) (4434-FL7); F7154(2) (4434-FL8); GSSA M2560(11) (4334-FL1); M2571(24) (4434-FL7); WAM 61.36(3) (4434-FL6); 65.679 (4334-FL1); 66.390 (4333-FL1); 69.355 (pair) (4434-FL6).

Distribution: Rce Calcarenite, present seas (southern Australia); Early Pleistocene, Holocene.

Genus **Timoclea** Brown, 1827

Subgenus **Veremolpa** Iredale, 1930 (=**Glycydonta** Cotton, 1936)

Timoclea (Veremolpa kendricki n. sp.

Plate 9, figs. 9-12, 15, 16

Type material: Holotype WAM 69.469a, from locality 4434-FL6, Hampton Microwave Repeater Tower Site. Grid Reference 563045, 31° 57′ 57″ S, 127° 34′ 45″ E, Roe Calcarenite; figured paratype GSWA F7001(2) (4434-FL7); unfigured paratypes GSSA M2574 (4434-FL7); M3214(2) (4334-FL1); M3282 (4234-FL1); GSWA F6969 (4534-FL2); F7001(8) (4434-FL7); 7130(2) (4334-FL1); WAM 61.42(3) (4334-FL6); 62.24 (4334-FL1); 66.534 (4333-FL1); 67.758(2) (4335-FL1); 69.469(21) (4434-FL6).

Description: Shell of medium size, thick, solid, ovately triangular, inequilateral, equivalve, inflated, posterior side produced and sharply rounded, dorsal margin roundly angulate. Lunule and escutcheon usually poorly defined, with fine radial riblets and less conspicuous concentric threads. Hinge short and broad with three divergent cardinals in each valve; right valve with a short anterior cardinal attached to the dorsal border, strong median and posterior cardinals; in the left valve the posterior cardinal is long, narrow, grooved, and bordering the nymph. Adductor scars oval, pallial sinus small, rounded; about 18 coarse denticulations on the ventral margin, dorsal margin with fine elongate, glycymerid-like denticulations. Surface ornamented with about 9 fine concentric riblets on the umbo and 20 ribs on the main body of the shell crossed and gemmulated by about 28 radial ribs with equal interspaces.

Dimensions: Holotype WAM 66.469a length 18, height 15 mm, paratype WAM 66.469b length 19.5, height 15.4 mm, paratype GSWA F7001(1) length 17.5 height 13.5 mm, paratype GSWA F7001(2) length 13, height 10 mm.

Remarks: Timoclea (Veremolpa) kendricki belongs to a group represented by *Glycydonta protomarica* Cotton and a species D12886 in the South Australian Museum Collection labelled "*Chione (Glycydonta) marica* Linne from Victoria" (the locality is uncertain and almost certainly incorrect). From photographs of syntypes kindly provided by the Linnean Society of London, the species is confirmed as *Venus marica*. The only justification for retaining *Glycydonta* for the *Venus marica* group is that the ornament is more or less consistent over the

body of the shell but slightly discrepant on the posterior and anterior areas. But the variability of this character is seen in *V. marica, Veremolpa ethica,* and some specimens of *T. (V.) kendricki. Venus marica* and related species may be divided into 4 intergrading groups:

(1) with *Veremolpa* hinge and moderately coarse marginal dentition and discrepant external ornament on the main part of the shell: *V. ethica, V. sp.* Darwin (SAM Coll.), WAM 540-68 from Queensland, and 2870-68 from Cockburn Sound.

(2) *Glycydonta* with ornament more or less consistent over the shell but different on the posterior and anterior areas: *Venus marica* from Geraldton Western Australia in the SAM Coll.; WAM 1957-68, 1987-68, 1954-68, 1950-68, 1958-68 from Sulu; WAM 1949-68, 1956-68, 104-69 from Fiji; 2968-68 from New Caledonia; 2894-68 Tanganyika; 3030-68 Shark Bay; and 1973-68 Mauritius.

(3) Very fine feather-like dentition and discrepant external ornament (not consistent); *V. scandularis* Hedley SAM D12887 (labelled *Glycydonta* by Cotton); WAM N-2754, 2794, 2795 from Abrolhos; 3236-68, 3239-68, 3265-68 from Sulu; 1991-68 Northwest Cape; 1960-68, 1983-68 Dirk Hartog Island.

(4) Very fine dentition consistent or nearly so around the entire margin. WAM 1983-68, 2138-68 from Sulu, Philippines.

T. (V.) kendricki is readily distinguishable from other members of the group; it is a small but very robust shell, longer than high in the ratio 1.2 : 1, with a broad short hinge and prominent teeth; the sculpture is coarse and prominent and the denticulations on the ventral margin coarse. The species is named for Mr. G. W. Kendrick of the Western Australian Museum for his assistance in many ways during the preparation of the monograph.

Distribution: Roe Calcarenite; Early Pleistocene.

Order	MYOIDA
Superfamily	MYACEA
Family	CORBULIDAE
Genus	**Corbula** Bruguière, 1797
Subgenus	**Notocorbula** Iredale, 1930

Corbula (Notocorbula) sp. cf. **C. (N.) iredalei** Cotton

Plate 9, figs. 13, 14

cf.1930 *Corbula iredalei* Cotton: p. 239, fig. 14

Material: WAM 66.408 (4333-FL1); 69.471, 70.7 (4434-FL6).

Remarks: A large heavy *Corbula,* the larger right valve ornamented with coarse concentric ridges equal to the grooves between them; usually about 21 ridges. The species is larger than *C. (N.) iredalei.*

Dimensions: WAM 66.408 length 21, height 17 mm.

Distribution: Roe Calcarenite; Early Pleistocene.

63616—(6)

Superfamily HIATELLACEA
Family HIATELLIDAE
Genus **Hiatella** Bosc, 1801

Hiatella australis (Lamarck)

Plate 9, fig. 23

1818 *Corbula australis* Lamarck: p. 495
1904 *Saxicava australis* (Lamarck) Pritchard & Gatliff: p. 220 (synonymy)
1916 *Saxicava australis;* Hedley: p. 169 (synonymy)
1921 *Saxicava australis;* May: p. 27 (synonymy)
1923 *Saxicava australis;* May: p. 12, fig. 9
1938 *Hiatella australis* (Lamarck) Cotton & Godfrey: p. 284, fig. 324
1955 *Hiatella australis;* Ludbrook: p. 78, pl. 5, fig. 10 (synonymy)
1958 *Hiatella australis;* May revised Macpherson, pl. 12, fig. 9
1961 *Hiatella australis;* Cotton: p. 303, fig. 333
1962 *Hiatella australis;* Macpherson & Gabriel: p. 379 fig. 444
1966 *Hiatella australis;* Macpherson: p. 237

Type material: MNHNP, 3 large valves on one tablet, length 37, height 24 mm. One individual on another tablet labelled *Corbula australe* var. jeune, from King George Sound; seen 3 March, 1952.

Material: The species is represented by a single specimen GSWA F7137, "loose in soil", locality 4634-FL3.

Distribution: Dry Creek Sands, Roe Calcarenite, present seas (Australia and New Zealand); recorded from Miocene to Holocene.

Suborder PHOLADINA
Superfamily PHOLADACEA
Family PHOLADIDAE
Subfamily PHOLADINAE
Genus **Pholas** Linnaeus, 1758

Pholas australasiae Sowerby

1849 *Pholas australasiae* Sowerby: p. 488, pl. 106, fig. 73
1865 *Barnea australasiae* (Sowerby) Angas: p. 643
1887b *Barnea australasiae* (Sowerby) Tate: p. 81
1903 *Barnea australasiae;* Pritchard & Gatliff: p. 98
1916 *Pholas australasiae;* Hedley: p. 169
1921 *Pholas australasiae;* May: pl. 28 (synonymy)
1923 *Pholas australasiae;* May: pl. 12, fig. 12
1938 *Pholas australasiae;* Cotton & Godfrey: p. 290, figs. 329, 330
1958 *Pholas australasiae;* May revised Macpherson: pl. 12, fig. 12
1961 *Pholas australasiae;* Cotton: p. 309, figs. 338, 339
1962 *Pholas australasiae;* Macpherson & Gabriel: p. 385, fig. 449
1966 *Pholas australasiae;* Macpherson: p. 238

Material: The species is represented by a single specimen GSWA F7114 "loose in soil" from locality 4634-FL2.

Distribution: Roe Calcarenite, present seas (widely distributed on Australian coasts burrowing in soft rock just below tide mark); Early Pleistocene, Holocene.

Subclass ANOMALODESMATA
Order PHOLADOMYOIDA
Superfamily PANDORACEA
Family MYOCHAMIDAE
Genus **Myadora** Gray, 1840

Myadora pervalida Cotton

Plate 9, fig. 17

1931 *Myadora pervalida* Cotton: p. 343, fig. 9

Type material: Holotype SAM D10149, from St. Francis Island 36.5 m.

Material: A single specimen WAM 66.407 from locality 4333-FL1, Nurina Cave.

Description: A fairly large *Myadora* with 24 prominent concentric ribs, smaller than the interspaces, reflected posteriorly over a conspicuous umbonal-posterior ridge. Posterior margin straight, nearly vertical; posterior area triangular.

Dimensions: WAM 66.407 length 23, height 17 mm.

Distribution: Roe Calcarenite, present seas (Beachport, South Australia to Bunbury, Western Australia); Early Pleistocene, Holocene.

Superfamily CLAVAGELLACEA
Family CLAVAGELLIDAE
Genus **Brechites** Guettard, 1770
Subgenus **Brechites** *s.s.*

Brechites (Brechites) australis (Chenu)

1843 *Aspergillum australe* Chenu: p. 3. pl. 3. fig. 1 1a
1971 *Brechites (Brechites) australis* (Chenu) Smith: p. 148, pl. 11, figs. 14-17 (synonymy)

Material: The only material recorded is that in the National Museum of Victoria from locality 4434-FL6 (Smith, 1971, p. 148).

Distribution: Roe Calcarenite, present seas (Western Australia, from Yampi Sound to Exmouth Gulf; South Australia, Point Sinclair); Early Pleistocene, Holocene.

Subgenus **Foegia** Gray, 1841

Brechites (Foegia) veitchi Smith

Plate 9, figs. 24, 25

1971 *Brechites (Foegia) veitchi* Smith: p. 154, 155, pl. 13, figs. 24-27

Type Material: Holotype NMV F27419, paratypes NMV F27419, SAM D14890, D14992, D14993; holotype from Cape Donnington, near Port Lincoln, South Australia.

Material: WAM 70.1509 (4434-FL6).

Distribution: Roe Calcarenite, present seas (Port Lincoln, Spencer Gulf, St. Francis Island); Early Pleistocene, Holocene.

Class SCAPHOPODA
Family DENTALIIDAE
Genus **Dentalium** Linnaeus
Subgenus **Dentalium** *s.s.*

Dentalium (Dentalium) bednalli Pilsbry & Sharp

Plate 9, fig. 27

1898 *Dentalium bednalli* Pilsbry & Sharp: p. 248, pl. 29, figs. 1-3
1938 *Dentalium bednalli;* Cotton & Ludbrook: p. 218 (synonymy)
1940 *Dentalium (Paradentalium) bednalli;* Cotton & Godfrey: p. 323, fig. 344

Material: WAM 69.473 (4434-FL6); 69.540 (4434-FL5).

Remarks: The living shell was fully described by Pilsbry & Sharp and the type description reproduced in a slightly modified form by Cotton and Godfrey. Of the two examples from the Roe Calcarenite one is broken and the other immature.

Dimensions: WAM 69.374 length 22, diameter at aperture 3 mm; WAM 69.540 length 12, diameter 1.8 mm.

Distribution: Roe Calcarenite, present seas (South Australia and westward to Geographe Bay); Early Pleistocene, Holocene.

Dentalium (Dentalium) latesulcatum Tate

Plate 9, fig. 26

1899b *Dentalium latesuclatum* (sic) Tate: p. 262, pl. 8, fig. 9
1899b *Dentalium latesulcatum* Tate: p. 267, pl. 8, fig. 9
1956 *Dentalium (Dentalium) latesulcatum;* Ludbrook: p. 1, pl. 1, figs. 10-14
1959a *Dentalium (Dentalium) latesulcatum;* Ludbrook: p. 142, pl. 1, fig. 1

Type Material: Holotype SAM Tate Coll. T1610A, from Grange Burn, Hamilton, Victoria; Grange Burn Coquina, Early Pliocene.

Material: 20 specimens GSSA M2526 (4334-FL1); WAM 69.472 (4434-FL6); 69.541 (4434-FL5); 69.638 (4334-FL5).

Description: (modified after Ludbrook, 1959). Shell large, rather short, thick, solid, only slightly curved, rapidly tapering, with 7 to 16 primary ribs, narrower than the interspaces, in which a variable number of secondary riblets may rise near the aperture by intercalation; interspaces irregularly and strongly crossed by growth striae which pass less conspicuously over the ribs. Apex with a notch. Aperture circular internally, polygonal externally.

Dimensions: Holotype length 40, diameter at apex 3, at aperture 8 mm. WAM 69.638a length 56, diameter at apex 4, at aperture 8 mm.

Distribution: Grange Burn Coquina, Dry Creek Sands (where it is common), Roe Calcarenite; Early Pliocene to Early Pleistocene.

Subgenus **Laevidentalium** Cossmann, 1888

Dentalium (Laevidentalium) largicrescens Tate

Plate 9, fig. 28

1899b *Dentalium largicrescens* Tate: p. 264, pl. 8, figs. 10, 10a
1959a *Dentalium (Laevidentalium) largicrescens;* Ludbrook: p. 145, pl. 1, fig. 4

Type Material: Holotype and paratypes SAM Tate Coll. T1611, from Beaumaris, Victoria; Sandringham Sands, Late Miocene or Early Pliocene.

Material: Four specimens WAM 70.8, 69.539(3) (4434-FL6).

Description: The Roe Calcarenite specimens are of moderate size, thick, smooth and shining, tapering rapidly, gently curved in the posterior one-third but only slightly curved towards the aperture. Apex circular, thick, with an apical fissure on the ventral side, aperture circular. They lack the oblique striae which characterize the species, and although they are broken, the apertures are thick.

Dimensions: WAM 70.8 length 38 mm; diameter at apex 1.5, at aperture 5 mm.

Distribution: Sandringham Sands, Grange Burn Coquina, Roe Calcarenite; Late Miocene to Early Pliocene, Early Pleistocene.

Family SIPHONODENTALIIDAE
Genus **Cadulus** Philippi, 1844
Subgenus **Dischides** Jeffreys, 1867

Cadulus (Dischides) yatalensis Ludbrook

Plate 24, fig. 13

1956 *Cadulus (Dischides) yatalensis* Ludbrook: p. 4, pl. 1, figs. 3, 4

Type Material: Holotype SAM Tate Coll. F15142, from Weymouth's Bore, Adelaide Plains, section 2271, hundred of Yatala, 94.48-99.06 m; Dry Creek Sands, Late Pliocene.

Material: The species is represented by a single specimen WAM 66.410 from locality 4333-FL1, Nurina Cave.

Remarks: It is a long slender *Dischides,* not conspicuously swollen, and very gradually tapering at each end.

Distribution: Dry Creek Sands and Roe Calcarenite; Late Pliocene to Early Pleistocene.

Subgenus **Gadila** Gray, 1847

Cadulus (Gadila) acuminatus Tate

Plate 24, fig. 14

1887e *Cadulus acuminatus* Tate: p. 194
1959a *Cadulus (Gadila) acuminatus;* Ludbrook: p. 147, pl. 1, fig. 7 (synonymy)

Type Material: Holotype SAM Tate Coll. T231A, from Aldinga Bay, Hallett Cove Sandstone, Late Pliocene.

Material: The species is represented by a single specimen WAM 66.409 from locality 4333-FL1a, Nurina Cave.

Remarks: The name *"Cadulus acuminatus* Deshayes" published by Angas (1871, p. 97) is a *nomen nudum.* Iredale & McMichael (1962, p. 97) have attributed the species to Deshayes, but neither Deshayes nor Angas described the species from Middle Harbour in the Cuming Collection, BMNH. The description given by Angas is of the genus *Cadulus* not of the species. As Ludbrook (1959, p. 148) has pointed out, Tate clearly explained his use of Deshayes's manuscript name, which was first validly used for the fossil species (Cotton & Godfrey, 1940, p. 339) from the Hallett Cove Sandstone of Late Pliocene, not Miocene, age.

Distribution: Hallett Cove Sandstone, Dry Creek Sands (Dry Creek and Abattoirs Bores), and Roe Calcarenite; Late Pliocene to Early Pleistocene.

Class	GASTROPODA
Subclass	PROSOBRANCHIA
Order	ARCHAEOGASTROPODA
Superfamily	PLEUROTOMARIACEA
Family	HALIOTIDAE
Genus	**Haliotis** Linnaeus, 1758
Subgenus	**Exohaliotis** Cotton & Godfrey, 1933

Haliotis (Exohaliotis) cyclobates Péron & Lesueur

Plate 10, fig. 1

1816 *Haliotis cyclobates* Péron & Lesueur: p. 80
1822a *Haliotis excavata* Lamarck: p. 215
1912a *Haliotis cyclobates;* Verco: p. 188 (synonymy)
1933c *Haliotis (Exohaliotis) cyclobates;* Cotton & Godfrey: p. 16, 19, pl. 1, fig. 7
1943 *Exohaliotis cyclobates* (Péron & Lesueur) Cotton: p. 176, pl. 24, fig. 3
1957 *Exohaliotis cyclobates;* Talmadge: p. 32
1959 *Exohaliotis cyclobates;* Cotton: p. 39, fig. 11
1962 *Exohaliotis cyclobates;* Macpherson & Gabriel: p. 31, fig. 44
1963 *Haliotis excavata;* Mermod & Binder: p. 142, figs. 212-2, 212-2
1971 *Haliotis cyclobates;* Wilson & Gillett: pl. 8, fig. 8

Type material: of *H. cyclobates?* MNHNP; of *H. excavata* MHNG, from Kangaroo Island.

Material: GSSA M2527 (4334-FL1); WAM 69.474 (4434-FL6); 69.542, 69.543 (4434-FL5); 69.650, 69.651 (4334-FL7), 70.1510 (4434-FL3).

Remarks: The species is distinguished principally by its elevated spire and roundly ovate outline, spiral ribs and radial folds.

Distribution: Roe Calcarenite, present seas (Victoria to the Recherche Archipelago (Wilson & Gillett); Early Pleistocene, Holocene.

Subgenus **Marinauris** Iredale, 1927

Haliotis (Marinauris) roei Gray

1827 *Haliotis roei* Gray: p. 493
1912 *Haliotis roei;* Verco: p. 188 (synonymy)
1916 *Haliotis roei;* Hedley: p. 176 (synonymy)
1933c *Haliotis (Notohaliotis) roei;* Cotton & Godfrey: p. 16, 17, pl. 1, fig. 3
1943 *Marinauris roei* (Gray) Cotton: p. 179, pl. 25, figs. 1, 2
1959 *Marinauris roei;* Cotton: p. 37, fig. 9
1962 *Marinauris roei;* Macpherson & Gabriel: p. 31, fig. 43
1966 *Haliotis roei;* Hodgkin *et al.*:p. 13, pl. 1, fig. 1
1971 *Haliotis roei;* Wilson & Gillett: p. 24

Material: The species is represented by a single juvenile specimen GSSA M3215 from locality 4333-FL1, Madura Cave.

Distribution: Roe Calcarenite, present seas (Victoria to Shark Bay, Western Australia (Wilson & Gillett)); Early Pleistocene, Holocene.

Family FISSURELLIDAE

Genus **Amblychilepas** Pilsbry, 1890

Amblychilepas crucis (Beddome)

Plate 10, fig. 2

1883 *Fissurella crucis* Beddome; p. 169
1902 *Fissurella (Lucapinella) crucis;* Tate & May: p. 408, text fig. 11
1921 *Lucapinella crusis* (sic) (Beddome) May: p. 36
1923 *Lucapinella crusis* (sic) (Beddome); May: pl. 17, fig. 16
1958 *Amblychilepas crusis* (sic) May revised Macpherson: pl. 17, fig. 16
1962 *Amblychilepas crucis;* Macpherson & Gabriel: p. 41
1962 *Sophismalepas crucis* (Beddome) Iredale & McMichael: p. 31

Type locality: Kelso Bay, Tamar River, Tasmania 31 m.

Material: Two specimens WAM 69.544 (4434-FL5) and 66.411 (4333-FL1).

Description: Shell elongate-subrectangular, laterally compressed, sides nearly parallel, ends rounded, elevated towards the dorsal orifice, sculptured with about 20 weak radial ridges, each ridge and interspace carrying about 5 fine radial riblets, all crossed by numerous very fine concentric threads; the surface is irregularly corrugated by concentric growth ridges. Orifice narrowly oval, a

little more than one-fifth the length of the shell; interior margin not thickened, and tending to be frilled by the radial folds; there is a wide thickened band inside the orifice. In both the living and fossil specimens there are triangular colour bands on the anterior and posterior, from which the shell takes its name. The dimensions of the fossil are close to those of Beddome's type. WAM 66.411 length 6, width 5.5, height 2 mm.

Distribution: Roe Calcarenite, present seas (Victoria and Tasmania); Early Pleistocene, Holocene.

Amblychilepas oblonga (Menke)

Plate 20, fig. 2

1843 *Fissurella oblonga* Menke: p. 33
1916 *Lucapinella oblonga* (Menke) Hedley: p. 175 (synonymy)
1959 *Sophismalepas oblonga* (Menke) Cotton: p. 74, fig. 35
1962 *Amblychilepas oblonga* (Menke) Macpherson & Gabriel: p. 41
1966 *Amblychilepas oblonga;* Macpherson: p. 207

Material: A single specimen WAM 70.9 (4434-FL6).

Description: (modified after Cotton, 1959) Shell elongate-oblong, with parallel sides, about twice as long as broad, ends abruptly rounded, slightly pinched on either side of the perforation; posterior end suddenly and highly, the anterior gradually and slightly, elevated; edge of shell arched in the middle; perforation narrowly ovate, a quarter of the length of the shell, margin of shell thickened within, perforation margin calloused. WAM 70.9 length 15, width 8.5, height 3.6 mm.

Distribution: Roe Calcarenite, present seas (Victoria, South Australia and southwestern Australia); Early Pleistocene, Holocene.

Amblychilepas omicron (Crosse & Fischer)

1864 *Fissurella omicron* Crosse & Fischer: p. 348
1865 *Fissurella omicron* Crosse & Fischer: p. 41, pl. 3, figs. 4-6
1903a *Fissurella omicron;* Pritchard & Gatliff: p. 182
1916 *Megatebennus omicron* (Crosse & Fischer) Hedley: p. 175 (synonymy)
1959 *Amblychilepas omicron* (Crosse & Fischer) Cotton: p. 71, fig. 33
1962 *Amblychilepas omicron;* Macpherson & Gabriel: p. 40
1966 *Amblychilepas omicron;* Macpherson: p. 207

Material: A single specimen WAM 69.588 from locality 4534-FL2.

Description: Shell suboval, narrower anteriorly, conical, with about 12 primary radial ribs between each pair of which are about 4 fine radial threads; margin thin, flattish, orifice oval. WAM 69.588 length 7, width 5.5, height 2 mm.

Distribution: Roe Calcarenite, present seas (Victoria to southwestern Australia, low tide to 63 m); Early Pleistocene, Holocene.

Suborder PATELLINA
Superfamily PATELLACEA
Family PATELLIDAE
Genus **Patella** Linnaeus, 1758
Subgenus **Scutellastra** H.&A. Adams, 1854
(=**Patellanax** Iredale, 1924)

Patella (Scutellastra) laticostata Blainville

1825 *Patella laticostata* Blainville: p. 111
1955 *Patellanax laticostata* (Blainville) Macpherson: p. 234, pl. 8, fig. 4 (synonymy)
1959 *Cellana laticostata* (Blainville) Cotton: p. 292, fig. 195
1966 *Patellanax laticostata;* Hodgkin *et al.*: p. 27, pl. 8, fig. 9
1973 *Patella (Scutellastra) laticostata;* Powell: p. 01-659 (Patella 135) (synonymy and description)

Material: A single specimen, in coastal dunes (Qpo), locality 4233-FL1, with a scar of *Acmaea (Patelloida) nigrosulcata* (Reeve).

Distribution: Peppermint Grove Limestone, coastal dunes (Qpo), present seas (South and Western Australia from Port Lincoln to Shark Bay); Late Pleistocene to Holocene.

Family ACMAEIDAE
Genus **Acmaea** Eschscholtz, 1833
Subgenus **Chiazacmea** Oliver, 1926

Acmaea (Chiazacmea) sp.
Plate 20, fig. 1

Material: Fourteen small specimens WAM 69.589, 69.590, 69.591, 69.665, 69.666 from locality 4534-FL2.

Description: Shell small, oval in outline, narrower toward the anterior, conical, fairly high, apex at the anterior one-third; sculptured with fine radial ribs which may be surmounted by fine radial threads about 3 on a rib and several in the interspaces. WAM 69.666 length 9.5, width 7.4, height 4 mm.

Remarks: The specimens are related to the species described by Verco (1912, p. 198) and Cotton (1959, p. 304, fig. 202) respectively as *Acmaea conoidea* and *Chiazacmea conoidea* (Quoy & Gaimard), the identity of which and relationship with *Acmaea (Chiazacmea) flammea* (Quoy and Gaimard) is in some doubt.

Distribution: Roe Calcarenite; Early Pleistocene.

Subgenus **Patelloida** Quoy & Gaimard, 1834

Acmaea (Patelloida) alticostata (Angas)

1865a *Patella alticostata* Angas: p. 56, pl. 2, fig. 11
1955 *Patelloida alticostata* (Angas) Macpherson: p. 240 (synonymy)
1959 *Patelloida alticostata*; Cotton: p. 300, fig. 119
1966 *Patelloida alticostata;* Hodgkin *et al.*: p. 27, pl. 8, fig. 5
1966 *Patelloida alticostata;* Macpherson: p. 208

Material: A single specimen GSWA F6991, in coastal dunes (Qpo), locality 4233-FL1.

Distribution: Peppermint Grove Limestone, coastal dunes (Qpo), present seas (southern Queensland to Geraldton, Western Australia); Late Pleistocene to Holocene.

Suborder	TROCHINA
Superfamily	TROCHACEA
Family	TROCHIDAE
Subfamily	CALLIOSTOMATINAE
Genus	**Calliostoma** Swainson, 1840
Subgenus	**Salsipotens** Iredale, 1924

Calliostoma (Salsipotens) rubiginosum (Valenciennes)

1846 *Trochus rubiginosus* Valenciennes: pl. 4, fig. 1,1a-b
1935 *Calliostoma rubiginosum* (Valenciennes) Cotton & Godfrey: p. 19, pl. 1, fig. 8
1959 *Salsipotens rubiginosus* (Valenciennes) Cotton: p. 151, fig. 83

Material: Two specimens WAM 69.592 from locality 4534-FL2.

Distribution: Roe Calcarenite, present seas (South Australia and southwestern Australia); Early Pleistocene, Holocene.

Subgenus **Fautor** Iredale, 1924

Calliostoma (Fautor) hedleyi Pritchard & Gatliff

1902b *Calliostoma hedleyi* Pritchard & Gatliff: p. 182, pl. 9, fig. 4
1923 *Calliostoma hedleyi;* May: pl. 19, fig. 16
1958 *Calliostoma hedleyi;* May revised Macpherson: pl. 19, fig. 16
1959 *Fautor hedleyi* (Pritchard & Gatliff) Cotton: p. 156, fig. 89
1962 *Calliostoma (Fautor) hedleyi;* Macpherson & Grabriel: p. 57, fig. 77

Type material: Holotype NMV F520; Victoria, 9.1-12.8 m.

Material: A small juvenile WAM 66.414, locality 4333-FL1 is referable to this species.

Distribution: Roe Calcarenite, present seas (southern Australia from Victoria and Tasmania to southwestern Australia); Early Pleistocene, Holocene.

Subfamily	GIBBULINAE
Genus	**Gibbula** Risso, 1924
Subgenus	**Notogibbula** Iredale, 1924

Gibbula (Notogibbula) sp. cf. **G. (N.) lehmanni** (Menke)

Plate 20, figs. 3, 4

cf.1843 *Turbo lehmanni* Menke: p. 18

Material: Sixteen specimens WAM 66.415 (4333-FL1); 1 specimen GSWA F7176 (4534-FL2).

Remarks: A *Notogibbula* with three keels between which are from 1 to 3 secondary and tertiary spiral lirae and on the base 7 strong lirae. The spiral ribbing is stronger than that of *G. (N.) lehmanni.* There are traces of colour pattern suggestive of *G. (N.) lehmanni* from which the species is not here specifically separated on the calcreted specimens available.

Dimensions: WAM 66.415a height 7, diameter 8.5 mm.

Distribution: Roe Calcarenite; Early Pleistocene.
The present distribution of *G. (N.) lehmanni* is Victoria to Fremantle, Western Australia.

Subfamily MONODONTINAE
Genus **Monodonta** Lamarck, 1801
Subgenus **Austrocochlea** Fischer, 1885

Monodonta (Austrocochlea) constricta Lamarck

1822 *Monodonta constricta* Lamarck: p. 36
1829 *Monodonta zebra* Menke: p. 17
1833 *Trochus taeniatus* Quoy & Gaimard: p. 249, pl. 63, figs. 15-17
1851 *Labio porcatus* A. Adams: p. 179
1859 *Trochocochlea multicarinata* Chenu: p. 360, fig. 2676
1902a *Monodonta (Austrocochlea) constricta;* Pritchard & Gatliff: p. 123 (synonymy)
1916 *Monodonta constricta;* Hedley: p. 178 (synonymy)
1917 *Monodonta obtusa* Hedley: p. 700, pl. 47, fig. 12 (not *Trochus obtusus* Dillwyn)
1921 *Monodonta constricta;* May: p. 39 (synonymy)
1921 *Monodonta obtusa;* May: p. 39 (synonymy) (not *Trochus obtusus* Dillwyn)
1923 *Monodonta constricta;* May: p. 19, fig. 2
1923 *Monodonta obtusa;* May: pl. 19, fig. 3
1934d *Austrocochlea torri* Cotton & Godfrey: p. 1, pl. 1, fig. 1
1934d *Austrocochlea zebra* (Menke) Cotton & Godfrey: p. 2, pl. 1, fig. 2
1958 *Austrocochlea constricta* (Lamarck) May revised Macpherson: pl. 19, fig. 2
1959 *Austrocochlea torri;* Cotton: p. 161, fig. 93
1959 *Austrocochlea zebra;* Cotton: p. 162, fig. 94
1962 *Austrocochlea constricta;* Macpherson: p. 174 (synonymy)
1962 *Austrocochlea constricta;* Macpherson & Gabriel: p. 69, fig. 94
1966 *Austrocochlea constricta;* Macpherson: p. 211
1966 *Austrocochlea constricta;* Hodgkin *et al.:* p. 21, pl. 5, fig. 3
1971 *Austrocochlea constricta;* Wilson & Gillett: p. 26, pl. 9, fig. 8, 8a-c

Material: GSWA F6914(2) (4434-FL7), F7030(2) (4133-FL4); GSSA M2517 (4434-FL9); WAM 69.668 (4534-FL2).

Description: Shell turbinate, conical, with a moderately high spire, solid, whorls five, slightly convex, sculptured with about 5 low spiral ridges on each whorl crossed by numerous fine oblique growth striae and surmounted by dark rhomboid colour flecks. Suture linear; columella oblique with an inconspicuous basal tooth; outer lip with a nacreous margin, inside which are about 9 spiral ridges.

Dimensions: GSWA F7030 height 21, diameter 18.7 mm.

Distribution: Roe Calcarenite, Glanville Formation, present seas (New South Wales to Western Australia); Early Pleistocene to Holocene.

Genus **Cantharidus** Montfort, 1810
Subgenus **Phasianotrochus** Fischer, 1885

Cantharidus (Phasianotrochus) apicinus (Menke)

Plate 20, figs. 5, 11

1843 *Monodonta apicina* Menke: p. 15
1846 *Trochus apicinus* (Menke) Philippi: p. 133, pl. 23, fig. 5
1889 *Cantharidus (Phasianotrochus) apicinus* (Menke) Tryon: p. 134, pl. 34, figs. 6, 7
1902a *Phasianotrochus apicinus* (Menke) Pritchard & Gatliff: p. 127 (synonymy)
1916 *Cantharidus apicinus;* Hedley: p. 178 (synonymy)
1934c *Cantharidus apicinus;* Cotton & Godfrey: p. 110, pl. 1, fig. 5
1959 *Phasianotrochus apicinus;* Cotton: p. 106, fig. 49
1962 *Phasianotrochus apicinus;* Macpherson & Gabriel: p. 65, fig. 88
1966 *Phasianotrochus apicinus;* Macpherson: p. 210

Material: Numerous specimens GSWA F6933 (4534-FL2); F7014 (4434-FL7); F7089(2) (4334-FL1); GSSA M1268 (4333-FL2); WAM 66.413 (c.1000), 66.493, 66.541(29) (4333-FL1); 69.667 (4534-FL2).

Description: Shell small, solid, elongate-conical, whorls evenly sloping, not convex, suture linear, impressed. Protoconch of $2\frac{1}{2}$ small smooth whorls, adult whorls 5, smooth except for very fine numerous microscopic and sometimes obscure spiral striae. Periphery obtusely subangulate; base very slightly convex, with about 12 spiral striae, stronger than those on the whorl, and faint microscopic oblique axials. Colour pattern variable but usually of bands of evenly-spaced light-brown axial lines giving a somewhat basket-weave appearance. Aperture roundly quadrate, slightly produced and angled at the periphery; outer lip thin. Columella slightly curved, with a small tooth below the middle.

Dimensions: WAM (69.667) height 11.0, diameter 8 mm.

Distribution: Roe Calcarenite, present seas (Victoria, South Australia and southwestern Australia); Early Pleistocene, Holocene.

Cantharidus (Phasianotrochus) irisodontes (Quoy & Gaimard)

1833 *Trochus irisodontes* Quoy & Gaimard: pl. 63, figs. 7-12
1834 *Trochus irisodontes* Quoy & Gaimard: p. 246
1902a *Phasianotrochus irisodontes* (Quoy & Gaimard) Pritchard & Gatliff: p. 126 (synonymy)
1916 *Cantharidus irisodontes* (Quoy & Gaimard) Hedley: p. 179
1921 *Cantharidus irisodontes;* May: p. 38
1923 *Cantharidus irisodontes;* May: pl. 18, fig. 19
1958 *Phasianotrochus irisodontes;* May revised Macpherson: pl. 18, fig. 19
1959 *Phasianotrochus irisodontes;* Cotton: p. 108, fig. 51
1962 *Phasianotrochus irisidontes;* Macpherson & Gabriel: p. 66, fig. 90
1966 *Phasianotrochus irisodontes;* Macpherson: p. 211
1966 *Phasianotrochus irisodontes;* Hodgkin *et al.*: p. 21, pl. 5, fig. 6

Type material: MNHNP from King George Sound.

Material: GSWA F6949(11) (4133-FL7); GSSA M2542(4) (4334-FL1).

Distribution: Roe Calcarenite, present seas (among algae, Tasmania and Victoria to Geraldton (Hodgkin *et al.,* 1966); Early Pleistocene, Holocene.

Cantharidus (Phasianotrochus) sp. cf. **C. (P.) rutilus** (Adams)

cf.1851 *Elenchus rutilus* A. Adams: p. 171

Material: The species is represented by 6 specimens GSWA F7026 (4133-FL4).

Remarks: The shell is solid, finely spirally striate, with a strong anterior columellar tooth and in some specimens a conspicuous parietal ridge. Some colour pattern remains, of diagonal stripes across the whorls and blotches between the striae on the base.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Leiopyrga** H. & A. Adams, 1863

Leiopyrga gemmifera n. sp.

Plate 20, figs. 19, 20

Type material: Holotype WAM 69.639a, from locality 4334-FL7, 145 km west of Eucla Motel, Grid Reference MADURA 548052, 31° 54′ 41″ S, 127° 25′ 30″ E; Roe Calcarenite; Early Pleistocene; figured paratype WAM 69.639b (4334-FL7); unfigured paratypes WAM 69.653 (4434-FL8), 69.639c-f., 74.1234(2) (4334-FL7).

Material: The type series and WAM 74.87 (abundant) from Paulik's Bore 41.9-42.1 m, Jandakot, Perth Basin.

Description: Shell small, thick, with an inner nacreous layer, imperforate, solid, conical, with a dome-shaped apex of 3 very small flattened turns, followed by 6 adult whorls, flat, sculptured with 4 to 6 flat spiral ribs per whorl equal to the interspaces, the adapical rib in the later whorls becoming wider than the others and weakly to conspicuously beaded, interspaces microscopically axially lirate; base with 8 to 10 flat spirals; suture imbricating. Aperture subrhomboidal, columella straight, columellar lip reflected over columella; outer lip weakly crenulated by the spirals.

Dimensions: WAM 69.639a height 12, diameter 6 mm WAM 69.639b height 8.5, diameter 5 mm.

Remarks: Leiopyrga gemmifera differs from *L. quadricingulata* Tate in the absence of an umbilicus, and in the suture which is imbricating in *L. gemmifera,* but impressed in *L. quadricingulata.* The wide gemmulate rib is distinctive, the other ribs being flattened and not the rounded threads of *L. quadricingulata.*

Distribution: Roe Calcarenite; Quaternary sediments of Perth Basin; Early Pleistocene.

Leiopyrga octona Tate

1891 *Leiopyrga octona* Tate: p. 260, pl. 11, fig. 5
1902a *Leiopyrga octona;* Pritchard & Gatliff: p. 128
1916 *Cantharidus octona* (Tate) Hedley: p. 179 (synonymy)
1959 *Leiopyrga octona;* Cotton: p. 112, fig. 3
1962 *Leiopyrga octona;* Macpherson & Gabriel p. 67

Type Material: Holotype SAM D13383, from Royston Head, Yorke Peninsula, South Australia.

Material: A single specimen WAM 66.442 from locality 4333-FL2.

Distribution: Dry Creek Sands, Roe Calcarenite, Glanville Formation, present seas (Western Port, Victoria to Bunbury, Western Australia); Late Pliocene to Holocene.

Genus **Thalotia** Gray, 1847
Subgenus **Thalotia** *s.s.*

Thalotia (Thalotia) conica (Gray)

1827 *Monodonta conica* Gray: p. 479
1828 *Trochus pictus* Wood: p. 17, pl. 5, Trochus fig. 28
1843 *Monodonta turrita* Menke: p. 15
1847 *Thalotia conica* (Gray) Gray: p. 145
1875 *Trochus lehmanni* Kiener: pl. 46, figs. 2, 2a (not *Trochus lehmanni* Menke)
1887 *Trochus (Thalotia) conicus* (Gray) Brazier: p. 117 (synonymy)
1902a *Thalotia conica;* Pritchard & Gatliff: p. 129
1916 *Cantharidus conicus* (Gray) Hedley: p. 179 (synonymy)
1921 *Cantharidus conicus;* May: p. 38 (synonymy)
1923 *Cantharidus conicus;* May: pl. 18, fig. 17
1958 *Thalotia conica;* May revised Macpherson: pl. 18, fig. 17
1959 *Thalotia conica;* Cotton: p. 115, fig. 55
1962 *Thalotia conica;* Macpherson & Gabriel: p. 67, fig. 93
1966 *Thalotia conica;* Hodgkin *et al.:* p. 21, pl. 5, fig. 8

Material: GSWA F6900(6) (4334-FL2); F7015 (4434-FL7).

Distribution: Roe Calcarenite, present seas (New South Wales to Geraldton, Western Australia in algae); Early Pleistocene, Holocene.

Subgenus **Odontotrochus** Fischer, 1879

Thalotia (Odontotrochus) chlorostoma (Menke)

Plate 10, fig. 23

1843 *Trochus chlorostomus* Menke: p. 17
1916 *Cantharidus chlorostomus* (Menke) Hedley: p. 178 (synonymy)
1959 *Odontotrochus chlorostomus* (Menke) Cotton: p. 122, fig. 61
1966 *Thalotia chlorostoma* (Menke) Hodgkin *et al.:* p. 19, pl. 4, fig. 2

Material: GSSA M3288 (4234-FL1); WAM 69.626 (4434-FL13).

Distribution: Roe Calcarenite, present seas (South Australia to Abrolhos, Western Australia in algae (Hodgkin *et al.,* 1966)); Early Pleistocene, Holocene.

Subfamily TROCHINAE
Genus **Clanculus** Montfort, 1810
Subgenus **Isoclanculus** Cotton & Godfrey, 1934

Clanculus (Isoclanculus) dunkeri (Koch)

1843 *Trochus (Monodonta) dunkeri* Koch: p. 67, pl. 2, fig. 5
1886 *Trochus (Clanculus) dunkeri;* Brazier: p. 202
1902a *Clanculus dunkeri* (Koch) Pritchard & Gatliff: p. 121 (synonymy)
1916 *Clanculus dunkeri;* Hedley: p. 178 (synonymy)
1934 *Clanculus (Isoclanculus) dunkeri;* Cotton & Godfrey: p. 78
1959 *Clanculus (Isoclanculus) dunkeri;* Cotton: p. 134, fig. 69
1962 *Clanculus (Isoclanculus) dunkeri;* Macpherson & Gabriel: p. 73
1966 *Clanculus dunkeri;* Hodgkin *et al.:* p. 17, pl. 3, fig. 6

Material: The species is represented by a single broken specimen, GSWA F7156 from locality 4133-FL3.

Distribution: Glanville Formation, coastal dunes (Qpo), present seas (southern Australia); Late Pleistocene to Holocene.

Subgenus **Euriclanculus** Cotton & Godfrey, 1934

Clanculus (Euriclanculus) tricingulatus n. sp.

Plate 20, figs. 8-10

Type material: Holotype WAM 69.476a from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E, Roe Calcarenite, Early Pleistocene; figured paratype WAM 69.476b (4434-FL6); unfigured paratypes WAM 66.412 (4333-FL2), 69.476c-k (4434-FL6).

Description: Shell small, solid, with a moderately high spire, falsely umbilicate. Protoconch of 1½ smooth whorls, adult whorls 4, moderately convex, suture canaliculate, periphery rounded; usually three cingulae on each whorl, but there may be 2 or 4, increasing in size and granulation on successive whorls, those of the first whorl being fine and smooth, of the second moderately fine with fine granulations, and of the third and the last whorl coarse and coarsely granulated; seven weakly granulose cords on the base; interspaces obliquely finely lirate. Colour pattern of light brown axial splashes. Aperture oblique, roundly tetragonal, outer lip thick with two rows of denticles, one short and bordering

the lip, the other lirate. Columella oblique, more or less denticulate according to the size of the specimen, with a prominent tooth at the lower edge.

Dimensions: Holotype WAM 69.476a diameter 7.6, height 8.5 mm; paratype WAM 69.476b diameter 7.0, height 7.5 mm.

Remarks: The species is close to *C. (E.) quadricingulatus* Ludbrook and *C. (E.) eucarinatus* Ludbrook from the Dry Creek Sands of the St. Vincent Basin, from which it differs by typically carrying three cingulae per whorl, the sculpture being coarser as a result.

Distribution: Roe Calcarenite; Early Pleistocene.

Subgenus **Mesoclanculus** Iredale, 1924

Clanculus (Mesoclanculus) consobrinus Tate

1893 *Clanculus consobrinus* Tate: p. 193, pl. 1, fig. 1
1916 *Clanculus consorbrinus* (sic); Hedley: p. 178
1934 *Clanculus (Mesoclanculus) consobrinus;* Cotton & Godfrey: p. 89, pl. 1, fig. 4
1959 *Mesoclanculus consobrinus* (Tate) Cotton: p. 139, fig. 74
1966 *Clanculus consobrinus;* Hodgkin *et al.:* p. 17, pl. 3, fig. 1

Type Material: Holotype SAM D13380, from Holdfast Bay, South Australia.

Material: Four poorly preserved specimens GSSA M1287 from locality 4333-FL4.

Distribution: Roe Calcarenite, Peppermint Grove Limestone, present seas (Gulf St. Vincent, South Australia to Shark Bay, Western Australia); Early Pleistocene to Holocene.

Clanculus (Mesoclanculus) plebeius (Philippi)

1851 *Trochus plebeius* Philippi: p. 41
1855 *Trochus plebeius* Philippi: pl. 46, fig. 10
1889 *Trochus (Clanculus) plebeius* Philippi; Tryon: p. 79, pl. 10, fig. 19-22; pl. 13, fig. 1, 2
1902a *Clanculus plebeius* (Philippi) Pritchard & Gatliff: p. 122 (synonymy)
1916 *Clanculus plebeius;* Hedley: p. 178
1921 *Clanculus plebeius;* May: p. 37
1923 *Clanculus plebeius;* May: pl. 18, fig. 13
1934 *Clanculus (Mesoclanculus) plebeius;* Cotton & Godfrey: p. 78, 89
1958 *Clanculus plebeius;* May revised Macpherson: pl. 18, fig. 13
1962 *Clanculus (Mesoclanculus) plebeius;* Macpherson & Gabriel: p. 73
1966 *Clanculus (Mesoclanculus) plebeius;* Macpherson: p. 212

Material: The species is represented by four specimens GSWA F7146 found loose in soil at locality 4634-FL2.

Distribution: ?Roe Calcarenite, Glanville Formation, present seas (southern Australia); ?Early Pleistocene to Holocene.

Subfamily UMBONIINAE

Genus **Nanula** Thiele, 1921

Nanula galbina (Hedley & May)

Plate 20, figs. 6, 7

1908 *Gibbula galbina* Hedley & May: p. 114, pl. 22, fig. 2
1921 *Calliotrochus galbina* (Hedley & May) May: p. 39
1923 *Calliotrochus galbina;* May: pl. 19, fig. 9
1935 *Nanula galbina* (Hedley & May) Cotton & Godfrey: p. 40, fig.
1958 *Nanula galbina;* May revised Macpherson: pl. 19, fig. 9
1959 *Nanula galbina;* Cotton: p. 99, fig. 44
1962 *Nanula galbina;* Iredale & McMichael: p. 33 (synonymy)

Material: Hypotype SAM May Coll. 322, off Cape Pillar, Tasmania, 183 m. Twenty-one specimens WAM 61.59(1) (4334-FL6); 66.417(18), 66.540(2) (4333-FL1).

Description: The Roe Calcarenite shell is small, fairly solid and thick, depressed turbinate; whorls five, flattened, weakly shouldered and impressed at the suture, rounded below; protoconch smooth, of 2½ whorls sculptured with numerous fine spiral lirae and microscopic axial growth lines; umbilicus of moderate width, deep, bounded by 2 spiral lirae, columella arcuate, with a thin callus extending over the last whorl; outer lip simple, rather sharp.

Dimensions: WAM 61.59 height 5, diameter 7 mm.

Distribution: Roe Calcarenite, present seas (New South Wales, Tasmania and South Australia 115-238 m); Early Pleistocene, Holocene.

Genus **Monilea** Swainson, 1840

Monilea euclensis n. sp.

Plate 10, figs. 4-8, 12

Type material: Holotype WAM 69.475a, from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E; Roe Calcarenite, Early Pleistocene; figured paratypes WAM 69.475b, 70.11 (4434-FL6); unfigured paratypes GSSA M2556(33) (4334-FL1); M2572(2) (4434-FL7); M3275(1) (4234-FL1); GSWA F6926(3) (4133-FL7); F7082(8), WAM 65.719(2), 66.607(2) (4334-FL1); 66.416(4) (4333-FL1); 69.475(28) (4434-FL6).

Description: Shell fairly large for the genus, solid, depressed-conical, perforate; protoconch smooth, of 2 whorls, adult whorls sculptured with fine spiral ribs extending over the whorls and base of the last whorl, about 4 to 6 on the first adult whorl increasing to as many as 22 from the suture to the umbilicus of last whorl; frequently there are fine secondary threads between the primary spirals. Colour pattern of dark probably brown flecks at fairly regular intervals on the spirals. Suture deeply impressed, umbilicus deep, spirally calloused. Aperture roundly subquadrangular, outer lip either bevelled or finely fluted, corresponding to the external ribs; columellar lip rounded, calloused, with a weak tooth at the base of the callus.

63616—(7)

Dimensions: Holotype WAM 69.475a diameter 26, height 18 mm; paratype WAM 69.475b diameter 34, height 21 mm. Average of 57 specimens diameter 18, height 11 mm.

