A RECENT OSTRACODE ASSEMBLAGE FROM ERITH ISLAND, BASS STRAIT, SOUTHERN AUSTRALIA—GEOGRAPHICAL AND ECOLOGICAL COMPARISONS, WITH A DESCRIPTION OF A NEW SPECIES OF *ROTUNDRACYTHERE* (OSTRACODA : CRUSTACEA)

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Recent ostracode assemblages from seven localities across southern Australia (of which four are considered in detail) are compared in terms of composition and diversity. The geographical and ecological factors influencing these assemblages are discussed in the light of current research on the relationship of such factors to composition and diversity. The absence of marked similarities or patterns amongst the assemblages is suggested to support the view that these ostracode communities represent chance associations of species with overlapping ecological requirements. A new species, *Rotundracythere phaseolus*, is described and its significance in the assemblage from Erith Island is discussed.

Key words: Ostracoda, Recent, *Rotundracythere*, ecology, assemblage.

THE assemblage of ostracodes which forms the basis of this study is briefly described in conjunction with the foraminiferal assemblage in Bell & Neil (1999). The sample of bottom sediment was collected at West Cove, Erith Island (a member of the Kent Group in Bass Strait) from a depth of 15 m (Kuiter 1981). A total of 565 specimens (valves and carapaces) was picked from part of this sample. More than 60 species from 39 genera are identified (Table 1). There is a substantial proportion of articulated carapaces in the assemblage (approximately 70%). The Erith Island assemblage is compared with other ostracode assemblages from Goode beach, W.A.; Robe, S.A.; Port Fairy, Victoria; Bass Strait; Wynyard, Tasmania and Twofold Bay, N.S.W. The species composition of these assemblages is also given in Table 1. A generalised breakdown of the composition of four of these assemblages is shown in Table 2 as percentages by families. The dominance of *Xestoleberis* species, and the abundance of the new species of *Rotundracythere phaseolus*, is noteworthy. In this study, the term 'assemblage' is used to refer collectively to the species identified as present in the picked sample. The 'fauna' of ostracodes at the sample site may or may not coincide in composition with the assemblage, depending on the variables of sample size, thoroughness of picking, sieving procedures, sample preparation and so on. Thus the 'fauna' is a hypothetical concept, allowing for generalisations about ecology and distribution based on actual and inferred species composition, whereas the 'assemblage' is the actual collection dealt with.

COMPARISON ASSEMBLAGES

The asssemblages used in these comparisons have been picked from samples collected from beach sand in the case of Twofold Bay (N.S.W.), Wynyard (Tasmania), Port Fairy (Victoria), Robe (S.A.) and Goode Beach (W.A.), and from bottom samples supplied by Museum Victoria in the case of Bass Strait locations. The assemblages from Robe and Goode Beach were used previously in a comparative study of Middle Miocene and Recent ostracode assemblages from southern Australia (Neil 1993). The locations of the samples are shown on the map (Fig. 1).

To make comparisons between assemblages from various localities suggests that any similarities and differences between them which can be identified and quantified may provide information about the factors governing the composition of those assemblages—in this case ecological and geographical factors. Before any such inferences are drawn from the data presented, it is necessary to consider: 1. Whether the association between species and genera of Ostracoda is governed by environmental, locational and faunal community relationships; 2. Whether it is due to random, stochastic factors; or 3. Whether it is due to some combination of factors 1 and 2.