Remarks: M. euclensis is very close to its living relative *M. callifera* from which it differs in sculpture, the ribs of *M. euclensis* being generally of equal size and spacing over the whorls and base; those of *M. callifera* tend to be granular and discrepant between the whorls and the base; they are not equidistant but usually grouped in pairs with conspicuous tranverse threads on the interspaces; there are about 8 ribs on the base, not grouped in pairs and with strong transverse threads. *M. euclensis* has a lower spire than *M. callifera* with a diameter to height ratio of 1.57:1 in 57 specimens. The diameter to height ratio of *M. callifera* is 1.19:1 in 60 specimens. These ratios are illustrated graphically in Figure 6.

Distribution: Roe Calcarenite; Early Pleistocene.

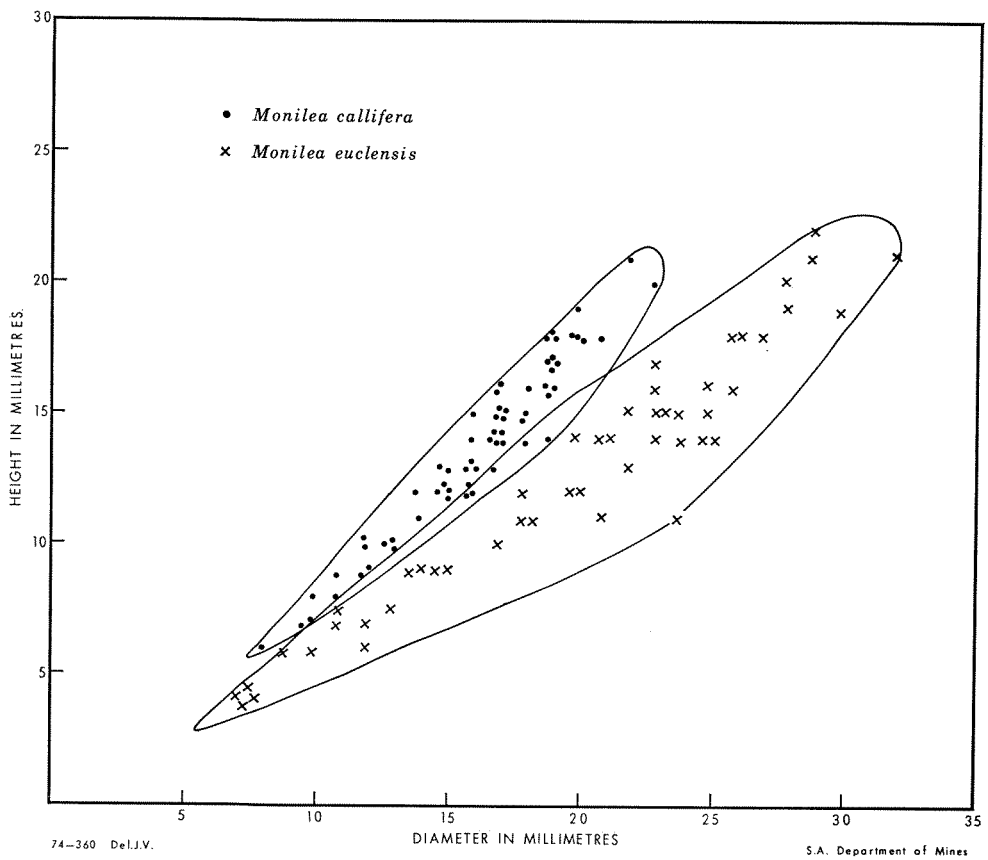


Figure 6. Scatter diagram of diameter:height of *Monilea callifera* **and** *Monilea euclensis* **(GSWA 16792)**

Subfamily ANGARIINAE
Genus **Angaria** Roeding, 1798

Angaria tyria (Reeve)

Plate 10, figs. 9-11

1842a *Delphinula tyria* Reeve: p. 102
1842b *Delphinula tyria* Reeve: pl. 211, figs. 1, 6
1843 *Delphinula tyria* Reeve: pl. 2, figs. 6a, 6b
1916 *Angaria delphinus* var. *tyria* (Reeve) Hedley: p. 181
1971 *Angaria tyria;* Wilson & Gillett: p. 26, pl. 9, fig. 1

Type material: Three syntypes BMNH 1953.4.7.35-37, from "Swan River Settlement", Western Australia.

Material: The single juvenile specimen WAM 70.10 from locality 4434-FL6 is an important element in the Roe Calcarenite, in view of the limited geographical distribution of the living species.

Distribution: Roe Calcarenite, present seas ("Cockburn Sound to Shark Bay" (Wilson & Gillett, 1971)); Early Pleistocene, Holocene.

Family TURBINIDAE
Subfamily LIOTIINAE
Genus **Liotina** Munier-Chalmas, 1885 *s.l.*

Liotina sp.

Material: WAM 69.594, locality 4534-FL2.

Remarks: The affinities of the single specimen have not been established. The shell is very small, thick, nacreous underneath the outer layer, each whorl with 3 spiral keels, a beaded spiral lira below the suture and a row of larger gemmules around the umbilicus, produced by radiating wrinkling on the base. Aperture subcircular, without a varix. It differs from *Munditia* or *Austroliotia (=Munditia)* in the absence of axial sculpture.

Distribution: Roe Calcarenite; Early Pleistocene.

Subgenus **Munditia** Finlay, 1927

Liotina (Munditia) subquadrata (Tenison Woods)

Plate 24, figs. 6-8

1878 *Liotia subquadrata* Tenison Woods: p. 236
1902a *Liotia subquadrata*; Pritchard & Gatliff: p. 96
1921 *Liotina subquadrata* (Tenison Woods) May: p. 44 (synonymy)
1923 *Liotina subquadrata;* May: pl. 21, fig. 12
1958 *Munditia subquadrata* (Tenison Woods) May revised Macpherson pl. 21, fig. 12
1959 *Munditia subquadrata*; Cotton: p. 210, fig. 129

Material: WAM 69.593 two small but well-preserved examples, diameter 3 mm from locality 4534-FL2.

Distribution: Roe Calcarenite, present seas (Victoria, Tasmania, South Australia to Hopetoun, Western Australia); Early Pleistocene, Holocene.

Subfamily TURBININAE
Genus **Turbo** Linnaeus, 1758
Subgenus **Ninella** Gray, 1850

Turbo (Ninella) torquatus Gmelin

1791 *Turbo torquatus* Gmelin: p. 3597, No. 106
1902a *Turbo stamineus* Martyn (non-binomial); Pritchard & Gatliff: p. 115 (synonymy)
1916 *Turbo stamineus* var. *lamellosus* Broderip; Hedley: p. 182 (synonymy)
1959 *Ninella torquata* (Gmelin) Cotton: p. 249, fig. 170
1962 *Ninella torquata;* Iredale & McMichael: p. 34 (synonymy)
1962 *Ninella torquata;* Macpherson & Gabriel: p. 79, fig. 107

Material: Two specimens GSWA F6987 (4233-FL1) and F7120 (4634-FL1) from coastal dunes and loose in soil.

Distribution: ?Roe Calcarenite, coastal dunes (Qpo), present seas (southern Australia); ?Early Pleistocene to Holocene.

Subgenus **Euninella** Cotton, 1939

Turbo (Euninella) gruneri Philippi

Plate 10, figs. 13, 14

1846 *Turbo gruneri* Philippi: p. 52, No. 47, pl. 2, figs. 7, 8
1887 *Turbo gruneri;* Brazier: p. 125 (synonymy)
1902a *Turbo gruneri;* Pritchard & Gatliff: p. 116 (synonymy)
1916 *Turbo gruneri*; Hedley: p. 181 (synonymy)
1921 *Turbo gruneri;* May: p. 42 (synonymy)
1923 *Turbo gruneri;* May: pl. 20, fig. 7
1939 *Turbo (Euninella) gruneri;* Cotton: p. 169
1958 *Subninella gruneri* (Philippi) May revised Macpherson: pl. 20, fig. 7
1959 *Euninella gruneri* (Philippi) Cotton: p. 250, fig. 171
1962 *Subninella gruneri;* Macpherson & Gabriel: p. 79, fig. 106
1966 *Subninella gruneri;* Hodgkin *et al.:* p. 23, pl. 6, fig. 2

Material: A single specimen WAM 69.480 from locality 4434-FL6.

Description: Shell of moderate size, imperforate, spire somewhat gradate, about half length of shell; apex acute, whorls 5, convex, tending to be carinate in the fossil specimen, sculptured with granulose ribs of varying thickness crossed by fine imbricating growth lirae. Aperture circular, columella rounded, with a thin callus, operculum thick, roundly elliptical, inner surface flat, spiral, outer surface with a flattened marginal rim.

Dimensions: WAM 69.480 height 31, diameter 29 mm.

Distribution: Roe Calcarenite, Peppermint Grove Limestone, present seas (Victoria, Tasmania, South Australia and southwestern Australia); Early Pleistocene to Holocene.

Subgenus **Subninella** Thiele, 1929

Turbo (Subninella) undulatus Solander

Plate 10, fig. 3

1786 *Turbo undulatus* Solander
1902a *Turbo undulatus;* Pritchard & Gatliff: p. 114
1916 *Turbo undulatus;* Hedley: p. 182
1921 *Turbo undulatus;* May: p. 52 (synonymy)
1923 *Turbo undulatus;* May: pl. 20, fig. 8
1958 *Subninella undulata* (Solander) May revised Macpherson: pl. 20, fig. 8
1959 *Subninella undulata;* Cotton: p. 248, fig. 169
1962 *Subninella undulata;* Macpherson & Gabriel: p. 78, fig. 105
1971 *Subninella undulata;* Wilson & Gillett: p. 28, pl. 10, figs, 4, 4a

Material: Seven specimens GSWA F6996(2) (4233-FL1); F7118(2) (4634-FL1); WAM 69.627 (4434-FL13); 70.2154 (4434-FL11).

Distribution: Roe Calcarenite, present seas (Victoria, Tasmania, South Australia and southwestern Australia); Early Pleistocene, Holocene.

Subfamily ASTRAEINAE
Genus **Astraea** Roeding, 1798
Subgenus **Bellastraea** Iredale, 1924

Astraea (Bellastraea) hesperus Ludbrook

Plate 10, figs. 15-20

1956 *Astraea (Bellastraea) hesperus* Ludbrook: p. 23, pl. 2, fig. 8

Type material: Holotype SAM Tate Coll. F15148, from Abattoirs Bore, Adelaide, section 97, hundred of Yatala, 98-152 m, Dry Creek Sands, Late Pliocene.

Material: Six specimens GSSA M1279 (4234-FL1); WAM 69.477(39), 70.1129 (4434-FL6).

Description: The species was originally described from a juvenile. Redescription of the species is based on Roe Calcarenite hypotype WAM 69.477a. Shell of moderate size, turbinate, with a low spire. Protoconch very small, sunken, of 2 smooth flat turns, adult whorls 4; posterior part of each whorl convex, anterior part of whorl produced into a stellate margin developing to an undulating sharp flange in the adult, sculptured with fine spirals which are crossed by fine oblique axial plications which produce weak gemmules at the intersections on the convex part of the whorl, spirals on the flange have imbricating scales. In the juvenile the stellate projections are ornamented with diverging threads which also flatten

out to about 8 concentric spirals on the flange of the adult. Base with about 16 imbricating scaly spirals, more widely spaced towards the columella, excavate below, overhanging above. Aperture obliquely oval, excavate below, overhanging above; outer lip angled and channelled at the periphery in the juvenile but becoming rounded in the adult, inner lip rounded and reflected with a parietal callus covering the umbilicus of the adult.

Dimensions: WAM 69.477a diameter 27, height 14 mm, 69.477b diameter 22, height 8 mm.

Remarks: The diameter:height ratio of *A. (B.) hesperus* is 2.1:1. Four specimens of WAM 69.477 have a diameter:height ratio of 1.6:1. This variety is very close to *Bellastraea squamifera* (Koch) of Cotton, (1959, p. 254, fig. 173) and represents a form transitional between the Late Pliocene and living species. Cotton (1959, p. 255) lists four variants of *B. squamifera.*

Distribution: Dry Creek Sands and Roe Calcarenite; Late Pliocene to Early Pleistocene.

Astraea (Bellastraea) sp. cf. **A. (B.) kesteveni** (Iredale)

cf. 1822b *Trochus fimbriatus* Lamarck: p. 12, not Borson
cf. 1924 *Bellastraea kesteveni* Iredale: p. 232 new name for *Trochus fimbriatus* Lamarck not Borson

Type material: The holotype of *Trochus fimbriatus* Lamarck is in the MHNG, where it was seen by Ludbrook on 5th March, 1952.

Material: A single specimen WAM 69.479 from locality 4434-FL6.

Remarks: WAM 69.479 has nearly smooth whorls but with corrugated suprasutural margins. The callus surrounding the umbilicus is broken, so that the band-like callus of *A. (B.) kesteveni* cannot be confirmed.

Distribution: Roe Calcarenite; Early Pleistocene. The distribution of *A. (B.) kesteveni* in present seas is from New South Wales to the Abrolhos Islands, Western Australia.

Subgenus **Micrastraea** Cotton, 1939

Astraea (Micrastraea) rutidoloma (Tate)

Plate 10, figs. 24, 25

1893 *Turbo (Astralium) rutidoloma* Tate: p. 192, pl. 1, fig. 9
1959 *Micrastraea rutidoloma;* Cotton: p. 257, fig. 176

Type material: Holotype SAM D9965, from Moonta Bay, South Australia.

Material: One hundred and twelve specimens GSSA M2539(13) (4334-FL1); GSWA F6939(19) (4133-FL7); F7103 (4133-FL3); WAM 65.682 (4334-FL1); 66.419 (4333-FL1); 69.595(37), 69.669(40) (4534-FL2).

Distribution: Roe Calcarenite, coastal dunes (Qpo), present seas (Moonta Bay, South Australia to Esperance, Western Australia); Early Pleistocene to Holocene.

Family PHASIANELLIDAE
Genus **Phasianella** Lamarck, 1802

Phasianella australis (Gmelin)

Plate 10, fig. 28

1791 *Buccinum australe* Gmelin: p. 3490
1853 *Phasianella australis* (Gmelin) Philippi: p. 2; pl. 1, figs. 1-7; pl. 2, fig. 1
1902a *Phasianella australis;* Pritchard & Gatliff: p. 111 (synonymy)
1916 *Phasianella australis;* Hedley: p. 181 (synonymy)
1921 *Phasianella australis;* May: p. 41 (synonymy)
1923 *Phasianella australis;* May: pl. 20, fig. 3
1958 *Phasianella australis;* May revised Macpherson: pl. 20, fig. 3
1959 *Phasianella australis;* Cotton: p. 261, fig. 177
1962 *Phasianella australis;* Macpherson & Gabriel: p. 82, fig. 110
1966 *Phasianella australis;* Hodgkin *et al.*: p. 29, pl. 9, fig. 2
1971 *Phasianella australis;* Wilson & Gillett: p. 28, pl. 10, fig. 11a, b

Material: Typical form: GSSA M1280(3) (4234-FL1); M1286(2), M2537(7), M2544(23) (4334-FL1); GSWA F6908(10) (4334-FL2); F7078(2) (4334-FL1); WAM 61.62(2) (4334-FL6); 62.47(5) (4334-FL1); 69.670(2), 69.671(1) (4534-FL2). Variety: WAM 66.420(6) 66.422(3), 66.542(3), 66.543(2) (4333-FL1); 70.12(2) (4434-FL6); 70.1094 (4434-FL13); opercula: GSSA M1281 (4333-FL2), M2537(7) (4334-FL1); WAM 66.421(8) (4333-FL1).

Remarks: The species is common in the Roe Calcarenite, although few specimens are well preserved. There are 58 examples of the usual form and 26 examples of the long narrow variety stated by Cotton (1959, p. 262) to be "found sub-fossil on the stranded beaches of the S.A. West Coast, such as on the Middle Recent stranded beach at Port Augusta", i.e. equivalents of the Glanville and St. Kilda Formations.

Distribution: Roe Calcarenite, Glanville Formation, St. Kilda Formation, present seas (Victoria, South Australia, Tasmania and Western Australia to Geraldton); Early Pleistocene to Holocene.

Phasianella variegata Lamarck

1822b *Phasianella variegata* Lamarck: p. 53
1841 *Phasianella variegata;* Delessert: pl. 37, fig. 10
1864b *Phasianella angasi* Crosse: p. 344, pl. 13, fig. 5
1902a *Phasianella variegata;* Pritchard & Gatliff: p. 113 (synonymy)
1916 *Phasianella variegata;* Hedley: p. 181 (synonymy)
1921 *Phasianella variegata;* May: p. 41 (synonymy)
1923 *Phasianella variegata;* May: pl. 20, fig. 5

1924 *Phasianella variegata;* Iredale: p. 231
1958 *Phasianella variegata;* May revised Macpherson: pl. 20, fig. 5
1959 *Orthomesus angasi* (Crosse) Cotton: p. 264, fig. 179
1962 *Phasianella variegata;* Macpherson & Gabriel: p. 84, fig. 112
1966 *Phasianella angasi;* Hodgkin *et al.:* p. 29, pl. 9, fig. 4

Material: GSWA F6973(8) (4534-FL2); WAM 66.426(10) (4333-FL1).

Distribution: Roe Calcarenite, present seas (southern Australia); Early Pleistocene, Holocene.

Phasianella ventricosa Swainson

1822 *Phasianella ventricosa* Swainson: Appendix 15
1828 *Phasianella perdix* Wood: pl. 6, fig. 46
1901 *Phasianella ventricosa;* Pritchard & Gatliff: p. 112 (synonymy)
1914 *Phasianella perdix;* Gatliff & Gabriel: p. 82
1916 *Phasianella perdix;* Hedley: p. 181 (synonymy)
1921 *Phasianella perdix;* May: p. 41 (synonymy)
1923 *Phasianella perdix;* May: pl. 20, fig. 4
1924 *Phasianella ventricosa;* Iredale: p. 231
1924 *Mimelenchus ventricosus* (Swainson) Iredale: p. 232
1958 *Phasianella ventricosa;* May revised Macpherson: pl. 20, fig. 4
1959 *Mimelenchus ventricosus;* Cotton: p. 262, fig. 178
1962 *Phasianella ventricosa;* Macpherson & Gabriel: p. 83, fig. 111
1966 *Phasianella ventricosa;* Macpherson: p. 213
1966 *Phasianella ventricosa;* Hodgkin *et al.:* p. 29, pl. 9, fig. 3
1971 *Phasianella ventricosa;* Wilson & Gillett: p. 28, pl. 10, fig. 10

Material: WAM 66.424 from locality 4333-FL1.

Remarks: The single small specimen may be referable to this species; the spire is short and the last whorl large.

Distribution: Roe Calcarenite, present seas (Victoria to Abrolhos, Western Australia (Hodgkin *et al.,* 1966)); Early Pleistocene, Holocene.

Superfamily COCCULINACEA
Family LEPETELLIDAE
Genus **Cocculinella** Thiele, 1909

Cocculinella salisburyensis Ludbrook

1956 *Cocculinella salisburyensis* Ludbrook: p. 26, pl. 2, fig. 1

Type material: Holotype SAM Tate Coll. F15150, from Tennant's Bore, Salisbury, section 5024, hundred of Port Adelaide, 89-102 m; Dry Creek Sands, Adelaide Plains sub-Basin, Late Pliocene.

Material: One specimen WAM 69.664, dimensions long diameter 6.6, short diameter 4.5 mm, from locality 4534-FL2.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Order MESOGASTROPODA
Superfamily LITTORINACEA
Family LITTORINIDAE
Genus **Bembicium** Philippi, 1846

Bembicium auratum (Quoy & Gaimard)

Plate 10, figs. 26, 27

1833 *Trochus auratus* Quoy & Gaimard: pl. 62, figs. 15-19
1834 *Trochus auratus* Quoy & Gaimard: p. 276
1951 *Bembicium auratum* (Quoy & Gaimard) Macpherson & Chapple: p. 118
1958 *Bembicium auratum*; Anderson: p. 560, pl. 3-5, figs. g, h (gives extensive synonymy)
1966 *Bembicium auratum;* Macpherson: p. 214

Type material: MNHNP, from D'Entrecasteaux Channel, Tasmania.

Material: Nineteen specimens GSSA M2522(3), M2538 (4334-FL1); M2576(2) (4434-FL7); GSWA F7171 (4534-FL2); WAM 61.50(3) (4334-FL6); 62.40 (4334-FL1); 66.423(3), 66.544(2) (4333-FL1); 69.640 (4334-FL5); 69.672 (2) (4534-FL2).

Remarks: The synonymy and diagnostic characters of the species were fully described by Anderson (1958).

Distribution: Roe Calcarenite, present seas ("sheltered muddy inlets and estuaries" southwest, southern and eastern Australia (Anderson, 1958)); Early Pleistocene, Holocene.

Bembicium nanum (Lamarck)

1822b *Trochus nanus* Lamarck: p. 30
1846 *Bembicium nanum* (Lamarck) Philippi: p. 131
1958 *Bembicium nanum;* Anderson: p. 558, pls. 3-5, figs. d, e, f (gives extensive synonymy)

Material: Two specimens GSWA F7172 from locality 4534-FL2.

Remarks: The synonymy and diagnostic characters of the species were fully discussed by Anderson.

Distribution: Roe Calcarenite, present seas (southern and eastern Australia from Bowen, Queensland, to Corny Point, South Australia, marine reefs and rocky beaches (Anderson, 1958)); Early Pleistocene, Holocene.

Superfamily RISSOACEA
Family RISSOIDAE
Genus **Epigrus** Hedley, 1903

Epigrus sp.

Plate 24, fig. 1

Material: Four specimens WAM 66.498 from locality 4333-FL1.
Remarks: The species is smaller than, but close to, *E. cylindraceus* Tenison Woods.
Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Pisinna** Monterosato, 1878

Pisinna sp.

Plate 24, fig. 2

Material: A single specimen WAM 66.498b from locality 4333-FL1.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Merelina** Iredale, 1915

Merelina cheilostoma (Tenison Woods)

Plate 24, fig. 3

1877 *Rissoa (Alvania?) cheilostoma* Tenison Woods: p. 152
1902a *Rissoa cheilostoma;* Pritchard & Gatliff: p. 107 (synonymy)
1915 *Merelina cheilostoma* (Tenison Woods) Iredale: p. 449
1921 *Merelina cheilostoma;* May: p. 50
1923 *Merelina cheilostoma;* May: pl. 23, fig. 18
1944 *Merelina cheilostoma;* Cotton: p. 299
1950 *Merelina cheilostoma;* Laseron: p. 264, fig. 13
1958 *Merelina cheilostoma;* May revised Macpherson: pl. 23, fig. 18
1962 *Merelina cheilostoma;* Macpherson & Gabriel: p. 92

Type material: Hypotype (figured May, 1923), SAM May Coll. 427. Tenison Woods's material came from Long Bay, Tasmania.

Material: Two examples WAM 66.496, locality 4333-FL1.

Description: Shell minute, turreted, solid, deeply excavate at the suture. Protoconch large, high, of 1½ whorls microscopically ornamented with about 8 minutely gemmulate spiral threads, the tip immersed, the protoconch terminating in a strong varix; adult whorls 4 to 4¾, very strongly sculptured with from 11 to 13 high axial ribs about equal to the interspaces, crossed and gemmulated by from 2 in the early whorls to 3 in the later whorls high adapically-imbricating spiral ribs situated in the middle three-fifths of the whorl, on either side of which the whorl is sunken and flat to the linear suture; base with 2 or 3 widely-spaced spiral lirae. Aperture oval, entire, with a strong varix extending round the basal lip to the anterior lirae.

The Roe Calcarenite specimens are immature, of 3½ whorls, height 2.6, diameter 1.2 mm, as compared with the type height 3, diameter 1 mm.

Remarks: The species has not previously been adequately described. The protoconch is spirally ornamented, an observation attributed to Iredale by Laseron, and not smooth as observed by Laseron "with ordinary magnification" (Laseron, 1950, p. 263).

Distribution: Roe Calcarenite, present seas (New South Wales, Victoria, Tasmania, South Australia); Early Pleistocene, Holocene.

Merelina cyrta Cotton

Plate 24, fig. 4

1944 *Merelina cyrta* Cotton: p. 300, pl. 16, fig. 7

Type material: Holotype SAM D14190, from King George Sound, Western Australia.

Material: WAM 66.471, locality 4333-FL1.

Description: Roe Calcarenite shell minute, fairly solid, subconical, with a smooth conical protoconch of 2 whorls; adult whorls 3, convex, with about 14 axial ribs on the penultimate whorl crossed and tuberculated by 4 spiral ribs, above which there is an adapical constriction; suture impressed. Base convex with 6 spiral ribs. Aperture ovate, slightly effuse at the base; there is no varix on the single specimen. Height 3, diameter 1.8 mm.

Remarks: The species is larger than the living *M. cyrta* of which there are numerous examples in the South Australian Museum, but this seems an inadequate reason for separating them specifically.

Distribution: Roe Calcarenite, present seas (Guichen Bay, South Australia to Rottnest Island, Western Australia); Early Pleistocene, Holocene.

Family HYDROCOCCIDAE

Genus **Hydrococcus** Thiele. 1928

Hydrococcus graniformis Thiele

1843 *Paludina granum* Menke: p. 8 (not Say, 1822)

1828 *Hydrococcus graniformis* Thiele new name for *Paludina granum* Menke not Say: p. 375, text fig. 30, pl. 8, fig. 10

1942 *Assiminea granum* (Menke) Cotton: p. 127

Material: Nine specimens WAM 66.451 from locality 4333-FL1, Nurina Cave.

Distribution: Roe Calcarenite, Peppermint Grove Limestone (recorded by Kendrick (1960) as *Notosetia nitens* (Frauenfeld) according to verbal information from G. Kendrick 25 September, 1975), present seas on tidal flats and marginal marine lakes South Australia and southwestern Australia to Shark Bay; Early Pleistocene to Holocene.

Superfamily CERITHIACEA

Family TURRITELLIDAE

Genus **Turritella** Lamarck, 1799

Subgenus **Gazameda** Iredale, 1924

Turritella (Gazameda) adelaidensis Cotton and Woods

Plate 11, fig. 1

1935 *Turritella (Gazameda) acricula adelaidensis* Cotton & Woods: p. 371, text fig. 2, p. 374, 376

1957 *Turritella (Gazameda) acricula adelaidensis;* Ludbrook: p. 17 (synonymy)

Type material: SAM Tate Coll. T1681, from Abattoirs Bore, Adelaide, section 97, hundred of Yatala, 98-152 m, Dry Creek Sands, Late Pliocene.

Material: Twelve specimens GSWA F6966(4) (4534-FL2); GSSA M2548(4) (4334-FL1); WAM 66.428(3) (4333-FL1); 70.1095 (4434-FL13).

Description: (from Dry Creek Sands material) Shell of moderate size, protoconch elevated of 2 whorls, smooth, tip very small, sharp; adult whorls 16, the first carinate at the middle with a strong spiral cord at the carination which usually weakens after the ephebic whorls but may persist throughout the shell; the weakening of the median cord is accompanied by development of spiral lirae of varying prominence and width; between the lirae are fine axial growth lines which produce a rhombic cancellation or punctation; convexity of the whorl varies from flat to slightly convex. Suture linear, impressed, in some specimens excavate. Base flat, smooth; aperture quadrate, outer lip a shallow sinus, columella concave.

Dimensions: GSSA M3104 height 34, diameter 8 mm.

Distribution: Dry Creek Sands, Roe Calcarenite; the species is common in the Dry Creek Sands; Late Pliocene to Early Pleistocene.

Turritella (Gazameda) iredalei (Finlay)

Plate 11, fig. 2

1843 *Turritella clathrata* Kiener: p. 38, pl. 14, fig. 1 (not Deshayes 1833)
1900a *Turritella clathrata;* Pritchard & Gatliff: p. 202 (synonymy)
1921 *Turritella clathrata;* May: p. 61 (synonymy)
1923 *Turritella clathrata;* May: pl. 28, fig. 4
1927b *Gazameda iredalei* Finlay: p. 496 (new name for *Turritella clathrata* Kiener not Deshayes)
1931a *Stiracolpus iredalei* (Finlay) Cotton & Godfrey: p. 59, pl. 2, fig. 4
1933 *Turritella (Gazameda) iredalei* (Finlay) Cotton & Woods: p. 384
1958 *Gazameda iredalei;* May revised Macpherson: pl. 29, fig.4
1962 *Gazameda iredalei;* Macpherson & Gabriel: p. 98, fig. 124
1973 *Gazameda iredalei*; Garrard: p. 312, pl. 28, fig. 13

Material: One hundred and sixty specimens GSSA M1277(2) (4333-FL2); M1278(5) (4133-FL6); M1284 (4234-FL1); M2541(3) (4334-FL1); GSWA F6905(19) (4334-FL2); F6941(32) (4133-FL7); F7025(4) (4133-FL4); F7048(2) (4133-FL3); F7019(2) (4434-FL7); F7083(3) (4334-FL1); F7138 (4634-FL2); WAM 66.427(70) (4333-FL1); 69.641(15) (4334-FL5); 70.13(2) (4434-FL6).

Description: Shell acutely lanceolate with a high pointed apex of two turns and from 16 to 18 whorls with two strong spiral cords in the lower half, one at about the middle of the whorl and the other just above the suture; between these there are very fine spiral lirae crossed by very fine axial growth lirae. Aperture quadrate, outer lip sinuate. Height 37, diameter 9 mm.

Distribution: Dry Creek Sands, Roe Calcarenite, Glanville Formation, present seas (southern Australia); Late Pliocene to Holocene.

Family VERMETIDAE
Genus **Tenagodus** Guettard, 1770

(= **Siliquaria** Bruguière, 1789; = **Tenagodes** Fischer, 1885)

Tenagodus australis (Quoy & Gaimard)

Plate 11, fig. 10

1834 *Siliquaria australis* Quoy & Gaimard: p. 302
1900a *Tenagodes australis;* Pritchard & Gatliff: 1900a, p. 204 (synonymy)
1912 *Siliquaria australis;* Verco: p. 208 (synonymy)
1921 *Siliquaria australis;* May: p. 62 (synonymy)
1923 *Siliquaria australis;* May: pl. 20, fig. 1
1931 *Siliquaria australis;* Cotton & Godfrey: p. 63, pl. 2
1957 *Tenagodus australis;* Ludbrook: p. 22 (synonymy)
1958 *Siliquaria australis;* May revised Macpherson: pl. 29, fig. 1
1962 *Siliquaria australis;* Macpherson & Gabriel: p. 103, fig. 129
1966 *Siliquaria australis:* Hodgkin *et al.:* p. 31

Material: The species is represented by a single immature specimen WAM 69.481 from locality 4434-FL6.

Distribution: Dry Creek Sands, Roe Calcarenite, present seas (southern Australia from Victoria to Geraldton, Western Australia); late Pliocene to Early Pleistocene, Holocene.

Family POTAMIDIDAE
Genus **Batillaria** Benson, 1842
Subgenus **Zeacumantus** Finlay, 1927

Batillaria (Zeacumantus) bivaricata (Ludbrook)

1941 *Clypeomorus bivaricatus* Ludbrook: p. 89, pl. 4, fig. 20
1957 *Batillaria (Zeacumantus) bivaricata* (Ludbrook) Ludbrook: p. 23

Type material: Holotype SAM Tate Coll. T1629, from Abattoirs Bore, Adelaide, section 97, hundred of Yatala, 98-152 m Dry Creek Sands, Late Pliocene.

Material: Five specimens WAM 66.440 from locality 4333-FL1a are referred to this species.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Batillaria (Zeacumantus) diemenensis (Quoy & Gaimard)

Plate 20, fig. 12

1833 *Cerithium diemenense* Quoy & Gaimard: pl. 55, figs. 11-13
1834 *Cerithium diemenense* Quoy & Gaimard: p. 128
1916 *Batillaria diemenense* (Quoy & Gaimard) Hedley: p. 191 (synonymy)
1921 *Pyrazus diemenensis* (Quoy & Gaimard) May: p. 58 (synonymy)
1923 *Pyrazus diemenensis;* May: pl. 26, fig. 30
1957 *Batillaria (Zeacumantus) diemenensis* (Quoy & Gaimard) Ludbrook: p. 23

1958 *Zeacumantus diemenensis* (Quoy & Gaimard) May revised Macpherson: pl. 26, fig. 30
1962 *Zeacumantus diemenensis;* Macpherson & Gabriel: p. 105, fig. 133
1966 *Zeacumantus diemenensis;* Macpherson: p. 215

Material: Forty-five specimens GSWA F6959(13) (4535-FL2); F6974 (4634-FL2); F7022(18) (4133-FL4); F7049 (4133-FL3); F7158(2) (4334-FL1); GSSA M2583(7) (4434-FL7); M3284 (4333-FL2); WAM 66.472(2) (4333-FL1).

Description: Shell small, turreted, with a blunt protoconch of 1½ whorls followed by 11 adult whorls in a height of 30 mm; whorls flatly convex, with from 10 to 16 axial plicae surmounted and granulated by 4 spiral lirae on each whorl, the axial plicae weaken over the base of the last whorl; suture deep, imbricating. Aperture subovate, oblique, columella straight, siphonal canal short, only slightly reflected, outer lip thin. Height 30, diameter 9 mm.

Distribution: Dry Creek Sands, Roe Calcarenite, Glanville Formation, St. Kilda Formation, present seas (southern Australia, estuarine and shallow water, sandy and muddy flats and weedy sandbanks); Late Pliocene to Holocene.

Batillaria (Zeacumantus) multilirata (Ludbrook)

1941 *Clypeomorus multiliratus* Ludbrook: p. 89, pl. 4, fig. 22
1957 *Batillaria (Zeacumantus) multilirata* (Ludbrook) Ludbrook: p. 24

Type material: Holotype SAM Tate Coll. T1633, from Abattoirs Bore, Adelaide, section 97, hundred of Yatala, 98-152 m, Dry Creek Sands, Late Pliocene.

Material: The species is represented in the Roe Calcarenite by a single specimen WAM 66.445 from locality 4333-FL1.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Subgenus **Batillariella** Thiele, 1929

Batillaria (Batillariella) estuarina (Tate)

1893 *Bittium estuarinum* Tate: p. 190, pl. 1, fig. 12
1900b *Bittium estuarinum;* Pritchard & Gatliff: p. 154
1957 *Batillaria (Batillariella) estuarina* (Tate) Ludbrook: p. 24
1962 *Batillariella estuarinum* (Tate) Macpherson & Gabriel: p. 109

Type material: Holotype SAM D13434, from Port River, Port Adelaide.

Material: Fifty specimens GSWA F6923(2) (4133-FL7); F6959(13) (4534-FL2); F7136(19) (4634-FL2); F7157(2) (4534-FL2); GSSA M3230 (4334-FL1); WAM 66.434(10), 66.435(3) (4333-FL1).

Description: (modified after Tate, 1893) Shell small, turriculate, protoconch small of 1½ smooth whorls, adult whorls about 10, convex, the early whorls

medially angulate, suture impressed; sculptured with spiral threads, usually 5 or 6 on the whorl, and slightly arched axial ribs, from 11 to 15 on the penultimate whorl, which usually become obsolete on the abapical part of the whorl, and which are weakly nodular where the ribs are crossed by the spiral lirae. Base convex, with spiral lirae and axial growth striae. In life the shell is covered with a bluish-black to grey epidermis beneath which the shell is reddish. Aperture ovately rounded, columella concave, basal lip expanded in a weak siphonal canal.

Dimensions: Holotype height 22, diameter 5; usual height 17, diameter 4.5 mm.

Distribution: Dry Creek Sands, Roe Calcarenite, St. Kilda Formation, present seas (Western Port, Victoria to southwestern Australia, in mud, between tide-marks); Late Pliocene to Early Pleistocene, Holocene.

Batillaria (Batillariella) nurinensis n. sp.

Plate 20, figs. 13, 14

Type material: Holotype WAM 66.432a from locality 4333-FL1a, Nurina Cave, surface of doline, Grid Reference BURNABBIE 505041, 32° 00′ 31″ S, 127° 00′ 30″ E; Roe Calcarenite, Early Pleistocene; 207 paratypes GSWA F6992(3) (4534-FL2); F7031 (4133-FL4); F7062(2), F7091(4) (4334-FL1); GSSA M2512 (4434-FL9); M2568, M3289, WAM 62.43(1) (4334-FL1); 66.432(130), 66.433(48), 66.546-7(15) (4333-FL1).

Material: (from Dry Creek Sands) GSSA M666(3) Govt. Bore 41, 122-124 m, section 413, hundred of Yatala; M691(1) Govt. Bore 41, 126 m; M674(18) Govt. Bore 41, 129 m; M680(2) Govt. Bore 21, 122-123 m, section 220, hundred of Adelaide; M3229(2) Govt. Bore 20, 110-115 m, section 526, hundred of Yatala.

Description: Shell turriculate, elongate-pagodiform, with a high, thin-shelled protoconch of 5 whorls and 12 to 13 adult whorls the first of which are almost smooth and slightly carinate at the middle, on the remaining whorls the sculpture is more prominent in the abapical half of the whorl where there are 2 strong granulose spiral ribs; the adapical half of the whorl has 3 spiral lirae, on the last whorl there are 3 adapical lirae and 4 ribs in the middle of the whorl, the adapical 2 of which are granulose. The axial sculpture consists of low plications, about 11 on the penultimate whorl. Aperture roundly oval, columella concave, with a short, broad, shallow siphonal canal.

Dimensions: WAM 66.432a, height 20, diameter 5.5 mm.

Remarks: The species is close to *B. (B.) estuarina,* but is readily distinguished by the two strong spiral ribs which give a pagodiform appearance to the shell.

Distribution: Dry Creek Sands, Roe Calcarenite; Pliocene to Early Pleistocene.

Genus **Manulona** Ludbrook, 1941

Manulona arrugosa Ludbrook

Plate 20, fig. 15

1941 *Manulona arrugosa* Ludbrook: p. 91, pl. 4, fig. 27
1957 *Manulona arrugosa* Ludbrook: p. 25

Type material: Holotype SAM Tate Coll. T1635, from Abattoirs Bore, Adelaide, section 97, hundred of Yatala, 98-152 m, Dry Creek Sands, Late Pliocene.

Material: Sixteen specimens WAM 66.437 locality 4333-FL1.

Description: (modified from Ludbrook, 1941, 1957) Shell small, slender, turreted, whorls flat to concave; protoconch of 2 smooth whorls, adult whorls 10 in a height of 8.7 mm conspicuously sculptured with an abapical thread above which is a prominent band with about 12 elevated tubercles, above the band three flattened lirae, the beads being about twice as numerous as, and very much smaller than, the tubercles, interspaces narrow. Suture linear, irregular. Base with three well spaced lirae; aperture oblique. subovate; columella slightly concave, columellar lip thin, reflected over the columella; outer lip thin, siphonal canal, short, straight.

Dimensions: WAM 66.437a, height 7, diameter 2 mm.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Family DIASTOMATIDAE
Genus **Diastoma** Deshayes, 1850

Diastoma adelaidense Ludbrook

Plate 11, figs. 3, 4

1971 *Diastoma adelaidense* Ludbrook: p. 32, pl. 1, figs. 3-7, pl. 6, figs. 9, 10

Type Material: Holotype GSSA M609, from Mitchell's Bore, Adelaide Plains Basin, section 353, hundred of Yatala, 127-151 m, Dry Creek Sands, Late Pliocene.

Material: Thirteen specimens GSWA F7160 (4534-FL2); WAM 65.721 (4334-FL1); 69.487(3), 70.1131(6), 70.1132, 70.1142 (4434-FL6).

Distribution: Melton Limestone, ?Hallett Cove Sandstone, Dry Creek Sands, Roe Calcarenite; Miocene to Early Pleistocene.

Diastoma melanioides (Reeve)

Plate 11, fig. 5

1849 *Mesalia melanioides* Reeve: pl. 1, fig. 3
1932 *Neodiastoma melanioides* (Reeve) Cotton: p. 541
1971 *Diastoma melanioides* (Reeve) Ludbrook: p. 32, pl. 1, figs. 1-21

Material: Four hundred and nineteen specimens GSWA F6901(12) (4434-FL8); F6906(9) (4334-FL2); F6920(48) (4133-FL7); F6958(5) (4534-FL2); F6997(11) (4434-FL7); F7021(5) (4133-FL4); F7040(6) (4133-FL3); F7059(11), F7076(18) (4334-FL1); GSSA M1283(7) (4133-FL6); M1288(20) (4333-FL2); M2519(1) (4434-FL9); M2566(94) (4334-FL1); M2569(11) (4434-FL7); WAM 61.60 (4334-FL6); 62.35, 62.37(3), 62.45(5) (4334-FL1); 66.429(43), 66.545(6) (4333-FL1); 66.593(3) (4233-FL2); 66.609(12), 66.610(2) (4334-FL1); 67.389(2) (4434-FL7); 67.783(15) (4434-FL1); 68.1359 (4434-FL1); 69.48(14), 69.49 (4334-FL7); 70.1088(7) (4434-FL5); 70.1096(3) (4434-FL13); 70.1097 (4534-FL5); 70.1103(15), 70.1130(26) (4434-FL6).

Distribution: Abundant in the Roe Calcarenite; rare in present seas (restricted to Spencer Gulf, St. Francis Island, Esperance and Cheyne Beach); Early Pleistocene, Holocene.

Family CERITHIIDAE
Genus **Thericium** Monterosato, 1890
Subgenus **Chavanicerithium** Ludbrook, 1957

Thericium (Chavanicerithium) darraghi Ludbrook

Plate 11, fig. 6

1971 *Thericium (Chavanicerithium) darraghi* Ludbrook: p. 35, pl. 5, figs. 7, 8

Type material: Holotype WAM 69.547, from locality 4434-FL5, 0.6 km north of Hampton Microwave Repeater Tower.

Material: Sixteen specimens GSSA M3225 (4334-FL1); WAM 66.430, 66.444(3), 66.550(2) (4333-FL1); 69.483 (4434-FL6); 69.547, 69.548(4) (4434-FL5); 71.330 (4434-FL6).

Distribution: Roe Calcarenite; Early Pleistocene.

Thericium (Chavanicerithium) westraliense Ludbrook

Plate 11, fig. 7

1971 *Thericium (Chavanicerithium) westraliense* Ludbrook: p. 37, pl. 5, figs. 5, 6

Type material: Holotype WAM 70.14, from locality 4434-FL6, Hampton Microwave Repeater Tower.

Material: Eleven specimens WAM 66.431 (4333-FL1); 69.482(7), 70.14, 70.1104, 70.1133 (4333-FL1).

Distribution: Roe Calcarenite; Early Pleistocene.

63616—(8)

Genus **Bittium** Leach, 1847
Subgenus **Semibittium** Cossmann, 1896

Bittium (Semibittium) granarium (Kiener)

1842 *Cerithium granarium* Kiener: p. 72, pl. 19, fig. 5
1886 *Bittium granarium* (Kiener) Watson: p. 539
1900 *Bittium granarium;* Pritchard & Gatliff: p. 153 (synonymy)
1915 *Bittium granarium;* Hedley: p. 718, pl. 77, fig. 6
1916 *Bittium granarium;* Hedley; p. 191 (synonymy)
1962 *Cacozeliana granaria* (Kiener) Macpherson & Gabriel: p. 108, fig. 135
1966 *Cacozeliana granaria;* Macpherson: p. 216
1966 *Cacozeliana granaria;* Hodgkin *et al.*: p. 41, pl. 15, fig. 8

Material: A single specimen GSWA F7181 in fine, soft incoherent sand (Q1), locality 3630-FL1.

Distribution: Glanville Formation, Peppermint Grove Limestone, lake deposits (Q1), present seas (New South Wales to Murchison River, Western Australia (Hodgkin *et al.,* 1966)); Late Pleistocene to Holocene.

Subgenus **Eubittium** Cotton, 1938

Bittium (Eubittium) lawleyanum Crosse

Plate 20, fig. 16

1863 *Bittium lawleyanum* Crosse: p. 87, pl. 1, fig. 4
1900b *Bittium lawleyanum;* Pritchard & Gatliff: p. 154 (synonymy)
1916 *Bittium lawleyanum;* Hedley: p. 191 (synonymy)
1921 *Bittium lawleyanum;* May: p. 58
1923 *Bittium lawleyanum;* May: pl. 26, fig. 27
1937 *Eubittium lawleyanum* (Crosse) Cotton: p. 2
1958 *Eubittium lawleyanum;* May revised Macpherson: pl. 26, fig. 27
1962 *Eubittium lawleyanum;* Macpherson & Gabriel: p. 109
1966 *Eubittium lawleyanum;* Macpherson: p. 166

Material: Twenty-seven specimens GSWA F6936(8) (4133-FL7); F6960(13) (4534-FL2); WAM 66.436(6) (4333-FL1).

Description: Shell small, turriculate, with a high protoconch of 3 smooth whorls, adult whorls 8, convex, gradually increasing in size, sculptured with about 8 flat spiral lirae per whorl, 14 on the last whorl and base, wider than the linear interspaces, crossed by axial growth striae; suture impressed. Aperture oval, with a very slightly expanded outer lip. Colour dark brown to dark grey.

Dimensions: Height 15, diameter 5 mm.

Distribution: Roe Calcarenite, Peppermint Grove Limestone, present seas (Victoria to southwestern Australia, Tasmania); Early Pleistocene to Holocene.

Genus **Diala** A. Adams, 1861
Subgenus **Diala** *s.s.*

Diala (Diala) lauta Adams

1862 *Diala lauta* A. Adams: p. 298
1887 *Litiopa (Diala) lauta* (Adams) Tyron: p. 282, pl. 53, fig. 83
1902a *Diala lauta;* Pritchard & Gatliff: p. 88 (synonymy)
1916 *Diala lauta;* Hedley: p. 188 (synonymy)
1921 *Diala lauta;* May: p. 54 (synonymy)
1923 *Diala lauta;* May: pl. 25, fig. 10
1950 *Diala lauta;* Laseron: p. 286; figs. 91-93
1958 *Diala lauta;* May revised Macpherson: pl. 25, fig. 10
1962 *Diala lauta;* Macpherson & Gabriel: p. 108
1966 *Diala lauta;* Macpherson: p. 215

Material: Twelve specimens GSWA F7145 loose in soil locality 4634-FL2(7), and F7179 in incoherent sand (Ql) locality 3630-FL1.

Distribution: ?Roe Calcarenite, Peppermint Grove Limestone, Glanville & St. Kilda Formations, lake deposits (Ql), present seas (New South Wales to Western Australia); ?Early Pleistocene to Holocene.

Subgenus **Mereldia** Ludbrook, 1941

Diala (Mereldia) incommoda (Ludbrook)

Plate 20, figs. 17, 18

1941 *Mereldia incommoda* Ludbrook: p. 92, pl. 5, fig. 3
1957 *Diala (Mereldia) incommoda* (Ludbrook) Ludbrook: p. 27

Type material: Holotype SAM Tate Coll. T1638, from Abattoirs Bore, Adelaide, section 97, hundred of Yatala 98-152 m, Dry Creek Sands, Late Pliocene.

Material: A single specimen GSWA F7159, loose in soil, locality 4133-FL7.

Description: Shell small, solid, conical, with a small dome-shaped protoconch of 2 smooth whorls, slightly convex; adult whorls nine, flat, gradually tapering adapically, suture linear, well-defined, imbricate. Whorls sculptured with numerous fine spiral striae. Aperture quadrately ovate, outer lip thin, columella short, straight, siphonal canal a weak notch.

Dimensions: GSWA F7159, height 12.5, diameter 5 mm.

Distribution: Dry Creek Sands, ?Roe Calcarenite; Late Pliocene, ?Early Pleistocene.

Genus **Semivertagus** Cossmann, 1889

Semivertagus subcalvatus Tate

Plate 11, figs. 8, 9

1894a *Semivertagus subcalvatus* Tate: p. 178, pl. 11, fig. 3
1894a *Semivertagus capillatus* Tate: p. 178, pl. 11, fig. 1
1957 *Semivertagus capillatus;* Ludbrook: p. 31, pl. 2, fig. 9

Type material: The type series of *S. subcalvatus* SAM Tate Coll. T212 from Aldinga Bay, South Australia (Hallett Cove Sandstone); the type series of *S. capillatus* from Dry Creek Bore, section 980, hundred of Port Adelaide (Dry Creek Sands).

Material: Three hundred and eighty-four specimens GSSA M1263(2) (4334-FL1); M1264(4) (4133-FL6); M1265(6) (4333-FL2); M1266 (4234-FL1); M2518 (4434-FL9); M2532(103) (4334-FL1); M2580(36) (4434-FL7); GSWA F6898(17) (4434-FL8); F6980(3) (4534-FL2); F7003(35) (4434-FL7); F7029(6) (4133-FL4); F7060(11), F7080(42), WAM 62.41(3), 65.683(2), 65.684 (4334-FL1); 66.439(39), 66.448(12), 66.549(12), 66.553 (2) (4333-FL1); 66.612(20) (4334-FL1); 69.484 (4434-FL6); 69.654, 69.659 (4434-FL8).