Species	1	2	3	4	5	6	7	T
Actinocythereis robusta		7	1		+	R		8
Aglaiocypris sp.				2		R		2
Arcacythere hornibrooki	15				+			15
Arculacythereis? sp.	1							1
Argilloecia sp.		3			+	R	C	3
Aspidoconcha sp.		1						1
Australimoosella sp.	3	11	9			C	R	23
Australocytheridea vandenboldi		1		1	+	C		2
Baltraella sp.		1	1		+			2
Baltraella keiji	1							2
Baltraella twofoldbayensis		16						16
Baltraella wilmablomae	1							1
'Bradleya' gilli			1					1
Bradleya? sp.		1			+			1
Bythocypris sp.			2					2
Callistocythere spp.	30	89	12	24	+	A	A	155
Caudites litusorienticolus		1						1
Caudoleptocythere? sp.	1	4						5
Chavocythere sp.				1	+			1
Chavocythere lauta			2					2
Cletocythereis rastromarginata		3	44	5	+			52
Copytus sp.		2						2
Copytus sp. cf. *C. rara*			2	1		C		3
Cyprideis? sp.				1		A		1
Cypridina sp.	1							1
Cytheralison cosmetica			32		+			32
Cythereis sp.	1							1
Cytherella sp. aff. *C. lata*	4							4
Cytherella spp.		4	22	4	+	C	A	30
Cytheretta spp.	1	3	3					7
Cytheretta altopunctata			1					1
Cytheretta robusta	2							2
Cytheroma sp.	2				+			2
Cytheropteron spp.	1	9	1	1	+	A		12
Cytherura spp.	4	8		3	+	R	R	15
Cytherura tenuifossulata	2							2
Dentibythere sp.			2		+			2
Echinocythereis melobesioides		5			+		R	5
Eucythere? spp.		15		2	+	C		17
Hanaiceratina arenacea		1			+			1
Hemicytherid indet.	3	3	6	4		R		16
Hemicytherura sp.				2				2
Hemicytherura sp. cf. *H. lakeillawarraensis*	1							1
Hemicytherura sp. cf. *H. seaholmensis*		7						7
Hemicytherura seaholmensis	5							5
Hemicytherura windangensis	3	1				A		4
'Hirschmannia' bermoguiensis	1							1
Kangarina sp.				1				1
Kangarina sp. cf. *K. radiata*		3				C		3
Keijcyoidea keiji	1		32	18			A	51
Keijia sp.	2	1		1		A		4
Labutisella sp.		4						4
Leptocythere sp.		1		1		A	R	2
Loxoconcha spp.	21	31	32	50	+	A	A	134
Loxoconchella sp.	6	1		3	+			10
Loxocythere sp.				1				1

Table 1 continued next page

Species	1	2	3	4	5	6	7	T
Loxocythere sp. cf. *L. kerryswansoni*	5							5
'*Macrocypris*' spp.	25	3	12	4	+	C	R	44
Maddocksella spp.		1	1		+	C	C	2
Maddocksella obscura	1		17					18
Maddocksella tumefacta	4							4
Mckenzieartia portjacksonenesis	1	5	5			A		11
Microcythere sp.	4	5	1			C		10
Microcytherura australis	1							1
Microcytherura? sp.	3	1		8		A	C	12
Microcytherura spp.	32							32
Munseyella punctata	1	24	3	2		C	C	30
Mutilus pumilus		1	78	16	+	A	A	95
Neobuntonia sp		7		2	+	C	A	9
Neomonoceratina sp.				1				1
Neonesidea spp.	29	21	103	11	+	A	A	164
Notocarinovalva sp.		3		1				1
Orlovibairdia sp.		1						1
Orlovibairdia sp. cf. *O. arcaforma*	1					R		1
Papillatabairdia sp. cf. *P. dentata*			2			R*	R*	2
Paracypria sp.		5						5
Paradoxostoma spp.	35	2	2	3	+	A	C	42
Parakeijia sp.	1	6						7
Parakrithella australis	1				+	A	C	1
Paranesidea spp.		1	23		+	C	R	24
Pectocytherinid indet.	1	5					R	6
Pectocythere sp.				1				1
Pellucistoma sp.				29				29
Phlyctenophora zealandica		33		1	+	C		34
Polycope spp.		4		1	+			5
Ponticocythereis sp.			1					1
Ponticocythereis militaris				2				2
Praemunita? sp.		1						1
Procythereis (Serratocythere) densuireticulata		1			+	A*	C*	1
Procythereis (Serratocythere) kerguelenensis	4	17	46	6				73
Propontocypris spp.	43			1		R	R	44
Pseudocythere sp.			1		+			1
Quadracythere sp.				3	+			3
Rotundracythere sp.	1							1
Rotundracythere phaseolus sp. nov.	99			1	+			100
Schizocythere sp.				1				1
Sclerochilus sp.	2	1						3
Semicytherura spp.	1	2			+	A	R	3
Semicytherura cryptifera	3	12	1	7		C	A	23
Semicytherura illerti		2						2
Semicytherura insularkangarooensis	1					A		1
Semicytherura tenuireticulata	6	1					R	7
Tanella gracilis		14	1	26	+			41
Trachyleberis sp.		11			+			11
Xestoleberis spp.	147	68	20	26	+	A	A	261
Yassinicythere sp.			2	3			C	5
Yassinicythere sp. cf. *Y. triornata*				19				19
'*Yassinicythere*' sp.		1						1
Totals	569	508	523	313				

Table 1. Assemblages: 1. Erith Island; 2. Twofold Bay; 3. Port Fairy; 4. Wynyard; 5. Bass Strait area; 6. Robe; 7. Goode Beach. T = total. *Note:* + = occurs; * = genus level determination only; R = rare (< 3 specimens); C = common; A = abundant.