Description: Shell turreted, with a small dome-shaped apex of 1½ whorls, adult whorls 12 to 13 in a height of 27 to 30 mm, whorls slightly convex, last whorl somewhat more than one-third height of shell; suture conspicuous, imbricating; sculpture variable but usually of very fine spiral lirae varying in number, some shells being nearly smooth and others more strongly sculptured with about 7 lirae per whorl, there may also be faint axial growth plicae. Aperture oblique, tending to be detached posteriorly; outer lip slightly reflected, columellar lip broad and thick and reflected over the columella, without folds; a weak parietal ridge below the adapical channel, anterior canal short, reflected.

Dimensions:	height (mm)	diameter (mm)
S. subcalvatus holotype	17 (est. 21)	6
SAM T212 C (apex broken)		
S. capillatus holotype	17	5
SAM T1539C		
S. subcalvatus WAM 66.439a	27	8
GSWA F7029(1)	16	5
average large specimen		
GSWA F7003	30	8

Remarks: The range of material from the Roe Plains confirms that *S. subcalvatus* from the Hallett Cove Sandstone and *S. capillatus* from the Dry Creek Sands (both Late Pliocene) are synonymous. The five specimens in the type series of *S. subcalvatus* are larger, thicker and microscopically more clearly sculptured than the 11 in the type series of *S. capillatus* from Dry Creek Bore, but the species ranges from nearly smooth to lightly spirally lirate. Roe Plains specimens are on the whole larger and more robust than those from the St. Vincent Basin.

S. subcalvatus has line priority (Tate, 1894a, p. 178) over *S. capillatus*.

Distribution: Hallett Cove Sandstone, Dry Creek Sands, Roe Calcarenite; Pliocene to Early Pleistocene.

Genus **Campanile** Bayle in Fischer, 1884

Campanile symbolicum Iredale

Plate 11, figs. 13, 14

1917 *Campanile symbolicum* Iredale: p. 326 new name for *Cerithium leve* Quoy & Gaimard 1833 not *Cerithium laevis* Perry, 1810
1971 *Campanile symbolicum;* Ludbrook: p. 33-4, pl. 2, figs. 1-7 (synonymy and description)

Material: Fifty-seven specimens GSSA M1272 (4333-FL2); M1302, M2564(29) (4334-FL1); M2581 (4434-FL7); M3231 (4434-FL5); M3240 (4334-FL1); GSWA F6882(2) (4334-FL2); F7068, F7079(3) (4334-FL1); WAM 61.54(2), 61.55 (4334-FL6); 62.57(3) (4334-FL1); 66.548 (4333-FL1); 66.611(8) (4334-FL1); 69.50 (4434-FL6); 69.384 (4334-FL7); 70.1105 (4434-FL6).

Distribution: Roe Calcarenite, present seas "Recherche Archipelago to Geraldton, sublittoral, sandy bottoms" (Hodgkin *et al.,* 1966); Early Pleistocene, Holocene.

Genus **Hypotrochus** Cotton, 1932

Hypotrochus monachus (Crosse & Fischer)

Plate 20, figs. 23, 24

1855 *Cerithium dubium* Sowerby: p. 864, pl. 181, fig. 120 (not *C. dubium* Sowerby, 1816)
1864 *Cerithium monachus* Crosse & Fischer: p. 347
1865 *Cerithium monachus* Crosse & Fischer: pl. 3, figs. 17-18
1880 *Cerithium eludens* Bayle: p. 245
1887 *Cerithium (Potamides) monachus;* Brazier: p. 124 (synonymy)
1900b *Cerithium monachus;* Pritchard & Gatliff: p. 152 (synonymy)
1932 *Hypotrochus monachus* (Crosse & Fischer) Cotton: p. 540
1962 *Hypotrochus monachus;* Macpherson & Gabriel: p. 109, fig. 136
1966 *Hypotrochus monachus;* Macpherson: p. 216
1966 *Hypotrochus monachus;* Hodgkin *et al.*: p. 41, pl. 15, fig. 9

Material: Eighty-three specimens GSSA M2584(2) (4434-FL7); M3287 (4333-FL2); GSWA F6916 (4334-FL2); F6945(7) (4133-FL7); F6972(2) (4534-FL2); F7000 (4434-FL7); F7167 (4334-FL1); WAM 61.64 (4334-FL6); 66.441(41), 66.505(2), 66.551(5) (4333-FL1); 69.485(12) (4434-FL6); 69.546 (4434-FL5); 69.596(4) (4534-FL2); 70.1134(2) (4434-FL6).

Description: Shell small, thin, turreted, spire about two-thirds height, protoconch of 2 smooth whorls followed by 6 to 8 adult whorls, convex, carinate, the last whorl bicarinate; colour cream marked with chestnut. There are about 12 axial ribs and 3 varices per whorl on the typical form, but the varices may be rare or absent; the axial ribs are most prominent just below the middle of the whorl at the obtuse carination; the abapical less prominent carina on the last whorl is represented on the earlier whorls by a strong cord above the suture

with chestnut spots between the ribs; the whole shell is sculptured spirally with fine striae which continue on to the base. Aperture subquadrate, columella straight, columellar and parietal lips thinly calloused and continuous with the outer lip which is thin; siphonal canal short, oblique.

Dimensions: Topotype height 14, diameter 7 mm, WAM 69.596a height 18, diameter 9 mm.

Remarks: The shell illustrated by Crosse and Fischer (1865) is a fairly smooth example of the varicate form with 3 varices per whorl; the two forms, varicate and non-varicate, were noted by Verco on the label accompanying the numerous Outer Harbor topotypes in the South Australian Museum. This was evidently not noticed by Cotton (1932, p. 539) in describing the genus as "beset with varices". Macpherson and Gabriel (1962, p. 109) described the whorls as "bearing about fourteen to eighteen prominent varices". The fossil species belongs almost entirely to the non-varicate form.

Distribution: Roe Calcarenite, St. Kilda Formation, present seas ("Victoria to Rottnest Island, under stones, among leafy algae" (Hodgkin *et al.,* 1966)); Early Pleistocene to Holocene.

Hypotrochus penetricinctus Cotton

Plate 20, figs. 21, 22

1932 *Hypotrochus penetricincta* Cotton: p. 540, fig. 5

Type material: Holotype SAM D13436, from Edithburg, South Australia, 16.5 m.

Material: Ninety-eight specimens GSSA M3228 (4334-FL7); WAM 66.443(94) (4333-FL1); 69.486(3) (4434-FL6).

Description: Shell small, solid, conical, pagodiform, protoconch of 1½ smooth whorls, adult whorls five, with straight oblique sides, strongly carinate in the abapical one-third and markedly constricted below the carina; sculptured with 10 radiating axial ribs per whorl, a spiral cord on the carina, two or more weaker cords on the base, the upper one remaining as a thin lira above the suture on the previous whorls, and about 12 very fine spiral lirae on each whorl. Aperture ovate, columella concave, outer lip slightly expanded and scalloped by the basal cords; siphonal canal broad, shallow, short. Colour creamy white with chestnut markings on the carinal cord between the ribs and on the basal lirae.

Dimensions: Height 11, diameter 5 mm.

Remarks: This is a small species, readily distinguishable by the pagodiform shape and radiating axial ribs.

Distribution: Roe Calcarenite, present seas (Gulf St. Vincent to King George Sound to depth 100 m); Early Pleistocene, Holocene.

Family TRIPHORIDAE
Genus **Triphora** Blainville, 1828
Subgenus **Notosinister** Finlay, 1927

Triphora (Notosinister) sp. cf. **T. (N.) festiva** A. Adams

cf. 1851 *Triphora festiva* A. Adams: p. 278

Material: Portion of a worn specimen WAM 66.474 from locality 4333-FL1.

Remarks: The specimen may be compared with the living species *Triphora (Notosinister) festiva* A. Adams.

Distribution: Roe Calcarenite, present seas (Victoria to southwestern Australia); Early Pleistocene, Holocene.

Superfamily SCALACEA
Family SCALIDAE
Genus **Opalia** H. & A. Adams, 1853
Subgenus **Granuliscala** Boury, 1909

Opalia (Granuliscala) granosa (Quoy & Gaimard)

Plate 10, figs. 21, 22

1833 *Turritella granosa* Quoy & Gaimard: pl. 35, figs. 29, 30
1834 *Turritella granosa* Quoy & Gaimard: p. 138
1900b *Scala granosa* (Quoy & Gaimard) Pritchard & Gatliff: p. 143 (synonymy)
1916 *Epitonium granosum* (Quoy & Gaimard) Hedley: p. 193 (synonymy)
1923 *Epitonium granosum;* May: pl. 29, fig. 10
1931 *Granuliscala granosa* (Quoy & Gaimard) Cotton & Godfrey: p. 8, pl. 1, fig. 8
1958 *Granuliscala granosa;* May revised Macpherson: pl. 29 fig. 10
1962 *Granuliscala granosa;* Macpherson & Gabriel: p. 114, fig. 140
1966 *Scala granosa* (Quoy & Gaimard) Hodgkin *et al.*: p. 35, pl. 12, fig. 4
1971 *Granuliscala granosa;* Wilson & Gillett: p. 34, pl. 13, fig. 1

Material: A single specimen GSWA F6988 from locality 4233-FL1 in coastal dunes.

Distribution: Coastal dunes (Qpo), Peppermint Grove Limestone, present seas (Victoria, Tasmania, South Australia and southwestern Australia); Late Pleistocene and Holocene.

Family JANTHINIDAE
Genus **Hartungia** Bronn, 1861 (= **Heligmope** Tate, 1893)

Hartungia dennanti chavani n. subsp.

Plate 12, figs. 1-14

Type material: Holotype WAM 69.300c from locality 4434-FL13, Grid Reference EUCLA 605057, 31° 51′ 33″ S, 127° 57′ E, 88 km west of Eucla, Roe Calcarenite, Early Pleistocene; figured paratypes: WAM 69.300d, g, i (4434-FL13), 69.299d (4534-FL5), 69.301b (4434-FL13), 69.305 ,(4534-FL3) 71.1438b (4534-FL1), GSSA M3296 (4434-FL7); unfigured paratypes: WAM 62.39, 62.44, 62.50, 67.778a, b (4434-FL1), 69.297a, b, 69.304 (4434-FL5), 69.298a-g (4434-FL8), 69.299a-c (4534-FL5), 69.300a, b, f, h, j-z, 69.301a, c, d, 69.628 (4434-FL13), 69.302a-c, 69.303 (4534-FL2), 69.306 (4434-FL6), 71.1438a, c-g (4534-FL1), 70.2155, 70.2156a-c (4434-FL12), GSSA M3297 (4434-FL7), GSWA F6903(1, 2) (4434-FL2).

Other material: Three broken specimens and numerous fragments from an unnamed formation in the Perth Basin: WAM 69.296 Kowalskis Bore, Gosnells, at 28.37-29.59 m; WAM 69.292, 69.294 Redcliffe Primary School No. 2 Bore at 19.8-21-.9 m; fragments from bores at West Bullsbrook, Redcliffe and Gosnells. From the Lower Southeast of South Australia GSSA M3310a, b from 1.6 km southeast of Naracoorte on the Kanawinka Scarp, Stone Reserve adjacent to section 798, hundred of Naracoorte, and M3311 from 'aeolianite' overlying Naracoorte Limestone, A. James and Sons Quarry 1.6 km east of Naracoorte (Ludbrook, 1961a, p.30, fig. 10); M3312 from shelly hard limestone at Reedy Wells, Culburra, hundred of Colebatch.

Description: Shell large, thin, turbinate-ovate, nonumbilicate, with a moderately high spire, ratio height:diameter of 70 specimens 1.088:1, increasing in relative height with age; protoconch of three smooth glossy whorls the last half-whorl sculptured with microscopic close-set axial striae followed abruptly by the first adult whorl which is strongly sculptured with fine lamelliform threads, the spiral ribs being completely absent or very weak, usually not more than 2 or 3 but in some specimens as many as 5; adult whorls $2\frac{3}{4}$, inflated, the axial threads of the first whorl usually developing into crowded growth lamellae; spiral sculpture of flattish rounded ribs about equal to the interspaces, varying on the last whorl from 10 to 12, but the 2 adapical ribs below the suture are usually suppressed or missing altogether; the strength of the ribs on the last whorl varies from obsolete to moderately strong. Sutures adpressed and smoothed thinly on to the previous whorl. Aperture nearly vertical, outer lip thin, slightly expanded and weakly crenulated by the spiral ribs; columella straight, columellar and parietal callus thin, the parietal callus continuing above the suture to the thin adpressed layer, basal lip with a conspicuous sinus near the junction with the outer lip, moderately broad and deep in the adult, bordered on the adapical side by a low, broad rib which runs around the base to above the columella, the position of earlier sinuses being indicated by concave growth lamellae extending around the columella and partly covered by the columellar lip.

Dimensions: Holotype 69.300c height 44, diameter 38, height of aperture 30, width of aperture 20 mm; average of 70 specimens height 34, diameter 31.2, ratio height:diameter 1.088:1 (Fig. 7).

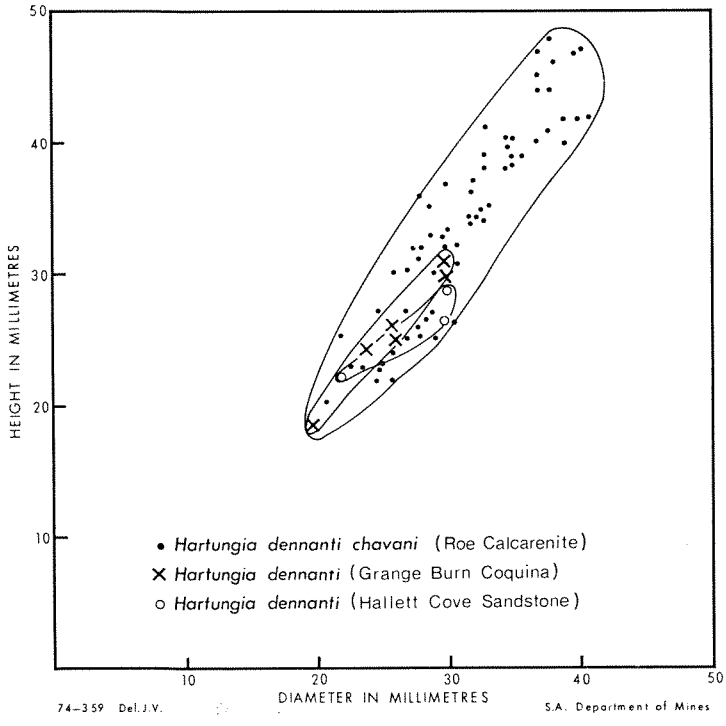


Figure 7. Scatter diagram of diameter:height of *Hartungia dennanti dennanti* **and** *Hartungia dennanti chavani* **(GSWA 16793)**

Remarks: This subspecies belongs to a closely-related group of *Hartungia* species described as *Hartungia typica* Bronn, *Janthina hartungi* Mayer from the Neogene of the Azores, *Acrybia (Hartungia) chouberti* Chavan from the Astian of Morocco, *Heligmope dennanti* Tate from the Pliocene of southern Australia and *Turbo postulatus* Bartrum from the Pliocene of New Zealand (Fleming, 1953). The pelagic habit of the Janthinidae makes them potentially valuable for purposes of correlation. While there may be good reason to suspect that the Australian and New Zealand material is identifiable at the specific level with the Azores *Hartungia typica* and its synonym *Janthina hartungi,* and to confirm such identity would have considerable correlative value, there is at present no tangible type material with which one can make firm comparisons. The whereabouts of the holotype of *Hartungia typica* Bronn or of *Janthina hartungi* Mayer are unknown (A. G. Beu, New Zealand Geological Survey in correspondence 1 February, 1974). Moreover, it appears unlikely that a holotype of *Janthina hartungi* ever existed separately from that of *Hartungi typica* Bronn since Mayer (1864, pl. VI, figs. 41a, b, c) seems merely to have reproduced three of Bronn's figures (1860, pl. XIX, figs. 3a, b, c, d), his 41a being Bronn's 3a, 41b Bronn's 3c, and 41c Bronn's 3b.

All the Azores specimens so far described and figured, including those by Krejci-Graf (1958, pl. 3, fig. 6, pl. 4, figs. 11a, b), are juveniles exhibiting an intraspecific variation in sculpture similar to that of juveniles and early whorls of specimens from the Roe Calcarenite. The only available material from which a neotype of *Hartungia typica* Bronn might be selected is that in the Senckenberg Museum identified as *H. typica* by Krejci-Graf (1958, p. 336, pl. 3, fig. 6, pl. 4, figs. 11a, b). But according to A. G. Beu (letter of 1 February, 1974) this is not *H. typica* but a form lacking spiral sculpture. Krejci-Graf's figures (11a, b) are of a specimen with strong close axial lamellae similar to those of GSSA M3296 figured here on pl. 12, figs. 13, 14.

However, the holotype of *Hartungia chouberti* (Chavan) is in the G. Lecointre Collection, Service de la Carte geologique, Rabat, Morocco, and through the courtesy of Dr. R. Wernli, Laboratoire de Micropalaeontologie, three photographs are reproduced on plate 12, figs. 17-19.

The Australian species *Hartungia dennanti* (Tate) is readily separable from the Moroccan species of which the amount of material appears to be extremely limited. *H. chouberti* has 14 spiral ribs, *H. dennanti* about 10. The ribs in typical *H. dennanti* (pl. 12, fig. 15) are sharply defined with relatively wide interspaces; the ribs in *H. chouberti* are more rounded, closer, and strongly crossed by the axial riblets. *H. dennanti* has a nearly straight and almost vertical columella; it appears to be shorter and oblique to the left in *H. chouberti.* Both *H. dennanti dennanti* and the new subspecies *H. dennanti chavani* have conspicuous columellar and parietal callus (pl. 12, figs. 7, 15, 16) which is apparently absent in the Moroccan specimen.

The new subspecies is named for M. Andre Chavan who first drew attention to the genus *Hartungia,* overlooked by authors such as Cossmann and Wenz, and its priority over *Heligmope* Tate, 1893; he distinguished the Australian species from the Moroccan (Chavan, 1951, p. 136). The Pleistocene subspecies is a large *Hartungia,* less strongly sculptured than *H. dennanti dennanti* and with the two spiral ribs below the suture suppressed. *H. chouberti* also (pl. 12, figs. 17-19) appears to have a weak rib below the suture. The relative dimensions of *H. dennanti dennanti* come within the range of those of *H. dennanti chavani* as shown in the scatter diagram of Figure 7 where dimensions of typical *H. dennanti* from Grange Burn (Kalimnan (Early Pliocene)) are plotted with those from the Hallett Cove Sandstone (Late Pliocene) and the Roe Calcarenite. Tate's paratypes of *Heligmope dennanti* SAM T1515a-c from the Hallett Cove Sandstone are relatively poorly preserved, and, as Tate described them, not typical of *H. dennanti.* Nor are they typical of *H. dennanti chavani,* and in the absence of a wider range of material are not here included in *H. dennanti chavani.* It would be advantageous to compare them with examples of *Hartungia postulata* (Bartrum), which according to Fleming (1966, p. 49) has a Pliocene range in New Zealand of Opoitian to Waitotaran.

Distribution: The subspecies is widely distributed in southern Australia. Its most westerly occurrence is in the Perth Basin where it has been recorded

(Kendrick in Johnstone *et al.* (1973, p. 14); Beu and Kendrick in Quilty (1974a, p. 308) and Kendrick in Quilty (1974b, p. 29)) as *Hartungia typica* Bronn. Most of the material is too fragmentary for specific determination, but broken specimens WAM 69.296 from Gosnells and WAM 69.292 and 69.294 from Redcliffe are of the same subspecies as that occurring in the Roe Calcarenite, and may be compared with specimens 69.300u from locality 4434-FL13, 69.297c from 4434-FL5 and 69.299a from 4534-FL5.

The Pliocene age claimed for the Perth Basin sediments on the basis of the occurrence of *H. typica typica* should be treated with caution. They are most likely of Late Pliocene to Early Pleistocene age, to be correlated broadly with the Hallett Cove Sandstone or Roe Calcarenite and perhaps the Dry Creek Sands (see Fig. 4). The sediments also contain a species of *Zenatia (Zenatiopsis* which is not *Zenatiopsis ultima* Darragh and Kendrick but one which occurs also in the Roe Calcarenite and the Dry Creek Sands (see p. 62).

H. dennanti chavani has recently been found also on the Padthaway Ridge to the north of the Otway Basin in marginal limestones or aeolianites of the series of more or less parallel beach ridges formed during the Pleistocene. The Naracoorte specimens M3310 a, b and M3311 came from very low in what was mapped as Bridgewater Formation (K. A. Rochow, 1969, NARACOORTE map sheet, Geological Atlas of South Australia 1 : 250 000 series), the lower part of which and its relationships with the Coomandook Formation are in need of definition. The Coomandook Formation has been omitted from the chart Fig. 4, on which the stratigraphic position of occurrences of *Hartungia dennanti chavani* are shown; the formation requires redefinition from a surface section.

The distribution in Australia of *Hartungia dennani chavani* is here considered to be the lowermost part of the Bridgewater Formation and its probable equivalents in the southeast of South Australia, the Roe Calcarenite of the Eucla Basin, and sediments of the Perth Basin. These are considered to be of Early Pleistocene age, though the possibility of those of the Perth Basin being of Late Pliocene to Early Pleistocene age is not excluded.

Superfamily	HIPPONICACEA
Family	HIPPONICIDAE
Genus	**Hipponix** Defrance, 1819
Subgenus	**Sabia** Gray, 1847

Hipponix (Sabia) conicus (Schumacher)

Plate 13, figs. 1, 2

1817 *Amalthea conica* Schumacher: p. 181, pl. 21, fig. 4
1957 *Hipponix (Sabia) conicus* (Schumacher) Ludbrook: p. 49, pl. 4, figs. 1-4 (synonymy)
1966 *Hipponyx conicus;* Macpherson: p. 217
1970 *Hipponix conicus;* Laws: p. 115-121

Material: Eighty-one specimens GSSA M1274(3) (4333-FL2); M2514 (4434-FL9); M2545 (4334-FL1); GSWA F6937(2) (4133-FL7); F7170(2) (4534-FL2); WAM 66.450(45) (4333-FL1); 69.78 (4534-FL5); 70.1189, 70.1090(3) (4434-FL5); 70.1106, 70.1107(5), 70.1109(6), 70.1135(6), 70.1136(4) (4434-FL6).

Remarks: The shell was described by Ludbrook (1957) from the holotype in the Zoologiske Museum, Kobenhavn, Schumacher 181, No. 1071; the reproductive biology and shell site preferences were described by Laws (1970). Specimen WAM 70.1136 is a female with a male shell scar and communication notch. *Hipponix* scars were also noted on WAM 69.489b *Tylospira pagodiformis* and on WAM 71.330 *Thericium (Chavanicerithium) darraghi.*

Distribution: Dry Creek Sands, Roe Calcarenite, Glanville Formation, Peppermint Grove Limestone, present seas (southern Australia); Late Pliocene to Holocene.

Superfamily CALYPTRAEACEA
Family TRICHOTROPIDIDAE
Genus **Icuncula** Iredale, 1924

Icuncula occidentalis n. sp.

Plate 20, figs. 25-28

Type material: Holotype WAM 66.418a from locality 4333-FL1a, Nurina Cave, surface of doline. Grid reference BURNABBIE 505041, 32° 00′ 31″ S, 127° 00′ 30″ E; Roe Calcarenite, Early Pleistocene; figured paratype WAM 66.418b (4333-FL1a); unfigured paratypes WAM 66.418(181) (4333-FL1a).

Description: Shell very small, gradate, with a smooth protoconch of 3 whorls, adult whorls 3, each with 2 increasing to 3 prominent keels, base with 3 or 4 strong spiral ribs nearly equal to the keels. Sutural ramp broad, smooth, slightly concave. Whorls convex, suture linear. Aperture subrounded, the outer lip deeply scalloped, extended and channelled at the external keels and spiral ribs, basal lip reflected, columella concave, umbilicus narrow.

Dimensions: Height 4.5, diameter 3.5 mm.

Remarks: The species is close to *I. consobrina* May, of which only 4 specimens and ribs on the last whorl of *I. occidentalis,* as against 5 in *I. consobrina.* the third keel develops earlier; there are more spiral ribs—a total of 6 to 7 keels and ribs on the last whorl of *I. occidentalis,* as against 5 in *I. consobrina.* The sutural ramp of *I. occidentalis* is relatively narrower and the shell generally larger and broader than *I. consobrina.*

Distribution: Roe Calcarenite; Early Pleistocene.

Family CAPULIDAE
Genus **Capulus** Montfort, 1810

Capulus violaceus Angas

Plate 24, fig. 15

1867a *Capulus violaceus* Angas: p. 114, pl. 13, fig. 23
1921 *Capulus violaceus;* May: p. 58
1923 *Capulus violaceus;* May: pl. 26, fig. 22
1958 *Capulus violaceus;* May revised Macpherson: pl. 26, fig. 22
1962 *Capulus violaceus;* Macpherson & Gabriel: p. 130
1962 *Capulonix violaceus* (Angas) Iredale & McMichael: p. 44
1966 *Capulus violaceus;* Macpherson: p. 217

Material: Twenty specimens WAM 74.894, mostly juvenile, from locality 4333-FL1.

Remarks: The species, described from Long Reef, New South Wales, has been recorded also from Victoria and Tasmania.

Distribution: Roe Calcarenite, present seas; Early Pleistocene, Holocene.

Family CALYPTRAEIDAE
Genus **Calyptraea** Lamarck, 1799
Subgenus **Sigapatella** Lesson, 1830

Calyptraea (Sigapatella) calyptraeformis (Lamarck)

Plate 13, figs. 3, 4

1822b *Trochus calyptraeformis* Lamarck: p. 12
1833 *Crepidula tomentosa* Quoy & Gaimard: pl. 72, figs. 1-5
1835 *Crepidula tomentosa* Quoy & Gaimard: p. 419
1841 *Trochus calyptraeformis;* Delessert: pl. 34, figs. 7a-c
1886 *Calyptraea (Sigapatella) calyptraeformis* (Lamarck) Tryon: p. 122, pl. 35, figs. 1-5
1886 *Trochita calyptraeformis* (Lamarck) Watson: p. 460, No. 1
1900a *Calyptraea calytraeformis* (sic); Pritchard & Gatliff: p. 199 (synonymy)
1916 *Sigapatella calyptraeformis* (Lamarck) Hedley: p. 189 (synonymy)
1921 *Sigapatella calyptraeformis;* May: p. 57
1923 *Sigapatella calyptraeformis;* May: pl. 26, fig. 17
1958 *Sigapatella calyptraeformis;* May revised Macpherson: pl. 26, fig. 17
1962 *Sigapatella calyptraeformis;* Macpherson & Gabriel: p. 130, fig. 155
1966 *Sigapatella calyptraeformis;* Macpherson: p. 217
1966 *Sigapatella calyptraeformis;* Hodgkin *et al.:* p. 35, pl. 12, fig. 5

Type material: Holotype MHNG, where it was seen on 5 March, 1952.

Type locality: Australia (coll. Péron); restricted to Maria Island, Tasmania, by Hedley (1913).

Material: Eight specimens GSWA F6891 (4434-FL7); F6985 (4534-FL2); WAM 66.452(5) (4333-FL1); 69.1186 (4534-FL3).

Description: Shell rather small, depressed, trochiform, spire eccentric with apex at about one-third from the margin; protoconch mammillate, elevated, circinately coiled, of about 1½ whorls, followed by 2 to 2½ adult whorls, rapidly increasing, flatly convex, smooth but for oblique, curved growth striae, suture imbricating abapically; aperture deep, septum deeply set, thin, concave. Colour of holotype cream-yellow.

Dimensions: Holotype diameter 19, height 7 mm; WAM 69.1186 diameter 20, height 14.4 mm, an unusually high example.

Distribution: Roe Calcarenite, present seas ("New South Wales to southwestern Australia on stones and dead shells" (Hodgkin *et al.*, 1966); Early Pleistocene, Holocene.

Subgenus **Zeacrypta** Finlay, 1927

Crepidula (Zeacrypta) immersa (Angas)

Plate 13, figs. 5, 6

1865a *Crypta immersa* Angas: p. 57, pl. 2, fig. 2
1886 *Crepidula immersa* (Angas) Watson: p. 460, No. 4
1900a *Crepidula immersa;* Pritchard & Gatliff: p. 201 (synonymy)
1916 *Crepidula immersa;* Hedley: p. 189 (synonymy)
1921 *Crepidula immersa;* May: p. 57
1923 *Crepidula immersa;* May: pl. 26, fig. 19
1957 *Crepidula (Zeacrypta) immersa;* Ludbrook: p. 52, pl. 4, figs. 9-11
1958 *Zeacrypta immersa* (Angas) May revised Macpherson: pl. 26, fig. 19
1962 *Zeacrypta immersa;* Macpherson & Gabriel: p. 131, fig. 156
1966 *Zeacrypta immersa;* Macpherson: p. 217
1966 *Zeacrypta immersa;* Hodgkin *et al.:* p. 35, pl. 12, fig. 6

Type material: Holotype BMNH from Port Lincoln, South Australia.

Material: GSSA M2585 (4434-FL7); WAM 70.16 (4434-FL6).

Distribution: Dry Creek Sands (where it is fairly common) Roe Calcarenite, present seas (New South Wales to southwestern Australia); Late Pliocene to Early Pleistocene, Holocene.

Family XENOPHORIDAE
Genus **Xenophora** Fischer von Waldheim, 1807

Xenophora neozelanica Suter

Plate 13, figs. 7-11

1908 *Xenophora neozelanica* Suter: p. 346, pl. 26, figs. 1, 2
1913 *Xenophora corrugata* Suter: p. 278 (not Reeve, 1842) (synonymy)
1915 *Xenophora corrugata;* Suter: pl. 15, fig. 13 (not Reeve)
1927a *Onustus neozelanica* (Suter) Finlay: p. 391

Type material: Two specimens from off Cuvier Island, depth 80 m, in the South Australian Museum, are close to being topotypes, the holotype having come from 58.5 m depth.

Material: Seven specimens WAM 69.490, 70.15; NMV P28428, P28429, P28430, P28431a, b, all from locality 4434-FL6; one specimen WAM 69.620 from locality 4434-FL8.

Description: Shell large, trochiform, with a high spire for the genus and broad whorls; protoconch broken in the fossils, adult whorls 5, rapidly increasing, moderately convex and subangulate at the middle of the whorls, periphery carinate; shells and other objects are attached above the periphery, subsequently cover the suture and are attached to the succeeding whorl, about 9 in one volution mostly broken off in the Roe Plains specimens but presumably covering the shell in life; shell surface without conspicuous sculpture. Base flatly convex with a slight depression under the periphery in juvenile specimens, sculptured with strongly curved growth striae and in some specimens with fine spiral lirae. Aperture subrhomboidal, produced towards the peripheral keel, basal lip nearly straight in the juvenile but concave in the adult, parietal callus thin, spreading over the umbilicus in the adult.

Dimensions:	diameter (D) mm	height (H) mm	ratio D:H
Two specimens (SAM) off Cuvier Island	68	45	1.51:1
	58	40	1.45:1
WAM 70.15	62	40	1.55:1
NMV P28428	54	38	1.42:1
NMV P28429	48	32	1.50:1
NMV P28430	62	40	1.55:1
NMV P28431	50	37	1.35:1

Remarks: The species is larger than the Tertiary *X. tatei* Harris, and the Pleistocene specimens are seldom sculptured. Whether this is due to erosion is not certain from the material available. It is possible that *X. peroniana* (Iredale) and *X. flindersi* (Cotton & Godfrey) are synonyms of *X. neozelanica;* a study of these species is being made by Dr. W. F. Ponder of the Australian Museum.

Distribution: Roe Calcarenite, present seas (New Zealand, ?Australia); Early Pleistocene, Holocene.

Superfamily STROMBACEA
Family STRUTHIOLARIIDAE
Genus **Tylospira** Harris, 1897

Tylospira pagodiformis n. sp.

Plate 13, figs. 12-15

Type material: Holotype WAM 70.1818 from locality 4534-FL1, Grid Reference EUCLA 618059, 31° 51′ 20″ S, 128° 06′ 30″ E, 76.6 km west of Eucla Motel, south side of highway, Roe Calcarenite, Early Pleistocene; figured paratypes WAM 69.489a, b (4534-FL1); unfigured paratypes WAM 69.1215 (4534-FL1).

Description: Shell of average size, gradate, with a fairly high spire, half the total height; protoconch broken at the tip in all available specimens but probably of 1½ or 2 rather flattened smooth whorls, adult whorls 6, grading from convex in the earliest whorls to nearly flat in the last whorl, sculptured where not calloused with fine spiral lirae about 6 on the first adult whorl increasing to about 12 on the penultimate, axial sculpture of sinuous growth striae and very faint obsolete nodules in the early whorls; suture deeply canaliculate. Callus thin, spreading over much of the last three whorls where it is preserved. Aperture broadly lenticular, outer lip thick, sinuous.

Dimensions: WAM 70.1818 height 46, diameter 30, aperture height 19, width 11 mm.

Remarks: Tylospira pagodiformis is intermediate in form between the Early Pliocene (Kalimnan) *T. coronata* (Tate) and the living *T. scutulata* (Gmelin). In shape and callosity it is close to *T. scutulata* from which it differs in the deeply excavate suture and almost complete absence of axial nodular sculpture. It differs from *T. coronata* in relative height, in the conspicuous gradate nature of all the whorls with the accompanying deep excavation of the suture throughout the spire, although this feature is present in worn specimens of *T. coronata* from the Bookpurnong Beds of the Murray Basin. The Late Pliocene *T. marwicki* has a relatively large whorl, a lower spire and whorls with oblique sides; it is scarcely gradate and the uncalloused whorls have nodular axial sculpture.

Distribution: Roe Calcarenite; Early Pleistocene.

Family ?STROMBIDAE
Genus ?**Strombus** Linnaeus, 1758

?**Strombus** sp.

Plate 13, fig. 16

Material: WAM 69.517 from locality 4434-FL6.

Remarks: The single specimen is a juvenile, possibly belonging to the subgenus *Canarium* Schumacher, 1817, of which the shells are small without the strongly flaring or winged outer lip. It appears to be related to *S. (C.) fragilis* (Roeding) from the Southwest Pacific and to *?Strombus* sp. of MacNeil (1960), from the Pliocene Chinen Sand, Okinawa.

Distribution: Roe Calcarenite; Early Pleistocene.

Superfamily CYPRAEACEA
Family TRIVIIDAE
Genus **Ellatrivia** Iredale, 1931

Ellatrivia merces (Iredale)

Plate 20, figs. 31, 32

1822b *Cypraea australis* Lamarck: p. 404 (not Schroeter, 1804)
1846 *Cypraea australis;* Reeve: pl. 24, fig. 138
1912 *Cypraea australis;* Verco: p. 215
1916 *Trivia australis* (Lamarck) Hedley: p. 200 (synonymy)
1921 *Trivia australis;* May: p. 67 (synonymy)
1923 *Trivia australis;* May: pl. 30, fig. 24
1924 *Triviella merces* Iredale: p. 257, pl. 35, figs. 16-17 (new name for *Cypraea australis* Lamarck, 1822 not Schroeter, 1804)
1931 *Ellatrivia merces* (Iredale) Iredale: p. 221
1932a *Ellatrivia merces;* Cotton & Godfrey: p. 44, pl. 1, fig. 13
1958 *Ellatrivia merces;* May revised Macpherson: pl. 30, fig. 24
1962 *Ellatrivia merces;* Macpherson & Gabriel: p. 145, fig. 172
1966 *Ellatrivia merces;* Hodgkin *et al.*: p. 51, pl. 20, fig. 10

Material: Two specimens, WAM 70.21 from locality 4434-FL6 and 70.1743 from locality 4434-FL3.

Distribution: Roe Calcarenite, present seas (New South Wales to Rottnest Island); Early Pleistocene, Holocene.

Family CYPRAEIDAE
Genus **Cypraea** Linnaeus, 1758
Subgenus **Zoila** Jousseaume, 1884

Cypraea (Zoila) sp.

Plate, 13, fig. 19

Material: Two specimens WAM 69.494 and 70.17 from locality 4434-FL6.

Remarks: Dr. B. R. Wilson of the Western Australian Museum has provided (18 June 1969) the following written comment on the species: "The shell (69.494) has been compared with a Recent series of *C. (Z.) venusta* Sowerby (= *episema* Iredale = *sorrentoensis* Schilder) from Western Australia. Differences noted are:

> in the fossil, the sides of the posterior channel do not project so far
> the columellar teeth are all present in the fossil and are stronger than in any known Recent shell. Recent shells only occasionally have the teeth complete
> the fossula goes deeper into the aperture, but the excavation is shallower than in the Recent shells".

Distribution: Roe Calcarenite; Early Pleistocene.

63616—(9)

Subgenus **Austrocypraea** Cossmann, 1903

Cypraea (Austrocypraea) reevei Sowerby

Plate 13, figs. 17, 18

1832 *Cypraea reevei* Sowerby: p. 3, No. 15, pl. 205, fig. 52
1916 *Cypraea reevei;* Hedley: p. 199
1932a *Luria reevei* (Sowerby) Cotton & Godfrey: p. 43, pl. 1, fig. 9
1957 *Austrocypraea reevei* (Sowerby) Allan: p. 35, pl. 2, figs. 21, 22
1970 *Austrocypraea reevei;* Burgess: p. 22, 330, pl. 37a, fig. D
1971 *Cypraea (Austrocypraea) reevei;* Wilson & Gillett: p. 43, 50

Material: Twenty-two specimens GSSA M1271(2), M2529(3), GSWA F7092, WAM 62.32(3), 65.685 (4334-FL1); 69.495, 69.496 (4434-FL6); 69.550 (4434-FL5); 69.575-7(3) (4434-FL4); 70.18(2) (4434-FL6); 70.1819 (4534-FL1); 71.320-1, 71.331a, b(2) (4434-FL6).

Description: Shell of medium size, globose-pyriform, thick, rather flattened posteriorly and abruptly narrowed anteriorly, spire usually visible, depressed or slightly elevated, of 2 whorls; last whorl either smooth or tessellated by faint spiral and radial ridges. Base convex, aperture slightly sinuate, moderately wide, anterior canal deep, bordered on the left by a strong terminal ridge; columellar teeth 15 to 17, usually 17, labial teeth 21 to 26, usually 23; fossula short, dying out between the fourth and ninth inner denticles, posterior to which the teeth are continuous over the columellar groove; posterior canal short, curved, posterior columellar callus thick, narrow, and elevated. Dimensions WAM 71.331a length (anterior-posterior 28, width (left to right) 21, height (base-dorsum) 18 mm. A large thick-shelled specimen WAM 69.495 has 21 columellar teeth and 31 labial teeth, 9 inner denticles; dimensions length 38, width 27, height 22 mm; the posterior canal is more sharply defined and the columellar callus is elevated to the level of the outer lip, the surface is very faintly tessellated, but the punctuations seem to be smaller and more quadrate than those of more typical *C. (A.) reevei.*

Remarks: Burgess (1970, p. 22) remarks that *A. reevei* is difficult to relate to other living species, reiterating the observation made by McCoy (1874, p. 38) in describing *Cypraea contusa,* the type species of *Austrocypraea* Cossmann. *A. reevei* has never been fully described. Although never numerous, it is not uncommon in the Roe Calcarenite where the shells are thicker than those of living specimens. Its present distribution possibly represents a survival from the Tertiary of southern Australia since its nearest relative appears to be *Cypraea (Austrocypraea) contusa* McCoy, described from the Middle Miocene of Mornington, Port Phillip Bay.

Distribution: Roe Calcarenite, present seas ("South Australia (rare) to Abrolhos" (Hodgkin *et al.,* 1966)); Early Pleistocene, Holocene.

Subgenus **Notocypraea** Schilder, 1929

Cypraea (Notocypraea) piperita Gray

Plate 11, figs. 11, 12

1825a *Cypraea piperita* Gray: p. 498
1900a *Cypraea angusta* var. *piperita;* Pritchard & Gatliff: p. 183 (synonymy)
1927 *Notocypraea piperita* (Gray) Schilder: p. 110
1932 *Notocypraea piperita;* Cotton & Godfrey: p. 41, pl. 1, fig. 7
1962 *Notocypraea piperita;* Macpherson & Gabriel: p. 142, fig. 170
1970 *Cypraea piperita;* Burgess: p. 313, pl. 34a, figs. C-F (synonymy)
1971 *Cypraea (Notocypraea) piperita;* Wilson & Gillett: p. 43, pls. 37, 38, figs. 13, 13a, b

Material: Twenty-three specimens GSSA M3243 (4334-FL1); GSWA F7017 (4434-FL7); WAM 66.626 (4334-FL1); 69.497 (4434-FL6); 69.551, 69.552 (4434-FL5); 69.578 (4434-FL4); 69.597, 69.598 (4534-FL2); 69.643, 69.644 (4334-FL5); 69.657(2) (4434-FL8); 69.674(3), 69.675 (4534-FL2); 70.19(2), 70.20(3) (4434-FL6).

Description: Shell small, solid, narrowly to subglobose pyriform, smooth, polished, spire depressed, usually covered by callus, last whorl smooth, polished, dorsum fairly high. Base convex, outer lip thickened by callus which is reflected on to the dorsum in a thick arched dorsal band, continuing dorsally over the posterior canal and spire to the posterior columellar callus; aperture rather narrow, curved, anterior canal short, fairly wide, only slightly curved, bordered on the left by a terminal ridge, posterior canal short, broad, slightly curved; columellar teeth 17-24 (average adult 23) labial teeth 19-30 (average adult 26) fossula long and narrow, broader anteriorly but linear over the posterior two-thirds, scarcely interrupting the columellar teeth which continue over the fossula.

Dimensions: Average specimen WAM 69.657a length (anterior-posterior) 22, width (left to right) 14, height (base-dorsum) 12 mm.

Distribution: Roe Calcarenite, present seas (Victoria to Cape Naturaliste, Western Australia, under stones (Hodgkin *et al.,* 1966)); Early Pleistocene, Holocene.

Superfamily NATICACEA
Family NATICIDAE
Subfamily POLINICINAE
Genus **Polinices** Montfort, 1810
Subgenus **Conuber** Finlay & Marwick, 1937

Polinices (Conuber) conicus (Lamarck)

Plate 14, figs. 1, 2

1822a *Natica conica* Lamarck: p. 198
1900a *Natica conica;* Pritchard & Gatliff: p. 193 (synonymy)
1916 *Polinices conicus* (Lamarck) Hedley: p. 197 (synonymy)
1921 *Polinices conicus;* May: p. 66 (synonymy)
1923 *Polinices conicus;* May: pl. 30, fig. 11

1937 *Polinices (Conuber) conicus;* Finlay & Marwick: p. 53
1958 *Polinices conicus;* May revised Macpherson: pl. 30, fig. 11
1962 *Polinices conicus;* Macpherson & Gabriel: p. 134, fig. 158
1962 *Conuber conica* (Lamarck) Iredale & McMichael: p. 57
1966 *Conuber conicum;* Hodgkin *et al.:* p. 31, pl. 10, fig. 13
1966 *Conuber conicum;* Macpherson: p. 218

Type material: Syntypes MHNG, Lamarck Collection No. 7, seen on 5 March, 1952; 2 specimens the larger figured by Delessert (1841) and by Mermod (1953, fig. 183).

Type locality: "Australia", limited by Tryon (1886) to South Australia.

Material: One hundred and twenty specimens GSSA M1297(3) (4133-FL6); M1298 (4234-FL1); M1299(5) (4133-FL6); M2547(4) (4334-FL1); M2586 (4434-FL7); GSWA F6881(84) (4334-FL2); F6924 (4133-FL7); F6952(14) (4534-FL2); F7077(2) (4334-FL1); WAM 61.48(2) (4334-FL6); 65.751, 66.613, 66.614 (4334-FL1).

Description: Shell moderately large, solid, ovate-conical, with a high spire about 3/8 height of shell, protoconch small, helicoid, of $2\frac{1}{2}$ whorls with a minute nucleus, adult whorls 4, rapidly increasing, convex; suture flatly imbricating adapically, sculpture of slightly sinuous growth striae which recurve just below the suture in the last whorl, and very faint microscopic spiral striae. Aperture ovate, parietal callus thick, terminating more or less abruptly at about $\frac{1}{2}$ the length of the columellar lip leaving exposed the lower part of the umbilicus and sometimes part of a narrow funicle. In life cream-coloured, shining, with an adapical band of fawn and yellow, brownish-fawn on the callus and around the umbilicus.

Dimensions: Larger syntype height 42, diameter 27, height of aperture 26 mm. GSWA F6881(1) height 41, diameter 31.6, height of base 28 mm.

Distribution: Dry Creek Sands, Roe Calcarenite, Glanville Formation, Peppermint Grove Limestone, present seas (Australian coast generally); Late Pliocene to Holocene.

Polinices (Conuber) cunninghamensis (Harris)

Plate 14, figs. 3, 4

1893 *Natica varians* Tate: p. 322, pl. 6, figs. 2, 9 (not Dujardin 1837)
1897 *Natica cunninghamensis* Harris: p. 257, new name for *Natica varians* Tate not Dujardin
1958 *Polinices (Conuber) cunninghamensis* (Harris) Ludbrook: p. 47, pl. 1, figs. 5, 6

Type Material: Syntypes SAM Tate Coll. T1504a, b (figured); T1504c-d; from Muddy Creek, Hamilton, Victoria, Grange Burn Coquina, Kalimnan; Early Pliocene.

Material: Two specimens GSWA F7185 (4434-FL7) and WAM 69.630 (4434-FL13).

Description: Shell moderately large, solid, subovate, with a low sharp conical spire and a large enveloping last whorl. Protoconch of 3 helicoid whorls with a minute nucleus nearly always broken off, adult whorls 2½, smooth but for oblique growth striae, slightly sinuous near the adapical suture, and microscopic, faint rather irregular spiral striae. Aperture oblique, ovate, parietal callus thick, terminating abruptly about the middle of the columellar lip exposing the umbilicus and funicle and continuing over the lower part of the columellar lip; funicle usually broad and low or abruptly terminated on the adapical side, grooved on the abapical or columellar side.

Dimensions: Syntypes SAM T1504b, figured Tate (1893, pl. 6, fig. 2), height 40, diameter 32 mm; T1504a, (pl. 6, fig. 9), height 41.5, diameter 36 mm; WAM 69.630 height 29, diameter 26 mm.

Distribution: Grange Burn Coquina, Jemmys Point Formation, Dry Creek Sands, Roe Calcarenite; Early Pliocene to Early Pleistocene.

Genus **Sigaretotrema** Sacco, 1890

Sigaretotrema albosutura (Verco)

Plate 14, figs. 5, 6

1909c *Eunaticina albosutura* Verco: p. 334, pl. 20, figs. 10, 11
1913b *Propesinum albosutura* (Verco) Cotton & Godfrey: p. 21, pl. 2, fig. 13

Type material: Holotype SAM D13472 from Thorny Passage, SE Eyre Peninsula, 45 m.

Material: Eight specimens GSWA F7011(3) (4434-FL7); WAM 61.46(2) (4334-FL6); 66.454 (4333-FL1); 69.493 (4434-FL6); 69.629 (4434-FL13).

Distribution: Roe Calcarenite, present seas (Gulf St. Vincent and Spencer Gulf); Early Pleistocene, Holocene.

Sigaretotrema umbilicatum (Quoy & Gaimard)

Plate 14, fig. 7

1832 *Natica umbilicata* Quoy & Gaimard: vol. 2, p. 234
1833 *Natica umbilicata* Quoy & Gaimard: pl. 66, fig. 22-23
1900a *Eunaticina umbilicata* (Quoy & Gaimard) Pritchard & Gatliff: p. 195 (synonymy)
1921 *Sinum umbilicatum* (Quoy & Gaimard) May: p. 66 (synonymy)
1923 *Sinum umbilicatum;* May: pl. 30, fig. 14
1924 *Propesinum umbilicatum* (Quoy & Gaimard) Iredale: p. 256
1958 *Sigaretotrema umbilicatum* (Quoy & Gaimard) May revised Macpherson: pl. 30, fig. 14
1962 *Sigaretotrema umbilicatum;* Macpherson & Gabriel: p. 137, fig. 163
1966 *Sigaretotrema umbilicatum;* Macpherson: p. 218
1966 *Sigaretotrema umbilicatum;* Hodgkin *et al.:* p. 31, pl. 10, fig. 5

Material: Seventeen specimens GSWA F6953(4) (4534-FL2); WAM 66.453(9), 66.555(3) (4333-FL1); 70.1820 (4534-FL1).

Description: Shell of moderate size, thin, globose-ovate, with a very short small spire and large enveloping last whorl. Protoconch of 2 helicoid whorls, adult whorls 1½ to 2, smooth but for oblique growth striae crossed by microscopic undulating spiral striae. Aperture suboval, columella straight, umbilicus wide and open, parietal callus thin, weakly reflected over the upper part of the columellar lip. In life the shell is cream-coloured, blotched with 3 spiral rows of brown axial streaks.

Dimensions: WAM 70.1820 height 19, diameter 17.5 mm.

Distribution: Roe Calcarenite, present seas (New South Wales to Fremantle, Western Australia (Hodgkin *et al.,* 1966); Early Pleistocene, Holocene.

Subfamily SININAE
Genus **Sinum** Roeding, 1798
Subgenus **Ectosinum** Iredale, 1931

Sinum (Ectosinum) zonale (Quoy & Gaimard)

Plate 14, fig. 10

1833 *Cryptostoma zonale* Quoy & Gaimard: pl. 66, figs. 1-3
1834 *Cryptostoma zonale* Quoy & Gaimard: vol. 3, pl. 221
1900a *Sigaretus zonalis* (Quoy & Gaimard) Pritchard & Gatliff: p. 195 (synonymy)
1921 *Sinum zonale* (Quoy & Gaimard) May: p. 66
1923 *Sinum zonale* (Quoy & Gaimard) May: pl. 30, fig. 15
1931 *Sinum zonale;* Cotton & Godfrey: p. 21, pl. 2, fig. 12
1958 *Ectosinum zonale* (Quoy & Gaimard) May revised Macpherson: pl. 30, fig. 15
1962 *Ectosinum zonale;* Macpherson & Gabriel: p. 137, fig. 164
1962 *Ectosinum zonale;* Iredale & McMichael: p. 58 (synonymy)
1966 *Ectosinum zonale;* Macpherson: p. 219
1966 *Ectosinum zonale;* Hodgkin *et al.:* p. 30
1971 *Ectosinum zonale;* Wilson & Gillett: p. 64, pl. 45, figs. 14, 14a

Material: Two specimens WAM 69.549 (4434-FL5); 69.656 (4434-FL8).

Description: Shell of moderate size, ear-shaped, with a small depressed spire, flat protoconch and large enveloping last whorl; whorls two in all, smooth but for arcuate growth striae which are wrinkled below the adapically imbricating suture, finely crossed by microscopic irregular spiral wrinkles. Aperture large, oval, parietal wall lightly calloused.

Dimensions: WAM 69.656 greatest diameter 26, height 12 mm.

Distribution: Roe Calcarenite, present seas (New South Wales to Rottnest Island, Western Australia); Early Pleistocene, Holocene.

Subfamily NATICINAE
Genus **Natica** Scopoli, 1777

Natica sp.

Plate 14, figs. 11, 12

Material: A single specimen WAM 72.25 from locality 4434-FL4.

Description: Shell large, thick, solid, subovate, with a low spire and large enveloping last whorl; protoconch moderately high, of 1½ whorls, adult whorls 3, smooth but for growth striae. Aperture oblique, ovate, outer lip rounded, columellar lip straight, parietal callus thick, covering the funicle and part of the umbilicus, funicle low and weak, umbilicus fairly wide and deep, finely radially wrinkled within.

Dimensions: height 59, diameter 48 mm.

Remarks: This very large *Natica* appears to be related to *N. vitella* Linnaeus, but it is less globose and an altogether larger and heavier shell.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Tanea** Marwick, 1931

Tanea sagittata (Menke)

Plate 14, fig. 8

1843 *Natica sagittata* Menke: p. 103
1900a *Natica sagittata*; Pritchard & Gatliff: p. 193 (synonymy)
1931b *Natica sagittata;* Cotton & Godfrey: p. 19
1962 *Tanea sagittata* (Menke) Macpherson & Gabriel: p. 138
1966 *Tanea sagittata;* Hodgkin *et al.:* p. 30, pl. 10, fig. 6
1971 *Notocochlis sagittata* (Menke) Wilson & Gillett: p. 64, pl. 45, figs. 12, 12a

Material: Forty-four specimens GSWA F7161 (4534-FL2); F7162(3) (4434-FL7; WAM 66.456(33), 66.554(6) (4333-FL1); 69.491 (4434-FL6).

Description: Shell small, rather thin, subglobose, with a low spire and large last whorl; protoconch of two flattish broad whorls, adult whorls 2½, smooth but for sinuous growth striae which tend to be slightly furrowed and wrinkled below the suture, suture imbricating. Aperture slightly oblique, subovate, parietal callus rather narrow and spreading thinly over the columellar lip, deeply notched above the funicle over which it continues to the basal lip, funicle thick, broad, set close to the columella and having a deep posterior umbilical channel above. Operculum calcareous, with 2 marginal grooves not seen in the fossil. In life the shell is cream coloured, faintly streaked with sagittate axial pinkish-brown colour markings.

Dimensions: WAM 69.491 diameter 14, height 13 mm.

Distribution: Roe Calcarenite, present seas ("Victoria to Rottnest, Western Australia" (Hodgkin *et al.,* 1966)); Early Pleistocene, Holocene.

Genus **Notocochlis** Powell, 1933

Notocochlis gualteriana (Récluz)

Plate 14, fig. 9

1843 *Natica gualteriana* Récluz: p. 208
1850 *Natica gualteriana* Récluz: p. 396
1913 *Natica gualteriana;* Hedley: p. 298
1966 *Natica gualteriana;* Hodgkin *et al.:* p. 30, pl. 10, fig. 7

Type material: The species was described from material in the Cuming Collection from Jagna, Bohol Islands and Sual, Luzon Island, Philippines, but it was not seen by Ludbrook in the British Museum (Natural History) in 1972.

There are 2 specimens No. 2156B. Waddington Coll. from Zanzibar and 26 from Dar-es-Salaam, 1933.1.5.246-265 in the BMNH.

Material: Nine specimens GSWA F7071(2), F7088 (4334-FL1); F7175 (4534-FL2); WAM 66.455(4) (4333-FL1); 69.492 (4434-FL6).

Description: Shell small, rather thin but solid, subglobose, with a low spire; protoconch of 2 small flattish whorls and 2½ to 3 adult whorls, convex, axially sculptured with the fine growth striae, axially wrinkled and furrowed below the suture; suture imbricating. Aperture slightly oblique, outer lip rounded, columellar lip straight, parietal callus fairly thick, spreading narowly over the whorl, notched above the funicle and continuing over the funicle to the basal lip; funicle large and heavy, with a deep posterior channel above; operculum calcareous with a single marginal groove. In life cream, finely spotted spirally with light brown.

Dimensions: WAM 69.492 diameter 14, height 13 mm.

Remarks: In the absence of the operculum, *N. gualteriana* is distinguished from *Tanea sagittata* by its thicker shell, and axial furrows beneath the suture. The colour pattern and single opercular furrow chiefly distinguish the living specimens.

Distribution: Roe Calcarenite, present seas (there are specimens in the South Australian Museum from Cape York, Caloundra and Moreton Bay in Queensland, and from Balmoral and Long Bay in New South Wales. The distribution in Western Australia is given as Albany to Abrolhos (Hodgkin *et al.,* 1966)); Philippines, East Africa; Early Pleistocene, Holocene.

Superfamily TONNACEA
Family CASSIDAE
Genus **Cassis** Scopoli, 1777
Subgenus **Hypocassis** Iredale, 1927

Cassis (Hypocassis) fimbriata Quoy & Gaimard

Plate 14, figs. 13-15

1833 *Cassis fimbriata* Quoy & Gaimard: pl. 43, figs. 7, 8
1835 *Cassis fimbriata* Quoy & Gaimard: p. 596

1968 *Cassis (Hypocassis) fimbriata;* Abbott: p. 61, pl. 4, figs. 1-4, pl. 37 (synonymy)
1971 *Cassis (Hypocassis) fimbriata;* Wilson & Gillett: p. 68, pl. 48, figs. 1, 1a, 1b

Type material: Abbott (1968, p. 63) was unable to locate the holotypes of either *Cassis fimbriata* Quoy and Gaimard or its synonym *C. bicarinata* Jonas.

Material: Fifteen specimens GSSA M1269, M2567(9) (4334-FL1); GSWA F6978 (4534-FL2); F7066 (4334-FL1); WAM 66.457 (4333-FL1); 69.600, 69.677 (4534-FL2).

Distribution: Dry Creek Sands, Roe Calcarenite, present seas (Flindersian Province from western Victoria to Houtman Abrolhos, Western Australia); Late Pliocene to Early Pleistocene, Holocene.

Genus **Phalium** Link, 1807
Subgenus **Semicassis** Moerch, 1852

Phalium (Semicassis) adcocki (Sowerby)

Plate 15, figs. 3-6

1896 *Cassis adcocki* Sowerby: p. 14, text fig.
1968 *Phalium (Semicassis) adcocki* (Sowerby) Abbott: p. 147, pl. 134 (synonymy)

Type Material: The holotype, from Yankalilla Bay, was not located by Abbott; his hypotype AMNH 87744 is a beach-worn specimen.

Material: Five specimens WAM 69.502, 70.22, 71.322(2), 71.332 (4434-FL6).

Description: Shell small, solid, subovate with a fairly high conical spire, one-third the total height of the shell; protoconch of 2 smooth whorls, flattened at the tip, adult whorls 3, the spire whorls lirate, crossed by axial riblets and weakly tuberculated at the intersections, all surmounted by microscopic axial striae; a slightly excavated shoulder in the upper third of the whorls with one or two adapical lirae above and from 4 to 6 abapical lirae below; last whorl with from 17 to 25 axial plicae, 20 spiral threads below the shoulder all crossed by microscopic axial striae. Aperture narrow, ear-shaped, outer lip with a heavy varix, more or less denticulate or wrinkled within, it may be denticulate over its whole length, have a few denticles posteriorly or anteriorly, or be smooth; former varices absent; the columellar shield is thick and wrinkled, the left edge partially or wholly covering the umbilicus, parietal shield thin; siphonal canal deep, short and upturned, bounded by a narrow gutter.

Dimensions: Normal-sized specimen WAM 69.502 height 33, diameter 21 mm.

Distribution: Roe Calcarenite, present seas (Flindersian Province, Victoria to southwestern Australia, rare); Early Pleistocene, Holocene.

Phalium (Semicassis) semigranosum (Lamarck)

Plate 15, figs. 1, 2

1822b *Cassis semigranosa* Lamarck: p. 228, no. 3
1968 *Phalium (Semicassis) semigranosum* (Lamarck) Abbott: p. 145, pl. 8, figs. 1, 2, pls. 130-131 (synonymy)

Type material: The holotype is in the Lamarck Collection MNHG according to Abbott who restricted the type locality to Hobart, Tasmania.

Material: A single specimen WAM 69.599 (4534-FL2).

Distribution: Dry Creek Sands, Roe Calcarenite, present seas (southern Australia from Tasmania to Bunbury, Western Australia); Late Pliocene to Early Pleistocene, Holocene.

Family CYMATIIDAE
Subfamily CYMATIINAE
Genus **Cymatiella** Iredale, 1924

Cymatiella gaimardi Iredale

Plate 15, figs. 7, 8

1929a *Cymatiella gaimardi* Iredale: p. 176, pl. 40, fig. 7
1931b *Cymatiella gaimardi;* Cotton & Godfrey: p. 12
1962 *Cymatiella gaimardi;* Macpherson & Gabriel: p. 156, fig. 188

Material: A single specimen GSSA M1295 (4133-FL6).

Description: Shell rather small, protoconch smooth, broken, probably of 2 whorls, adult whorls 6, with a varix about every ¾ of a whorl, sculptured with 10 axial ribs between each varix crossed and tuberculated by 3 primary spiral cords on each whorl, 10 on the last whorl and base, and one or more fine spiral lirae between each pair of cords. Aperture subovate, outer lip thin, varicate behind, columella almost straight, columellar lip thin, narrow, with 3 denticles anteriorly, siphonal canal short, recurved.

Dimensions: Height 19, diameter 9.5 mm.

Distribution: Roe Calcarenite, Glanville Formation, present seas (Victoria, South Australia and southwestern Australia); Early Pleistocene to Holocene.

Cymatiella sexcostata (Tate)

Plate 15, figs. 9, 10

1887f *Triton sexcostatus* Tate: p .127, pl. 6, fig. 9

Type material: Holotype and paratypes SAM Tate Coll. T514 A-D from Hallett Cove Sandstone, Blanche Point, Aldinga Bay, South Australia; Late Pliocene.

Material: Four specimens WAM 69.501(2) (4434-FL6); 69.676(2) (4534-FL2).

Description: Shell of moderate size, turriculate, with a protoconch of 2 high smooth whorls, adult whorls 6, early whorls with 11 to 12 axial costae crossed and tuberculated by 4 primary spiral threads, varices developing on the third whorl, and secondary spiral threads between the primaries, the two primaries below the periphery stronger than the others, later whorls with a varix every ¾ of a whorl

with 6 costae between each pair; suture irregular, imbricating abapically. Aperture ovate, outer lip formed in front of the thick cord-like varix with 6 coarse denticles within, columella concave, columellar lip with 3 tubercles anteriorly.

Dimensions: WAM 69.676a height 18, diameter 7.6 mm.

Remarks: The species is closest to the living *C. columnaria* Hedley and May which has a larger protoconch, 8 intervariceal costae and is sculptured with fine microscopic axial striae and spiral lirae. The differences between *C. sexcostata* and *C. adelaidensis* Ludbrook were discussed by Ludbrook (1941, p. 95).

Distribution: Hallett Cove Sandstone, Roe Calcarenite; Late Pliocene to Early Pleistocene.

?Cymatiella sp.

Plate 15, figs. 11, 12

Material: Two specimens GSWA F6934 (4133-FL7) and WAM 69.545 (4434-FL5), the identity of which is uncertain.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Negyrina** Iredale, 1929

Negyrina antecedens n. sp.

Plate 15, fig. 13, 14

Type material: Holotype WAM 70.23 from locality 4434-FL6, Hampton Microwave Repeater Tower, grid reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E, 53 km east of Madura; Roe Calcarenite, Early Pleistocene; 9 paratypes GSWA F7018 (4434-FL7); WAM 66.615 (4334-FL1); 69.499, 69.500, 69.553(3), 70.23, 71.323(2) (4434-FL6).

Description: Shell small, fusiform, solid, thick, spire high, half height of shell, protoconch of 1½ rather gradate whorls with flat sides and immersed tip, adult whorls 5, convex, with a strong cord-like varix, deeply channeled in front, every 240°, beginning at the third or fourth whorl; suture irregular, imbricating; whorls sculptured with about 5 primary nodular spiral ribs with finer secondaries between them, and about 25 primaries on the last whorl from the adapical suture to the siphonal canal, secondaries developed on the whorl and base but to a lesser extent on the neck; on the shoulder a row of about 6 prominent nodules between each varix. Aperture elongate-ovate, outer lip forming in front of the high cord-like varix, rather thin and only slightly reflected, denticulate within; columellar lip thin and narrow, wrinkled as it is reflected over the base and not covering the pseudumbilicus; a small weak parietal ridge and slight adapical channel, pseudumbilicus and short, curved, reflected siphonal canal.

Dimensions:	height (mm)	diameter (mm)
holotype WAM 70.23	31	16
paratype WAM 69.553a	34	18
paratype WAM 71.323	32	17

Remarks: The shell is about half the size and proportionately narrower than *N. subdistorta* (Lamarck), the aperture is relatively more elongate, the outer lip is narrower and not reflected in front of the varix, the columellar lip is thin and narrow as compared with that of *N. subdistorta*, and the number of inter-variceal spiral nodules significantly less, and in one row only. From *N. delecta* Cotton it differs also in size and sculpture. The specific name *antecedens* is given because the species seems to be the earliest known *Negyrina* in Australia.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Argobuccinum** Herrmannsen, 1846

Argobuccinum bassi (Angas)

Plate 15, figs. 15, 16

1869 *Triton bassi* Angas: p. 45, pl. 2, fig. 2
1898 *Lotorium bassi* (Angas) Pritchard & Gatliff: p. 263 (synonymy)
1921 *Argobuccineum* (sic) *bassi* (Angas) May: p. 65
1923 *Argobuccineum* (sic) *bassi* May: pl. 29, fig. 28
1931 *Gondwanula bassi* (Angas) Cotton & Godfrey: p. 11
1958 *Argobuccinium* (sic) *bassi;* May revised Macpherson pl. 29, fig. 28
1961 *Gondwanula bassi;* Iredale & McMichael: p. 55
1962 *Argobuccinum bassi;* Macpherson & Gabriel: p. 153, fig. 183

Type Material: In BMNH from Corner Inlet, Victoria.

Material: A single specimen, WAM 70.42 (4434-FL11), height 31, diameter 14 mm.

Remarks: The species appears to be uncommon always.

Distribution: Dry Creek Sands, Roe Calcarenite, present seas (New South Wales, Victoria, Tasmania and South Australia); Late Pliocene to Early Pleistocene, Holocene.

Order	NEOGASTROPODA
Suborder	RACHIGLOSSA
Superfamily	MURICACEA
Family	MURICIDAE
Subfamily	MURICINAE
Genus	**Chicoreus** Montfort, 1810
Subgenus	**Chicoreus** *s.s.*

Chicoreus (Chicoreus) lundeliusae n. sp.

Plate 16, figs. 1-8

Type material: Holotype WAM 70.1137 from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E, Roe Calcarenite, Early Pleistocene; figured paratypes WAM 69.504 (4434-FL6), 70.1144 (4534-FL2), GSWA F6884 (4334-FL2); unfigured paratypes GSSA M1289, M2530 (4334-FL1), GSWA F6885 (4434-FL2), F6961 (4534-FL2), WAM 69.503 (4434-FL6), 69.631, 69.632 (4434-FL13), 70.1138 (4434-FL6), 70.1821 (4534-FL1), 71.333(2) (4434-FL6).

Description: Shell large, fusiform, with a protoconch of probably 2 smooth whorls, followed by 6 convex adult whorls, suture deeply incised; early whorls more or less cancellate with about 11 rather irregular axial folds crossed by spiral threads, on the fourth adult whorl every third or fourth node begins to increase in size to form a varix, three strong obliquely continuous varices per whorl being developed; the intermediate folds continue as intervariceal folds or swellings, one or two between each pair of varices; on the fifth whorl the varices develop high recurved and upturned hollow spines which are most strongly developed on the long siphonal canal where there may be as many as five in the adult; the spine on the shoulder is usually the strongest of those on the whorl. The spiral sculpture consists of microscopically squamose spiral threads, at first about 4 but increasing in number and covering the whorls and base with the exception of a constricted band immediately below the suture; on the later whorls the spiral threads are bunched together in groups of five with a primary in the middle and secondaries on either side, each group extending on to and forming the spines on the varices; between the groups are small threads which crenulate the outer lip; surface between the threads deeply incised; the vertical, spines open and foliaceous. Aperture roundly ovate, outer lip formed in advance of the varix and deeply and sharply crenulated; parietal lip smooth and separated from the outer lip by a small adapical channel; columellar lip separated from the columella anteriorly and folding over into a lamellar extension almost covering the siphonal canal; former canals divergent.

Dimensions:	height (mm)	diameter (mm)
WAM 70.1137	84	47
69.504	74	40
GSWA F6884	106	c.56
F6885	100 (est.)	54
WAM 69.631	41	21
69.632	53	38
70.1821	48	29
GSSA M1289	79	44

Remarks: The species is close to *C. ramosus* (Linnaeus), from which it is distinguished by its higher spire, more indented suture and by the closing of all the spines behind the continuous but sharply crenulated outer lip; the spines are not ramose but strongly reflexed and upturned, even in the juvenile (pl. 16, figs. 2, 5); the spiral sculpture is more deeply incised and the spiral threads

are all beset with fine scales. It differs from *C. (C.) denudatus* (Perry) in that the intervariceal sculpture is of relatively sharp axial folds whereas in *C. (C.) denudatus* it consists of one or two nodular swellings. The varices are not frondose as in *denudatus* and the outer lip is crenulated but not denticulate as it is in *denudatus*. Young specimens show a striking resemblance to *C. lepidotus dujardinoides* (Vokes).

The species is named in honour of Mrs. Judith Lundelius of Texas, U.S.A., who made the first substantial collection of molluscs from the Roe Calcarenite.

Distribution: Roe Calcarenite, Early Pleistocene.

Genus **Pterynotus** Swainson, 1833
Subgenus **Pterynotus** *s.s.*

Pterynotus (Pterynotus) triformis (Reeve)

Plate 15, figs. 17, 18

1845a *Murex triformis* Reeve: p. 87
1845b *Murex triformis* Reeve: pl. 13, fig. 53
1895 *Murex triformis;* Verco: p. 95
1898 *Murex (Pteronotus) triformis,* Pritchard & Gatliff: p. 251 (synonymy)
1916 *Murex triformis;* Hedley: p. 213
1921 *Murex triformis;* May: p.85 (synonymy)
1923 *Murex triformis;* May: pl. 39, fig. 21
1932c *Pteronotus triformis* (Reeve) Cotton & Godfrey: p. 129, pl. 1, fig. 3
1958 *Pterynotus triformis* (Reeve) May revised Macpherson: pl. 39, fig. 21
1962 *Pterynotus triformis;* Macpherson & Gabriel: p. 170, 171, fig. 204
1966 *Pterynotus triformis;* Macpherson: p. 220

Material: Two specimens GSSA M1290 (4333-FL2); WAM 70.24 (4434-FL6).

Description: Shell triangular-fusiform, protoconch of 1½ high smooth turns, terminated by a varix, adult whorls 6, convex, suture imbricating adapically, whorls convex, somewhat concave above the shoulder, with three wing-like varices, erect, foliated underneath, spinose at the periphery, forming oblique laminae across the spire and last whorl; between the varices usually two, but the number is variable, intervariceal nodules; spiral sculpture of about 12 ribs on the spire whorls, about 36 of varying intensity on the last whorl, base and pillar; ribs and interspaces crossed by fine axial scales. Aperture elongate-oval, outer lip folded into the peripheral spine, crenulate in advance of the varix, the crenulations corresponding to the primary spiral ribs; columellar lip smooth, fairly thick, anteriorly folding over and nearly covering the siphonal canal; siphonal canal fairly long, slightly recurved abapically.

Dimensions: Average specimen height 60, diameter 30 mm.

Distribution: Roe Calcarenite, Glanville Formation, present seas (Victoria, Tasmania, South Australia and southwestern Australia, depth 9 to 70 m); Early Pleistocene to Holocene.

Genus **Murex** Linnaeus, 1758
Subgenus **Haustellum** Schumacher, 1817

Murex (Haustellum?) darraghi n. sp.
Plate 15, figs. 19, 20

Type material: Holotype WAM 70.25 from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E, Roe Calcarenite, Early Pleistocene; 3 paratypes WAM 70.26, NMV F28842(2) (4434-FL6).

Description: Shell of moderate size for the genus, fairly stoutly fusiform. Protoconch small, smooth, conical, of probably 2½ high whorls, adult whorls 5, convex, sculptured with about 15 well-developed axial ribs on the early whorls, every fifth of which on the later whorls develops into a varix, 3 per whorl, without spines but folded over and elevated into a strong cord excavate behind; between each varix 4 axial ribs extending over the last whorl to the base; spiral sculpture of from 4 to 6 strong threads on each whorl, about 15 on the last whorl and 15 on the neck, with occasional fine secondary threads; suture deep, impressed. Aperture oval, set at an angle of 20° to the axis; outer lip formed in advance of the varix, crenulated with about 14 lirations within and a slight posterior notch; columellar lip thin, separating from the columella anteriorly and folding over and almost covering the siphonal canal; siphonal canal long, nearly straight.

Dimensions:	canal (mm) height including	(mm) diameter
WAM 70.25	48	22
WAM 70.26	35	20
NMV P28842	39	20

Remarks: This species is related to a species-group of *Murex* described from the Western Atlantic Tertiary by Vokes (1963), to *Murex saplisi* MacNeil, 1960, *Haustellum wilsoni* D'Attilio & Old, 1971, *Murex multiplicatus* Sowerby, 1895, and *Murex tweedianus* Macpherson, 1962, placed by Wilson & Gillett (1971) in *Haustellum*. The question of the diagnostic importance of the posterior notch in the aperture of *Haustellum* is as yet unresolved, and until the radular and opercular characters of *H. wilsoni* are known, the generic placement of the species is uncertain. The species is named in recognition of the contributions made by Mr. T. A. Darragh of the National Museum of Victoria to the systematics of Australian Tertiary Mollusca.

Distribution: Roe Calcarenite; Early Pleistocene.

?**Murex** sp.
Plate 15, fig. 21

Material: A single, apparently distorted specimen WAM 69.498 from Hampton Microwave Repeater Tower site, the affinities of which have not yet been established.

Distribution: Roe Calcarenite; Early Pleistocene.

Subfamily TYPHINAE
Genus **Typhis** Montfort, 1810
Subgenus **Typhina** Jousseaume, 1880

Typhis (Typhina) yatesi Crosse & Fischer

Plate 15, figs. 22, 23

1865 *Typhis yatesi* Crosse & Fischer: p. 54, pl. 2, fig. 3
1895 *Typhis yatesi;* Verco: p. 97, pl. 2, fig. 6
1898 *Typhis yatesi;* Pritchard & Gatliff: p. 256 (synonymy)
1932c *Typhis yatesi;* Cotton & Godfrey: p. 133, pl. 1, fig. 6
1944 *Typhis (Typhinella) yatesi;* Keen: p. 56, 68
1961 *Typhina (Typhina) yatesi* (Crosse & Fischer) Vella: p. 387, pl. 47, fig. 16; text fig. 4(5)
1962 *Typhis yatesi;* Macpherson & Gabriel: p. 173, fig. 208
1964 *Typhis (Typhina) yatesi;* Keen & Campbell: p. 47

Material: A single specimen WAM 69.602 from locality 4534-FL2.

Description: Shell small, thin, biconical, protoconch of two high whorls with nearly flat sides, adult whorls 4, with 4 varices per whorl extended into a single adapically-curved spine on the shoulder, varices thin, lamellar, curved forward and crenulated, terminating and folded on to the whorls above the shoulder, abapically extending down onto the anterior canal; on the shoulder between each varix very slightly towards the preceding varix a long tube directed abaxially and abaperturally. Aperture ovate, outer lip thin and formed in advance of the varix, anterior canal long, closed, bent to the right, siphonal fasciole with remnants of earlier canals. Height 13, diameter 7 mm.

Remarks: The one specimen is a juvenile with the crenulations on the varix very weak as compared with those of the living *T. (T.) yatesi.*

Distribution: Roe Calcarenite, present seas (Victoria and South Australia, dredged 15 m); Early Pleistocene, Holocene.

Subfamily THAIDINAE
Genus **Thais** Roeding, 1798

"Thais" crassulnata Hedley

Plate 15, fig. 24

1915 *Thais crassulnata* Hedley: p. 749, pl. 85, fig. 90

Type material: Syntypes AM C15818, SAM D7893, BMNH 1915.12.31.112, from Sweers Island, Queensland.

Material: Two specimens WAM 70.28, 71.324 (4434-FL6).

Remarks: The fossils and specimens from Sweers Island ("cotypes" of Hedley) are conspecific with two specimens labelled *"Drupa margariticola* Broderip" collected Verco, Geraldton W.A., in the South Australian Museum. The six axial ribs per whorl tend to develop into 6 rounded varices with lamellose scaly

faces, quite similar to *Murex veatchi* Maury from the Miocene Chipola Formation, Florida, placed by Gardner (1947, p. 532) in *Urosalpinx* and by Vokes (1968, p. 101) "somewhat arbitrarily" in *Hexaplex*. *Thais crassulnata, Murex veatchi,* and possibly *Murex margariticola* are, as Vokes (1968, p. 86) has noted in placing *M. veatchi* in *Hexaplex*, unusual shells forming a group intermediate between the Muricinae and Drupinae. Their taxonomic history of being variously placed in *Murex, Thais, Coralliophila, Urosalpinx* and *Drupa* bears witness to the complex affinities of the shell with the developing varices and more or less well-developed cord around the umbilicus. W. S. Ponder (in correspondence 14 September, 1971) stated "I have mounted a radula from this species *(T. crassulnata)* but this does not help very much as it is fairly typical of the subfamily Muricinae".

Distribution: Roe Calcarenite, present seas (northern Australia); Early Pleistocene, Holocene.

Genus **Lepsiella** Iredale, 1912

Lepsiella flindersi (Adams & Angas)

Plate 17, figs. 12, 13

1863 *Purpura flindersi* Adams & Angas: p. 421, pl. 37, fig. 22
1880 *Trophon flindersi* (Adams & Angas) Tryon: p. 150, pl. 33, fig. 357
1898 *Trophon flindersi;* Pritchard & Gatliff: p. 257 (synonymy)
1932c *Emozamia flindersi* (Adams & Angas) Cotton & Godfrey: p. 140, pl. 1, fig. 7
1962 *Lepsiella flindersi* (Adams & Angas) Macpherson & Gabriel: p. 179, fig. 215
1966 *Lepsiella flindersi;* Hodgkin *et al.*: p. 45, pl. 17, fig. 4

Material: Five specimens GSSA M3249 (4334-FL1); GSWA F7046 (4133-FL3); WAM 66.594 (4233-FL2); 69.505, 70.27 (4434-FL6).

Description: A rather large *Lepsiella,* biconical, angulate at the periphery, sculptured in the fossil specimens with prominent spiral ribs, 2 on the spire whorls, 8 on the last whorl, more or less nodulose on the periphery, shoulder with only faint spiral ribs; entire surface covered with undulating irregular growth lamellae. Aperture elongate-ovate, outer lip ridged within, columella slightly concave, columellar lip fairly thick, siphonal canal of medium length, curved, siphonal fasciole separated from the columellar lip by a distinct pseudumbilicus.

Dimensions: WAM 70.27 height 45, diameter 20 mm.

Distribution: Roe Calcarenite, Glanville Formation, present seas (Victoria and southern coast of Australia to Cockburn Sound, Western Australia, on rocks and algae between tides); Early Pleistocene to Holocene.

63616—(10)

Lepsiella sp.

Plate 20, figs. 35, 36

Material: Four specimens WAM 69.678(2) (4534-FL2); 69.1182, 69.1183 (4334-FL7).

Description: Shell of moderate size, biconical, spire moderately high, about half height of the shell, protoconch broken but probably of 1½ whorls, adult whorls 5, angulate at the periphery, sculptured with 8 axial folds, sharply nodular on the periphery; spiral sculpture of 8 lirae of about equal strength on the sutural ramp and 2 to 3 below the shoulder of the whorls, about 8 primary lirae on the last whorl and base with secondaries between them, all crossed and weakly cancellated by fine axial lirae. Aperture elongate-subovate, outer lip thin, angulate at the periphery, lirate within in a well-preserved specimen but smooth in others; columella nearly straight, smooth, siphonal canal moderately long, slightly recurved, open, margins parallel; siphonal fasciole slightly curved, long, pseudumbilicus narrow only just separating the fasciole from the canal at the adapical end.

Dimensions: WAM 69.678a height 18, diameter 9, height of spire 8 mm.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Dicathais** Iredale, 1936

Dicathais orbita (Gmelin)

Plate 17, fig. 14

1791 *Buccinum orbita* Gmelin: p. 3490
1816 *Purpura succincta* Lamarck: pl. 398, figs. 1a, 1b
1816 *Purpura textilosa* Lamarck: pl. 398, figs. 4a, 4b
1829 *Purpura scalaris* Menke: p. 34
1846 *Purpura aegrota* Reeve: Purpura pl. 9, No. 42
1952 *Dicathais vector* Thornley: p. 43, figs. 1, 1a, 1b
1973 *Dicathais orbita* (Gmelin) Phillips *et al.*: p. 65 (discussion & synonymy)

Material: Four specimens GSWA F6990(2) (4233-FL1); WAM 69.652(2) (4334-FL7).

Remarks: All the Roe Plains specimens are rather fresh-looking and their occurrence in the Pleistocene is a little doubtful. Verco (1895, p. 100) and Iredale (1924, p. 273) discussed the differences and gradations between *Thais orbita* (Gmelin) (= *succincta* Martyn), *T. textilosa* (Lamarck) and *T. aegrota* (Reeve); Phillips, Campbell and Wilson (1973) demonstrated that they all belong to the one species. The specific name *textiliosa* has been commonly applied to the species in mistake for *textilosa*. *Purpura textiliosa* Lamarck is a Paris Basin fossil.

Distribution: ?Roe Calcarenite, coastal dunes (Qpo) present seas (southern Australia); ?Early Pleistocene to Holocene.

Superfamily BUCCINACEA
Family PYRENIDAE
Genus **Mitrella** Risso, 1826
Subgenus **Ademitrella** Ludbrook, 1941

Mitrella (Ademitrella) insolentior (Ludbrook)

Plate 15, fig. 25

1941 *Ademitrella insolentior* Ludbrook: p. 196, pl. 5, fig. 11
1958 *Mitrella (Ademitrella) insolentior* (Ludbrook) Ludbrook: p. 63

Type material: Holotype SAM Tate Coll. T1669, from Abattoirs Bore No. 1, Adelaide, section 97, hundred of Yatala, 98-152 m, Dry Creek Sands, Late Pliocene.

Material: Seven specimens WAM 66.459 (4333-FL1).

Remarks: Roe Plains specimens reach a slightly larger size — height 8, diameter 2.5 mm — than those from the Dry Creek Sands. The pointed protoconch with eccentric tip and a ridge within the outer lip parallel to the margin, characterize the species.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Subgenus **Dentimitrella** Ludbrook, 1958

Mitrella (Dentimitrella) lincolnensis (Reeve)

Plate 15, fig. 26

1859 *Columbella lincolnensis* Reeve: pl. 29, figs. 184a, b
1899 *Columbella lincolnensis;* Pritchard & Gatliff: p. 199 (synonymy)
1958 *Mitrella (Dentimitrella) lincolnensis* (Reeve) Ludbrook: p. 62, pl. 3, fig. 5 (synonymy)
1962 *Dentimitrella lincolnensis* (Reeve) Macpherson & Gabriel: p. 185
1966 *Dentimitrella lincolnensis;* Macpherson: p. 223

Material: Six specimens WAM 66.461 from locality 4333-FL1a, Nurina Cave, surface of doline.

Distribution: Dry Creek Sands, where it is not uncommon, Roe Calcarenite, Glanville Formation, present seas (Victoria to Houtman Abrolhos, Western Australia (Hodgkin *et al.,* 1966)); Late Pliocene to Holocene.

Mitrella (Dentimitrella) pulla (Gaskoin)

1851 *Columbella pulla* Gaskoin: p. 6
1899 *Columbella tenuis* Pritchard & Gatliff: p. 201 (not Gaskoin) (synonymy)
1958 *Mitrella (Dentimitrella) pulla* (Gaskoin) Ludbrook: p. 61
1958 *Dentimitrella pulla* (Gaskoin) May revised Macpherson: pl. 39, fig. 1
1921 *Pyrene pulla* (Gaskoin) May: p. 83 (synonymy)
1923 *Pyrene pulla;* May: pl. 39, fig. 1

1962 *Dentimitrella pulla;* Macpherson & Gabriel: p. 185, fig. 222
1962 *Dentimitrella pulla;* Iredale & McMichael: p. 70
1966 *Dentimitrella pulla;* Macpherson: p. 222 (synonymy)

Material: A single specimen GSWA F7183, loose in soil, locality 4133-FL7.

Distribution: ?Roe Calcarenite, present seas (New South Wales to southwestern Australia); ?Early Pleistocene, Holocene.

Mitrella (Dentimitrella) purpureocincta (Verco)

Plate 15, figs. 27, 28

1910 *Pyrene menkeana* Reeve var. *purpureocincta* Verco: p. 129
1932b *Pyrene acuminata* Menke var. *purpureocincta;* Cotton & Godfrey: p. 99

Type material: Holotype SAM D13490 from Hardwicke Bay, South Australia.

Material: Eleven specimens GSWA F7028(2) (4133-FL4); F7148(2) (4634-FL2); WAM 62.46 (4334-FL1); 66.460, 66.468, 66.475 (4333-FL1a).

Description: Shell small, acuminate, with a small high protoconch (broken in the fossils), adult whorls 6, slightly convex, smooth but for from 6 to 9 lirae on the neck, suture impressed. Aperture narrowly subrhomboid, columella straight anteriorly, excavate at about the posterior one-third, columellar lip thin, feebly wrinkled anteriorly, corresponding to the lirae on the neck, outer lip straight and almost parallel to the columella, only slightly thickened, with 6 denticles within, siphonal canal short, rather narrow.

Dimensions: GSWA F7028 height 15.5, diameter 6.4 mm.

Distribution: Roe Calcarenite, present seas (Hardwicke Bay, S.A.); Early Pleistocene, Holocene.

Family BUCCINIDAE
Genus **Cominella** Gray, 1840

Cominella acutinodosa (Reeve)

Plate 15, figs. 29, 30

1846 *Buccinum acutinodosum* Reeve: species 21, pl. 4, fig. 21
1864a *Buccinum adelaidense* Crosse: p. 276, pl. 11, fig. 6
1932a *Cominella acutinodosa* (Reeve) Cotton & Godfrey: p. 84, pl. 4, fig. 2

Material: Two specimens GSSA M1292 (4333-FL2); GSWA F7032 (4133-FL4).

Description: Shell ovate-fusiform, thick, solid, spire slightly less than half height of shell, protoconch of 1½ high smooth whorls, adult whorls 5, roundly angulate on the shoulder and constricted below the suture, ornamented with about 11 axial ribs on each whorl tending to be nodulose on the shoulder and becoming obsolete towards the base of the last whorl, both ribs and interspaces bearing close, microscopic axial growth striae, whorls spirally grooved throughout.

Aperture ovate, outer lip thin, lirate within corresponding to the spiral grooves and ridges and indented posteriorly at the subsutural constriction; columella concave posteriorly straight and slightly oblique anteriorly with a narrow callus which usually covers the pseudumbilicus, siphonal canal moderately broad, reflected, siphonal fasciole broad, rather low.

Dimensions: Topotype height 30, height of aperture 16, diameter 17 mm; GSSA M1292 height 32, height of aperture 19, diameter 18.5 mm.

Remarks: The colour of the living shell is variable; it is usually greenish or yellowish or greenish-cream with brown spiral rectangular flecks. Interior of aperture usually light brown.

Distribution: Roe Calcarenite, present seas (the species has been recorded by Cotton (1959, p. 382) from north and south Western Australia, South Australia and Victoria, but the only specimens in the South Australian Museum are from Outer Harbor and some labelled *"C. lineolata* var. *tasmanica"* from North Coast and Flinders Island, Tasmania, May Coll. 794 (part)); Early Pleistocene, Holocene.

Cominella eburnea (Reeve)

Plate 15, figs. 31, 32

1833 *Buccinum costatum* Quoy & Gaimard: p. 417, pl. 30, figs. 17-20 (not Linnaeus, 1758 nor Da Costa, 1778 nor Meuschen, 1787)
1846 *Buccinum eburneum* Reeve: Species 31, pl. 12, fig. 93
1864a *Buccinum angasi* Crosse: p. 275, pl. 11, fig. 5
1881 *Cominella costata* (Quoy & Gaimard) Tryon: p. 205, pl. 81, figs. 430, 434
1898 *Cominella costata;* Pritchard & Gatliff: p. 274 (synonymy)
1932a *Cominella eburnea* (Reeve) Cotton & Godfrey: p. 84, pl. 4, fig. 14
1962 *Cominella eburnea;* Macpherson & Gabriel: p. 190, fig. 227
1966 *Cominella eburnea;* Macpherson: p. 225
1971 *Cominella eburnea;* Wilson & Gillett: p. 96, pl. 63, figs. 7, 7a

Material: One hundred and eight specimens GSSA M1275(3) (4333-FL2); M1276(4) (4133-FL6); M2534(8) (4334-FL1); M2575(2) (4434-FL7); GSWA F6911(18) (4334-FL2); F6929(8) (4133-FL7); F6984(10) (4534-FL2); F7004(2) (4434-FL7); F7033(2), F7044(4) (4133-FL4); F7050 (4133-FL3); F7085 (4334-FL1); F7117(9) (4634-FL1); F7139(11) (4634-FL2); WAM 62.38 (4334-FL1); 66.462, 66.557(2), 66.558 (4333-FL1); 66.616 (4334-FL1); 69.601 (4534-FL2); 69.645(2) (4334-FL5); 69.507 (4434-FL6); 69.555(4) (4434-FL5).

Description: Shell rather small, fusiform, moderately thin but solid, spire acuminate, half height of shell, protoconch rather bulbous, of 1½ smooth high whorls, adult whorls 6, angulate on the shoulder and constricted below the suture, ornamented with about 9 axial ribs which are angulate at the shoulder and extend to the abapical suture but fade out on the sutural ramp and on the base of the last whorl, whorls spirally grooved throughout. Aperture oval, outer lip thin

and smooth, strongly lirate within and indented posteriorly at the subsutural constriction; columella concave posteriorly, slightly curved anteriorly, siphonal canal of moderate width, reflected, siphonal fasciole low. In life colour yellow-brown with spiral oblong-shaped brown flecks, interior of aperture brown. The species is very variable in shape and colour pattern.

Dimensions: WAM 69.601 height 30, height of aperture 15, diameter 13 mm.

Distribution: Roe Calcarenite, Glanville Formation, St. Kilda Formation, present seas (southern Australia); Early Pleistocene to Holocene.

Family NASSARIIDAE
Genus **Nassarius** Duméril, 1806
Subgenus **Reticunassa** Iredale, 1936

Nassarius (Reticunassa) subcopiosa (Ludbrook)

Plate 17, figs. 1, 2

1958c *Hinia (Reticunassa) subcopiosa* Ludbrook: p. 64, pl. 3, fig. 1

Type material: Holotype SAM Tate Coll. F15403, from Hindmarsh (Govt. No. 6) Bore, 137-148 m, section 370, hundred of Yatala.

Material: Twenty-four specimens GSWA F6993(2) (4133-FL4); WAM 66.464 (22) (4333-FL1).

Distribution: Dry Creek Sands, Roe Calcarenite, surface deposit (Qpo); Late Pliocene to Pleistocene.

Genus **Amyclina** Iredale, 1918

Amyclina wilsoni n. sp.

Plate 17, figs. 3, 4

Type material: Holotype WAM 70.29b, from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E; Roe Calcarenite, Early Pleistocene; paratypes WAM 61.52, 70.29a (4334-FL6), 66.510 (4333-FL1); 71.325 (4434-FL6).

Description: Shell small, ovate-conical, with a small protoconch of 2 whorls, adult whorls 5, slightly gradate, smooth but for about 12 spiral striae on the base and fasciole and weak radial folds near the varix on the last whorl, one spiral striae below the suture; suture impressed to canaliculate. Aperture ovate, outer lip thick, varicate, with 6 teeth within; columella concave, columellar lip thick, narrow, very weakly lirate within and with a cord anteriorly, siphonal canal short, reflected.

Dimensions:	height (mm)	height of spire (mm)	height of aperture (mm)	diameter (mm)
WAM 70.29b	13	7	6	7.6
70.29a	13	7	6	7.5
61.52	13	7	6	7.5
66.510	12	7	5	6.5
71.325	12.5	6.5	6	7.5
typical *A. semistriata*	16.5	6.5	10	9.0

Remarks: This appears to be the first record of the genus in Australia: The 5 specimens seem to be related to species placed in *Alectrion* such as *A. particeps* (Hedley) and *A. rufula* (Kiener) and to *Zeuxis dorsatus* (Roeding) (Wilson and Gillett, 1971). Its smaller size and the absence of axial ribs on the early whorls distinguishes it from any of these species. The species is closely related to *Amyclina semistriata* (Brocchi) from the Neogene of North Italy, discussed by Caprotti (1973), specimens of which were collected by the writer with Dr. Caprotti in 1962 from the Piacenzian of Castell'Arquato. *A. wilsoni* differs from *A. semistriata* (as figured by Caprotti pl. 1, figs. A1, b, c) principally in having a relatively low aperture and last whorl. The aperture is less than the height of the spire in *A. wilsoni* and greater than the spire height in *A. semistriata.* It differs also in the thicker and narrower parietal callus and columellar lip which in *A. wilsoni* descends obliquely to or concavely from the adapical channel to the siphonal canal. In *A. semistriata* the parietal callus is roundly quadrate extending horizontally from the junction of the aperture and whorl and then vertically to the siphonal canal.

The species is named for Dr. Barry Wilson of the Western Australian Museum who collected the first specimen from locality 4334-FL6. Although there are only 5 specimens, they are well-preserved, well-dispersed and of particular interest for their relationship with *Amyclina semistriata* which (Caprotti, 1973, p. 148) has a range of Tortonian to Holocene with a maximum in the Piacenzian and Calabrian.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Niotha** Adams & Adams, 1853

Niotha pyrrhus (Menke)

1843 *Buccinum pyrrhus* Menke: p. 21, No. 93
1915 *Alectrion victorianus* Iredale: p. 467
1921 *Nassarius victorianus* (Iredale) May: p. 82 (synonymy)
1923 *Nassarius victorianus;* May: pl. 38, fig. 18
1932 *Nassarius victorianus;* Cotton & Godfrey: p. 98, pl. 1, fig. 6
1958 *Niotha pyrrhus* (Menke) May revised Macpherson: pl. 38, fig. 18
1962 *Niotha pyrrhus;* Macpherson & Gabriel: p. 196, fig. 233
1966 *Niotha pyrrhus;* Macpherson: p. 226
1971 *Niotha pyrrhus;* Wilson & Gillett: p. 102, pl. 66, figs. 4, 4a

Material: Nineteen specimens GSSA M1267(2) (4333-FL2); M2551(2) (4334-FL1); GSWA F6977(9), F7024 (4534-FL2); F7034(3), F7043 (4133-FL4); WAM 65.686 (4334-FL1).

Description: Shell small, solid, ovately conical, with a protoconch of 2 smooth convex whorls, the first very small, followed by 2 brephic whorls with about 12 axial ribs per whorl increasing on the adult whorls to 20 on the last whorl; on the second brephic and succeeding whorls the axials are crossed and granulated by flat spiral ribs with linear interspaces, 4 on the penultimate and 8 on the last whorl; suture deep, impressed. Aperture ovate, outer lip with a varix behind and six denticles within, columellar lip thick and rather narrow, reflected over the columella with about 4 widely-separated tubercles anteriorly and a marked parietal ridge; siphonal canal short, recurved, siphonal fasciole broad.

Dimensions: GSWA F7024 height 16.4, diameter 9.4 mm.

Distribution: Roe Calcarenite, Glanville Formation, present seas (Victoria to Fremantle, Western Australia); Early Pleistocene to Holocene.

Genus **Tavaniotha** Iredale, 1936

Tavaniotha nigella nuttalli, n. subsp.

Plate 20, figs. 33, 34

Type material: Holotype WAM 69.658 from locality 4434-FL8, 61 km east of Madura, Grid Reference EUCLA 567052, 31° 53′ 47″ S, 127° 35′ E, Roe Calcarenite, Early Pleistocene; paratypes WAM 66.463 (4333-FL1); 66.617 (4334-FL1); 69.556(2) (4434-FL5); 69.679 (4534-FL2); 70.30 (4434-FL6); GSWA F7016(2) (4434-FL7).

Description: Shell small, acuminately ovate with a fairly high spire, a small smooth protoconch of 2 whorls, adult whorls 6, sculptured with 16 axial ribs per whorl, beaded below the suture, below the beaded row the ribs are depressed by a spiral channel; spiral striae weak or absent on the whorls and usually confined to the base, there being 5 on the base of the holotype. Aperture subovate, outer lip thick, varicate, with 4 unequal denticles within, columella arcuate, columellar lip thick and wide and reflected almost to the adapical suture, with 4 denticles anteriorly and a conspicuous parietal ridge, siphonal canal short, reflected.

Dimensions: WAM 69.658 (a slender example) height 20, diameter 10 mm.

Remarks: The fossil subspecies is larger than *Tavaniotha nigella* (Reeve) (= *Niotha munierana* Crosse, = *N. tasmanica* Tenison Woods); it has a stronger parietal ridge and the conspicuous anterior denticles on the columella. The subspecies is named in honour of Mr. C. P. Nuttall of the British Museum (Natural History) in gratitude for his help with the genus *Tavaniotha.*

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Tavaniotha sp.

Material: A single specimen GSWA F7142 (4634-FL2).