Family	Erith Island	Twofold Bay	Port Fairy	Wynyard
Xestoleberididae	26.0	14.3	4.1	8.6
Leptocytheridae	5.5	19.7	2.5	8.3
Loxoconchidae	4.8	6.7	6.6	17.6
Macrocyprididae	4.4	R	2.5	R
Eucytheridae	17.7	3.2	—	R
Pectocytheridae	3.5	9.6	1.7	R
Bairdiidae	5.1	4.6	26.5	3.7
Cytherellidae	R	R	11.2	7.3
Pontocyprididae	8.5	R	3.7	VR
Hemicytheridae	R	4.8	26.9	8.6
Trachyleberididae	R	8.2	2.7	8.0

Table 2. Assemblage percentages by family.

A substantial body of research has addressed this question over the years (Valentine 1969; Hoffman 1978, 1979; Pimm 1984; Ricklefs 1987; McNaughton 1988; Valentine & Jablonski 1993). The balance of current opinion favours an interpretation of marine communities as chance associations of species with overlapping ecological requirements, rather than associations of closely interdependent and co-evolving species (Jackson 1994; Jackson et al. 1996). Some of the research leading to this view has been concerned with the marine microfauna (foraminifers) eg. Buzas & Culver (1994) and some of it with the macrofauna eg. Valentine & Jablonski (1993). An important exception to the chance association view is reef

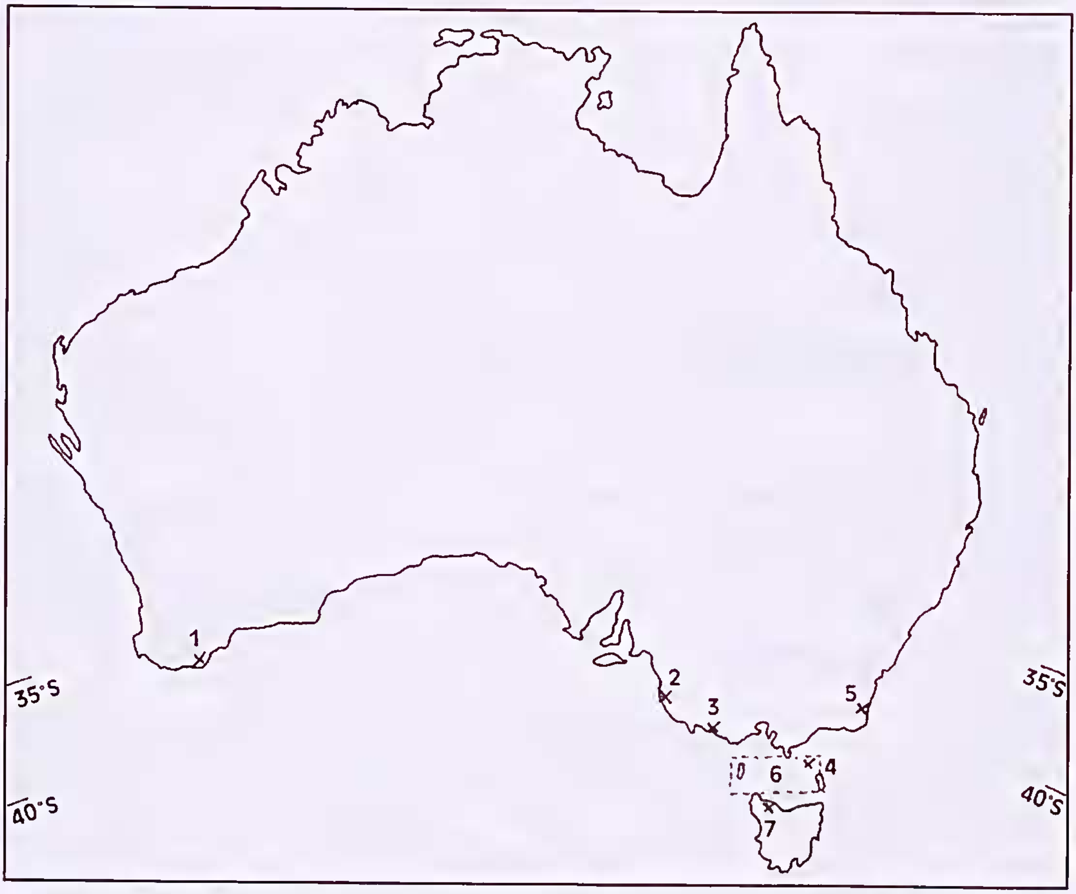


Fig. 1. Locations of the assemblages: 1. Goode Beach, Frenchman's Bay, King George Sound, W.A.; 2. Robe, Guichen Bay, S.A.; 3. Port Fairy, Victoria; 4. Erith Island, Kent Group, Bass Strait; 5. Twofold Bay, N.S.W.; 6. Bass Strait sample area; 7. Wynyard, Tasmania.