Description: Shell small, solid, ovately conical, with a small protoconch of 2 rather flattish whorls followed abruptly by 5 adult whorls with about 20 axial ribs per whorl crossed and weakly granulated by 4 flat spiral ribs, 10 on the last whorl, separated by linear striae. Aperture subovate, outer lip thick with a varix and 8 long denticles within, columella concave, columellar lip thick and broad spreading almost to the adapical suture and with an anterior denticle; siphonal canal short, reflected, siphonal fasciole broad and curved. Height 13.5, diameter 7.0 mm.

Remarks: The style of sculpture with a gemmulate row below the suture and the axial ribs intersected by spiral striae is similar to that of *N. optata* (Gould) figured by Hedley (1915, pl. 83, fig. 78). The denticles on the outer lip and columellar lip however distinguish it from this species but relate it to *Niotha? caelata* var. *torresiana* (Hedley) figured by Hedley (1915, pl. 83, fig. 76). Like *N. caelata,* it is three times the size of the variety *torresiana* in which the spiral striae cross only the interspaces.

Distribution: Roe Calcarenite; Early Pleistocene.

Family FASCIOLARIIDAE
Genus **Pleuroploca** Fischer, 1884

Pleuroploca australasia (Perry)

Plate 17, fig. 9

1811 *Pyrula australasia* Perry: pl. 54, fig. 4
1902 *Fasciolaria australasia* (Perry) Gatliff: p. 76
1906 *Fasciolaria australasia;* Pritchard & Gatliff: p. 43
1912 *Fasciolaria australasia;* Verco: p. 222
1916 *Fasciolaria australasia;* Hedley: p. 208
1921 *Fasciolaria australasia;* May: p. 78 (synonymy)
1923 *Fasciolaria australasia;* May: pl. 37, fig. 1
1932a *Fasciolaria australasia;* Cotton & Godfrey: p. 70, pl. 3, fig. 15
1958 *Pleuroploca australasia* (Perry) May revised Macpherson: pl. 37, fig. 1
1962 *Pleuroploca australasia;* Macpherson & Gabriel: p. 198, fig. 235
1971 *Pleuroploca australasia;* Wilson & Gillett: p. 98, pl. 64, fig. 2

Material: Three specimens GSSA M3250(2) (4334-FL1); WAM 70.1091 (4434-FL5); juveniles.

Distribution: Roe Calcarenite, Glanville Formation, present seas (southern Australia); Early Pleistocene to Holocene.

Genus **Fusinus** Rafinesque, 1815

Fusinus australis (Quoy & Gaimard)

Plate 17, figs. 7, 8

1833 *Fusus australis* Quoy & Gaimard: p. 495, pl. 34, figs. 9-14
1895 *Fusus australis;* Verco: p. 104, pl. 3, fig. 4 (synonymy)
1932a *Colus australis* (Quoy & Gaimard) Cotton & Godfrey: p. 71, pl. 3, fig. 16
1962 *Fusus australis;* Macpherson & Gabriel: p. 201, fig. 239
1966 *Fusus australis:* Hodgkin *et al.:* p. 41, pl. 15, fig. 2
1971 *Fusinus australis* (Quoy & Gaimard) Wilson & Gillett: p. 98, pl. 64, fig. 10

Material: Seven specimens GSSA M3254 (4334-FL1); GSWA F6909(2) (4334-FL2); F7036 (3630-FL1); WAM 69.508 (4434-FL6); 69.557 (4434-FL5); 72.23 (4434-FL6).

Description: Shell fairly large, elongate-fusiform, with a high slender spire less than half height of shell, protoconch small, high and bulbous, of 2 smooth whorls the first of which is very small, adult whorls 8, convex and angulated on the shoulder, sculptured with axial folds weakly nodulose at the periphery and increasing in number from about 6 on the first adult whorls to more than 12 on the penultimate whorl, becoming more numerous and obsolete on the last whorl, crossed by about 8 strong spiral cords with secondaries between them on each spire whorl and continuing over the last whorl and base, interspaces crossed with fine axial threads; suture undulated by the axial folds. Aperture ovate, outer lip wrinkled, columella concave, siphonal canal long and nearly straight, a weak adapical channel corresponding to the subsutural spiral cord.

Dimensions: WAM 69.557 height 73, diameter 28, height of aperture 42 mm. The Pleistocene specimens do not appear to reach the size of the living species.

Distribution: Roe Calcarenite, Peppermint Grove Limestone, present seas (Victoria to Geraldton, Western Australia); Early Pleistocene to Holocene.

Fusinus novaehollandiae (Reeve)

Plate 17, fig. 11

1848 *Fusus novaehollandiae* Reeve: pl. 18, fig. 70
1898 *Fusinus novaehollandiae* (Reeve) Pritchard & Gatliff: p. 269 (synonymy)
1921 *Fusinus novaehollandae* (sic) (Reeve) May: p. 79 (synonymy)
1923 *Fusinus novaehollandae* (sic); May: pl. 37, fig. 10
1924 *Fusinus novaehollandiae;* Iredale: pl. 34, fig. 9
1932a *Colus novaehollandiae* (Reeve) Cotton & Godfrey: p. 72
1958 *Fusus novaehollandiae;* May revised Macpherson: pl. 37, fig. 10
1962 *Fusus novaehollandiae;* Macpherson & Gabriel: p. 210, fig. 238
1971 *Fusinus novaehollandiae;* Wilson & Gillett: p. 98, pl. 64, fig. 5

Material: A single specimen WAM 69.633 (4434-FL13).

Description: Shell large, elongate-fusiform with a high spire and long siphonal canal, whorls rounded, sculptured with strong spiral ribs with one or two finer

riblets between them, and weak axial folds. Aperture ovate, outer lip thin and scalloped by the spiral ribs, columellar lip separating from the columella, bearing numerous transverse lirae within, a weak parietal ridge and sharp adapical channel, siphonal canal long, straight.

Dimensions: Height 160, diameter 60 mm.

Distribution: Roe Calcarenite, present seas (New South Wales to South Australia); Early Pleistocene, Holocene.

Genus **Microcolus** Cotton & Godfrey, 1932

Microcolus dunkeri (Jonas)

Plate 20, figs. 29, 30

1846 *Fusus dunkeri* Jonas: p. 129
1895 *Fusus dunkeri;* Verco: p. 105
1898 *Fusus dunkeri;* Pritchard & Gatliff: p. 270 (synonymy)
1916 *Fusinus dunkeri* (Jonas) Hedley: p. 207 (synonymy)
1921 *Verconella dunkeri* (Jonas) May: p. 79 (synonymy)
1923 *Verconella dunkeri;* May: pl. 37, fig. 4
1932a *Microcolus dunkeri* (Jonas) Cotton & Godfrey: p. 72, pl. 3, fig. 21
1958 *Microcolus dunkeri;* May revised Macpherson: pl. 37, fig. 4
1962 *Microcolus dunkeri;* Macpherson & Gabriel: p. 201, fig. 240
1966 *Microcolus dunkeri;* Hodgkin *et al.:* p. 41, pl. 15, fig. 4
1966 *Microcolus dunkeri;* Macpherson: p. 226

Material: Twelve specimens GSWA F7141(9) (4634-FL2); WAM 66.458, 66.556 (4333-FL1).

Distribution: Roe Calcarenite, present seas (Victoria to Fremantle, Western Australia); Early Pleistocene, Holocene.

Genus **Propefusus** Iredale, 1924

Propefusus pulleinei (Verco)

Plate 17, fig. 10

1895 *Latirus pulleinei* Verco: p. 90, pl. 1, figs. 1a, 1b
1932a *Latirofusus pulleinei;* Cotton & Godfrey: p. 74, pl. 3, fig. 22

Type material: Holotype SAM D13503 from Eyre, Western Australia.

Material: Twenty-three specimens GSSA M2531(3) (4334-FL1); GSWA F6907(6) (4334-FL2); F7041 (4133-FL3); WAM 61.47, 61.49(3) (4334-FL6); 66.465(3), 66.501(3), 66.588 (4333-FL1); 66.595 (4233-FL2); 69.509 (4434-FL6).

Description: Shell rather small, elongate-fusiform, solid, spire high, a little less than half height of shell, protoconch small, elevated, of 2 whorls, adult whorls 8, convex, sculptured with about 15 low axial folds per whorl about equal to the interspaces, and microscopic growth striae all of which are surmounted by

prominent spiral lirae 6 on the penultimate whorl, with secondary lirae between them. Suture undulating, bordered adapically by 2 lirae of equal strength. Aperture elongate-oval, slightly oblique, outer lip thin, crenulated, lirate internally, columella concave with a very thin callus through which the spiral lirae protrude, siphonal canal as long as the aperture, subconcave on the left side.

Dimensions: WAM 61.47 height 49, diameter 18, height of aperture 26 mm.

Distribution: Roe Calcarenite, surface sand (Qpo), present seas (Port Adelaide to Eyre); Early Pleistocene to Holocene.

Superfamily VOLUTACEA
Family OLIVIDAE
Genus **Amalda** A. Adams, 1853

Amalda (*s. l.*) sp.

Material: GSWA F7173, a small *Amalda*, rather slender, probably belonging to *Gracilispira*; locality 4334-FL2, 4.8 km east of Madura, Roe Calcarenite.

Distribution: Roe Calcarenite; Early Pleistocene.

Subgenus **Gracilispira** Olson, 1956

Amalda (Gracilispira) monilifera (Reeve)

Plate 17, figs. 5, 6

1844 *Ancillaria lineata* Kiener: p. 16, pl. 3, fig. 2 not *Ancilla lineata* Perry 1811
1846b *Ancillaria monilifera* Reeve: p. 10, figs. 36a,b not *Oliva monilifera* Reeve, 1850
1898 *Ancilla lineata* (Kiener) Pritchard & Gatliff: p. 195 (synonymy)
1916 *Ancilla lineata;* Hedley: p. 202 (synonymy)
1924 *Ancilla monilifera* (Reeve) Iredale: p. 260
1932a *Baryspira monilifera* (Reeve) Cotton & Godfrey: p. 53
1962 *Alocospira monilifera* (Reeve) Macpherson & Gabriel: p. 207, fig. 246
1966 *Alocospira monilifera;* Hodgkin *et al.*: p. 49, pl. 19, fig. 5

Material: Forty-four specimens GSSA M1282(8) (4133-FL6); GSWA F6913(4) (4334-FL2); F6968(6) (4534-FL2); F7069, F7086 (4334-FL1); WAM 61.56(3) (4334-FL6); 65.687 (4334-FL1); 66.466(12) (4333-FL1); 69.680(8) (4534-FL2).

Description: Shell small, usually thin, smooth and polished, ovately fusiform, spire a little less than half height of shell, enamelled by thin callus, protoconch small, dome-shaped, of 2 whorls the second of which is more or less enveloped by the first adult whorl, adult whorls 5, constricted in a sutural band, suture calloused over, last whorl somewhat swollen at the periphery, aperture elongate-ovate, outer lip convex, columella concave, columellar callus narrow and twisted into 4 to 6 spiral ridges anteriorly, parietal callus very thin, fasciolar band narrow. Surface

smooth but for incised spiral striae, one below the suture marking the edge of the spire callus; one above, one on the edge of, and two on the fasciolar band; the last whorl is microscopically axially striate on the broad band between the spire callus and the fasciolar band. Recent shells patterned with faint light-brown zig-zag lines and brown spiral splashes on the sutural band and above the fasciolar band.

Dimensions: WAM 69.680d, height 23, diameter 11, height of spire 10 mm.

Remarks: The species is unrelated to *Alocospira* which is characterized by a small papillate protoconch and spirally lirate spire.

Distribution: Roe Calcarenite, present seas (Victoria to Fremantle, Western Australia); Early Pleistocene, Holocene.

Genus **Zemira** H.&A. Adams, 1853
Subgenus **Eburnopsis** Tate, 1889

Zemira (Eburnopsis) intermedia n. sp.

Plate 17, figs. 19, 20

Type material: Holotype WAM 70.1139 from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E, Roe Calcarenite, Early Pleistocene; 3 paratypes WAM 69.562 (4434-FL5), 70.1108(2) (4434-FL6).

Description: Shell large and slender for the genus, gradate-subfusiform, spire higher than aperture, protoconch smooth, large, high, of 1½ whorls, adult whorls 5, slightly convex, deeply excavate at the suture, keeled at the shoulder, smooth but for faint spiral striae which are stronger on the base and fasciolar band. Aperture elongate-subovate, outer lip slightly convex, sharply angled at the shoulder, columella nearly straight or slightly concave, smooth, with a thin callus; siphonal fasciole clearly defined and separated by a posterior groove, siphonal canal short, turned to the left.

Dimensions: WAM 70.1139 height 36, diameter 17 mm.

Remarks: The specific name *intermedia* is used for this shell which seems to occupy an intermediate place between the Buccinidae, Cancellariidae and Olividae (Pseudolivinae). It is easily confused with the cancellariid *Nevia spirata* (Lamarck) which has 3 folds on the columella. It is closely related to *Zemira australis* (Sowerby) from which its main generic or subgeneric difference is that it lacks on the posterior edge of the fasciolar band the deep furrow which ends in the tooth-like projection on the outer lip. The fasciolar band is represented only by about 10 spiral striations. It differs from *Babylonia*, to which it has some superficial resemblances, in being nonumbilicate, lacking the parietal ridge, and having a larger protoconch proportional to the size of the shell. Its nearest fossil relative is *Eburnopsis aulacoessa* Tate, the holotype of which is without the incised groove at the posterior edge of the fasciolar band.

In erecting the genus *Eburnopsis,* Tate (1889, p. 117) indicated its affinity with *Eburna* (i.e. *Eburna* Lamarck, 1822 = *Babylonia* Schlueter, 1838, type species *Eburna spirata* Lamarck, not *Eburna* Lamarck, 1801, type species *Buccinum glabratum* Linnaeus, which Wenz (1943, p. 1275) makes a subgenus of *Ancilla* Lamarck, 1799). Tate (1894) subsequently described *Eburnopsis tessellatus* from "Spring Creek" (?Puebla Formation, Torquay, Victoria), which has the characteristic groove and tooth-like projection of *Zemira* and is congeneric with *Zemira praecursoria* Tate. Subsequent to erecting the genus Tate therefore seems to have used *Zemira* and *Eburnopsis* synonymously. *Eburnopsis* is here retained as a subgenus of *Zemira* for *E. aulacoessa* Tate and the new species *Z. (E.) intermedia,* neither of which, so far as available material shows, has the fasciolar groove and corresponding projection on the outer lip. Iredale & McMichael (1962, p. 49) place *Zemira australis* in the family Zemiridae adjacent to the Struthiolariidae.

Distribution: Roe Calcarenite; Early Pleistocene.

Family MITRIDAE
Genus **Austromitra** Finlay, 1927

Austromitra lincolnensis (Angas)

Plate 17, figs. 15, 16

1878 *Mitra (Costellaria) lincolnensis* Angas: p. 313, pl. 18, figs. 10, 11
1932a *Austromitra lincolnensis* (Angas) Cotton & Godfrey: p. 80, pl. 4, fig. 10

Material: Twenty-six specimens WAM 66.469, 66.470(17) (4333-FL1); 69.559(2) (4434-FL5); 69.604(3), 69.681(2) (4534-FL2); GSWA F6943 (4133-FL7).

Description: (slightly modified from Angas, 1878): Shell acuminately fusiform, solid, whitish tinged with irregular longitudinal chestnut flames, with a narrow band of interrupted spots encircling the centre of the whorls, the lower half of the last whorl chestnut, with a faint band of reticulated brown and white spots in the middle. Protoconch small, high, smooth, of 1½ whorls, adult whorls 7, a little convex, with about 20 stout transverse ribs on the later whorl, about 13 to 15 on the early ones, slightly nodulose below the sutures; interspaces smooth, sutures impressed; spire about three-fifths height of shell. Aperture elongate, slightly oblique, outer lip gently concave, columella nearly straight, with 4 strong folds, siphonal canal short, slightly recurved, siphonal fasciole low, with about 6 spiral lirae.

Dimensions: WAM 69.604a height 10, diameter 3 mm.

Distribution: Roe Calcarenite, present seas (South Australia and southwestern Australia); Early Pleistocene, Holocene.

Austromitra pauciplicata Ludbrook

Plate 17, figs. 17, 18

1958c *Austromitra pauciplicata* Ludbrook: p. 70, pl. 3, fig. 7

Type material: Holotype SAM Tate Coll. F15407, from Abattoirs Bore No. 1, 98-152 m, section 97, hundred of Yatala.

Material: Eight specimens WAM 66.473(6), 66.487(2) (4333-FL1).

Remarks: The Roe Calcarenite specimens are larger than those from the Dry Creek Sands. The axial ribs tend to be more angulate than shown in the original figure and description, and the whorls to be more or less compressed below the suture. The two specimens (pl. 17, figs. 17, 18) show the variability in the number of ribs from 9 to 12 on the adult or last whorls.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Austromitra sp. cf. **A. retrocurvata** (Verco)

cf. 1909 *Mitra retrocurvata* Verco: p. 338, pl. 24, figs. 4, 5

Material: Three specimens GSWA F7027 (4133-FL7) and WAM 66.618(2) (4334-FL1).

Remarks: The species is a little more than half the size of *A. retrocurvata*, but has axial ribs only on the early whorls. This feature was noted by Verco: "In some of the cotypes the axial ribs fade out on the third whorl, and in others on the fourth". The specimen figured by May (1923, pl. 27, fig. 17) lacks ribs on the penultimate and last whorls.

Distribution: Roe Calcarenite; Early Pleistocene.

Austromitra sp.

Material: A poorly preserved specimen WAM 66.477 (4333-FL1).

Remarks: The aperture is high and the spire short in relation to the shell in comparison with other species of *Austromitra*.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Mitra** Lamarck, 1798

Subgenus **Eumitra** Tate, 1889

Mitra (Eumitra) australis Swainson

Plate 18, figs. 1, 2

1821 *Mitra australis* Swainson: p. 18, 3 lower figures

1899 *Mitra australis*; Pritchard & Gatliff: p. 185 (synonymy)

1921 *Mitra australis;* May: p. 79 (synonymy)

1923 *Mitra australis;* May: pl. 37, fig. 11
1932a *Mitra australis;* Cotton & Godfrey: p. 77, pl. 4, fig. 2
1958 *Eumitra australis* (Swainson) May revised Macpherson: pl. 37, fig. 11
1962 *Eumitra australis;* Macpherson & Gabriel: p. 210, fig. 251
1966 *Mitra australis;* Macpherson: p. 227
1966 *Eumitra australis;* Hodgkin *et al.:* p. 47, pl. 18, fig. 1
1971 *Eumitra australis;* Wilson & Gillett: p. 118, pl. 76, fig. 1

Material: One specimen WAM 69.558 (4434-FL5).

Description: Shell rather large, elongate-fusiform, protoconch broken in the fossil, adult whorls 9, nearly straight in profile, sutures deep, impressed, aperture about two-fifths height of shell, whorls sculptured with numerous microscopic spiral striae and axial growth striae, on the first adult whorls there are about 12 obscure axial ribs which become obsolete on the later whorls, but a general tendency to axial ridging can be seen when the shell is viewed in strong oblique light. The living shell is brown, with a white band in the middle of the last whorl; this band can be seen in the fossil. Aperture elongate-ovate, slightly oblique, outer lip thick, columella with 4 strong folds; base and siphonal fasciole spirally lirate, the lirae being of unequal strength.

Dimensions: WAM 69.558 height 55, height of aperture 22, diameter 18 mm.

Remarks: The single specimen is larger by one whorl than is usual for *M. (E.) australis*; it is thicker and the sutures are deeper, but *M. (E). australis* also has a tendency to faint axial ribbing in the early whorls, noted by Cotton & Godfrey (1932a), as well as the light colour band. It is closest to several shells in the Verco Collection of the South Australian Museum labelled *"M. australis* variety Dredged S.A.", one of which carries a label that it was "dredged 40 fathoms off Beachport".

Distribution: Roe Calcarenite, present seas (Victoria to Rottnest Island, Western Australia); Early Pleistocene, Holocene.

Mitra (Eumitra) coxi (Ludbrook)

1958b *Mitraria (Eumitra) coxi* Ludbrook: p. 71, pl. 6, fig. 4

Type material: Holotype BMNH G39670, from McDonalds, Muddy Creek, Victoria, Grange Burn Coquina, Kalimnan, Early Pliocene; paratypes GSSA M889, Thebarton Bore, M890 Kooyonga Bore, AUGD Abattoirs Bore.

Material: A single specimen WAM 71.334 (4434-FL6).

Remarks: This is a fairly large *Eumitra* with a comparatively short aperture. Although the species was described as "rather broad", this appears to be an error, because the species is rather slender for *Eumitra.* The Roe Calcarenite specimen is close to paratypes from the Dry Creek Sands.

Distribution: Grange Burn Coquina, Dry Creek Sands and Roe Calcarenite; Early Pliocene to Early Pleistocene.

Mitra (Eumitra) glabra Swainson

Plate 18, fig. 3

1821 *Mitra glabra* Swainson: pl. 24
1899 *Mitra glabra;* Pritchard & Gatliff: p. 186
1916 *Mitra glabra;* Hedley: p. 208
1921 *Mitra glabra;* May: p. 79 (synonymy)
1923 *Mitra glabra;* May: pl. 37, fig. 6
1932a *Mitra glabra;* Cotton & Godfrey: p. 76, pl. 4, fig. 1
1936 *Vicimitra exposita* Iredale: p. 320, pl. 23, fig. 14
1951 *Mitra (Vicimitra) exposita* (Iredale) Laseron: p. 339, fig. 7
1958 *Eumitra glabra* (Swainson) May revised Macpherson: pl. 37, fig. 6
1962 *Eumitra glabra;* Macpherson & Gabriel: p. 212, fig. 253
1966 *Eumitra glabra;* Macpherson: p. 227
1971 *Eumitra glabra;* Wilson & Gillett: p. 118, pl. 76, fig. 2

Material: Six specimens GSWA F6950 (4133-FL7); WAM 66.596 (4233-FL2); 66.619 (4334-FL1); 69.603 (4534-FL2); 69.634 (4434-FL13); 71.326 (4434-FL6).

Description: Shell of medium size, elongate-fusiform, with a high spire and aperture a little more than one-third height of shell, protoconch usually broken or eroded, adult whorls 9, flatly convex, sculptured with fine well-separated punctate spiral grooves and fine axial growth striae; suture impressed. Aperture slightly oblique, narrow; columella nearly straight with 4 or 5 folds, outer lip gently concave, siphonal canal rather narrow, recurved, siphonal fasciole low.

Dimensions: WAM 69.634 height 47, height of aperture 19, diameter 15; WAM 69.603 height 46, height of aperture 16, diameter 13 mm.

Distribution: Roe Calcarenite, Glanville Formation, present seas (New South Wales to Fremantle, Western Australia); Early Pleistocene to Holocene.

Family VOLUTOMITRIDAE
Genus **Waimatea** Finlay, 1927

Waimatea obscura (Hutton)

Plate 22, figs. 24, 25

1845 *Mitra pica* Reeve: pl. 31, sp. 247 (not Deshayes & Edwards, 1844)
1873 *Mitra obscura* Hutton: p. 19
1970 *Waimatea obscura* (Hutton) Cernohorsky: p. 127, pl. 16, figs. 11-14 (synonymy)

Material: One specimen WAM 69.682 (4534-FL2).

Remarks: The species has been described and the synonymy discussed by Cernohorsky (1970). In the Roe Calcarenite specimen the early whorls are weakly axially ribbed and there is a fifth weak anterior fold on the columella.

Distribution: Roe Calcarenite, present seas (New Zealand; southern Australia, Victoria, Tasmania and South Australia (recorded as *Proximitra pica* (Reeve)); Early Pleistocene, Holocene.

63616—(11)

Family HARPIDAE
Genus **Austroharpa** Finlay, 1931

Austroharpa kendricki n. sp.

Plate 18, figs. 4-6

Type material: Holotype WAM 69.560 from locality 4434-FL5, 0.6 km north of Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 36″ S, 127° 34′ 45″ E; Roe Calcarenite, Early Pleistocene; figured paratype WAM 69.683a (4434-FL4); unfigured paratypes WAM 66.627(2) (4334-FL1); 69.579, 69.580(2) (4434-FL4); 69.683-4(3) (4434-FL4); GSSA M3244(3) (4334-FL1); GSWA F6976 (4534-FL2).

Description: Shell solid, of moderate size, unequally biconical with a gradate spire less than one-third total height of shell. Protoconch smooth, dome-shaped, of 2½ whorls, adult whorls 3, slightly convex, shoulder flat to concave, keel roundly rectangular; whorls sculptured with low spiral sulci, three on the penultimate whorl and 12 on the last whorl, all overridden by 20 high axial lamellae per whorl which are folded inwards on the whorl but elevated and frilled on the shoulder, sinuate over the siphonal fasciole. Aperture elongate, fairly narrow, outer lip thickened, occasionally denticulate; columellar lip with a thin callus, siphonal canal short, reflected.

Dimensions: Holotype height 42, diameter 27 mm.

Remarks: This species belongs to the lineage of *A. sulcosa* (Tate) and *A. tatei* Finlay of which *A. sulcosa* has 38 axial lamellae, *A. tatei* 33 and *A. kendricki* 20. The species is named in honour of Mr. G. W. Kendrick of the Western Australian Museum.

Distribution: Roe Calcarenite; Early Pleistocene.

Austroharpa spiralistriata n. sp.

Plate 18, figs. 7-12

Type material: Holotype WAM 72.24 from locality 4434-FL6, Hampton Microwawe Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E; Roe Calcarenite, Early Pleistocene; figured paratypes WAM 70.31, 71.327 (4434-FL6); unfigured paratype WAM 66.476 (4333-FL1).

Material: The holotype and the juvenile paratypes with the strong spiral striae and very weak axial lamellae.

Description: Shell small for the genus, thin, unequally biconical with a roundly gradate rather high spire, although the height varies from less than one-quarter to one-fifth the height of the shell. Protoconch smooth, large, dome-shaped, of 1½ whorls, adult whorls 3, slightly convex, shoulder rounded, sculptured with from

3 to 5 incised spiral striae on the whorl below the shoulder, none above the shoulder and about 16 on the last whorl. Axial lamellae very thin and weak, becoming obsolete below the shoulder, irregular in number and disposition but about 15 to 20 per whorl. Aperture elongate, of moderate width, outer lip thickened, columellar lip thinly calloused, siphonal canal rather long and cord-like, reflected.

Dimensions: Holotype WAM 72.24 height 25, diameter 16, height of spire 4 mm; paratype WAM 70.31 height 25, diameter 13.5, height of spire 7 mm.

Distribution: Roe Calcarenite; Early Pleistocene.

Family VOLUTIDAE
Genus **Lyria** Gray, 1847

Lyria gracilicostata n. sp.

Plate 18, figs. 15-18

Type material: Holotype GSWA F6951, from locality 4133-FL7, 21 km north-east of Eyre, Grid Reference BURNABBIE 443032, 32° 05′ 08″ S, 126° 24′ 30″ E, Roe Calcarenite, Early Pleistocene; figured paratype WAM 69.511 (4434-FL6), unfigured paratypes GSSA M1270 (4333-FL2); M3251(3) (4334-FL1); GSWA F6951(2) (4133-FL7); WAM 66.621(2) (4334-FL1); 69.510 (4434-FL6); 69.561(2), 70.32(2), 70.33 (4434-FL5).

Description: Shell of moderate size, ovate-fusiform, spire less than half height of shell, protoconch of 1½ smooth whorls followed abruptly by 5 finely axially-ribbed adult whorls with 18 ribs on the first adult whorls increasing to 36 on the last whorl of a medium size specimen and 46 on the last whorl of the holotype; they are of unequal strength; from 7 to 10 spiral lirae on the base. Aperture narrow, elongate-ovate, more than half height of shell, outer lip thickened, with a cord-like varix behind, either smooth or irregularly marked within short grooves. Columella nearly straight but roundly angled to the parietal lip, with from 6 to 8 folds, the anterior two of which are stronger than the others; anterior canal short, recurved.

Dimensions: Holotype height 43, height of aperture 25, diameter 19 mm.

Remarks: The holotype is considerably weathered, but it is the largest and most complete specimen available. There are gradational forms (such as WAM 66.621) between *L. mitraeformis* and *L. gracilicostata* but apart from these, the two species are readily distinguishable by the more numerous and finer axial ribs in *L. gracilicostata.*

Distribution: Roe Calcarenite; Early Pleistocene.

Lyria mitraeformis (Lamarck)

Plate 18, figs. 13, 14

1811 *Voluta mitraeformis* Lamarck: p. 73
1822b *Voluta mitraeformis* Lamarck: p. 347
1827 *Voluta multicostata* Broderip: p. 82, pl. 3, fig. 2
1882 *Lyria mitraeformis* (Lamarck) Tryon: p. 103, pl. 31, fig. 143
1898 *Lyria mitraeformis;* Pritchard & Gatliff: p. 284 (synonymy)
1921 *Lyria mitraeformis;* May: p. 68 (synonymy)
1923 *Lyria mitraeformis;* May: pl. 33, fig. 6
1932a *Lyria multicostata* (Broderip) Cotton & Godfrey: p. 51, pl. 2, fig. 12
1958 *Lyria mitraeformis;* May revised Macpherson: pl. 33, fig. 6
1962 *Lyria mitraeformis;* Macpherson & Gabriel: p. 217, fig. 258
1971 *Lyria mitraeformis;* Wilson & Gillett: p. 126, pl. 83, figs. 7, 7a, 7b

Material: GSSA M2552(2); GSWA F7063(3), WAM 62.42, 65.688, 66.620 (4334-FL1); 69.605(8), 69.685(10) (4534-FL2).

Description: Shell of moderate size, ovate-fusiform, with a spire half the total height of the shell, protoconch of 1½ smooth whorls followed abruptly by 6 axially-ribbed adult whorls, about 14 ribs on the first adult whorls and 15 to 18 on the last whorl, ribs somewhat sinuous, extending to and slightly undulating the suture; between and on the ribs the whorls are axially finely striate; about 12 spiral grooves on the base. Aperture elongate-ovate, equal in height to the spire, outer lip thickened with a varix behind, slightly reflected in front of the varix, smooth within, columella gently curved, with 2 or 3 folds anteriorly and a number of weaker thread-like plications posterior to these; columellar lip thin, anterior canal short, reflected.

Dimensions: WAM 69.685a height 44, diameter 20 mm.

Distribution: Dry Creek Sands, Roe Calcarenite, present seas (southern Australia); Late Pliocene to Early Pleistocene; Holocene.

Genus **Cymbiola** Swainson, 1831
Subgenus **Aulicina** Rovereto, 1899

Cymbiola (Aulicina) irvinae (Smith)

Plate 18, figs. 22, 23

1909 *Voluta irvinae* Smith: p. 97, pl. 5
1971 *Aulicina irvinae* (Smith) Wilson & Gillett; p. 130, pl. 87, fig. 1

Material: Twelve specimens WAM 66.623 (4334-FL1); 69.512-4 (4434-FL6); 69.581 (4434-FL4); 69.635 (4434-FL13); 69.686 (4534-FL2); 70.1513(2), 70.1647(2) (4434-FL2).

Description: Shell large, subpyriform, ventricose, with a large high dome-shaped protonch of 4½ whorls rapidly increasing in size from a very small flattish initial whorl and becoming weakly axially ribbed with about 16 fine ribs per

whorl, adult whorls 3, excavate and flattened below the suture and angulate at the shoulder which has a crown of 14 or 15 short hollow angular spines, increasing to about 20 on the last whorl. Aperture large, angulate at the shoulder and expanding below with age, outer lip thin, columella with 4 strong folds. The living shell is a deep salmon-pink flecked with white and with 2 spiral bands of dark, irregular linear blotches. Specimen WAM 70.1513 is 164.5 mm high, diameter 100.5 mm; 2 other large specimens are approximately 140 mm high, diameter 90 mm.

Distribution: Dry Creek Sands, Roe Calcarenite, present seas ("Cape Naturaliste to Geraldton" (Wilson & Gillett, 1971)); Late Pliocene to Early Pleistocene, Holocene.

Genus **Amoria** Gray, 1855
Subgenus **Amoria** *s.s.*

Amoria (Amoria) grayi Ludbrook

Plate 19, fig. 1

1954a *Amoria (Amoria) grayi* Ludbrook: p. 136, pl. 14, figs. 4, 5 (synonymy)
1971 *Amoria grayi;* Wilson & Gillett: p. 128, pl. 85, figs. 3, 3a-c

Type material: Holotype BMNH 1952.3.21.1 from "Swan River, Western Australia".

Material: GSSA M2554 (4334-FL1).

Distribution: Dry Creek Sands, Roe Calcarenite, present seas ("Geographe Bay to North Kimberley" (Wilson & Gillett, 1971)); Late Pliocene to Early Pleistocene, Holocene.

Genus **Nannamoria** Iredale, 1929

Nannamoria lundeliusae n. sp.

Plate 18, figs. 20, 21

Type material: Holotype GSSA M2521 from locality 4434-FL9, 64 km east of Madura, Grid Reference EUCLA 575054, 31° 53′ 42″ S, 127° 41′ 30″ E; Roe Calcarenite, Early Pleistocene; 8 paratypes GSSA M3253(2) (4334-FL1); GSWA F6942 (4133-FL7); F7084 (4334-FL1); WAM 62.49, 66.622(2) (4334-FL1); 72.26 (4434-FL3).

Description: Shell of moderate size, ovate-fusiform, spire two-fifths height of shell, protoconch a fairly high dome of 4 smooth whorls with deep sutures; adult whorls 3, smooth but for weak nodulations on the shoulder, axial growth ridges and striae and short close-set wrinkles below the suture, suture deep, imbricating. Aperture long, narrow, outer lip broken in the holotype but in other specimens thickened, nearly parallel to the columella which has four strong folds. Colour pattern still showing in the fossil consists of widely spaced sinuous axial lines.

Dimensions: Holotype height 48, height of aperture 31, diameter 18 mm.

Remarks: The species is larger and relatively narrower than the type species *Nannamoria amicula* Iredale, and differs also in the number of whorls in the protoconch and the number of folds on the columella. The colour pattern is similar to that of *N. amicula.* The species is named in honour of Mrs. Judith Lundelius of Texas.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Notovoluta** Cotton, 1946

Notovoluta kreuslerae subtilis n. subsp.

Plate 19, figs. 4, 5

Type material: Holotype WAM 69.515, from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E; Roe Calcarenite, Early Pleistocene; 2 paratypes WAM 69.606(2) (4534-FL2).

Description: Shell fairly large for the genus, elongate-fusiform, spire less than half height of shell, protoconch bluntly papillose, smooth, of 2½ whorls; adult whorls 3½, slightly convex, smooth but for microscopic growth striae, suture imbricating, oblique, on some specimens a weak suggestion of a shoulder with faint plications. Aperture more than half height of shell, elongate-subtriangular, expanding anteriorly, outer lip thickened internally, columella nearly straight anterior to the middle with 4 or 5 folds, concave above the folds.

Dimensions: Holotype height 67, height of aperture 39, diameter 25 mm.

Remarks: N. kreuslerae varies in the degree of plications on the shoulder, one specimen from Encounter Bay in the South Australian Museum being smooth. The Roe Calcarenite specimens differ from this in being more slender and having a higher spire. For this reason the Pleistocene smooth form is given subspecific rank.

Distribution: Roe Calcarenite; Early Pleistocene.

Notovoluta verconis (Tate)

Plate 18, fig. 19

1892 *Voluta verconis* Tate: p. 125, pl. 1, fig. 5
1912 *Scaphella verconis* (Tate) Verco: p. 224
1946 *Notovoluta verconis* (Tate) Cotton: p. 16, fig.
1971 *Notovoluta verconis;* Wilson & Gillett: p. 124, pl. 81, fig. 3

Type material: Holotype SAM D442 from Yankalilla Bay, South Australia.

Material: One specimen WAM 66.559 (4333-FL1).

Remarks: The fossil shell is poorly preserved but shows the characteristic axial ribbing of about 10 nodulose plications on each whorl abruptly terminating at

the shoulder. There are, however, 5 and not 4 folds on the columella, the fifth bordering the siphonal canal being scarcely visible unless the shell is rotated to show the interior of the aperture.

Dimensions: WAM 66.559 height 28, height of aperture 17, diameter 11 mm.

Distribution: Roe Calcarenite, present seas (Kangaroo Island, Spencer Gulf and Gulf St. Vincent, South Australia); Early Pleistocene, Holocene.

Genus **Ericusa** H. & A. Adams, 1858

Ericusa fulgetrum orca Cotton

Plate 19, figs. 2, 3

1952a *Ericusa orca* Cotton: p. 53, pl. 4, figs. 5, 6
1971 *Ericusa fulgetrum* Sowerby; Wilson & Gillett: p. 124, pl. 81, fig. 2

Type material: Holotype SAM D13816 from 145 km west of Eucla at 182 m.

Material: One specimen WAM 71.337 from locality 4434-FL11, 98 km west of Eucla.

Description: Shell large, fusiform, slender, smooth but for fine axial growth striae, spire a little less than half height of shell, protoconch high, papillary, slightly oblique, of three whorls the suture between the first and second whorls being very oblique; adult whorls 4, only slightly convex, suture well-defined and imbricating. Aperture a little more than half height of shell, subtriangular, expanding anteriorly, outer lip slightly thickened, slightly concave, columella gently convex with 3 well-spaced folds anterior to the middle and set well within the aperture, anterior canal broad and very short.

Dimensions: Height 102, height of aperture 48, diameter 39 mm.

Remarks: Whether this form, described as a separate species by Cotton, should be placed within the specific range of *E. fulgetrum* cannot be determined until the animals are studied. It is distinguished from the usual form of *E. fulgetrum* by its narrower shape, which also includes the protoconch, and less convex whorls. It is only slightly narrower than the form described by Verco (1909, p. 274, pl. 21, fig. 7) as *Voluta fulgetrum* var. *dictua*. The specimen figured by Wilson & Gillett (1971, pl. 81, fig. 2) shows a faint reticulate colour pattern which characterizes the variety *dictua*. The name *orca* is here retained as a subspecies for the very narrow form at the extreme end of the morphological range of *fulgetrum*. It is the only form occurring in the Roe Calcarenite and is within 50 km of the type locality of *E. orca*. There is, however, no confirmation of Cotton's (1952, p. 54) suggestion that the subspecies inhabited deeper water than *E. fulgetrum fulgetrum*.

Distribution: Roe Calcarenite, present seas (145 km west of Eucla); Early Pleistocene, Holocene.

Family CANCELLARIIDAE
Genus **Cancellaria** Lamarck, 1799
Subgenus **Charcolleria** Olsson, 1942

Cancellaria (Charcolleria) sp.

Plate 22, figs. 26, 27

Material: One specimen WAM 70.35 from locality 4434-FL6.

Description: Shell fusiform, small, spire approximately equal in height to the aperture, protoconch of 2 high rapidly increasing whorls with tip immersed; adult whorls 4, convex, sutures deep, each whorl ornamented with about 30 fine axial ribs which fade out over the base, crossed and weakly tuberculated by 6 spiral ribs on each spire whorl, about 30 on the last whorl from the adapical suture to the siphonal fasciole. Aperture elongate-ovate, outer lip rounded, with 11 conspicuous lirae within, columella nearly straight, with 3 folds, the posterior strong and transverse, the median oblique, bordering the siphonal canal which is short, well open and only slightly reflected.

Dimensions: WAM 70.35, height 18, height of aperture 9, diameter 16 mm.

Remarks: Because there is only one specimen, the species is not named. It is more finely ornamented than *Sydaphera delicosa* Laseron to which it appears to be related. It is tentatively placed in *Cancellaria (Charcolleria)* because of its resemblance to *C. (C.)* sp. from the Melajo Clay (late Miocene or slightly younger) of Trinidad (Jung, 1969). Species of *Charcolleria* described from Venezuela and Trinidad have two folds on the columella whereas the present species has three. More material and further study are required to confirm the presence of the subgenus in the Eucla Basin.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Nevia** Jousseaume, 1887

Nevia spirata (Lamarck)

Plate 19, figs. 6, 7

1822b *Cancellaria spirata* Lamarck: p. 115
1832 *Cancellaria spirata;* Sowerby: fig. 25
1848 *Cancellaria excavata* Sowerby: p. 137
1856 *Cancellaria spirata;* Reeve: pl. 12, fig. 56
1899 *Cancellaria spirata;* Pritchard & Gatliff: p. 206 (synonymy)
1916 *Cancellaria spirata;* Hedley: p. 204
1921 *Cancellaria spirata;* May: p. 72 (synonymy)
1923 *Cancellaria spirata;* May: pl. 34, fig. 5
1932a *Cancellaria spirata;* Cotton & Godfrey: p. 55, pl. 3, fig. 4
1958 *Nevia spirata* (Lamarck) May revised Macpherson: pl. 34, fig. 5
1962 *Nevia spirata;* Macpherson & Gabriel: p. 226, fig. 270
1966 *Nevia spirata;* Hodgkin *et al.*: p. 43, pl. 16, fig. 6

Material: Thirteen specimens GSSA M2525(2) (4334-FL1); GSWA F7051 (4133-FL3); WAM 61.61 (4334-FL6); 66.625 (4334-FL1); 69.518(2) (4434-FL6); 69.563(2) (4434-FL5); 69.59(2) (4334-FL6); 69.607 (4534-FL2); 71.329 (4434-FL6).

Description: Fossil shell of moderate size for the genus, gradate-subfusiform, height of spire equal to aperture, protoconch smooth, of 1½ high whorls, adult whorls convex, deeply excavate at the suture, sculptured with numerous fine axial ribs in the early whorls, obsoletely axially ribbed or grooved in the later whorls, crossed by numerous fine spiral grooves. Aperture subovate, angled at the shoulder, outer lip lirate within, columellar lip lirate over the threads on the base, columella with three folds, siphonal canal short, curved slightly to the right.

Dimensions: WAM 69.607 height 31, diameter 17 mm.

Remarks: The sculpture varies considerably, but all the Roe Calcarenite specimens are more strongly sculptured than most of the Holocene specimens examined.

Distribution: Roe Calcarenite, present seas (Victoria to Point Peron, Western Australia (Hodgkin *et al.,* 1966)); Early Pleistocene, Holocene.

Genus **Trigonostoma** Blainville, 1827
Subgenus **Arizelostoma** Iredale, 1936

Trigonostoma (Arizelostoma) sp.

Plate 19, figs. 8, 9

Material: A single specimen WAM 70.34 from locality 4434-FL6.

Description: Shell of moderate size, rather thin, gradate-subfusiform, deeply umbilicate, spiral equal in height to the aperture, protoconch high, smooth, of 1½ whorls with deep sutures and flat sides, tip immersed; adult whorls 4, suture deeply canaliculate, shoulder angulate, ornament cancellate with four spiral ribs and 17 lamellose axial ribs per whorl which thicken and tuberculate the spiral ribs at the intersections, but extend as lamellae on the sutural ramp. Last whorl with 7 spiral ribs, the anterior one a cord bordering the large, funnel-shaped umbilicus in which the whorls are visible, ribs and axial lamellae continuing within the umbilicus. Aperture triangular, columella concave with two strong and one weaker intermediate folds, outer lip strongly crenulated by the spiral ribs, siphonal canal short, turned to the right.

Dimensions: Height 18, diameter 14, height of aperture 9 mm.

Remarks: The species is left unnamed until more material can be found. The only other species of the subgenus so far on record appears to be the type species *Arizelostoma laseroni* Iredale which is less conspicuously cancellate, having fewer axial ribs and more spirals on each whorl.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Sydaphera** Iredale, 1929

Sydaphera undulata (Sowerby)

Plate 19, figs. 10, 11

1832 *Cancellaria granosa* Sowerby: pl. 10, fig. 16 (not pl. 10, fig. 17)
1848 *Cancellaria undulata* Sowerby: p. 136
1855 *Cancellaria undulata* Sowerby: p. 443, pl. 92, fig. 12, pl. 95, fig. 79
1899 *Cancellaria undulata;* Pritchard & Gatliff: p. 205 (synonymy)
1921 *Cancellaria australis* Sowerby; May: p. 72 (synonymy)
1923 *Cancellaria australis;* May: pl. 34, fig. 1
1932 *Cancellaria undulata;* Cotton & Godfrey: p. 54, pl. 3, fig. 2
1958 *Sydaphera undulata* (Sowerby) May revised Macpherson: pl. 34, fig. 1
1962 *Sydaphera undulata;* Macpherson & Gabriel: p. 226, fig. 259
1966 *Sydaphera undulata;* Hodgkin *et al.*: p. 43, pl. 16, fig. 5

Material: A single specimen WAM 70.1822 from locality 4534-FL1.

Description: Shell large, solid, elongate-ovate, with a high gradate spire; spire half the height of the shell, whorls convex, shoulder angulate, excavate at the suture to a variable degree, sculptured with axial ribs varying in number on the last whorl, about 18 on the penultimate whorl, slightly nodulose on the shoulder; ribs and interspaces crossed by numerous spiral grooves and lirae. Aperture sub-ovate, outer lip sharp, lirate within; columella with 3 strong folds, columella lip wide, separating from the columella, with 5 or 6 lirae anteriorly; siphonal canal short, broad, curved to the right; fasciole strongly curved, low but cordlike.

Dimensions: WAM 70.1822 height 42, height of aperture 22, diameter 25 mm.

Distribution: Roe Calcarenite, present seas (Victoria to Fremantle, Western Australia (Hodgkin *et al.,* 1966)); Early Pleistocene, Holocene.

Family MARGINELLIDAE
Genus **Cypraeolina** Cerulli-Irelli, 1911

Cypraeolina newmanae (Cotton)

Plate 22, figs. 34, 35

1949b *Marginella newmanae* Cotton: p. 199, pl. 20, *newmanae*

Type material: Holotype SAM 14229 from Esperance, Western Australia.

Material: Two specimens WAM 66.480 from locality 4333-FL1a.

Description: Shell elongate-subrectangular, the spire enveloped by the last whorl and the outer lip extending above the suture; last whorl long, moderately narrow and contracting gently anteriorly; aperture long, narrow, outer lip nearly straight but slightly contracting just below the middle, below which there are about 6 long weak denticles, lip scarcely thickened and incurved; columella gently curved to the anterior with 2 long folds anteriorly within a fasciolar band and about 8 folds weakening progressively posterior to these two; siphonal canal fairly narrow, turned to the left.

Dimensions: WAM 66.480a length 6.7, diameter 4 mm.

Remarks: The fossil specimens are smaller than the holotype.

Distribution: Roe Calcarenite, present seas (Beachport to Esperance 25 to 365 m depth); Early Pleistocene, Holocene.

Genus **Volvarina** Hinds, 1844
Subgenus **Sinuginella** Laseron, 1957

Volvarina (Sinuginella) clima (Cotton)

Plate 22, figs. 28, 29

1949b *Marginella clima* Cotton: p. 213, pl. 18 *clima*
1958b *Gibberula clima* (Cotton) Ludbrook: p. 80, pl. 3, fig. 13

Type material: Holotype SAM P8797 from Government Bore No. 21 at 122 m; Torrens Outlet Channel, Henley Beach Road, section 220, hundred of Adelaide; Dry Creek Sands, Late Pliocene.

Material: Twenty-five specimens GSWA F7169 (4534-FL2); WAM 66.481(22) (4333-FL1); 69.564(2) (4434-FL5).

Description: Shell ovate-pyriform, solid, thick, with a small conical spire and large last whorl; protoconch a single dome-shaped whorl, adult whorls three so far as can be seen from the sutures visible through the glossy callus; last whorl inflated, constricted anteriorly. Aperture moderately wide, expanding anteriorly, outer lip nearly straight with a thick varix, smooth within, attached just below the suture; columella convex posteriorly, concave anteriorly, with 4 strong folds anteriorly, the lowest bordering the siphonal canal being somewhat stronger than the rest.

Dimensions: WAM 69.564a length 7, diameter 4.9; 69.564b height 6.2, diameter 4.7 mm.

Remarks: The species is thicker and more globose, with a differently shaped spire and thicker labial varix than *V. (S.)* sp. cf. *V. (S.) caducocincta* (May) discussed below.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Volvarina (Sinuginella) talla (Cotton)

1949b *Marginella talla* Cotton: p. 213, pl. 18, fig. *talla*
1958b *Gibberula talla* (Cotton) Ludbrook: p. 80, pl. 3, fig. 14

Type material: Holotype SAM P8796 from Government Bore No. 21 at 122 m, Torrens Outlet Channel, Henley Beach Road, section 220, hundred of Adelaide; Dry Creek Sands, Late Pliocene.

Material: One specimen GSWA F7143 from locality 4334-FL1.