coral assemblages (Pandolfi 1996; Wood 1998), but none of the assemblages dealt with here is associated with a reef. Buzas & Culver (1994) refer to foraminiferal communities in the Cenozoic shelf deposits of the the North American Atlantic Coastal Plain. These communities show little shared variation over 55 million years of successive transgressions and regressions, but reflect the necessity of a species pool to sustain species diversity during this period. The assemblages studied here will be considered in the light of these views, not only as chance associations, but also as being maintained from just such a species pool.

The taxonomic level at which an assemblage is analysed is obviously a factor in the kinds of similarities and differences which might be identified. At the level of species, great apparent precision can be achieved in inferring environmental associations, and this is lessened by using higher taxonomic categories. On the other hand, large-scale environmental differences such as those between fresh- and salt-water, or between lacustrine and marine habitats, tend to be reflected in differences between ostracode members of assemblages at the higher taxonomic levels of genera and families.

When the total membership of an ostracode assemblage is considered in relationship to that of other assemblages, then the community structure question referred to above emerges. If ostracode species are environmentally very sensitive (van Harten 1988), then the inferences about the environment in which a given assemblage lives which can be drawn from its species composition will be more detailed than if a higher taxonomic level were used. However, the likelihood of conflicting signals from particular species is increased if the environmental sensitivity of those species is overestimated. The potential source of conflicting evidence is lessened by using the higher category of genus or family, but the value of the more generalised inferences about the reasons for the composition of the assemblage may also be diminished. In this study, comparisons are made at the level of genera, except where reliable data at the species level is available.

GEOGRAPHICAL COMPARISONS

As Fig. 1 shows, the assemblages represent a wide range of longitude (117–150°E), but a relatively smaller latitudinal range (35–41°S). The localities from which beach sand samples were collected (Twofold Bay, Wynyard, Port Fairy, Robe and Goode Beach) reflect a variety of coastal situations. Twofold Bay is an extensive embayment protected from the ocean, which lies to the east. Wynyard is an open beach facing Bass Strait to the north. Port Fairy is protected from the Southern Ocean by a cape and an island. Robe, on Guichen Bay, is more or less open to the Southern Ocean to the south-west. Goode Beach is on Frenchman Bay, King George Sound, near Albany, and is an eastward-facing sheltered location. The Bass Strait samples, including the Erith Island assemblage, are bottom samples ranging in depth from 15 m for Erith Island to 92 m for the deepest Bass Strait samples.

The assemblages may be characterised as temperate latitude shallow (estuarine, intertidal or shelf). However, the individual locations show a fairly wide range of influences. They are exposed or protected to varying extents from winds and currents, since they cover the southern part of the continent from west to east. Thus, the variations in composition of these assemblages may be influenced by geographical position rather than by ecological parameters. For benthonic organisms with a limited capacity for transport (there are no planktonic or nektonic forms at the adult stage, except for one cypridinid specimen), it is not surprising to find great differences at the species level from one assemblage to another. However, some species are notably cosmopolitan (*Mutilus pumilus*; *Cletocythereis rastromarginata*; *Neonesidea australis*; *Munseyella punctata*; *Semicytherura cryptifera*), presumably because their adaptation is generalised. Hartmann (1979, 1981), McKenzie (1967) and Swanson (1979) record *M. pumilus* from Western Australia to New South Wales and on the Otago Shelf, New Zealand. Reyment et al. (1988) have analysed the variation in morphology of populations of *M. pumilus* from its Australian locations and have tentatively concluded this variation is due to seasonal temperature changes. This supports the suggestion that the species is cosmopolitan because it is adaptable, though the question of its dispersion over such a wide geographic range remains unanswered.

ECOLOGICAL COMPARISONS

The ecological characteristics attributed to the species found in the assemblages studied here are listed in Table 4. These data from Hartmann (1978, 1979); McKenzie (1974); Howe & McKenzie (1989); Yassini & Wright (1988); Yassini & Jones (1987, 1995) and Yassini et al. (1993) are fairly general in character and do not provide an adequate basis for discriminating amongst the assemblages in anything but the broadest terms. The abundance of the most commonly occurring species in the four main assemblages is given in Table 3.

The Erith Island assemblage is marked by a striking abundance (17.5%) of the new species *Rotundracythere phaseolus*. It is very rare in the Wynyard assemblage and only one other specimen occurs (amongst the Bass Strait samples). The species does not occur in the other assemblages. Other substantial occurrences in the Erith Island assemblage which should be noted are *Xestoleberis* spp. (26.0%); '*Macrocypris*' spp. (4.7%)—very rare elsewhere; *Paradoxostoma* spp. (6.2%)—rare to very rare at Twofold Bay, Wynyard, Port Fairy and Bass Strait, though abundant at Robe and common at Goode Beach; *Propontocypris* spp. (7.6%)—very rare at Wynyard and absent elsewhere.

On the other hand, many species abundant or common in the other assemblages are absent or rare at Erith Island.

All the following species are absent from the Erith Island assemblage but found in substantial numbers in some of the comparison assemblages: 1. *Cletocythereis rastromarginata* (9.1% at Port Fairy); 2. *Cytheralison cosmetica* (6.6% at Port Fairy); 3. *Mutilus pumilus* (16.1% at Port Fairy, 5.3% at Wynyard, abundant at Robe and Goode Beach); 4. *Pellucistoma* sp. (9.6% at Wynyard); 5. *Phlyctenophora zealandica* (6.9% at Twofold Bay); 6. *Tanella gracilis* (8.6% at Wynyard); and 7. *Yassinicythere ornata* (6.3% at Wynyard).

The following species, whilst varying from abundant to common at some of the other locations, are rare to very rare in the Erith Island assemblage: 1. *Baltraella twofoldbayensis* (3.4% at Twofold Bay); 2. *Cytherella* spp. (4.9% at Port Fairy); 3. *Keijcyoidea keiji* (6.6% at Port Fairy, 6.0% at Wynyard); 4. *Munseyella punctata* (5.0% at Twofold Bay); and 5. *Procythereis (Serratocythere) kerguelenensis* (9.5% at Port Fairy).

This irregularity of distribution is characteristic of the other assemblages also. Where specimens are identified to species level, Port Fairy has a diverse representation with five species aggregating 47.9% of the assemblage (*Mutilus pumilus* 16.1%, *Procythereis (Serratocythere) kerguelenensis* 9.5%, *Cletocythereis rastromarginata* 9.1%, *Cytheralison cosmetica* 6.6%, *Keijcyoidea keiji* 6.6%). The Erith Island assemblage is dominated by one species (*Rotundracythere phaseolus*). This species does not occur at Port Fairy and the five dominant species from the latter assemblage are either rare or absent from Erith Island. The Twofold Bay assemblage has four species aggregating 14.8% of the total, and of these *Procythereis (Serratocythere) kerguelenensis* is the only one common to more than two assemblages. The Wynyard assemblage has five species aggregating 29.2% of the total (*Tanella gracilis* 8.6%, *Yassinicythere* sp. cf. *Y. triornata* 7.3%, *Keijcyoidea keiji* 6.0%, *Mutilus pumilus* 5.3%, *Procythereis (Serratocythere) kerguelenensis* 2.0%). The first three of these species are prominent at Port Fairy also, but only *Procythereis (Serratocythere) kerguelenensis* and *Tanella gracilis* are common at both Wynyard and Twofold Bay. The Erith Island assemblage is quite distinct from the others (see Table 3).

When the assemblages from Robe and Goode Beach are considered, the occurrence of the cosmopolitan species *Mutilus pumilus* (6.8% at Robe, 32.8% at Goode Beach), *Procythereis (Serratocyhtere) kerguelenensis* (6.2% at Robe) and *Keijcyoidea keiji* (2.9% at Goode Beach) is not unexpected. However, the relative abundance of *Cytheropteron* sp. A (4.7%) and *Cytherelloidea* sp. A (4.4%) at Goode Beach is not matched at any of the eastern assemblages. *Neobuntonia foveata* (2.9%) is a distinctive feature of the Robe assemblage.