Description: Spire low and rather small, last whorl long, rounded at the shoulder and gradually tapering anteriorly; aperture long and rather narrow, outer lip inflected and only slightly thickened, attached at the suture; columella gently curved, with 4 folds the anterior of which borders the siphonal canal which is of moderate width.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Volvarina (Sinuginella) sp. cf. **V. (S.) caducocinta** (May)

Plate 22, figs. 32, 33

cf. 1916 *Marginella caducocincta* May: p. 88, pl. 2, fig. 11

Material: Seven specimens WAM 66.482 from locality 4333-FL1a.

Description: Shell rather small, pyriform, smooth with a bluntly conical pimple-like spire, sutures covered with callus, last whorl moderately long and inflated, aperture long, moderately wide and somewhat expanding anteriorly; outer lip gently curved with a moderately thick varix, smooth within; columella gently convex posteriorly and concave anteriorly with 4 strong folds on the anterior half, the lowest bordering the siphonal canal stronger than the other three; siphonal canal wide, turned slightly to the left and reflected.

Dimensions: WAM 66.482a length 5.1, diameter 3.4 mm.

Remarks: This species is related very closely to *V. (S.) caducocincta* (May), but is very much larger than the 16 "cotypes" of *Marginella caducocincta* from Thouin Bay 73 m in the May Collection SAM 650, the dimensions of which are length 3, diameter 2 mm.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Volvarinella** Habe, 1951

Volvarinella lodderae (May)

Plate 22, figs. 30, 31

1911 *Marginella lodderae* May: p. 384, pl. 13, fig. 5
1921 *Marginella lodderae* May: p. 71
1923 *Marginella lodderae* May: pl. 31, fig. 15
1958 *Longinella lodderae* (May) May revised Macpherson: pl. 31, fig. 15

Material: Eight specimens WAM 66.479(7) (4333-FL1), 70.36 (4434-FL6).

Description: Shell of moderate size, biconical, spire a little shorter than the aperture; when well-preserved rather hyaline with the sutures showing through the glossy surface, protoconch blunt and small, of about 1½ whorls, adult whorls 4, gradually increasing, last whorl only moderately inflated; aperture elongate, outer lip gently curved, with a thick varix, smooth within, attached at the

periphery, about half way between the base and adapical suture, and with a very slight posterior canal; columella convex posteriorly and concave anteriorly with 4 strong approximately equal folds in the anterior half; siphonal canal of moderate width, straight.

Dimensions: WAM 70.36 length 9, height 5 mm.

Remarks: The May "cotypes" SAM May Coll. 675 are more slender than the Roe Calcarenite specimens; the dimensions of the figured type are length 8, height 4 mm.

Distribution: Roe Calcarenite, present seas (Tasmania); Early Pleistocene, Holocene.

Suborder TOXOGLOSSA
Superfamily CONACEA
Family TURRIDAE
Genus **Apiotoma** Cossmann, 1889

Apiotoma euclensis n. sp.

Plate 22, figs. 22, 23

Type material: Holotype WAM 69.612 from locality 4534-FL2, 74 km west of Eucla Motel, Grid Reference EUCLA 626061, 31° 50′ S, 128° 11′ E; Roe Calcarenite, Early Pleistocene; 5 paratypes WAM 66.478(2) (4333-FL1); 69.522 (4434-FL6); 69.689(2) (4534-FL2).

Description: Shell small, elongate-fusiform with a gradate spire and long tapered last whorl, loosely coiled, protoconch high, of 2 whorls the tip high and pointed, adult whorls 5, shoulder slightly concave, whorls flat below the periphery, sculptured with 9 prominent peripheral nodules on each whorl, otherwise smooth except for growth lirae on the neck. Aperture elongate, about half of shell, outer lip thin, sinus moderately deep, columella and siphonal canal usually straight but may be slightly sinuous.

Dimensions: Holotype WAM 69.612 height 14.6, diameter 4.5 mm.

Remarks: The species is more sharply gradate than any described species of *Apiotoma.* Its nearest relatives appear to be in the Victorian Oligocene-Miocene, particularly *A. pritchardi* Powell.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Liratomina** Powell, 1942

Liratomina adelaidensis Powell

Plate 19, figs. 12, 13

1944 *Liratomina adelaidensis* Powell: p. 27, pl. 7, fig. 5
1958c *Liratoma adelaidensis;* Ludbrook: p. 86
1966 *Liratomina adelaidensis* Powell: p. 38

Material: Two specimens GSSA M2524 (4334-FL1); WAM 69.519 (4434-FL6).

Remarks: The Pleistocene specimens are larger than the holotype; GSSA M2524, a large and slender specimen, has dimensions height 51.5, diameter 24 mm. Fragments from Observation Bore A, Virginia, section 3224, hundred of Munno Para, indicate that adult specimens are about 50 mm high.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Liratomina? singularis n. sp.

Plate 22, figs. 1-4

Type material: Holotype WAM 69.566 a, from locality 4434-FL5, 0.6 km north of Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 36″ S, 127° 34′ 45″ E; Roe Calcarenite, Early Pleistocene; figured paratype WAM 69.566b (4434-FL5); unfigured paratypes GSSA M3255 (4334-FL1); WAM 69.506, 69.520(2) (4434-FL6).

Description: Shell moderately large, elongate-fusiform, weakly shouldered; protoconch smooth, bluntly rounded, of 1½ whorls, adult whorls 8, with a shallow constriction above the narrow shoulder, sculptured with fine spiral lirae varying in number and disposition, in the holotype there are 8 on the penultimate whorl and about 25 on the last whorl and base, axial sculpture is of fine microscopic growth striae. Aperture subovate, less than half height of shell, oblique, outer lip thin, concave; columella slightly concave, siphonal fasciole narrow, high.

Dimensions: Holotype WAM 69.566a height 44, height of aperture 19, diameter 17 mm.

Remarks: The true position of the labial sinus is difficult to determine. It does not occupy the depressed band in which the apertural lip is convex instead of concave; below this the lip is scalloped by the spiral ribs, which tends to obscure the possible shallow sinus on the peripheral carina which might relate the shell to *Epidirona*. In some respects the species appear to be an elongate *Epidirona quoyi* (Desmoulins). Because of the peculiar sinus and weak sculpture the species is doubtfully placed in *Liratomina*. The single specimen 69.506 (4434-FL6) has very convex whorls, in contrast to the flattish whorls of the normal species.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Splendrillia** Hedley, 1922

Splendrillia harpularia (Desmoulins)

Plate 22, figs. 5, 6

1840 *Pleurotoma harpula* Kiener: p. 58, pl. 18, fig. 3 (not *Murex harpula* Brocchi, 1814 nor *Pleurotoma harpula* Deshayes, 1834)

1842 *Pleurotoma harpularia* Desmoulins: p. 162, new name for *Pleurotoma harpula* Kiener not Deshayes

1909c *Drillia harpularia* (Desmoulins) Verco: p. 296 (synonymy)
1922 *Melatoma harpularia* (Desmoulins) Hedley: p. 251 (synonymy)
1966 *Splendrillia harpularia* (Desmoulins) Powell: p. 83

Material: Thirty-five specimens GSSA M3256 (4334-FL1); M3257(2) (4434-FL7); GSWA F6915 (4334-FL2); F6932(4) (4133-FL7); F6975 (4534-FL2); F6999 (4434-FL7); WAM 66.483(12), 66.561(3), 66.562(2) (4333-FL1); 69.521 (4434-FL6); 69.567(2), 69.568 (4434-FL5); 69.609, 69.688, 70.1140 (4534-FL2).

Description: Shell moderately large for the genus, slender or moderately so, with a smooth protoconch of 2 fairly high whorls, adult whorls 7 sculptured with from 15 to 20 oblique axial ribs terminating abruptly at the sinus, below the suture a strong more or less beaded spiral cord and fine well-spaced spiral striae on the interspaces between the ribs in some specimens although the striae are obsolete in others, 10 spiral lirae on the base and neck. Aperture oblique, outer lip convex with a moderately deep sinus on the shoulder; columella nearly straight with a narrow fairly thick callus, parietal callus pad thick.

Dimensions: WAM 69.688 height 20, diameter 8 mm.

Remarks: Specimen WAM 69.688 has two *Hipponix* scars.

Distribution: Roe Calcarenite, present seas (Victoria, South Australia, south-western Australia). "Dredged alive at all depths from 11 to 35 m. It has not been taken alive or dead beyond 35 m" (Verco, 1909c); Early Pleistocene, Holocene.

Splendrillia sp. cf. **S. harpularia** (Desmoulins)

Plate 22, fig. 7

Material: Three specimens GSWA F6998 (4434-FL7); F7094 (4334-FL1); WAM 69.608 (4534-FL2).

Description: Shell large for the genus, elongate-fusiform, solid, protoconch not known, adult whorls 8, weakly sculptured with faint curved axial ribs about 9 per whorl in the early whorls, obsolete in the later whorls, and axial growth striae and ridges which are crossed and very weakly tuberculated by spiral lirae, about 5 below the sinus. Aperture narrow, oblique, outer lip thickened, sinus deep and tending to be tubular, columella nearly straight, with a thick callus, parietal callus pad thick, siphonal canal fairly wide and slightly recurved.

Dimensions: WAM 69.608 height 25, diameter 10 mm.

Remarks: The three specimens may be a weakly-sculptured form of *S. harpularia.*

Distribution: Roe Calcarenite, Early Pleistocene.

Splendrillia sp.

Material: Two specimens (WAM 74.892), not identified, from locality 4333-FL1a.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Syntomodrillia** Woodring, 1928

Syntomodrillia decemcostata (Ludbrook)

Plate 22, figs. 8, 9

1941 *Austrodrillia decemcostata* Ludbrook: p. 98, pl. 5, fig. 19
1944 *Syntomodrillia decemcostata* (Ludbrook) Powell: p. 34
1958c *Syntomodrillia decemcostata;* Ludbrook: p. 88

Type material: Holotype SAM Tate Coll. T1672 from Abattoirs Bore No. 1, 98-152 m, Adelaide, section 97, hundred of Yatala; Dry Creek Sands, Late Pliocene.

Material: Three speecimens WAM 66.484 from locality 4333-FL1a.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Genus **Tomopleura** Casey, 1904

Tomopleura ludbrookae Powell

Plate 22, figs. 10, 11

1944 *Tomopleura ludbrookae* Powell, 1944: p. 38, pl. 2, fig. 14
1958c *Tomopleura ludbrookae;* Ludbrook: p. 89, pl. 5, fig. 5

Material: One specimen WAM 69.569 from locality 4434-FL5.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Genus **Epidirona** Iredale, 1931

Epidirona sp.

Plate 22, figs. 12, 13

Material: One specimen WAM 70.37 from locality 4434-FL6.

Description: Shell of moderate size, elongate-fusiform, solid, aperture about one-third height of shell; protoconch partly broken but probably of 2 smooth fragile whorls, adult whorls 9, not inflated, sculptured in the adapical three-quarters with fine axial ribs which, after the first adult whorl, are interrupted in the middle of the whorl by the depressed band corresponding to the labial sinus, above the sinus band they are turned to the right, below the band to the left, there are 16 on the penultimate whorl; the axials are cut off by the spiral sculpture which occupies three bands; an adapical band of spiral lirae developed by intercalation from none in the first whorl to 5 on the last whorl, a median band corresponding to the deep labial sinus with from one to nine fine lirae and an adapical band with 2 striae which are the upper two of the grooves which continue over the base and neck. Aperture subovate, slightly oblique, outer lip somewhat thickened, labial sinus deep, on the shoulder; columella gently arcuate, columellar callus fairly wide and thickened anteriorly, siphonal fasciole separated below the columellar lip, a slight parietal callus.

Dimensions: WAM 70.37 height 29, diameter 11, height of aperture 11 mm.

Remarks: The species, not named because there is only one specimen, is related to *E. hedleyi* which has coarser and more granular axial sculpture.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Antiguraleus** Powell, 1942

Antiguraleus incisus? (Powell)

1944 *Guraleus (Paraguraleus) incisus* Powell: p. 51, pl. 5, fig. 14
1958c *Guraleus (Paraguraleus) incisus;* Ludbrook: p. 92, pl. 5, fig. 11

Material: A single specimen WAM 66.597 (4233-FL2) only one-third to one-half the size of *A. incisus,* but with the 13 axials per whorl of that species.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Antiguraleus sp. cf. **A. incisus** (Powell)

Plate 22, figs. 14, 15

cf. 1944 *Guraleus (Paraguraleus) incisus* Powell: p. 51, pl. 5, fig. 14

Material: Four specimens WAM 66.467(3) (4333-FL1); 69.611 (4534-FL2).

Description: Shell small, fusiform, protoconch high, of 2 smooth whorls, adult whorls 4, moderately convex, somewhat gradate with a deeply impressed suture, sculptured with 15 high axial ribs per whorl, narrower than the interspaces which are crossed by about 10 spiral lirae on each spire whorl, on the last whorl the lirae become flatter and broader, separated by fine spiral striae which pass over both the ribs and interspaces. Aperture half height of shell, oblique, elongate-ovate, outer lip strongly variced, labial sinus fairly deep, columella nearly straight, siphonal canal broad, slightly expanding.

Dimensions: WAM 69.611 height 11, height of aperture 5.5, diameter 5 mm.

Remarks: The species differs in sculptural details from *A. incisus* of which there is very little material for comparison.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Etrema** Hedley, 1918

Etrema sp. cf. **E. elegans** Hedley

Plate 22, figs. 16, 17

cf. 1922 *Etrema elegans* Hedley: p. 278, pl. 47, fig. 77

Material: Four specimens WAM 66.504a-d (4333-FL1).

63616—(12)

Description: Shell small, with a high protoconch, the initial whorl of which is small and upstanding, followed by one smooth only slightly inflated whorl. Adult whorls 4, with a well-defined shoulder and angular periphery below which the whorl descends flatly to the abapical suture; 10 prominent axial ribs per whorl extending from suture to suture but weakening on the shoulder and dying out on the base, crossed and tuberculated by spiral lirae, one or two on the shoulder and below the periphery on the spire whorls and 13 on the last whorl and base. Aperture one-third height of shell, subtrapezoidal, outer lip varicate, denticulate within, labial sinus deep, columella straight, siphonal canal short, effuse.

Dimensions: WAM 66.504a height 5, diameter 2 mm.

Remarks: E. elegans is a North Queensland shallow-water species, with which the Roe Calcarenite specimens can be closely compared, but the identity needs confirmation by study of the type material.

Distribution: Roe Calcarenite; Early Pleistocene.

Etrema exsculpta Powell

Plate 22, figs. 18, 19

1944 *Etrema exsculpta* Powell: p. 54, pl. 5, fig. 4

Material: Ten specimens WAM 66.485(5), 66.486(3) (4333-FL1); 69.613(2) (4534-FL2).

Description: Shell small, elongate-fusiform, with a small high protoconch of 2 whorls, adult whorls 6, angulate at the shoulder, with 12 axial ribs per whorl crossed by spiral threads the strongest of which, two on the periphery and one or more below the periphery, tend to tuberculate the axials at the intersections; on the shoulder there are about 5 fine spirals, and below the periphery 5 of varying strength on the spire whorls, 17 on the last whorl. Aperture wide, outer lip thin, incurved, weakly lirate within, strengthened behind with a varix, labial sinus deep, parietal tubercle small but strong, siphonal canal broad, reflected.

Dimensions: WAM 69.613 height 8, diameter 3.6 mm.

Remarks: The Pleistocene specimen 69.613 has 6 adult whorls in a height of 8 mm as compared with 5 in the Miocene holotype.

Distribution: Altona, Victoria (Newport Formation) and Roe Calcarenite; Miocene, Early Pleistocene.

Genus **Nepotilla** Hedley, 1918

Nepotilla sp.

Plate 24, fig. 11

Material: Two specimens WAM 66.507 from locality 4333-FL1a.

Description: Shell minute, turreted, deeply constricted at the sutures, whorls very convex. Protoconch high and weakly lirate, with a small oblique nucleus and cylindrical second whorl terminated by a varix; adult whorls 3 ornamented with 9 axial ribs per whorl crossed by 5 spiral lirae on the spire whorls, 12 over the last whorl and base. Aperture subovate with a fairly long siphonal canal, columella straight, a varix behind the outer lip, posterior sinus broad, semicircular.

Dimensions: WAM 66.507a height 3.6, diameter 1.6 mm.

Remarks: Only one of the specimens is complete, the other has the early whorls missing.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Exomilus** Hedley, 1918

Exomilus nodulosus n. sp.

Plate 24, fig. 12

Type material: Holotype WAM 66.506a from locality 4333-FL1a, Nurina Cave, surface of doline, Grid Reference BURNABBIE 505041, 32° 00′ 31″ S, 127° 00′ 30″ E; Roe Calcarenite, Early Pleistocene; 3 paratypes WAM 66.506b-d (4333-FL1a).

Description: Shell minute, solid, elongate-pagodiform, with a high, smooth protoconch of 1½ whorls, adult whorls 5, suture linear, undulating; each whorl sculptured with 8 high nodulose axial ribs, highest on the shoulder above the middle of the whorl; on the third and following whorls an abapical row of about 10 gemmules develops immediately above the suture, the undulations on the suture corresponding to the beads; last whorl with 8 nodular ribs on the periphery and the row of 10 beads above the base; 5 spiral lirae on the neck. Aperture elongate-subrectangular, columella straight with a thin callus, outer lip broken in all specimens but probably somewhat incurved with a shallow posterior sinus, siphonal canal slightly reflected.

Dimensions: WAM 66.506a height 5.3, diameter 1.6, height of aperture 1.6, width of aperture 0.4 mm.

Remarks: The species is most nearly related to *E. dyscritos* (Verco) which is nearly twice the size of *E. nodulosus* from which it differs also in details of sculpture.

Distribution: Roe Calcarenite; Early Pleistocene.

Exomilus telescopialis (Verco)

Plate 24, fig. 10

1896 *Drillia telescopialis* Verco: p. 222, pl. 7, figs. 1, 1a, 1b
1900a *Drillia telescopialis;* Pritchard & Gatliff: p. 172
1922 *Exomilus telescopialis* (Verco) Hedley: p. 335
1958 *Emomilus* (sic) *telescopialis;* May revised Macpherson: pl. 49, fig. 12

Type material: Holotype SAM D13564 from Backstairs Passage.

Material: Two specimens WAM 66.497 from locality 4333-FL1a.

Distribution: Roe Calcarenite, present seas (Victoria, Tasmania and South Australia); Early Pleistocene, Holocene.

Genus **Austrocarina** Laseron, 1954

Austrocarina? unicingulata n. sp.

Plate 22, figs. 20, 21; Plate 24, fig. 9

Type material: Holotype WAM 66.533 from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E; Roe Calcarenite, Early Pleistocene; 6 paratypes WAM 66.447 (4333-FL1).

Description: Shell small, slender, with a somewhat gradate spire, protoconch erect, of 1½ smooth whorls, adult whorls 6, high, sculptured with a thread on the shoulder which is concave in the holotype and the thread strong, the degree of the peripheral carina is variable, though to what extent this is due to preservation is uncertain; in some specimens the thread and carina are absent; six spiral striae on the neck. Aperture elongate-subrectangular, outer lip reflected, angulate at the position of the spiral thread, sinus broad and shallow, occupying the shoulder slope, siphonal canal short, somewhat reflected.

Dimensions: Holotype WAM 66.533 height 6.5, diameter 1.4 mm; largest specimen 66.447a height 8, diameter 1.8 mm.

Remarks: The species is more slender than *A. recta* (Hedley) and lacks the spiral lirae of that species.

Distribution: Roe Calcarenite; Early Pleistocene.

Family CONIDAE
Genus **Conus** Linnaeus, 1758
Subgenus **Floraconus** Iredale, 1930

Conus (Floraconus) anemone Lamarck

Plate 21, figs. 8, 9

1810 *Conus anemone* Lamarck: p. 272
1900a *Conus anemone;* Pritchard & Gatliff: p. 180 (synonymy)
1921 *Conus anemone;* May: p. 73 (synonymy)
1923 *Conus anemone;* May: pl. 34, fig. 16
1930b *Floraconus anemone* (Lamarck) Iredale: p. 80
1932a *Floraconus anemone;* Cotton & Godfrey: p. 68, pl. 3, fig. 12
1945a *Floraconus anemone;* Cotton: p. 262, pl. 1, fig. 4

1958 *Floraconus anemone;* May revised Macpherson: pl. 34, fig. 16

1962 *Floraconus anemone;* Macpherson & Gabriel: p. 235, fig. 273

1966 *Floraconus anemone;* Hodgkin *et al.:* p. 45, pl. 17, fig. 8

1971 *Conus anemone;* Wilson & Gillett: p. 148, pl. 99, figs. 6, 6a-c

Material: Eight specimens GSWA F6922(2) (4133-FL7); F6964 (4534-FL2); WAM 69.565 (4434-FL5), 69.614, 69.687(2) (4534-FL2); 71.335 (4434-FL6).

Description: Shell of medium size, spire usually low but varying in height and in outline from concave to roundly gradate; protoconch small and high, of 2 smooth whorls, adult whorls 8, convex, all spirally lirate but the first 4 weakly axially plicate; last whorl large, four-fifths height of shell, shoulder rounded, whorl convex below the shoulder, sculptured with numerous spiral lirae and weak microscopic axial growth striae; aperture rather narrow but expanding anteriorly, both outer lip and columella convex.

Dimensions: WAM 71.335 height 41, height of spire 8, diameter 21 mm.

Remarks: The weak axial plications on the early whorls do not appear to have been recorded by previous authors, but they are present on living shells also.

Distribution: Roe Calcarenite, Glanville Formation, present seas ("Central New South Wales to Geraldton, Western Australia" (Wilson & Gillett, 1971)); Early Pleistocene to Holocene.

Conus (Floraconus) sp.

Plate 21, figs. 6, 7

Material: One specimen WAM 69.531 from locality 4434-FL6.

Description: Shell of small to moderate size, biconical, with a fairly high spire, protoconch missing in the fossil, adult whorls 8, constricted in the middle of the spire whorls and sculptured with punctate spiral striae and microscopic concave axial striae on the sutural ramp, last whorl with straight sides in profile sculptured below the shoulder with flattish spiral lirae about half the width of the interspaces and increasing in strength anteriorly. Aperture narrow, oblique, expanding a little anteriorly, outer lip folded over, with a conspicuous posterior sinus.

Dimensions: WAM 69.531 height 40, height of spire 11, diameter 18 mm.

Distribution: Roe Calcarenite; Early Pleistocene.

Conus (Floraconus) compressus Sowerby

Plate 21, figs. 10, 11

1866 *Conus compressus* Sowerby: p. 325, pl. 5, figs. 602, 603

1945a *Floraconus compressus* (Sowerby) Cotton: p. 265, pl. 1, fig. 7

1971 *Conus compressus;* Wilson & Gillett: p. 148, pl. 99, fig. 7

Material: One hundred and twenty-three specimens GSSA M1273(2) (4333-FL2); M2516 (4434-FL9); M2523(30) (4334-FL1); M2582(2) (4434-FL7); GSWA F6899(2) (4434-FL8); F6912(15) (4334-FL2); F6948 (4133-FL7); F7002(2) (4434-FL7); F7023(4) (4133-FL4); F7047 (4133-FL3); F7070(5), F7090(4) (4334-FL1); WAM 61.63(4) (4334-FL6); 62.48 (4334-FL1); 66.488(26), 66.560(9) (4333-FL1); 66.624(8) (4434-FL1); 69.526-69.530(5) (4434-FL6).

Description: Shell small, biconical, with a gradate spire of varying height but commonly about or a little less than one-third height of shell, protoconch of 2 elevated smooth whorls, adult whorls 7, gradate, shoulder angulate; the suture may be at or well below the shoulder; sutural ramp with from 2 to 5 or 6 fine spiral lirae, a broader one on the shoulder below which the whorl is smooth; the lirae may also be absent on the sutural ramp; last whorl weakly striate or smooth but for 10 spiral grooves on the base; axial sculpture of weak microscopic striae; concave on the sutural ramp, reflecting a weak sinus in the outer lip. Aperture long, narrow, oblique, outer lip and columella straight and parallel.

Dimensions: WAM 69.527 (lirate form very close to the specimen figured by Sowerby) height 28, height of spire 8, diameter 13 mm; WAM 69.528 (the smooth gradate form) height 33, height of spire 11, diameter 15 mm.

Remarks: The abundance of this species in the Roe Calcarenite in contrast to the comparative rarity in present seas is worthy of note.

Distribution: Roe Calcarenite, Glanville Formation, present seas (South Australia in Encounter Bay and Gulf St. Vincent); Early Pleistocene to Holocene.

Subgenus **Leptoconus** Swainson, 1840

Conus (Leptoconus) petasus n. sp.

Plate 21, figs. 1-5

Type material: Holotype WAM 69.523 from locality 4434-FL6, Hampton Microwave Repeater Tower, Grid Reference EUCLA 563045, 31° 57′ 57″ S, 127° 34′ 45″ E; Roe Calcarenite, Early Pleistocene; figured paratypes WAM 69.385 (4434-FL7); 69.525, 70.38 (4434-FL6); unfigured paratypes WAM 66.489(25), 66.490 (4333-FL1); 69.524 (4434-FL6); 69.582 (4434-FL4); 71.328 (4434-FL6).

Description: Shell large, obconic, with a gradate sharply-pointed concavely-elevated spire, flattening on the periphery, of varying height from one-fifth to one-third height of shell; protoconch small of 2 high smooth whorls, adult whorls 10, each almost completely embracing the previous whorl, shoulder angulate, sutural ramp flat to concave, surface smooth but for concave axial growth striae above the shoulder reflecting the sinus in the outer lip and about 12 weak lirae on the base of the last whorl; last whorl large, narrow and straight in profile in young shells but becoming broader and convex in profile in older specimens. Aperture fairly

narrow, oblique, outer lip parallel to the columella, margin convex below and sinuate above the shoulder, columella gently convex, with a strong tooth-like callus anteriorly bordering the siphonal canal. Two specimens show a colour pattern of spiral rows of fine dots on the last whorl.

Dimensions:	height (mm)	height of spire (mm)	diameter (mm)
WAM 69.523	109	21	57
69.385	64	10	41
69.525	50	16	21
70.38	66	12	33

Remarks: This species is very close to *C. (L.) monile* Hwass in Bruguière (1792). The lack of spiral sculpture on the spire whorls which have only axial growth striae reflecting the apertural sinus is the same in both species. The spire tends to be larger in *C. (L.) petasus*. The colour pattern of *C. (L.) monile* ("necklace") is that of a number of spiral rows of dots like a series of necklaces of different-sized beads whereas in *C. (L.) petasus* it may be likened to bands of fine seed-pearl necklaces. In this the pattern is more like that of *C. (L.) nielsenae* Marsh as figured by Wilson & Gillett (1971, pl. 101, fig. 5). The strong tooth-like callus at the base of the columella is not present in *C. (L.) monile*. The specific name is given because of the faint resemblance of the spire to a conical sun-hat. Paratype WAM 69.525 is an immature shell with an unusually high gradate spire; the anterior tooth-like callus is well developed.

Distribution: Roe Calcarenite; Early Pleistocene.

Family TEREBRIDAE
Genus **Terebra** Bruguière, 1789
Subgenus **Dimidacus** Iredale, 1929

Terebra (Dimidacus) sp. cf. **T. (D.) melamans** (Iredale)

Plate 23, fig. 3

cf. 1929b *Perirhoe melamans* Iredale p. 341, pl. 38, fig. 7

Material: Three specimens GSSA M2535 (4334-FL1); WAM 66.491 (4333-FL1); 70.39 (4434-FL6).

Description: Shell elongate-subulate, early whorls missing, 15 remaining in a height of 36 mm, probable total 20 in a height of 48 mm; suture impressed, imbricating, whorls low, sculptured with a spiral linear groove about one-third the distance from the adapical suture, above the groove a band with about 24 weak gemmules, below the groove the whorl is constricted and sculptured with about 4 spiral striae the abapical of which borders a narrow, very finely and weakly gemmulated band. Aperture subrhomboid, low, outer lip thin, straight, columella straight, twisted anteriorly, siphonal canal short, reflexed.

Dimensions: WAM 70.39 (incomplete, 14 whorls) height 33, diameter 7.5 mm; GSSA M2535 (15 whorls) height 36, diameter 8.4 mm.

Remarks: The Roe Calcarenite species belongs to a group represented by *T. (D.) melamans* (Iredale), *T. (D.) exulta* (Iredale) and *T. (D.) albomarginata* (Deshayes). It differs from *T. (D.) melamans* in details of sculpture, the gemmules on the adapical band being more pronounced than in the three living species; the whorls are more numerous in the fossil, 14 in a height of 33 mm as against 20 in a height of 75 mm in *T. (D.) melamans.*

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Hastula** H.&A. Adams, 1853
Subgenus **Nototerebra** Cotton, 1947

Hastula (Nototerebra) flindersi (Cotton)

Plate 23, fig. 2

1952a *Nototerebra flindersi* Cotton: p. 41, pl. 3, fig. 4

Type material: Holotype SAM D14435 dredged Beachport, South Australia, 182 m.

Material: One specimen GSWA F7042 from locality 4133-FL3, Quarternary surface deposit (Qpo).

Description: Shell small, moderately subulate, rather thin, protoconch missing in the single fossil specimen, adult whorls 9, scarcely convex, very weakly sculptured in the early whorls with faint axial ribs which become obsolete in the later whorls where the axials are sinuous growth striae only; about one-quarter the width of the whorl below the suture there is a weak spiral depression. Aperture elongate-rhomboid, outer lip gently concave with a slight constriction posteriorly at the spiral depression; columella nearly straight, slightly oblique, with a thin callus, siphonal fasciole well-marked, bounded posteriorly by a thin thread; siphonal canal moderately broad, reflexed.
Dimensions: GSWA F7042 height 29, diameter 8 mm.

Distribution: Surface sand (Qpo) present seas (Beachport, South Australia, to Rottnest Island, Western Australia); ?Pleistocene, Holocene.

Genus **Strioterebrum** Sacco, 1891
Subgenus **Pervicacia** Iredale, 1924

Strioterebrum (Pervicacia) crassum (Tate)

Plate 23, fig. 1

1886a *Terebra crassa* Tate: p. 7
1889 *Terebra crassa* Tate: p. 161, pl. 9, fig. 9
1958c *Strioterebrum (Pervicacia) crassum* (Tate) Ludbrook: p. 99, pl. 6, fig. 7

Type material: Holotype SAM Tate Coll. T688C, type series T688.

Material: Eleven specimens GSWA F6921(3) (4133-FL7); WAM 66.438(5) (4333-FL1); 69.570 (4434-FL5); 69.615 (4534-FL2); 70.1141 (4434-FL6).

Description: Shell rather small, subulate, with a protoconch of 1½ high smooth whorls; adult whorls 10, strongly sculptured with from 20 to 22 axial ribs per whorl and a deep spiral groove set below the adapical suture at about three-fifths the height of the whorl. Suture deep, imbricating, aperture curved, rhomboid, of even width throughout, columella slightly convex, fasciolar band conspicuous and bordered posteriorly by a spiral rib; siphonal canal short, open, recurved.

Dimensions: WAM 69.570 height 20.5, diameter 5.5 mm.

Distribution: Hallett Cove Sandstone, Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Subclass	OPISTHOBRANCHIA
Order	TECTIBRANCHIA (CEPHALASPIDEA)
Superfamily	BULLACEA
Family	BULLIDAE
Genus	**Bulla** Linnaeus, 1758

Bulla botanica Hedley

Plate 23, fig. 6

1825b *Bulla australis* Gray: p. 408 (not Férussac, 1822)
1903a *Bulla australis;* Pritchard & Gatliff: p. 214 (synonymy)
1916 *Bullaria australis* (Gray) Hedley: p. 221 (synonymy)
1918 *Bulla botanica* Hedley: p. M104 new name for *Bulla australis* Gray not Férussac
1921 *Bullaria botanica* (Hedley) May: p. 103 (synonymy)
1923 *Bullaria botanica;* May: pl. 46, fig. 14
1929b *Quibulla botanica* (Hedley) Iredale: p. 349
1933 *Quibulla botanica;* Cotton & Godfrey: p. 84, pl. 1, fig. 13
1958 *Bullaria botanica;* May revised Macpherson: pl. 46, fig. 14
1962 *Bullaria botanica;* Macpherson & Gabriel: p. 243, fig. 281
1966 *Bullaria botanica;* Hodgkin *et al.:* p. 53, pl. 21, fig. 5

Material: Thirteen specimens GSWA F7115(4) (4634-FL1); F7184 (4634-FL2); GSSA M1291(2) (4234-FL1); WAM 62.33 (4334-FL1); 69.616(2) (4534-FL2); 69.636(2) (4434-FL13); 69.646 (4334-FL7).

Description: Shell involute, ovate, narrower posteriorly, rather thin, smooth but for numerous fine growth lines, with a deep and narrow adapical umbilicus. Aperture long, wide, gently curved above the shell posteriorly and expanding into a moderate curve below the shell margin anteriorly; columella concave, with a moderately thick crescent-shaped columellar callus. In life the shell is mottled light brown in colour, some of this colour being retained in the specimen GSWA F7115.

Dimensions: WAM 69.646 (an average size specimen) height 43, diameter 28 mm; large specimens can reach a size of 67 x 40 mm (Cotton & Godfrey, 1933).

Distribution: Roe Calcarenite, Glanville Formation, St. Kilda Formation, present seas (sandy mudflats and river mouths from New South Wales to Houtman Abrolhos, Western Australia); Early Pleistocene to Holocene.

Family ATYIDAE
Genus **Haminoea** Turton, 1830
Subgenus **Liloa** Pilsbry, 1921

Haminoea (Liloa) brevis (Quoy & Gaimard)

Plate 23, figs. 7, 8

1833 *Bulla brevis* Quoy & Gaimard: p. 358, pl. 26, figs. 36-37
1894 *Haminea brevis* (Quoy & Gaimard) Pilsbry: p. 373, pl. 40, figs. 9, 10, 96 (synonymy)
1921 *Haminoea (Liloa) brevis* Pilsbry: p. 370
1969 *Liloa brevis* (Quoy & Gaimard) Burn: p. 68-72 (synonymy)

Material: Seven specimens GSWA F7113(4) (4634-FL1); F7178(3) (3630-FL1).

Description: Shell rather small, thin, somewhat ovately cylindrical, truncated at both ends, spire concealed, apex sunken in a broad funnel-shaped depression. Last whorl completely enveloping the rest of the shell, surface smooth but for 12 to 20 spiral striae anteriorly and numerous microscopic growth striae. Aperture wide over its entire length expanding a little anteriorly, outer lip arched above the whorl posteriorly. Columella concave, with a narrow columellar lip.

Dimensions: GSWA F7113 (1) length 12, diameter 6.6 mm.

Remarks: The living shell and animal were described by Burn (1969).

Distribution: Glanville Formation, Peppermint Grove Limestone, lake and lagoonal deposits (Ql), present seas (from New South Wales to Fremantle, Western Australia in algae (Hodgkin *et al.*, 1966)); Late Pleistocene to Holocene.

Family RETUSIDAE
Genus **Retusa** Brown, 1827
Subgenus **Semiretusa** Thiele, 1925

Retusa (Semiretusa) coxi Ludbrook

1958c *Retusa (Semiretusa) coxi* Ludbrook: p. 104, pl. 6, fig. 21

Type material: Holotype SAM Tate Coll. F15445 from H. K. Weymouth's Bore, 94.48-99.06 m, section 2271, hundred of Yatala; Dry Creek Sands.

Material: Five specimens WAM 66.509 from locality 4333-FL1a.

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Retusa (Semiretusa) nurinensis n. sp.

Plate 24, fig. 16

Type material: Holotype WAM 66.494a, from locality 4333-FL1a Nurina Cave, surface of doline, Grid Reference BURNABBIE 505941 32°00′ 31″ S, 127° 00′ 30″ E; Roe Calcarenite, Early Pleistocene; 13 paratypes WAM 66.494(12) (4333-FL1); 69.583 (4434-FL4); 69.618 (4534-FL2).

Description: Shell small, with a pyramidal spire and cylindrical last whorl tapering slightly and rounded anteriorly, protoconch fairly large, high, of 1½ whorls, adult whorls 4, rather weakly gradate, more or less concave on the sutural ramp, shoulder angulate, sides oblique; spire about one-fifth height of shell. Aperture long, widening anteriorly, outer lip obtuse-angled posteriorly, thin and fragile and turned gently inwards, basal lip rounded below the margin of the whorl anteriorly, columella concave, a thin narrow callus extending over the columellar lip and wall.

Dimensions: WAM 66.494a length 6.8, diameter 3.1 mm.

Remarks: The species belongs to a group of which *Retusa (Semiretusa) canaligradata* is the Dry Creek Sands representative. *R. (S.) nurinensis*, which also occurs rarely in the Dry Creek Sands, differs from *R. (S.) canaligradata* in the pyramidal shape of the spire and attachment of the outer lip at the shoulder.

Distribution: Dry Creek Sands and Roe Calcarenite; Late Pliocene to Early Pleistocene.

Family SCAPHANDRIDAE

Genus **Tornatina** A. Adams, 1850

Tornatina pachyptycha Cossmann

Plate 23, figs. 4, 5

1897 *Tornatina pachyptycha* Cossmann: p. 6, pl. 1, figs. 20, 21

Material: A single specimen GSWA F7177 from locality 4534-FL2.

Distribution: Grange Burn Coquina, Muddy Creek, Victoria, Roe Calcarenite; Early Pliocene, Early Pleistocene.

Genus **Cylichna** Loven, 1846

Cylichna arachis (Quoy & Gaimard)

Plate 23, fig. 9

1833 *Bulla arachis* Quoy & Gaimard: p. 361, pl. 26, figs. 28-30
1903a *Bullinella arachis* (Quoy & Gaimard) Pritchard & Gatliff: p. 214
1921 *Cylichnella arachis* (Quoy & Gaimard) May: p. 103
1923 *Cylichnella arachis;* May: pl. 46, fig. 11

1933 *Cylichnella arachis;* Cotton & Godfrey: p. 81, pl. 1, fig. 10
1958 *Cylichna arachis* (Quoy & Gaimard) May revised Macpherson: pl. 46, fig. 11
1962 *Cylichna arachis;* Macpherson & Gabriel: p. 245, fig. 285

Material: One hundred and forty-one specimens GSSA M2528 (4334-FL1); M2587(2) (4434-FL7); M3286(2) (4333-FL2); GSWA F6965(7) (4534-FL2); F7067 (4334-FL1); WAM 61.57 (4334-FL6); 66.492(108), 66.563(11) (4333-FL1); 69.571(2), 69.572 (4434-FL5); 69.617(3), 69.690 (4534-FL2); 70.1824 (4534-FL1).

Description: Shell solid, involute, rolled in an elongate cylinder, the posterior end sunken with a deep adapical umbilicus, sculptured with very fine to conspicuous microscopic spiral striae. Aperture long, narrow, widening anteriorly, outer lip convex and turned slightly inwards, curved in a narrow arch, slightly above the shell posteriorly and in a broad curve anteriorly; columella oblique with a single thick anterior fold, columellar lip with a thin callus.

Dimensions: WAM 69.572 length 33, diameter 14 mm.

Remarks: In life the shell is white, covered with a brown epidermis, and, as its name implies, is like a ground nut or peanut.

Distribution: Roe Calcarenite, present seas (Victoria, Tasmania, South Australia and southwestern Australia); Early Pleistocene, Holocene.

Superfamily PYRAMIDELLACEA
Family PYRAMIDELLIDAE
Genus **Odostomia** Fleming, 1817

Odostomia sp.

Plate 24, fig. 5

Material: A single specimen WAM 66.498a from locality 4333-FL1a.

Genus **Otopleura** Fischer, 1885

Otopleura australis Laseron

Plate 23, figs. 10, 11

1959 *Otopleura australis* Laseron: p. 188, fig. 9

Material: Two specimens WAM 69.532 and 70.40 from locality 4434-FL6.

Remarks: The species was described by Laseron from a single specimen from North-west Island, Capricorn Group, Queensland. Although neither is complete, the two Roe Calcarenite specimens are thick, solid and otherwise similar to the holotype, the height of which is 24 mm; WAM 70.40 has height 18 mm;

the estimated height of WAM 69.532 is 27 mm. From a preliminary examination of material in the South Australian Museum, it is likely that the species, or one closely allied, may have a wider range than indicated by the two isolated and widely separated occurrences.

Distribution: Roe Calcarenite, present seas (North Queensland); Early Pleistocene to Holocene.

Otopleura robinsoni n. sp.

Plate 23, figs. 12, 13

Type material: Holotype WAM 66.425a from locality 4333-FL1a, Nurina Cave, surface of doline, Grid Reference BURNABBIE 505041, 32° 00′ 31″ S, 127° 00′ 30″ E; Roe Calcarenite, Early Pleistocene; 9 paratypes WAM 66.425b-h (4333-FL1a), GSWA F7174 (4334-FL1).

Description: Shell small for the genus, narrowly ovately-conical with a small smooth protoconch of about 2 whorls, the tip submerged, passing inconspicuously into the spire whorls. Adult whorls 6, with flat sloping sides, sutures linear, impressed; whorls ornamented with about 25 sharp axial ribs equal to the interspaces and extending from suture to suture, in the interspaces are almost imperceptible spiral grooves, 4 or 5 on the penultimate whorl. Aperture elongate-ovate, slightly oblique, outer lip gently curved, basal lip slightly expanded, columella with three folds the posterior one prominent, horizontal and continuous, forming a conspicuous internal rib, anterior two weak and oblique. Columellar lip narrow, standing away from the slight umbilical chink and small fasciolar band.

Dimensions: WAM 66.425a height 8, diameter 3.5 mm.

Remarks: The species is close to but not identical with a small series in the South Australian Museum, named by Sir Joseph Verco *Turbonilla festiva* Angas, from an unspecified locality. It is named for its collector Mr. Bruce W. Robinson, who is responsible for the rich material from Nurina Cave given to the Western Australian Museum.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Eulimella** Gray, 1847

Eulimella sp.

Material: A single specimen WAM 66.552 from locality 4333-FL1b.

Distribution: Roe Calcarenite, Early Pleistocene.

Genus **Syrnola** A. Adams, 1860
Subgenus **Agatha** A. Adams, 1860

Syrnola (Agatha) jonesiana (Tate)

1898a *Odontostomia (Syrnola) jonesiana* Tate: p. 70
1898b *Odontostomia (Syrnola) jonesiana* Tate: p. 83, text fig.
1957 *Syrnola (Agatha) jonesiana* (Tate) Ludbrook: p. 41, pl. 3, fig. 6

Material: One worn specimen WAM 66.499 (4333-FL1a).

Distribution: Dry Creek Sands, Roe Calcarenite; Late Pliocene to Early Pleistocene.

Syrnola sp.

Material: Three specimens WAM 66.500 from locality 4333-FL1a.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Cingulina** A. Adams, 1860

Cingulina sp. cf. **C. spina** (Crosse & Fischer)

cf. 1864 *Turritella spina* Crosse & Fischer: p. 347

Material: Two specimens WAM 66.446 from locality 4333-FL1a.

Remarks: The subulate specimens differ from *C. spina* in being smaller, with less convex whorls.

Distribution: Roe Calcarenite; Early Pleistocene.

Genus **Turbonilla** Risso, 1826
Subgenus **Chemnitzia** d'Orbigny, 1839

Turbonilla (Chemnitzia) sp. cf. **T. (C). mappingae** Ludbrook

cf. 1957 *Turbonilla (Chemnitzia) mappingae* Ludbrook: p. 43, pl. 3, fig. 11

Material: Four specimens WAM 66.449 from locality 4333-FL1a.

Distribution: Roe Calcarenite; Early Pleistocene.

Subclass PULMONATA
Order BASOMMATOPHORA
Superfamily ELLOBIACEA
Family ELLOBIIDAE
Genus **Ophicardelus** Beck, 1838

Ophicardelus ornatus (Férussac)

1821 *Auricula ornata* Férussac: p. 103
1921 *Phytia ornata* (Férussac) May: p. 88 (synonymy)
1923 *Phytia ornata;* May: pl. 40, fig. 24

1926 *Ophicardelus ornatus* (Férussac) Iredale: p. 286, fig 1 (synonymy)
1932c *Ophicardelus ornatus;* Cotton & Godfrey: p. 157, pl. 3, fig. 2
1958 *Ophicardelus ornatus;* May revised Macpherson: pl. 40, fig. 24
1962 *Ophicardelus ornatus;* Macpherson & Gabriel: p. 258, fig. 295

Material: Two specimens GSWA F6967 from locality 4534-FL2.

Remarks: The two specimens come within the range of the living species, although F6967(1) is large and appears somewhat more slender since the protoconch is not eroded as it usually is in living examples.

Dimensions: GSWA F6967(1) height 14.6, diameter 7.5 mm.

Distribution: Roe Calcarenite, margins of present seas (New South Wales, Victoria and Tasmania and southwestern Australia "amongst herbage in creeks etc. reached by the tide" (May, 1923)); Early Pleistocene, Holocene.

Superfamily AMPHIBOLACEA
Family AMPHIBOLIDAE
Genus **Salinator** Hedley, 1900

Salinator fragilis (Lamarck)

Plate 23, fig. 16

1822a *Ampullaria fragilis* Lamarck: p. 179
1832 *Ampullacera fragilis* (Lamarck) Quoy & Gaimard: vol. 2, p. 201, (in part)
1833 *Ampullacera fragilis;* Quoy & Gaimard: pl. 15, figs. 13, 14 (not fig. 10)
1838 *Ampullaria quoyana* Potiez & Michaud: p. 288, pl. 28, figs. 15, 16 (*fide* Woolacott, 1945)
1841 *Ampullaria fragilis;* Delessert: pl. 31, figs. 4a, b, c
1878 *Amphibola fragilis* (Lamarck) von Martens: p. 4, pl. 1, figs. 2 M,m,N,S,S^1,S^2
1900 *Salinator fragilis* (Lamarck) Hedley: p. 511
1921 *Salinator fragilis;* May: p. 88 (synonymy)
1932c *Salinator fragilis;* Cotton & Godfrey: p. 151, pl. 3
1945 *Salinator fragilis;* Woolacott: p. 36, pl. 3, figs. 3-6, 10
1958 *Salinator fragilis;* May revised Macpherson: pl. 41, fig. 1
1962 *Salinator fragilis;* Macpherson & Gabriel: p. 260, fig. 296
1966 *Salinator fragilis;* Macpherson: p. 228

Type material: Syntypes in Collection Lamarck, MNHG from King George Sound, Western Australia.

Material: Thirteen specimens GSSA M1285 (4234-FL1); M2550 (4334-FL1); GSWA F6917 (4334-FL2); F6925(2) (4133-FL7); F6955(9) (4534-FL2); F7012 (4434-FL7); 66.495(3), 66.503 (4333-FL1).

Description: Shell globose, thin but solid, umbilicated, spire less than half height of shell, suture deeply impressed, protoconch small, of 1½ flattish loosely-coiled whorls, adult whorls 4, inflated, sculptured with conspicuous irregular somewhat sinuous growth striae. Aperture oblique, almost a half-circle, outer lip strongly rounded and basal lip somewhat expanded, columellar lip nearly straight, oblique, parietal lip thin, attached; umbilicus fairly wide, deep.

Dimensions:	height (mm)	height of spire (mm)	height of aperture (mm)	diameter (mm)
Syntype (Mermod 1952)	11.5		7.5	11
Typical specimen from samphire flats Port Wakefield	16.5	7	9	14
GSWA F6955(1)	11	4	7	10

Distribution: Roe Calcarenite, Glanville Formation, St. Kilda Formation, margins of present seas (Queensland to southwestern Australia); Early Pleistocene to Holocene.

Salinator lawsae n. sp.

Plate 23, figs. 20-23

Type material: Holotype WAM 69.673b from locality 4534-FL2, 64 km west of Eucla, Grid Reference EUCLA 626061, 31° 50′ S, 128° 11′ E; Roe Calcarenite, Early Pleistocene; figured paratype 69.642 (4334-FL7); unfigured paratypes GSSA M1294 (4333-FL2); M1296(4) (4334-FL1); M2510 (4434-FL9); M3274 (10) (4334-FL1); GSWA F6931(16) (4334-FL2); F6954(2) (4534-FL2); F7013 (4434-FL7); F7081(3) (4334-FL1); WAM 61.53, 61.58 (4434-FL6); 62.36(4), 66.608(3) (4334-FL1); 69.488 (4434-FL6); 69.655(4) (4434-FL8); 69.673a, c (4534-FL2).

Description: Shell large, helicoid, thin but solid, widely and deeply umbilicated, spire low, about one-third height of shell, suture deeply impressed; protoconch of 1½ loosely-coiled flattish whorls with tip submerged, adult whorls 4, inflated, barely in contact, last whorl large, very slightly carinate at the periphery, sculptured with sinuous imbricating growth striae and folds. Aperture oblique, outer lip expanded with a broad sinuosity which is reflected in the growth lines, basal lip slightly expanded towards the outer lip but curving sharply to the almost straight oblique columellar lip, parietal lip thin, weakly attached to the preceding whorl; umbilicus wide, deep, with all whorls visible and sealed only by the protoconch, incremental striae strong within the umbilicus.

Dimensions: WAM 69.673b height 20, height of aperture 13, diameter 26 mm.

Remarks: The species is readily distinguishable from other species of *Salinator* by its large size, low spire, wide and deep umbilicus, loose coiling and sinuous growth striae and folds. The species is named in honour of Dr. Helene Laws, formerly of the South Australian Museum, for her assistance in many ways during the preparation of the monograph.

Distribution: Roe Calcarenite; Early Pleistocene.

Salinator solida (von Martens)

Plate 23, figs. 14, 15

1878 *Amphibola solida* von Martens: p. 2, pl. 1, figs, 1M, N, R, S
1832 *Ampullacera fragilis* (Lamarck) Quoy & Gaimard: vol. 2, p. 201 (in part)
1833 *Ampullacera fragilis;* Quoy & Gaimard: pl. 15, fig. 10 (not figs. 13, 14)
1945 *Salinator solida* (von Martens) Woolacott: p. 35, pl. 3, figs. 1, 2, 7-9
1962 *Salinator solida;* Macpherson & Gabriel: p. 260, fig. 297

Material: A single specimen WAM 66.495d (4333-FL1) may be referable to this species.

Remarks: Salinator solida differs from *S. fragilis* in having a relatively thick solid shell with a higher spire, a thick strong operculum with a conspicuous projecting spiral rib on the inner face. No opercula occur among the fossil material.

Dimensions: WAM 66.495d height 9, diameter 6.5 mm.

Distribution: Roe Calcarenite and Glanville Formation, margins of present seas (from Queensland south to Western Australia); Early Pleistocene to Holocene.

Order	STYLOMMATOPHORA
Superfamily	BULIMULACEA
Family	BULIMULIDAE
Genus	**Bothriembryon** Pilsbry, 1894

Bothriembryon barretti barretti Iredale

Plate 23, fig. 17

1879c *Bulimus indutus* var. *pallidus* Tate: p. 134 (not *Bulimus pallidus* C. B. Adams, 1845)
1900 *Bothriembryon indutus* var. *pallidus* Pilsbry: p. 15, pl. 3, figs. 64, 65 (not fig. 63)
1930 *Bothriembryon barretti* Iredale, 1930: 119, text fig.
1939 *Bothriembryon barretti* Iredale: p. 35, pl. 2, figs. 41, 42
1957 *Bothriembryon barretti;* Hartley: p. 33

Type material: The holotype of *Bulimus indutus* var. *pallidus* Tate SAM D3176, topotypes SAM D11346, from "Hampton, Western Australia" (?Hampton Scarp, near Eucla). Holotype of *Bothriembryon barretti* in Australian Museum.

Material: GSWA F6982 (4534-FL2); WAM 61.51 (4334-FL6).

Description: Shell of medium size, elongate-turbiniform, thin but solid, aperture equal in height to the spire; protoconch prominent of 2 whorls with tip immersed, microscopically pitted and wrinkled although the initial whorl may be smooth and the wrinkles visible under the glassy surface, adult whorls 4, moderately convex, sculptured with fine axial wrinkles crossed and weakly tuberculated by fine spiral threads particularly near the adapical suture; both axial and spiral sculpture weakens on the base. Aperture subovate, outer lip thin, sharp, columella nearly straight, columellar lip reflected over the umbilical chink.

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Dimensions: Average of 173 specimens from Point Sinclair, South Australia, height 31.5, diameter 17.7 mm.

Distribution: Roe Calcarenite and Bridgewater Formation, living on Nullarbor Plain and in western South Australia; Early Pleistocene to Holocene.

Bothriembryon barretti indictus Iredale

Plate 23, figs. 18, 19

1900 *Bothriembryon indutus var. pallidus* Pilsbry: p. 13, pl. 3, fig. 63 (not figs 64, 65)
1939 *Bothriembryon barretti indictus* Iredale: p. 36, pl. 2, fig. 42

Material: GSSA M2520 from locality 4434-FL9.

Remarks: The subspecific name is here tentatively retained for the narrow variety to which it was originally applied (Iredale, 1939). The narrow form comprises about 12 per cent of the specimens occurring in the upper member of the Bridgewater Formation at Point Sinclair and Cape Nuyts and near Coorabie in the Fowlers Bay area. An average of 20 specimens from Point Sinclair gives height 38.6, diameter 19.95 mm. The subspecies is, on the whole, less strongly sculptured than *B.b. barretti,* the spiral threads and wrinklings below the adapical suture being absent or inconspicuous. Whether it should be separated from *B.b. barretti,* with which it occurs both living and fossil, can only be determined by anatomical studies of living material.

Distribution: Roe Calcarenite, Bridgewater Formation, living on Nullarbor Plain and in western South Australia; Early Pleistocene to Holocene.

Family CAMAENIDAE
Genus **Sinumelon** Iredale, 1930

Sinumelon nullarboricum (Tate)

1879 *Helix nullarboricum* Tate: p. 133, pl. 5, figs. 1a, b
1932 *Notobadistes nullarboricum* (Tate) Cotton & Godfrey: p. 173
1939 *Sinumelon nullarboricum* (Tate) Iredale: p. 53, pl. 3, fig. 19

Type material: Holotype SAM D13602 from "Nullarbor Plain".

Material: Four specimens GSWA F7147(2) (4634-FL2); F7163(2) (4534-FL2); all loose in soil.

Distribution: Living on Nullarbor and Roe Plains; Holocene.

Genus **Angasella** Angas, 1864

1864 *Angasella* Angas: p. 521
1887 *Pleuroxia* Ancey: p. 38 new name for *Angasella* Angas, April, 1864 not *Angasiella* Crosse, January, 1864

Remarks: The genus *Pleuroxia* is usually employed for the species recorded below. Under Article 56 (a) of the International Code of Zoological Nomenclature, *Angasella* is not a homonym of *Angasiella*. It may be noted also that there is a genus *Pleuroxis* Rafinesque, 1848 (Mollusca) and *Pleuroxus* Baird, 1843 (Crustacea).

Angasella oligopleura (Tate)

1894 *Hadra oligopleura* Tate: p. 193
1896 *Angasella oligopleura* (Tate) Tate: p. 219, pl. 19, fig. 29
1939 *Pleuroxia oligopleura* (Tate) Iredale: p. 56, pl. 3, figs. 23, 28

Type material: Holotype SAM D13606, from Eyre, Roe Plains.

Material: Two specimens GSSA M3276 (4334-FL1) and GSWA F6944 (4133-FL7), in soil.

Distribution: Living on Roe Plains; Holocene.

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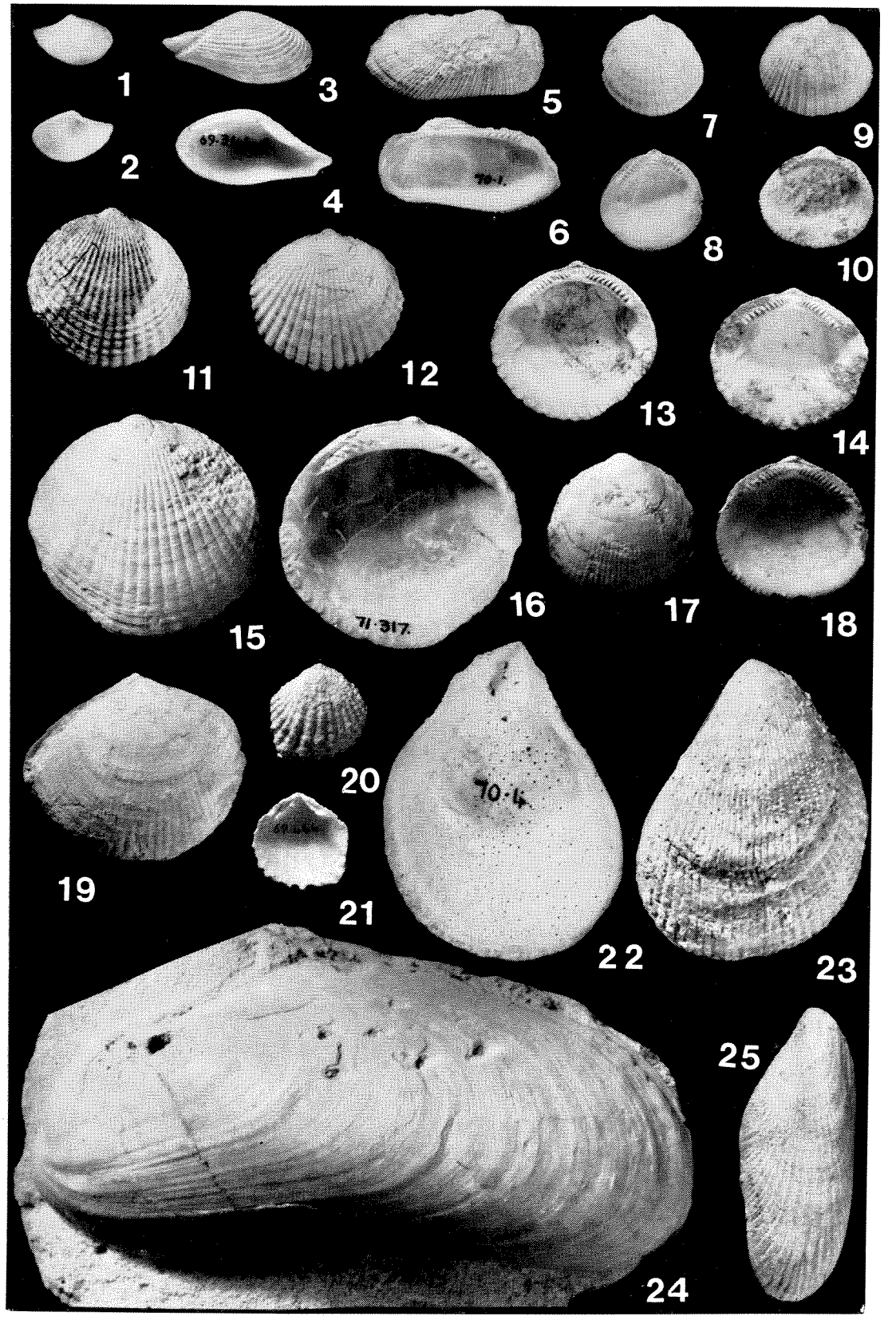

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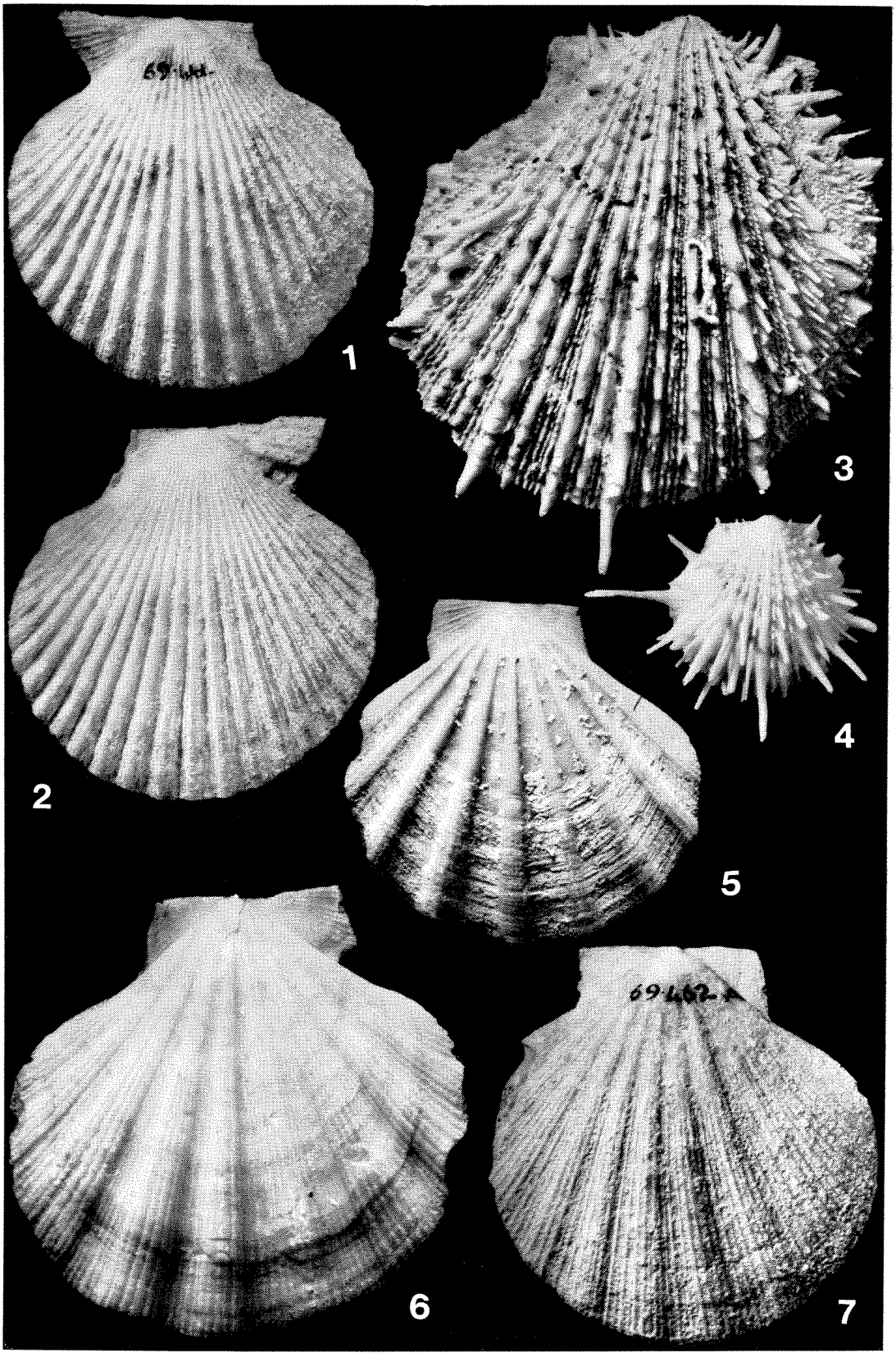

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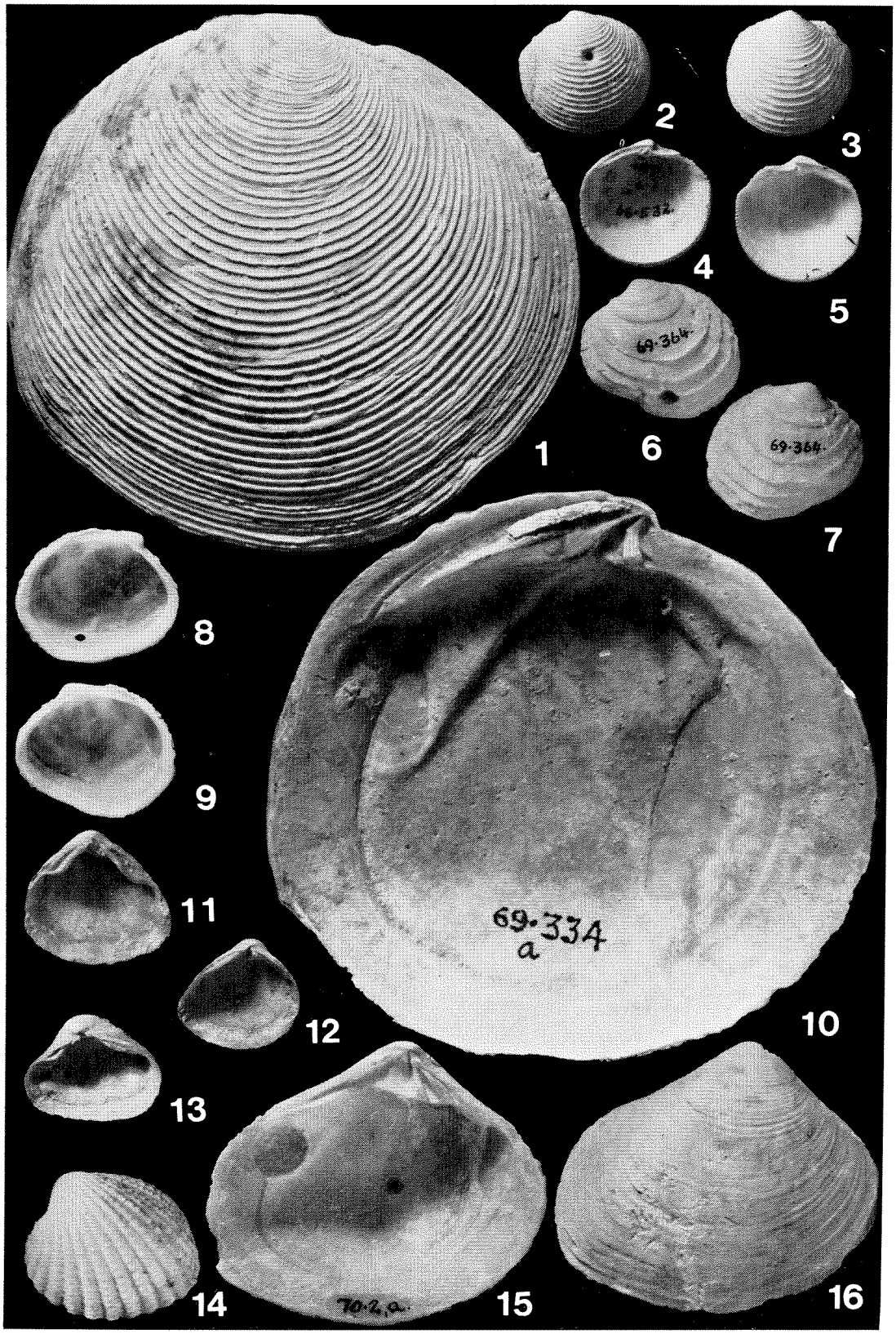
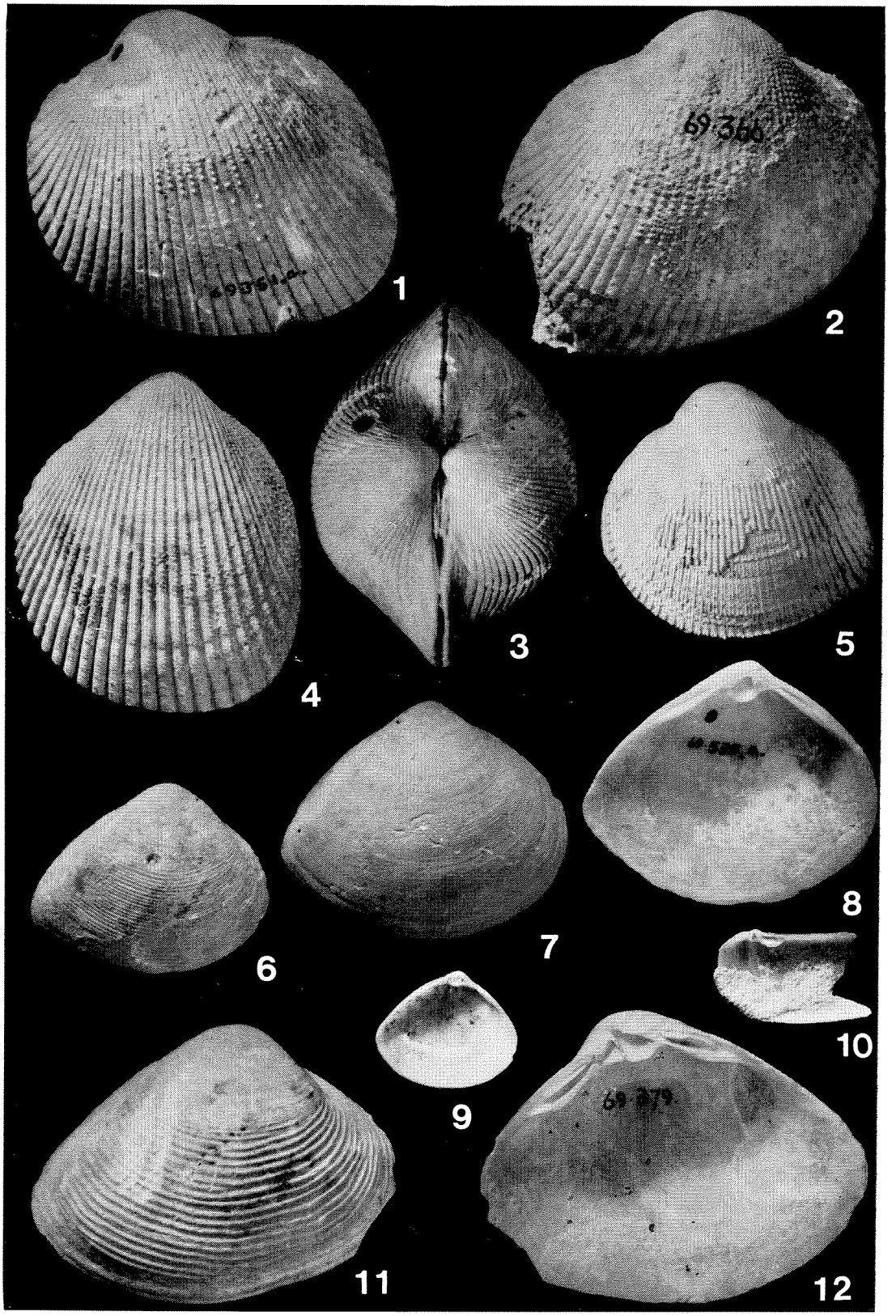


PLATE 4



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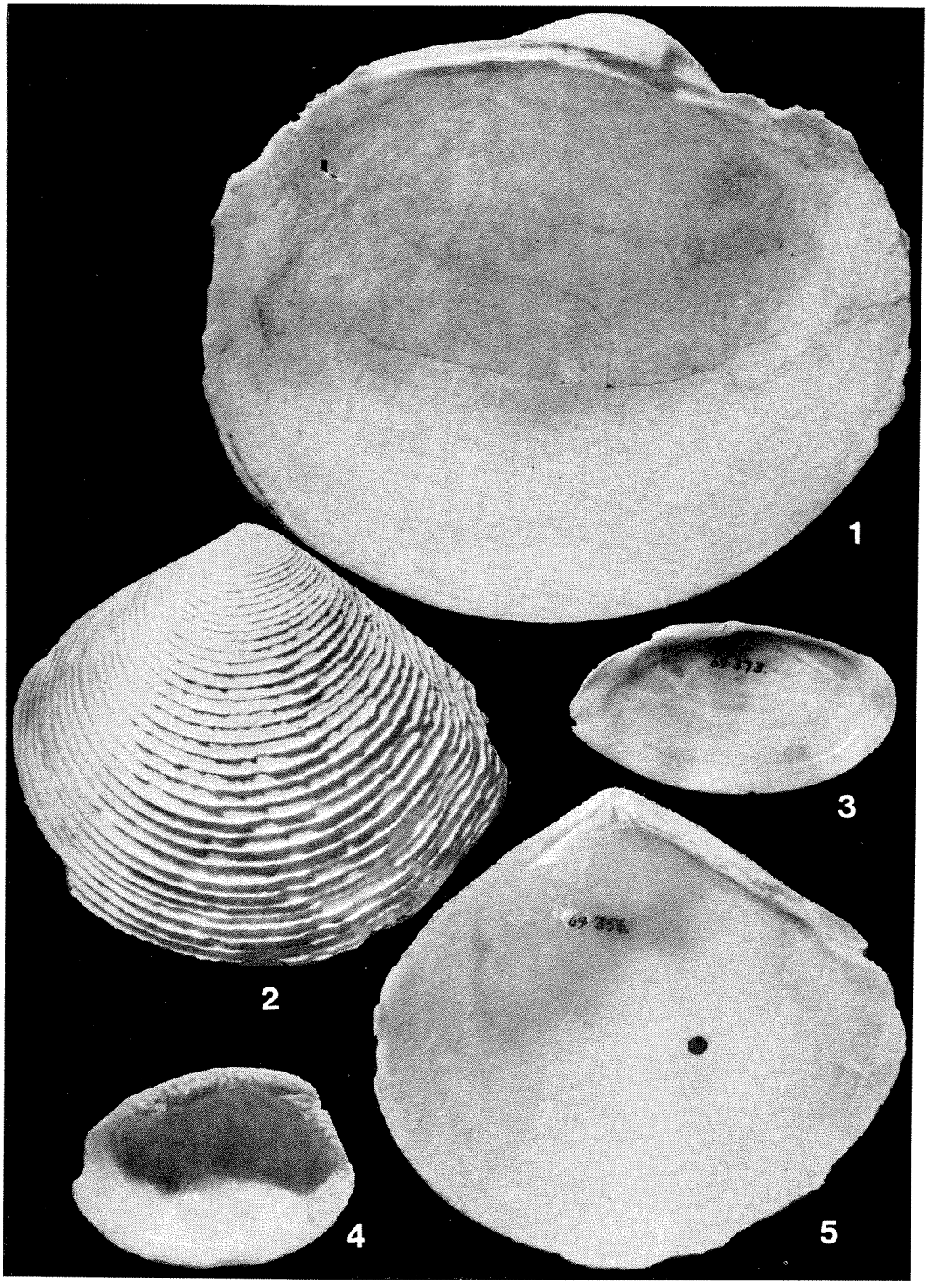

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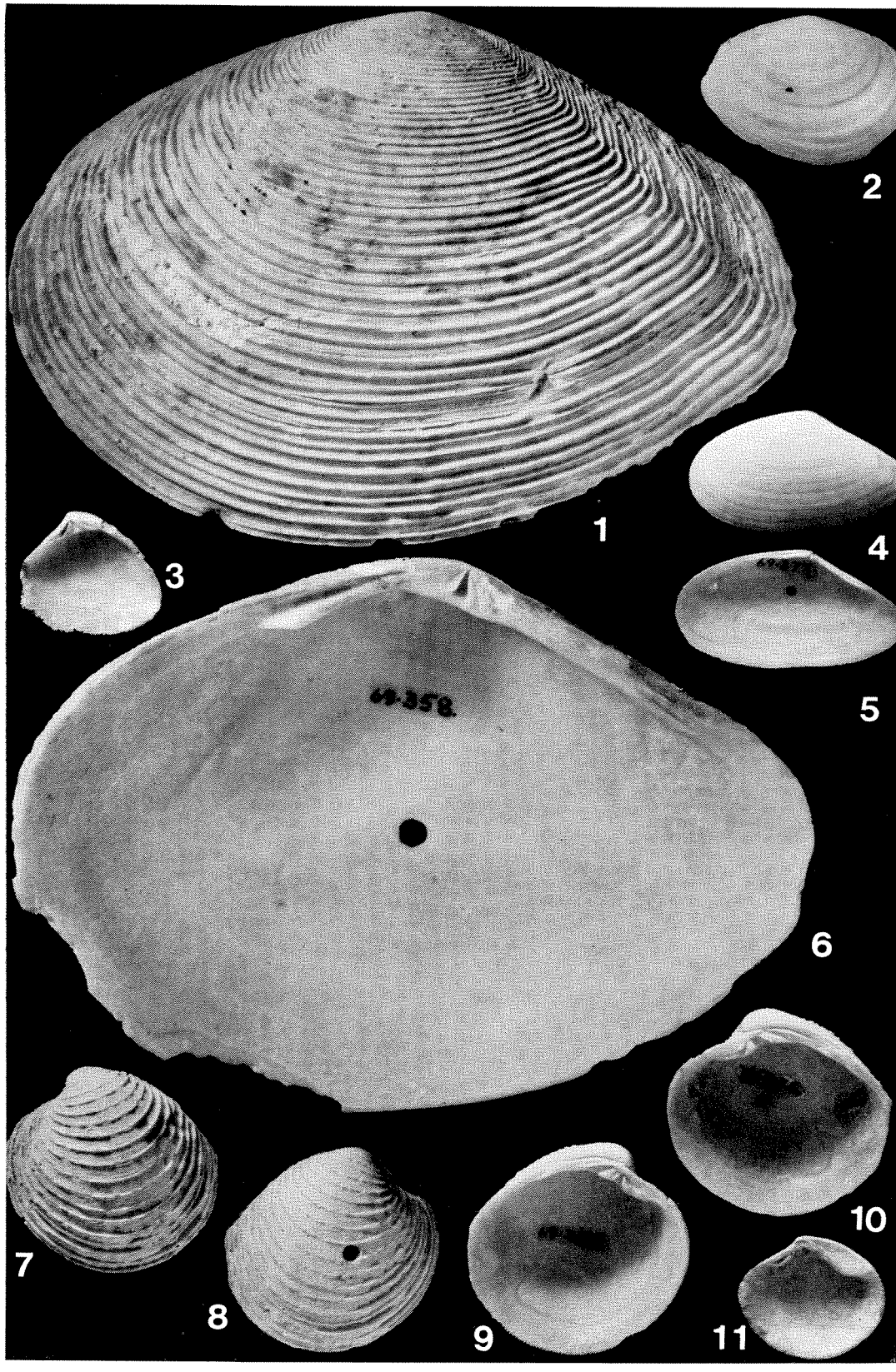

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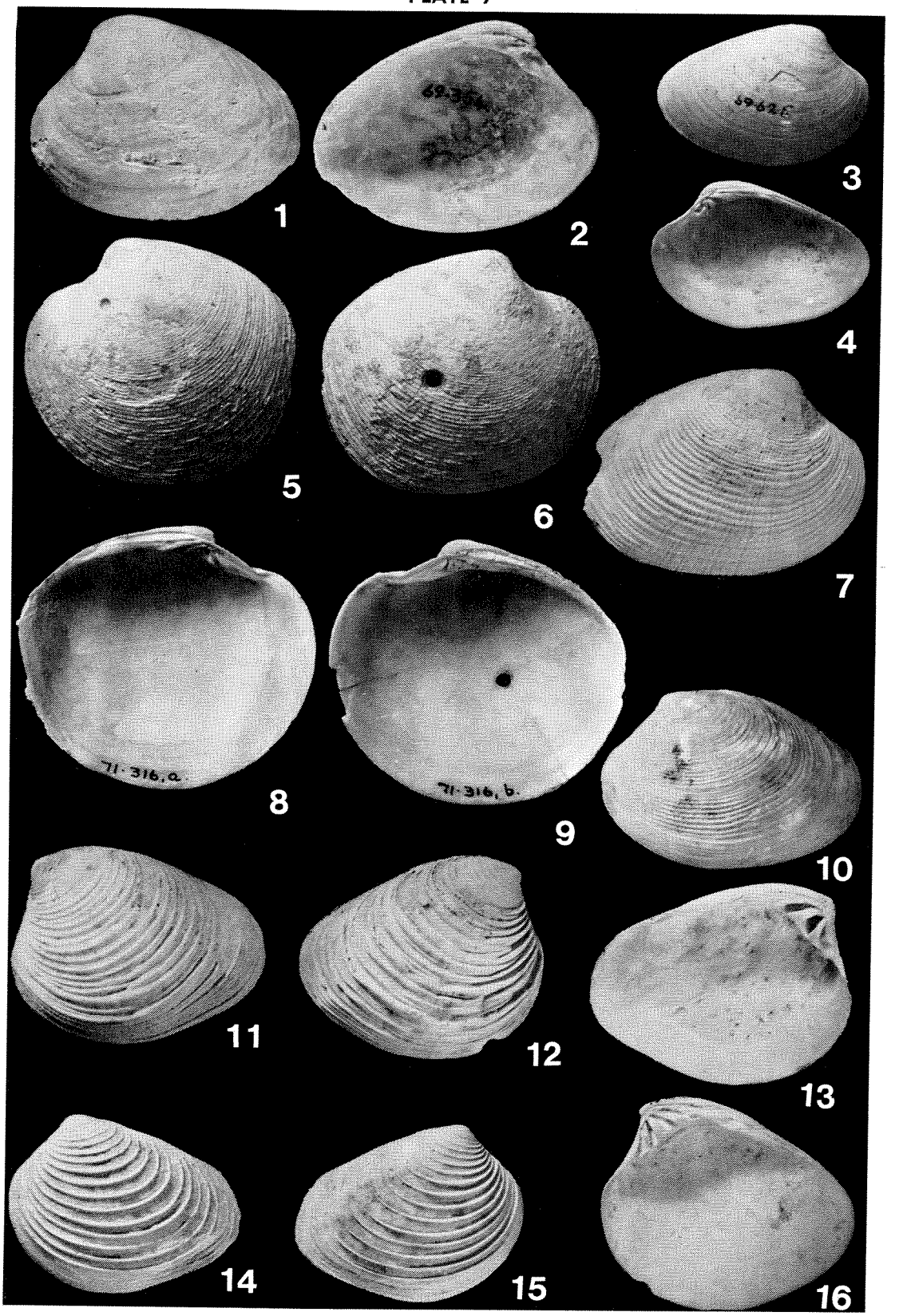

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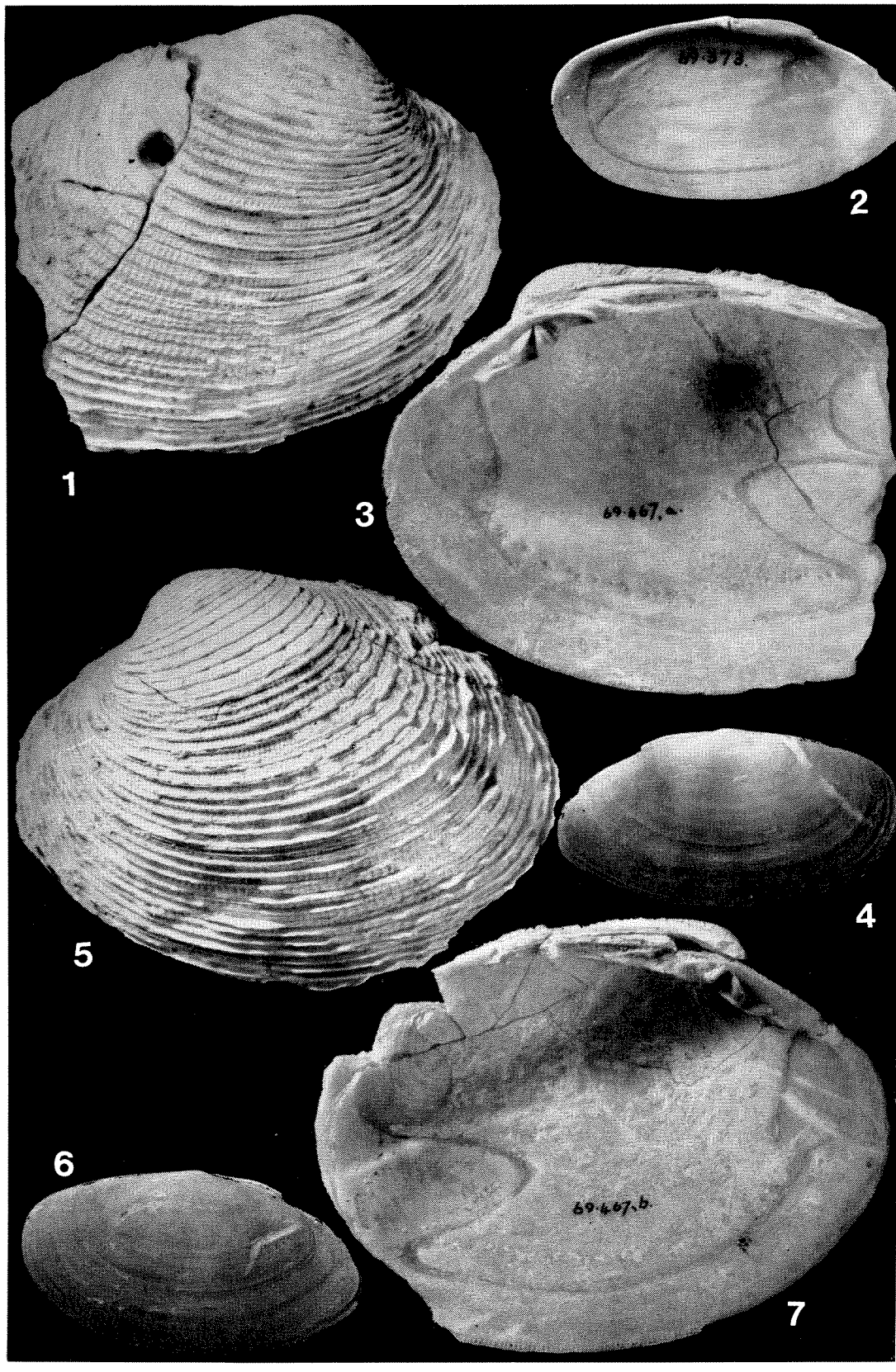

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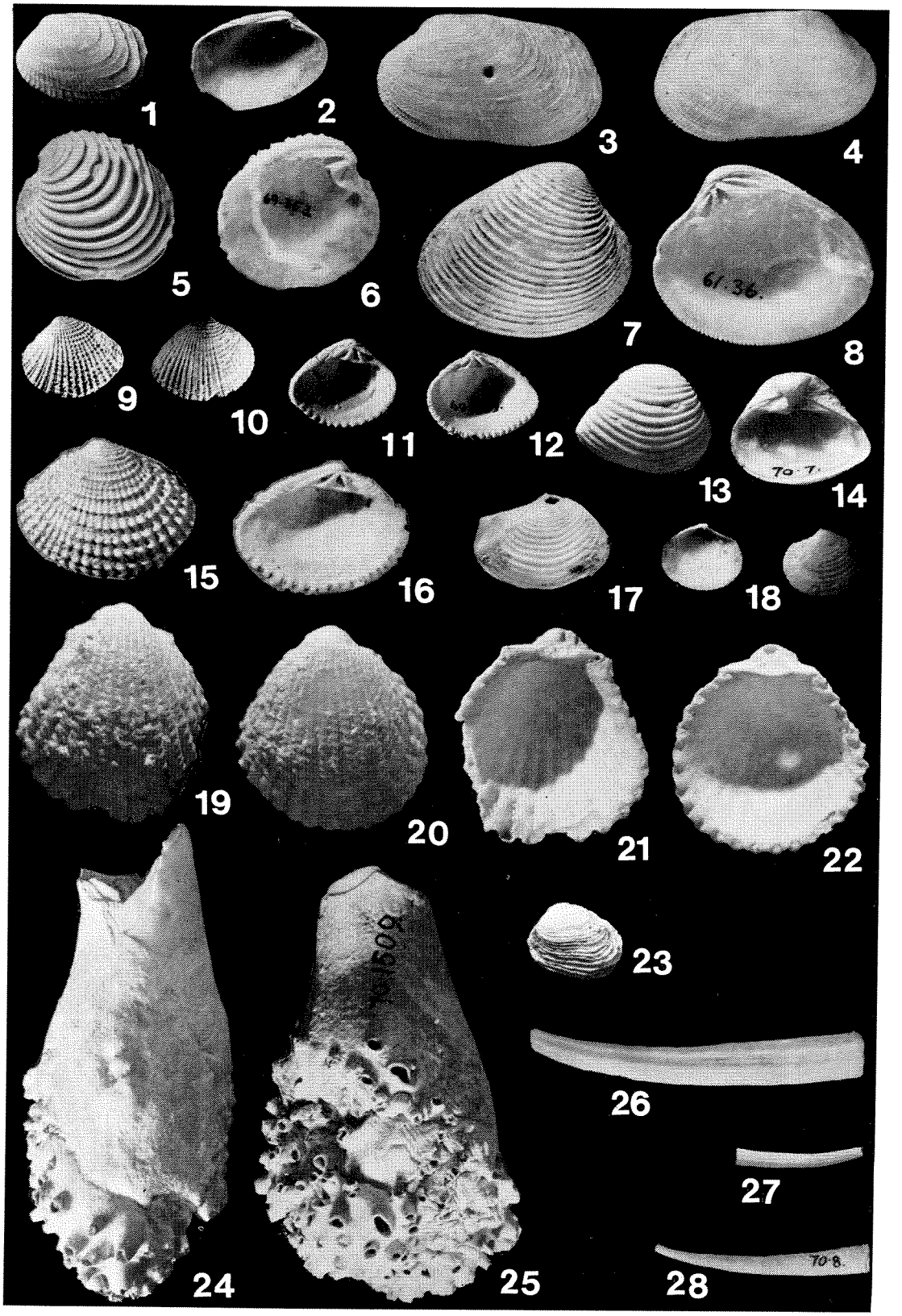

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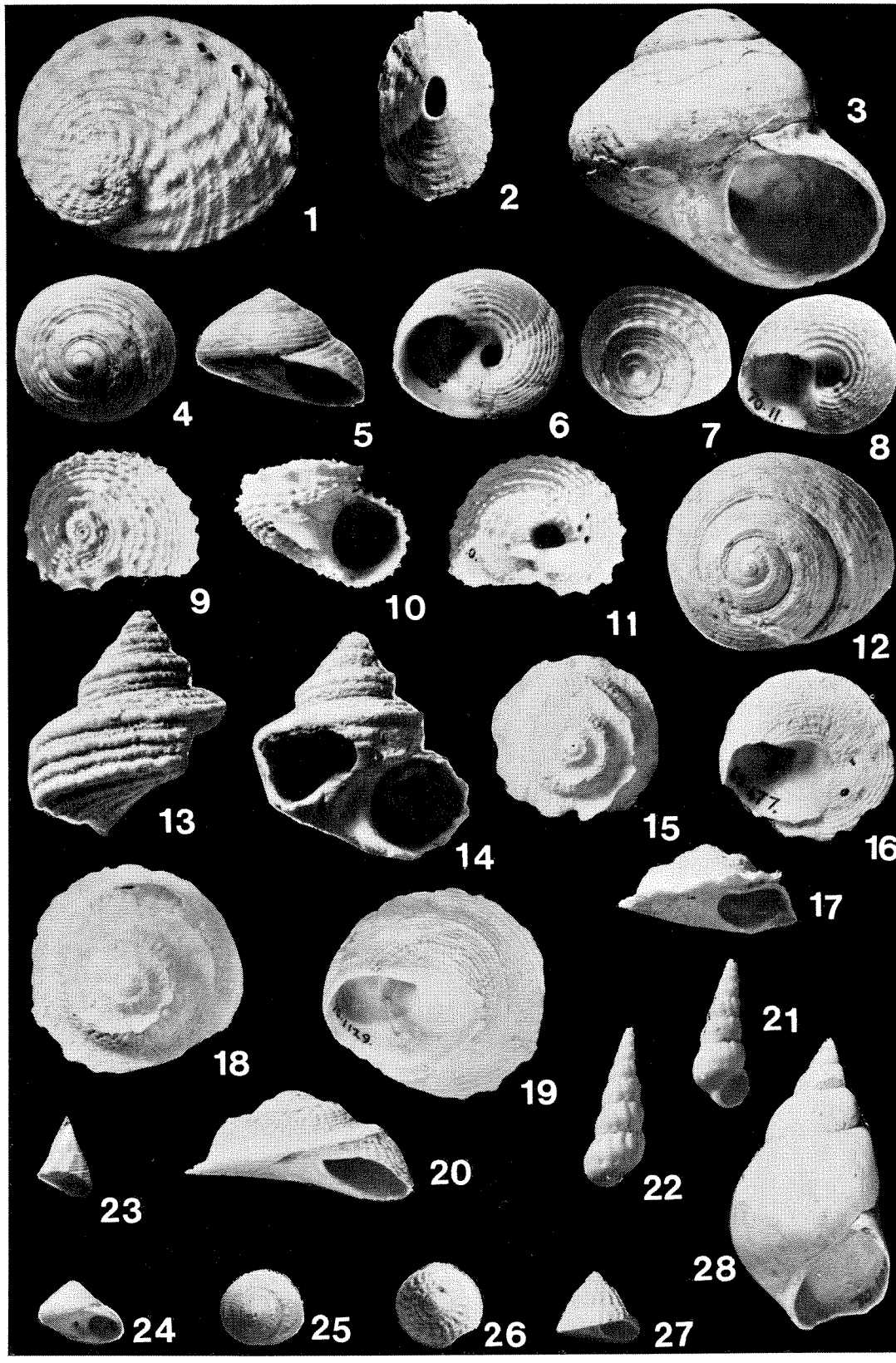

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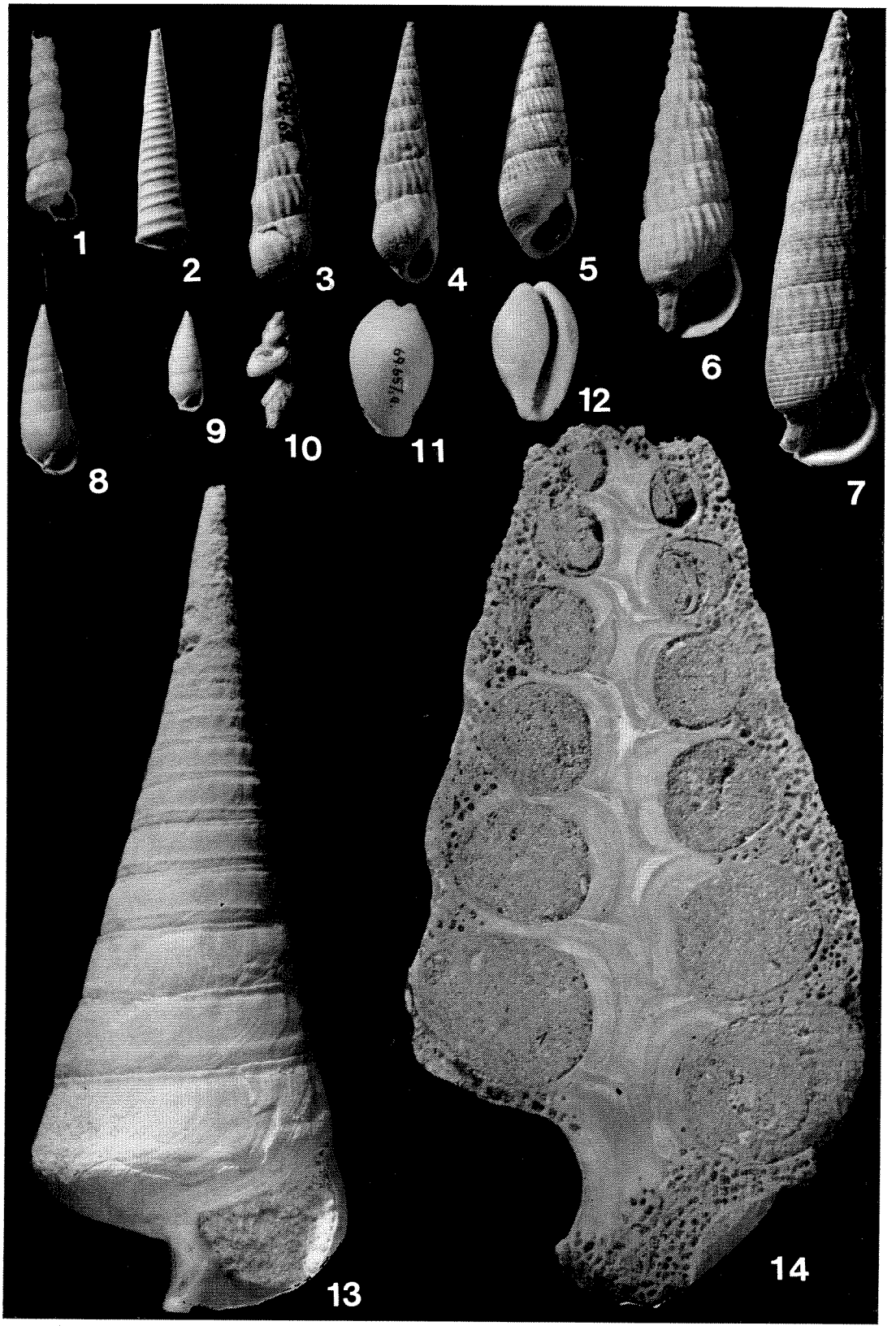

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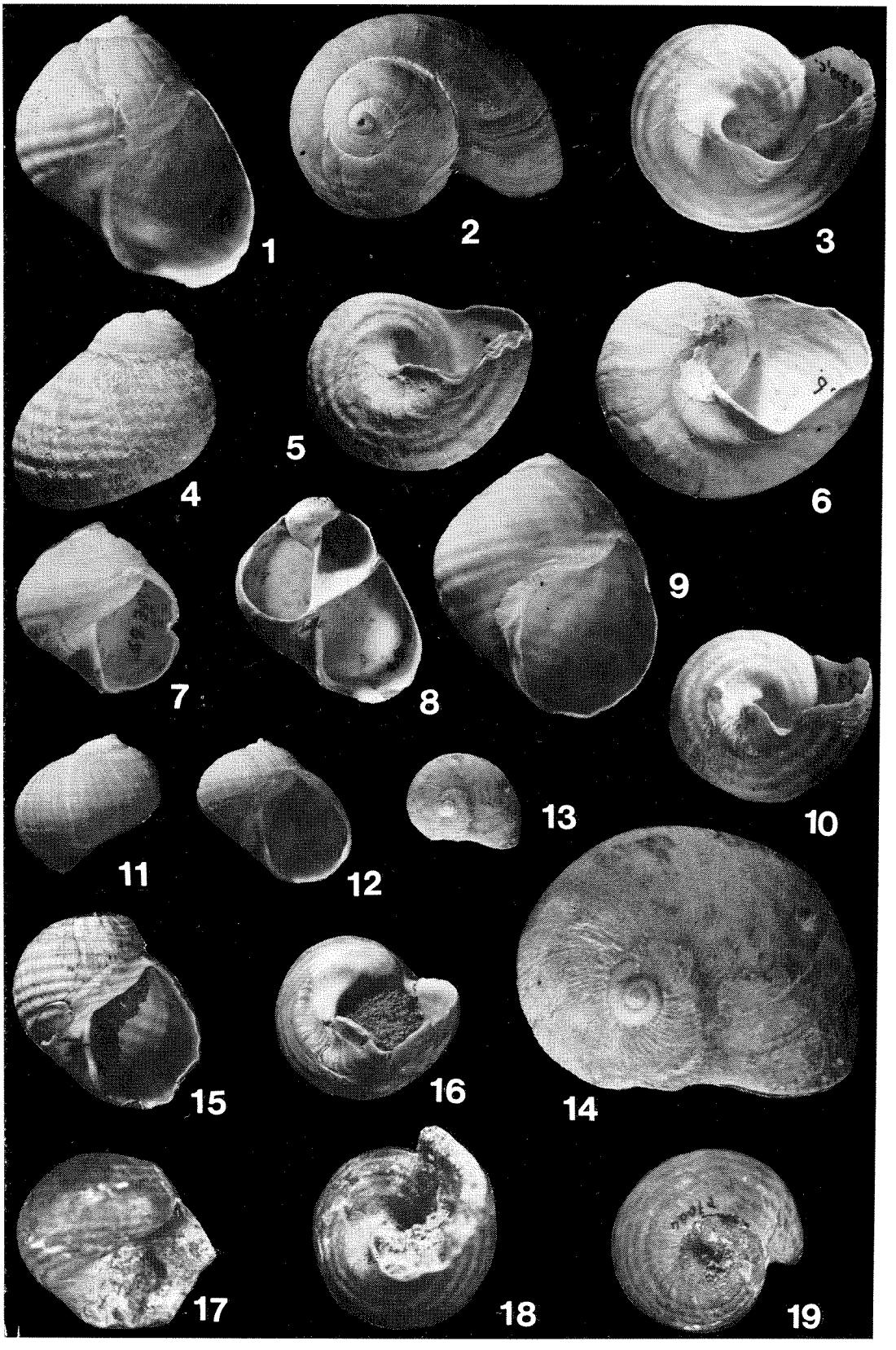

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Holotype, Service de la Carte géologique, Rabat, Maroc, No. P7064, Feuille Meknes, Astien, Moghrebien, Localité Ain es Seba. Collection G. Lecointre. Photographs M. Daoudi, Laboratoire de Micropaléontologie.