Taxon	Erith Island	Twofold Bay	Port Fairy	Wynyard
Xestoleberis spp.	26.0	14.3	4.1	8.6
Callistocythere spp.	5.3	18.7	2.5	8.0
Loxoconcha spp.	3.7	6.5	6.6	16.6
Macrocypris spp.	4.4	R	2.5	R
Rotundracythere sp. nov.	17.5	—	—	VR
Arcacythere sp.	2.7	—	—	—
Microcytherura spp.	6.4	VR	—	2.7
Neonesidea–Paranesidea spp.	5.1	4.6	26.5	3.7
Munseyella punctata	VR	5.0	R	R
Phlyctenphora zealandica	—	6.9	—	VR
Cletocythereis rastromarginata	—	R	9.1	1.7
Cytheralison cosmetica	—	—	6.6	—
Cytherella spp.	R	R	4.6	R
Keijcyoidea keiji	VR	—	6.6	6.0
Propontocypris sp.	8.5	R	3.7	VR
Mutilus pumilus	—	VR	16.1	5.3
P. (Serratocythere) kerguelenensis	R	3.6	9.5	2.0
Tanella gracilis	—	2.9	VR	8.6
Yassinicythere sp. cf. *Y. triornata*	—	VR	R	7.3

Table 3. Comparison of species abundance as percentage of total.

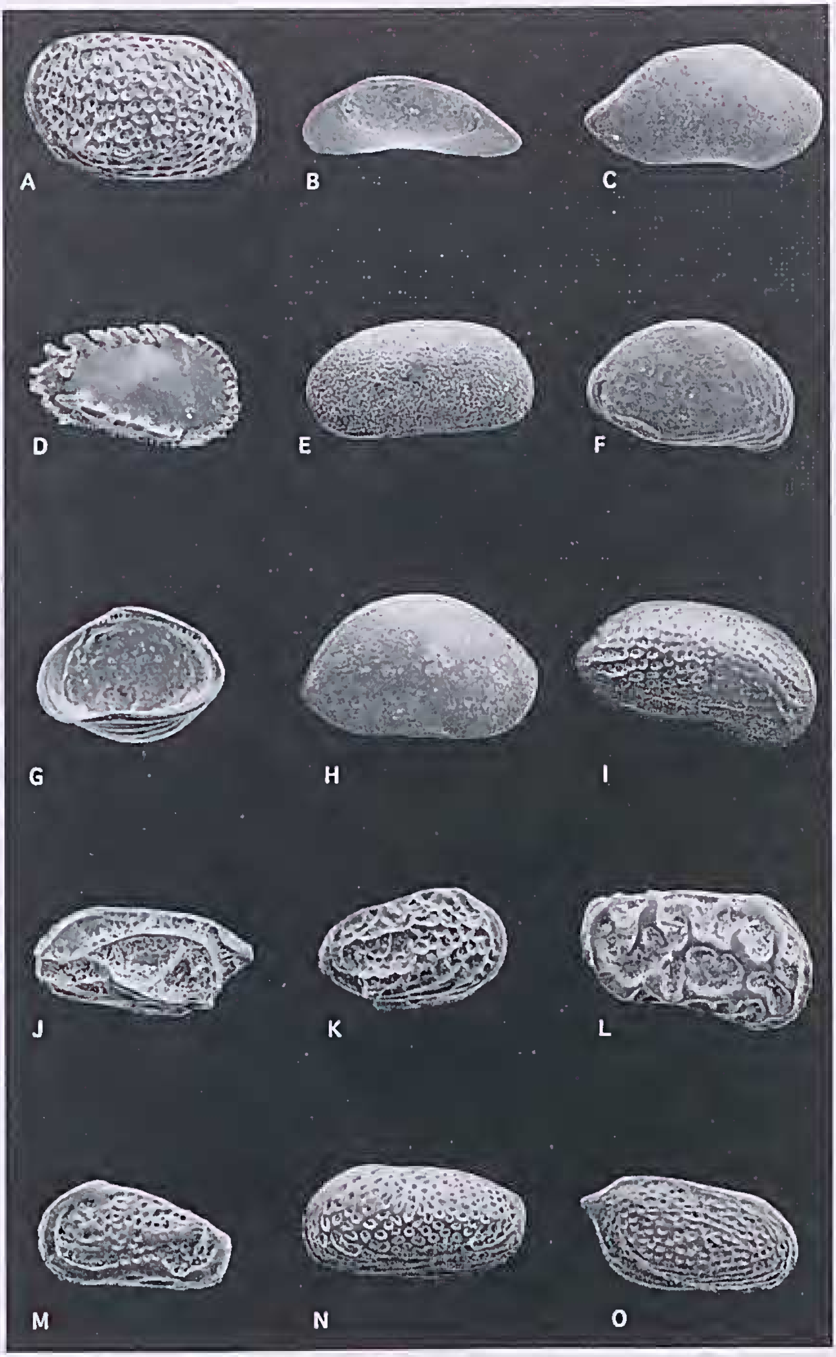


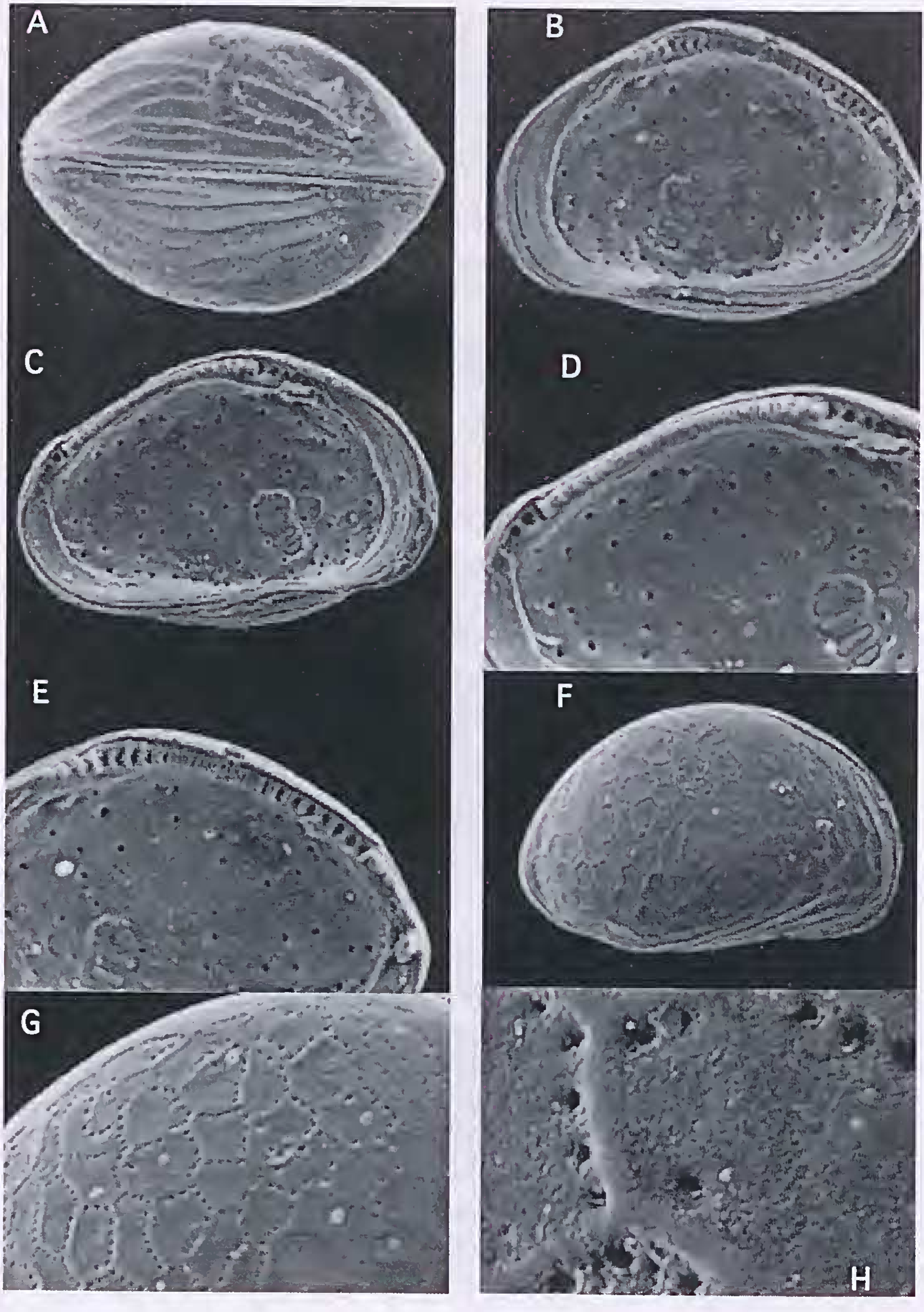
Fig. 2. Erith Island Ostracoda—selected species: A. *Loxoconcha cumulus*, × 75; B. *Tasmanocypris dietmarkeyseri*, × 35; C. *Neonesidea* sp., × 45; D. *Pterygocythereis* sp. aff. *velivola*, × 60; E. *Papillatabairdia elongata*, × 60; F. *Rotundracythere phaseolus*, × 90; G. *Rotundracythere phaseolus*, × 90; H. *Paranesidea sinusaquilensis*, × 60; I. *Procythereis (Serratocythere) densuireticulata*, × 60; J. *Semicytherura illerti*, × 90; K. *Loxoconcha gilli*, × 75; L. *Callistocythere keiji*, × 75; M. *Munseyella punctata*, × 90; N. *Arcacythere hornibrooki*, × 80; O. *Cytherura* sp., × 75.