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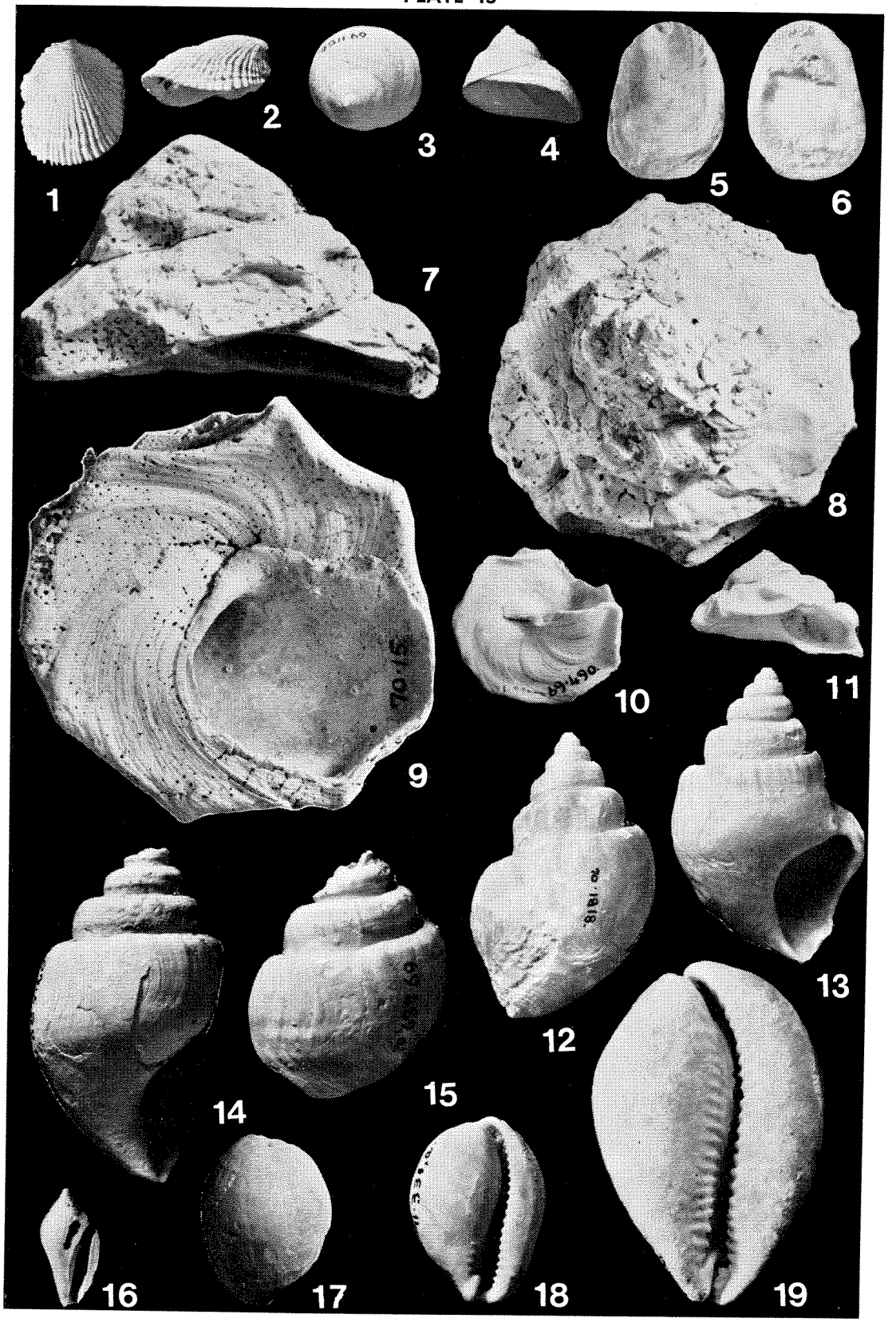
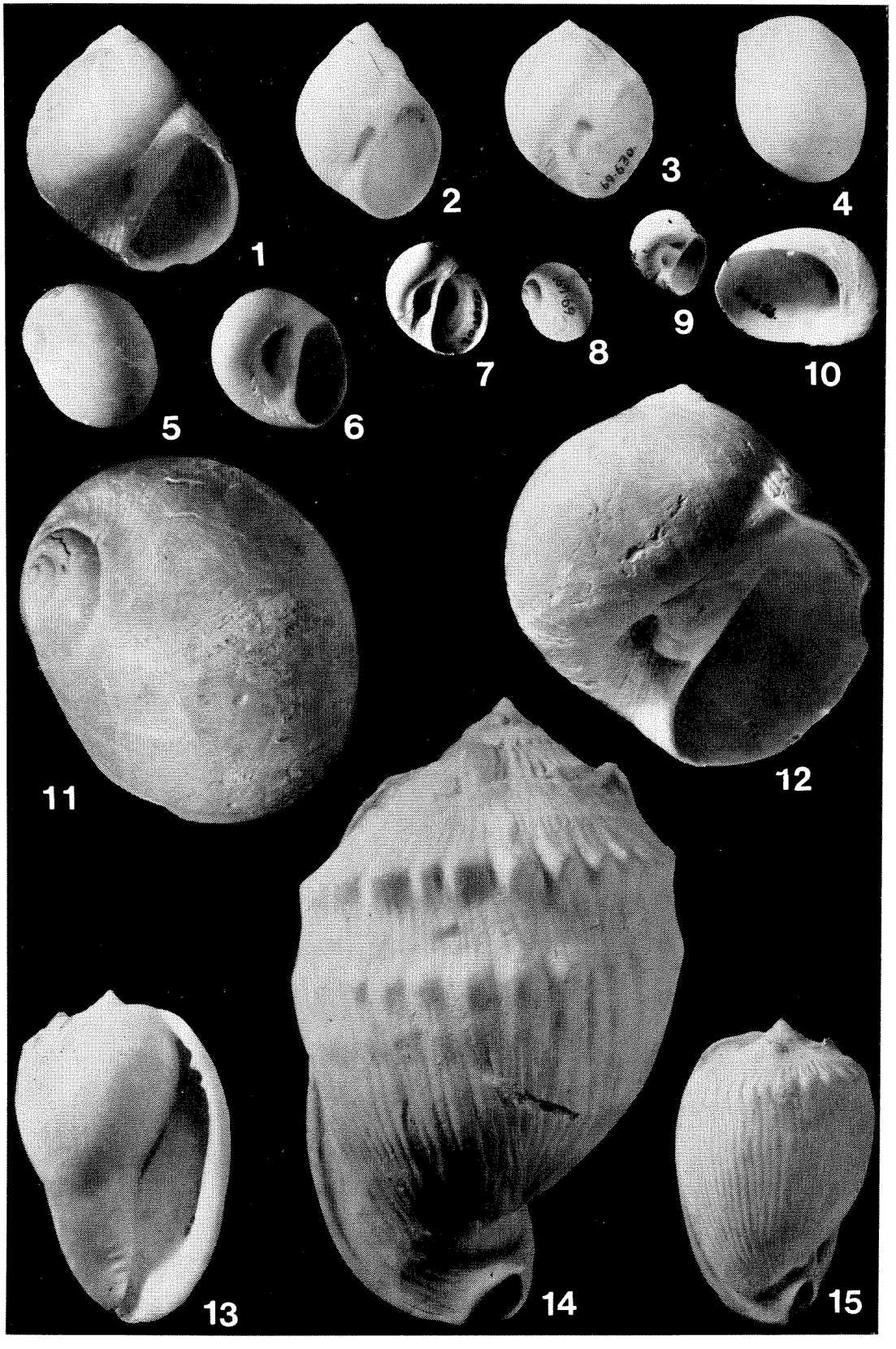


PLATE 14



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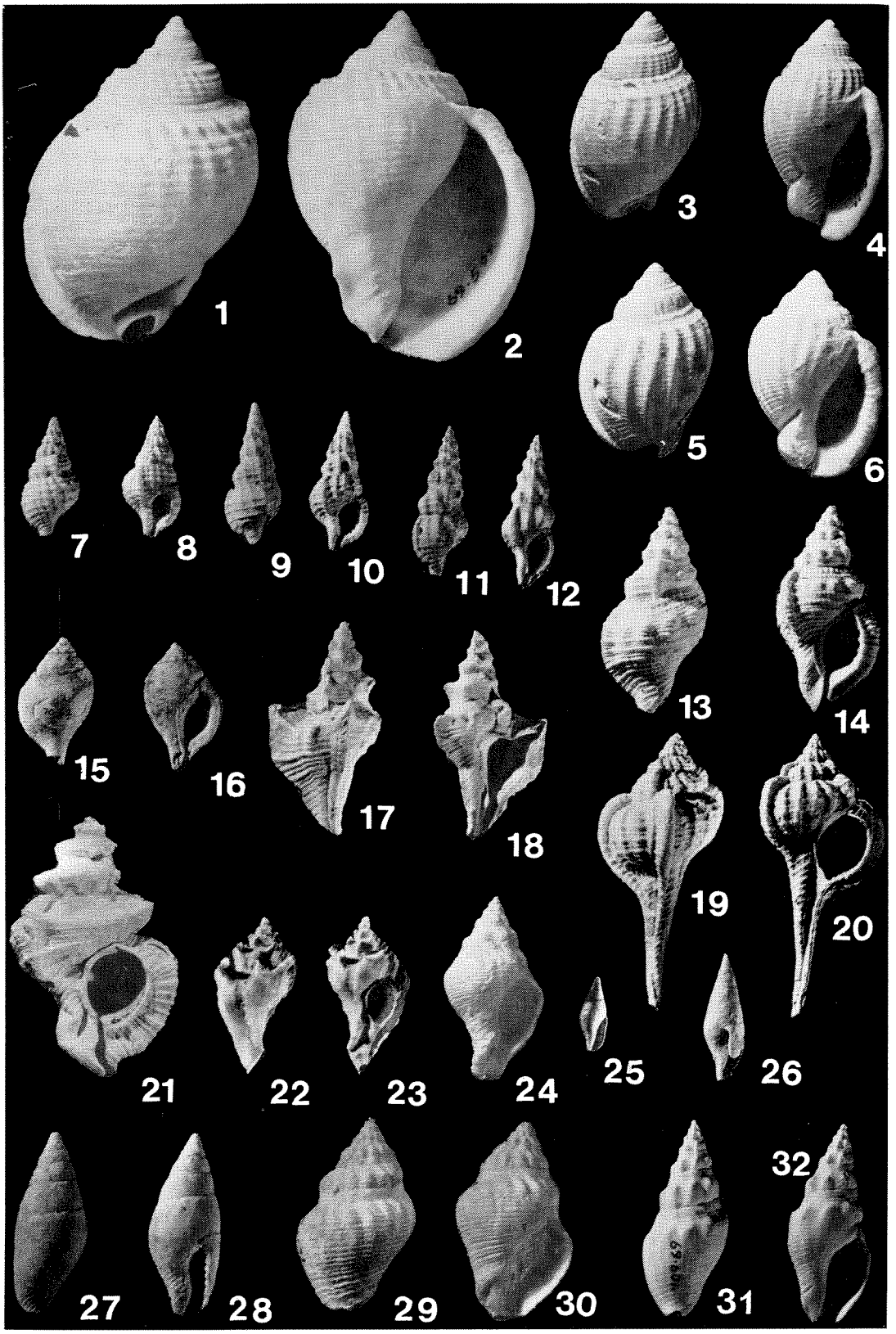

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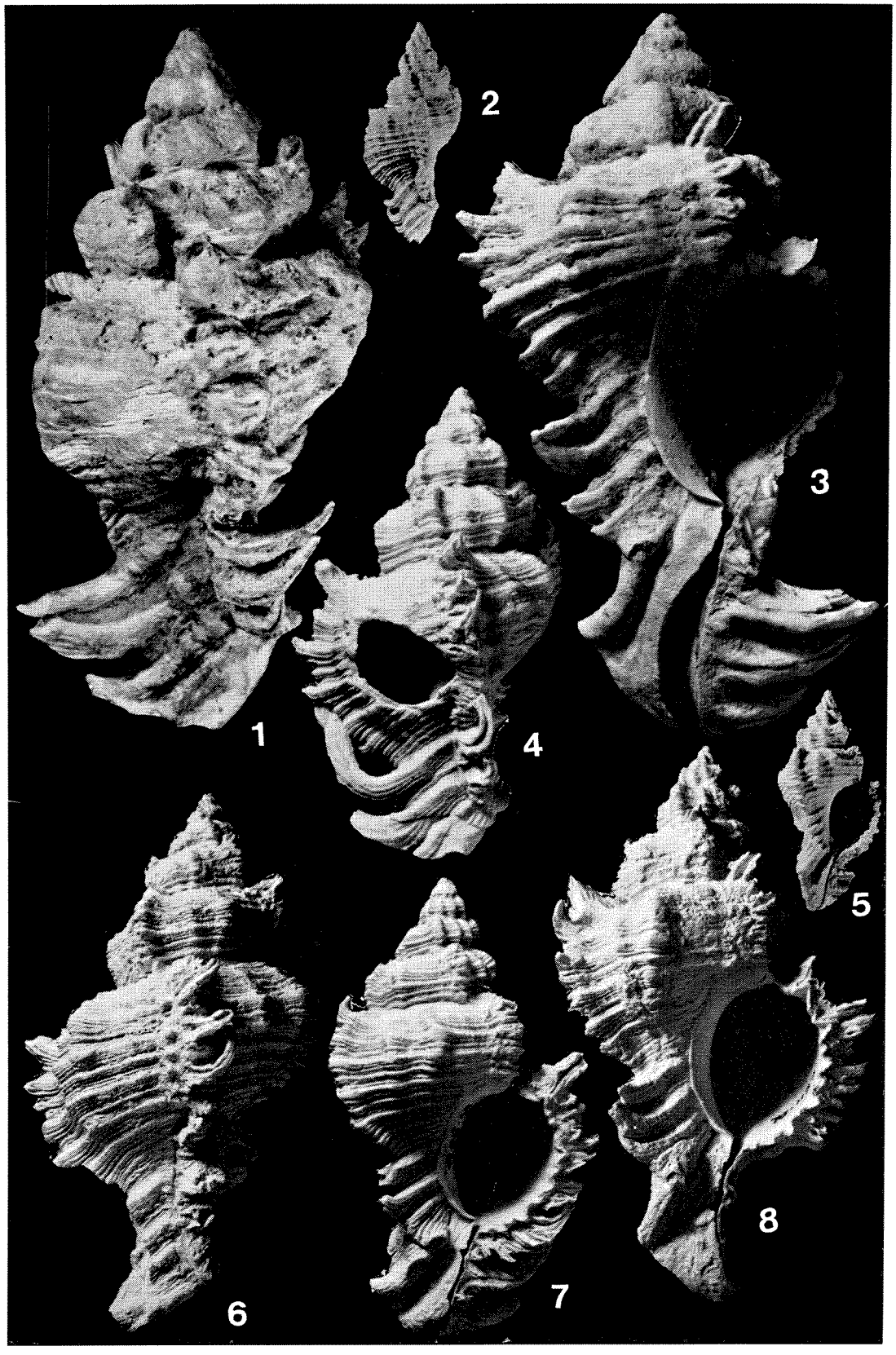

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(1, 2, 5, 6, 12, 13, 15, 16, T. G. M. Marcelis (GSSA) photographs; 3, 4, 17, 18, E. Matthews (GSSA) photographs)

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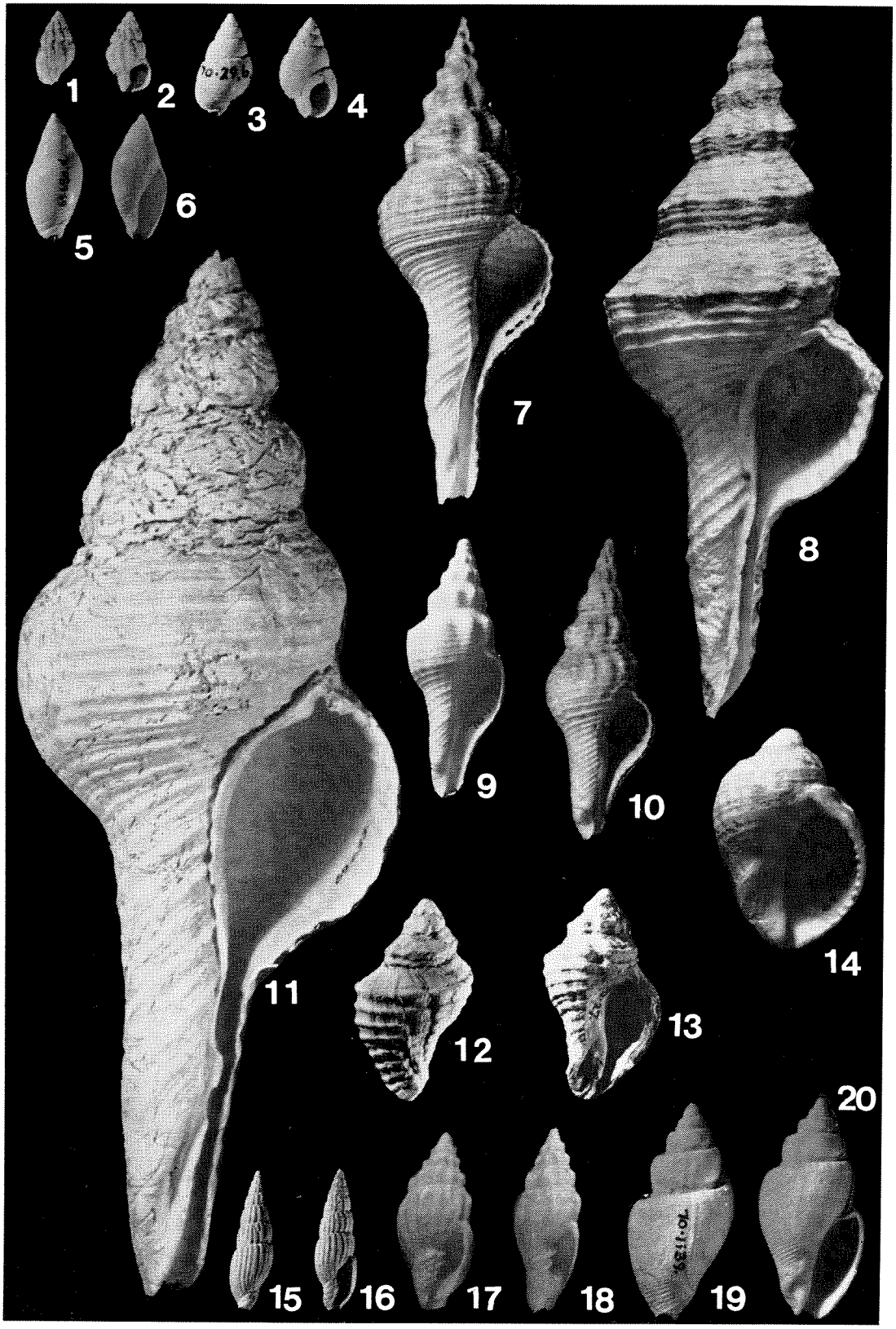

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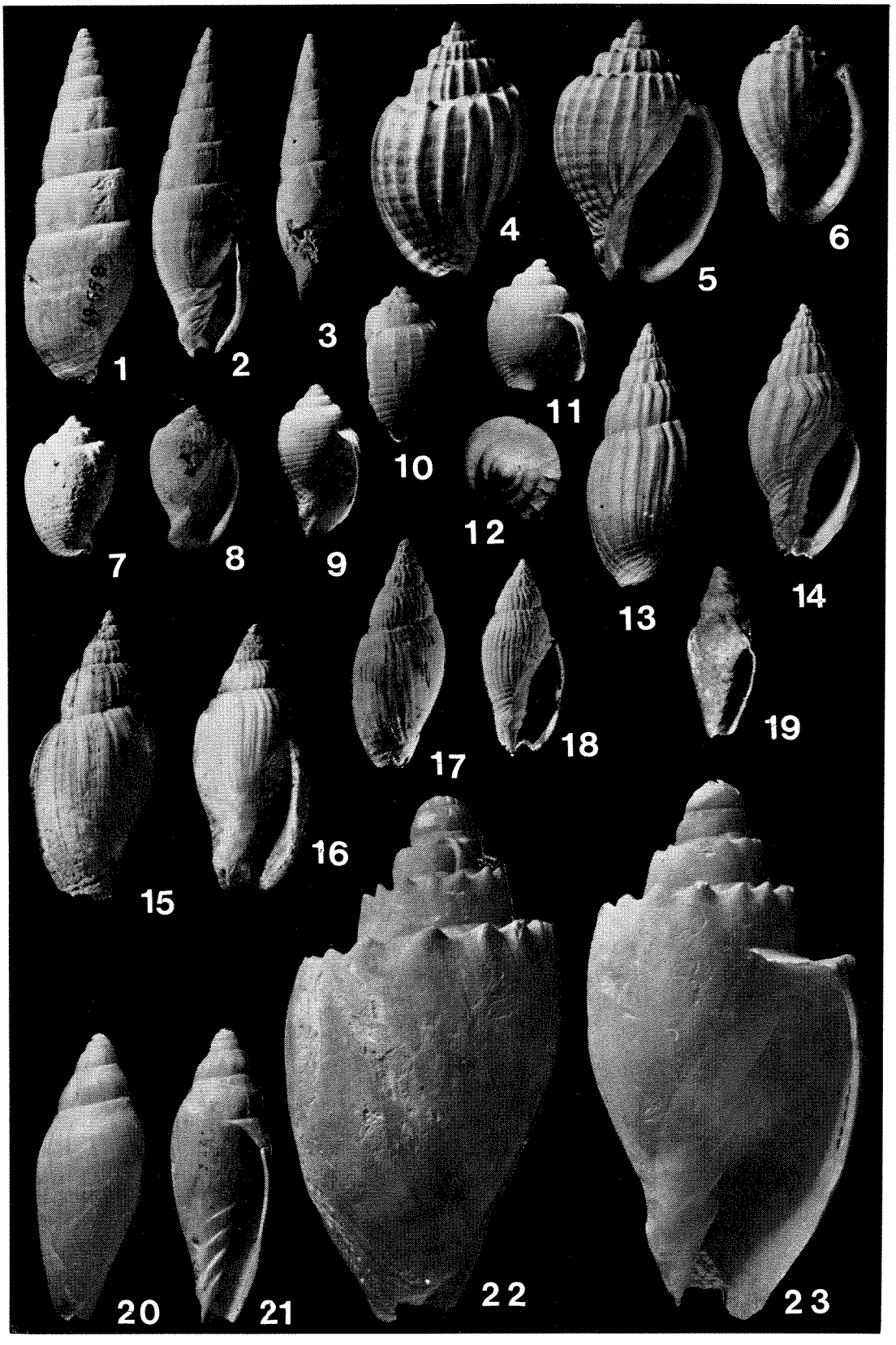

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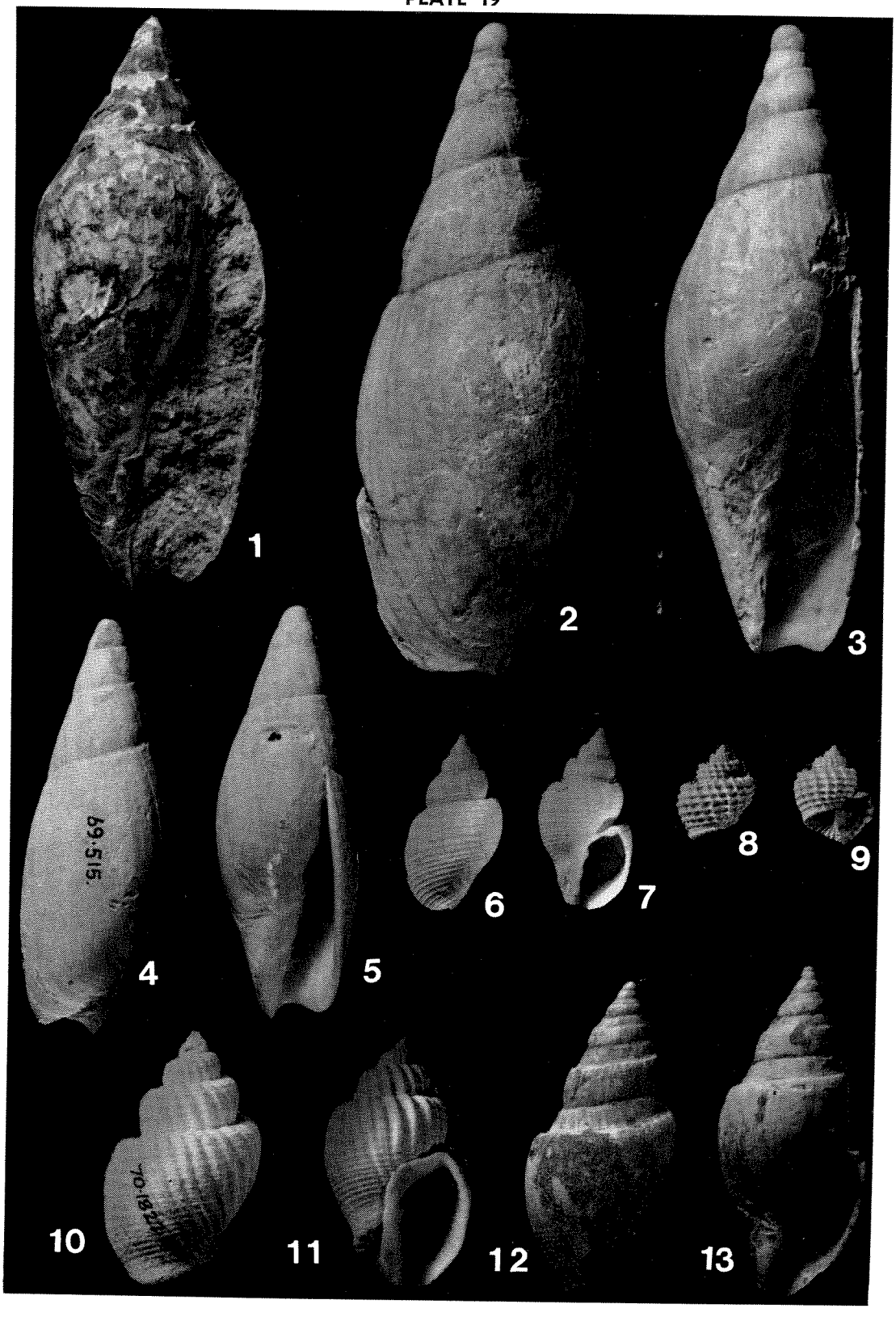

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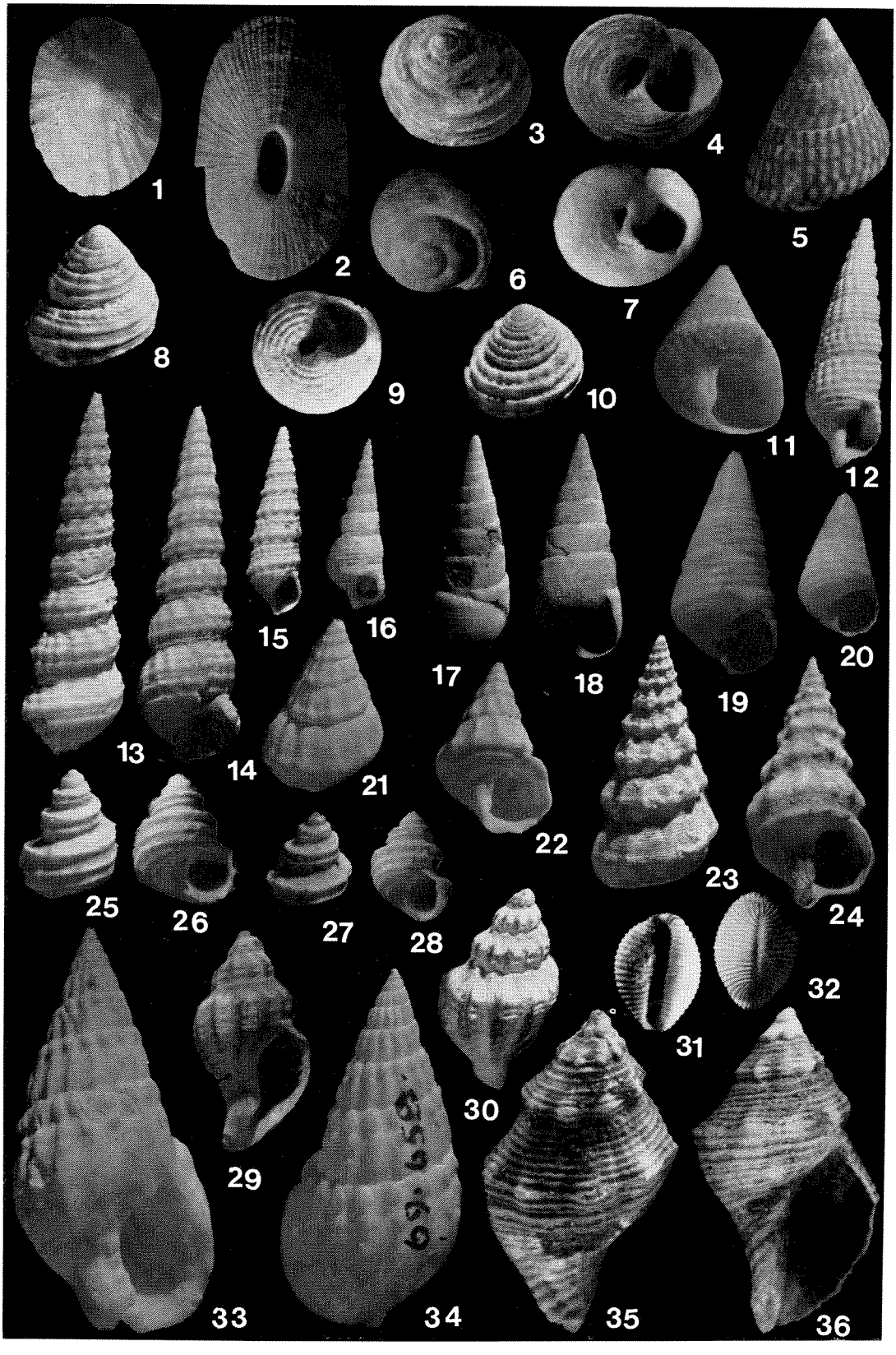
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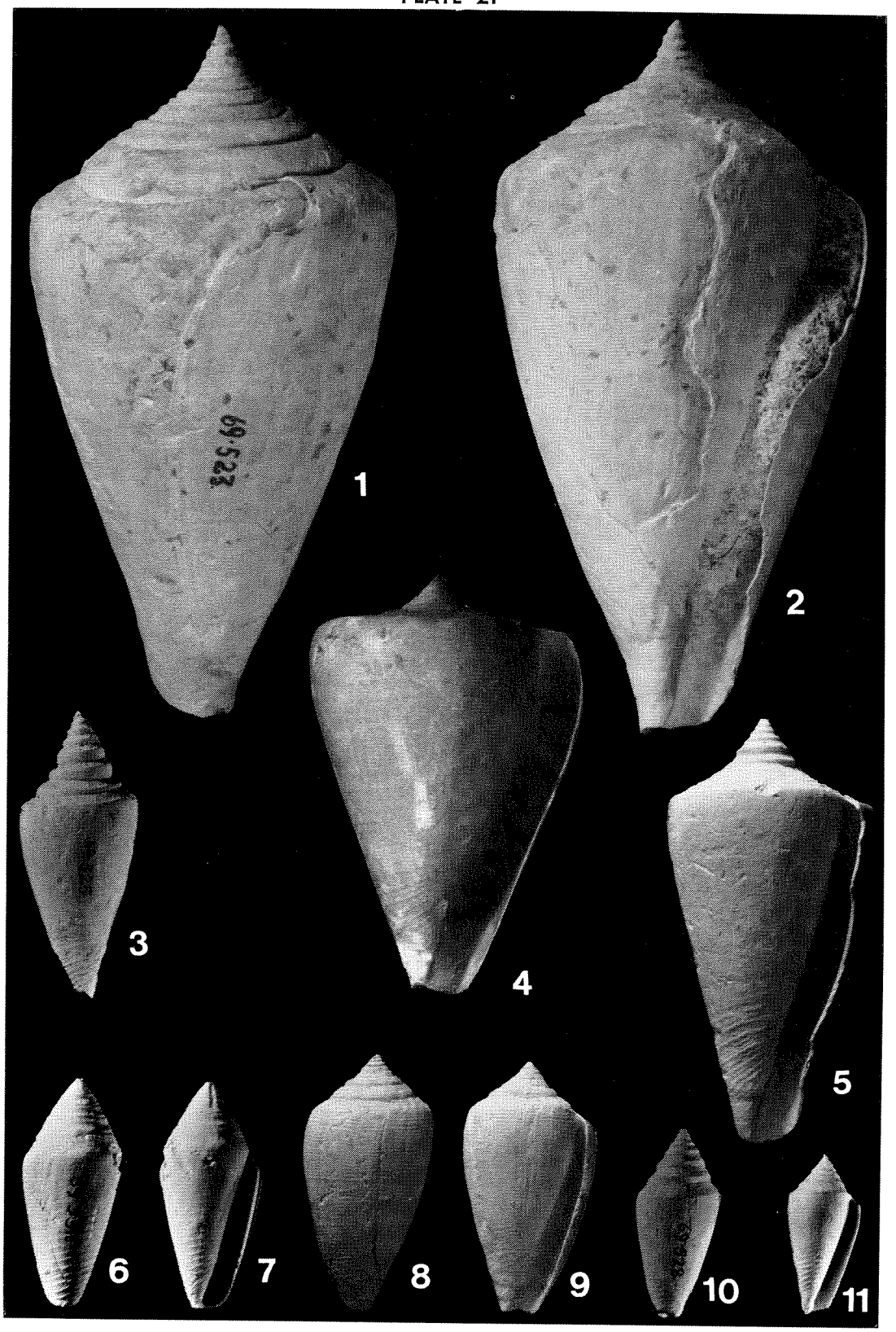
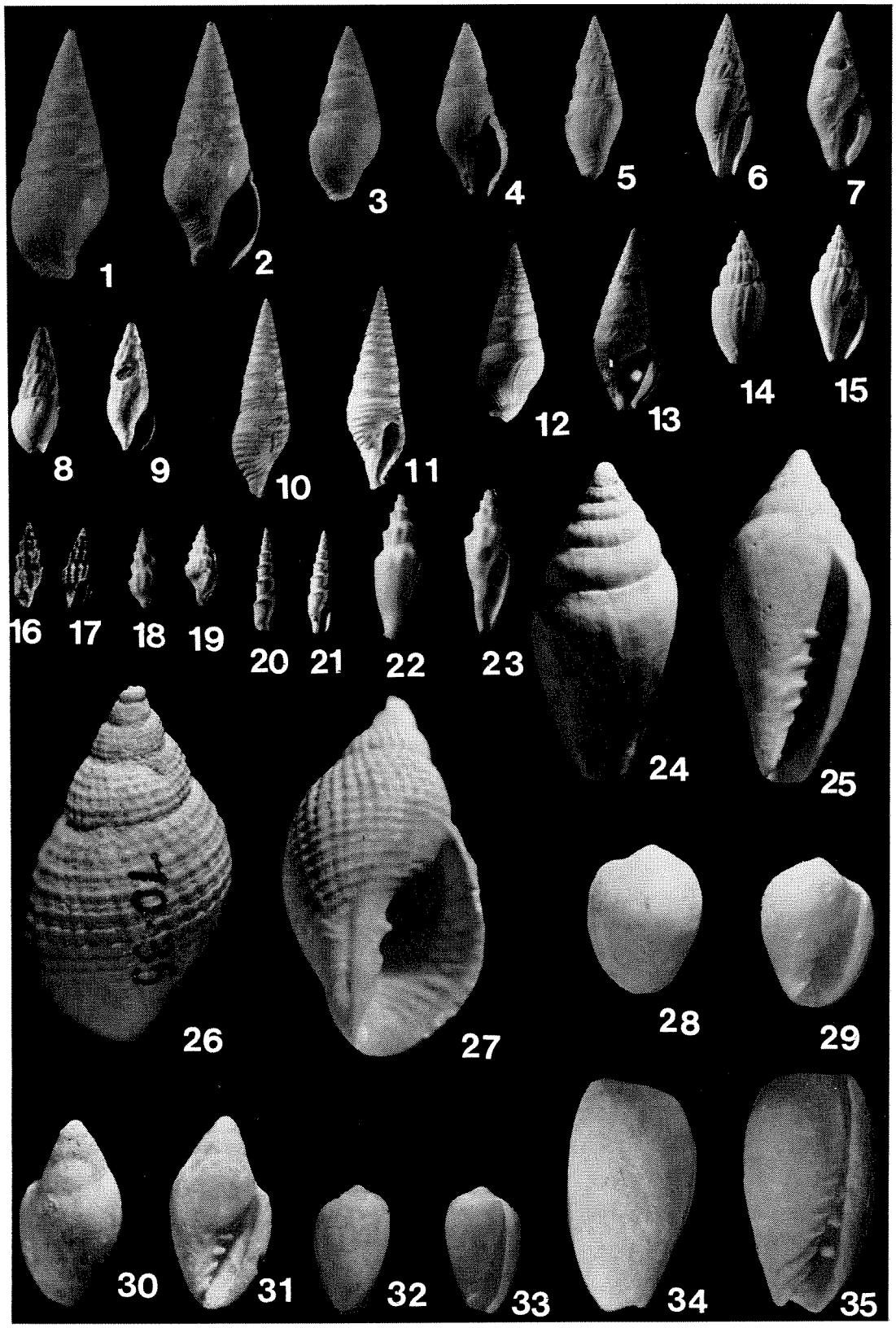


PLATE 22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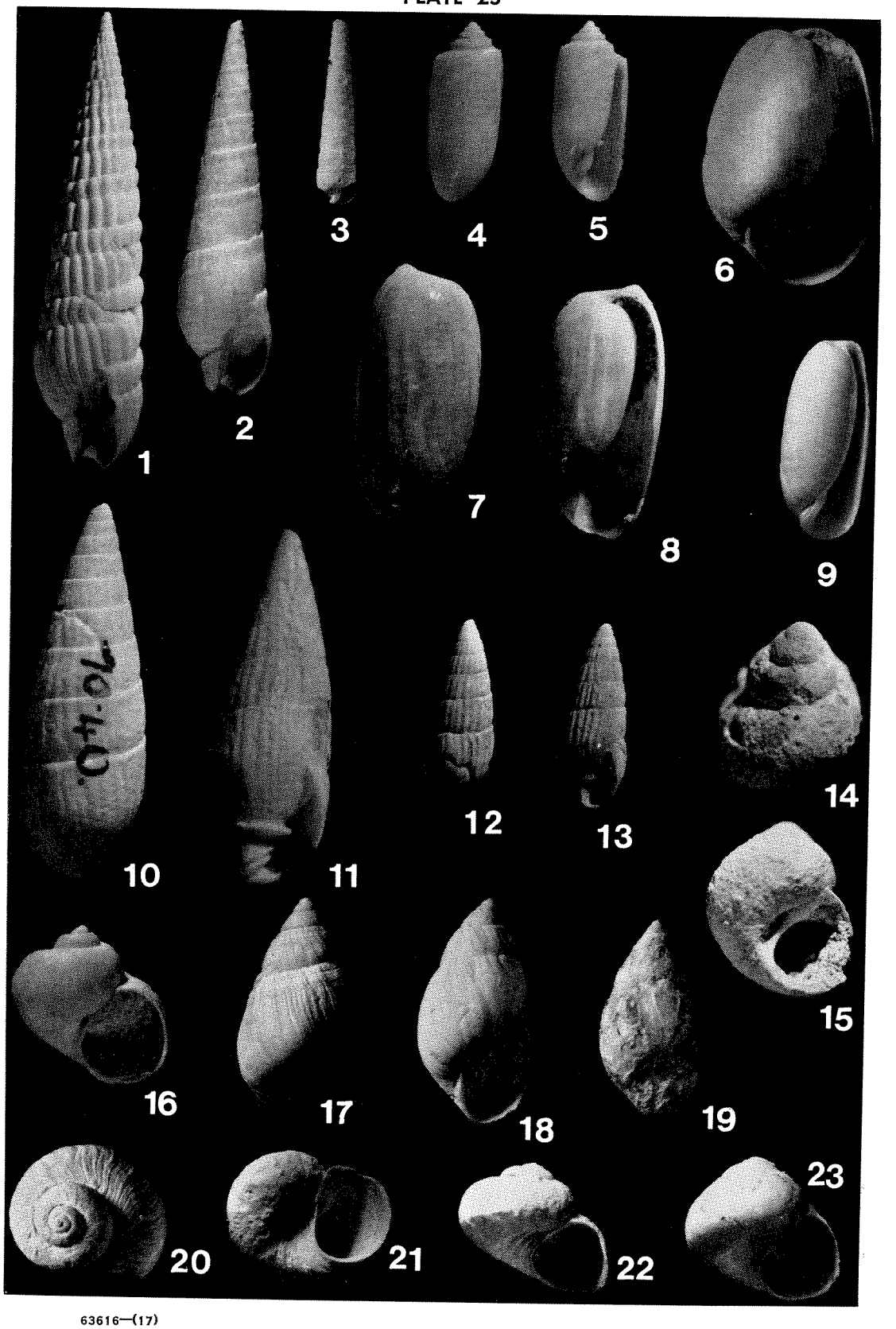

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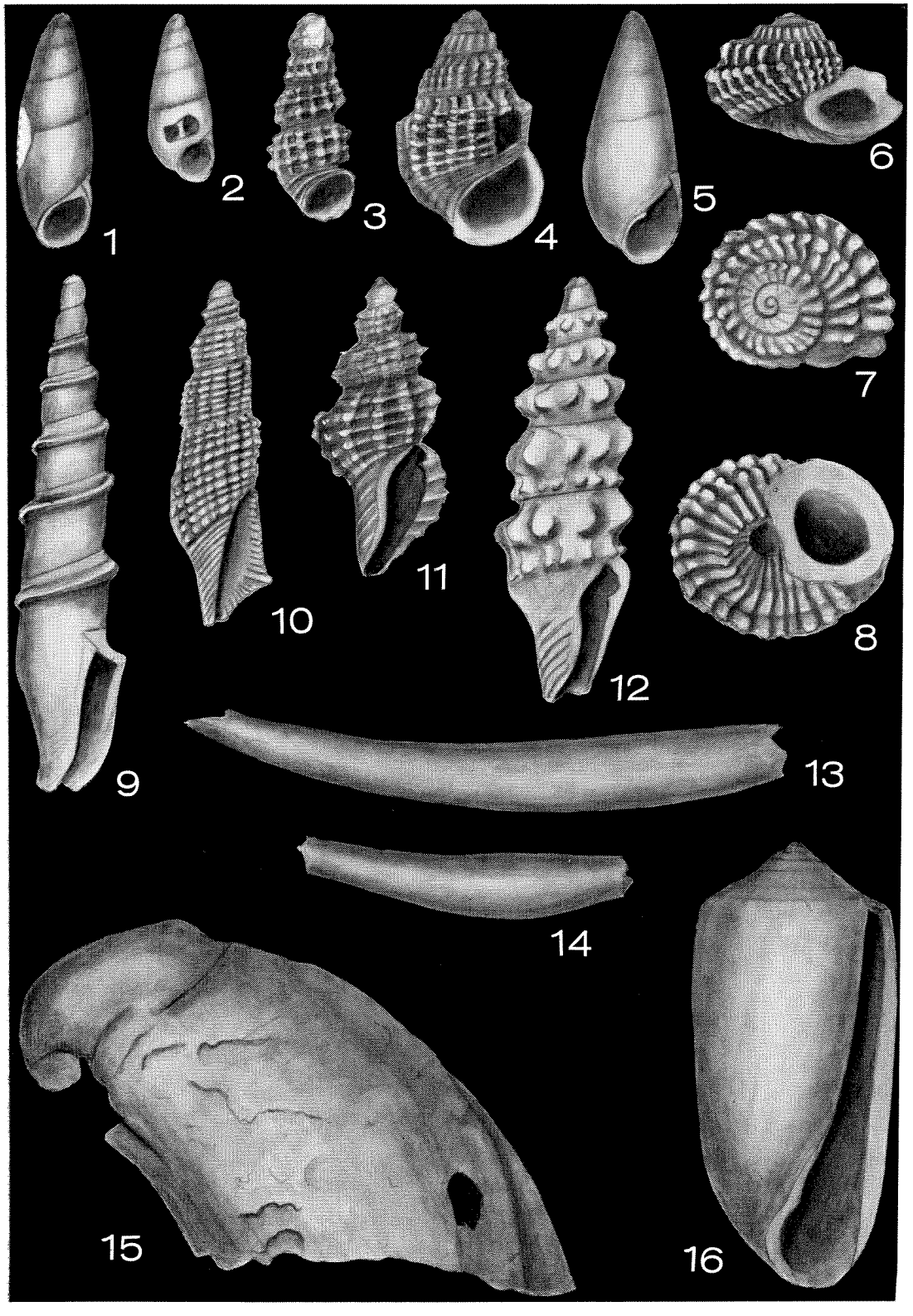

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