Actinocythereis rabusta Yassini & Jones, 1987—shallow open marine; sheltered marine
Aglaiocypris sp.—marine, mainly epineritic warmer water
Arcacythere hornibrooki Yassini & Jones, 1995—shallow open marine
Arculacythereis? sp.—open estuaries, inner and middle shelf
Argilloecia sp.—marine; silty, clayey substrate
Aspidoconcha sp.—marine
Australimoosella sp.—marine estuarine, sheltered oceanic embayments, inner shelf
Australocytheridea vandenboldi McKenzie, 1967—shallow sheltered marine embayments, inner shelf
Baltraella sp.—marine, middle shelf
Baltraella keiji Yassini & Jones, 1995—marine, middle shelf
Baltraella twofoldbayensis Yassini & Jones, 1995—marine, middle shelf
Baltraella wilmablomae Yassini & Jones, 1995—marine, middle shelf
'*Bradleya*' *gilli* McKenzie, Reyment & Reyment, 1990—marine, middle shelf
Bradleya? sp.—shallow, moderate depth marine
Bythocypris sp.—marine
Callistocythere spp.—lagoonal, estuarine, marine intertidal, algal mats
Caudites litusorientiicolus Hartmann, 1981—supratidal, infralittoral zone of sheltered embayments, algal biota
Caudoleptocythere? sp.—marine sheltered embayments
Chavocythere sp.—marine, open estuaries, sheltered open embayments, inlet channels of coastal lagoons, intertidal zone of inner shelf
Chavocythere lauta (Brady, 1880)—as for *Chavocythere* sp.
Cletocythereis rastromarginata (Brady, 1880)—similar to *Chavocythere* sp.
Copytus sp.—shallow open marine
Copytus sp. cf. *C. rara* McKenzie, 1967—shallow open marine
Cyprideis? sp.—saline lakes, coastal lagoons
Cypridina sp.—marine, pelagic
Cytheralison cosmetica Yassini & Jones, 1987—open marine, continental shelf
Cythereis sp.—marine
Cytherella sp. aff. *C. lata* Brady, 1880—marine, outer shelf below 80 m
Cytherella spp.—estuarine to inner middle shelf
Cytheretta spp.—estuarine, marine
Cytheretta altopunctata Yassini & Jones, 1995—open estuaries, sheltered oceanic embayments
Cytheretta robusta Yassini & Jones, 1995
Cytheroma sp.—marine, seagrass beds
Cytheropteron spp.—variable marine, inner/outer shelf, intertidal zone, inlet channels of coastal lagoons, open estuaries, sheltered oceanic embayments
Cytherura spp.—predominantly lagoonal
Cytherura tenuifossulata Hartmann, 1978—marine, estuarine
Dentibythere sp.—marine
Echinocythereis melobesioides (Brady, 1880)—inner/middle shelf, some intertidal occurrences
Eucythere? spp.—estuarine, marine
Hanaiceratina arenacea (Brady, 1880)
Hemicytherid indet.
Hemicytherura sp. cf. *H. lakeillawarraensis* Yassini & Jones, 1995—marine, estuarine, intertidal channel, lagoonal inlet
Hemicytherura sp. cf. *H. scaholmensis* McKenzie, 1967—epiphytal
Hemicytherura sealholmensis McKenzie, 1967—epiphytal
Hemicytherura windangensis Yassini & Jones, 1987—algal mats (described as 'Tropical' from W.A.)
'*Hirschmannia*' *bermaguiensis* Yassini & Jones, 1995—shallow open marine
Kangarina sp.—marine, intertidal zone
Kangarina sp. cf. *K. radiata* (Hornibrook, 1952)—marine, intertidal, sheltered embayments; silty, clayey substrate
Keijcyoidea keiji (McKenzie, 1967)—rocky substrate, intertidal zone of open estuaries and sheltered oceanic embayments
Keijia sp.—marine, estuarine; inlet channels, intertidal, open estuaries, sheltered oceanic embayments
Labutisella sp.
Leptocythere sp.—Sp. 1: marine, continental shelf; Sp. 2: seagrass beds, sandy substrate
Loxoconcha spp.—estuarine, intertidal, shallow open marine. Seagrass beds and algal mats
Loxaconchella sp.—marine

Table 4 continued next page

Loxocythere sp. cf. *L. kerryswansoni* Yassini & Jones, 1995—tidal estuary, intertidal, coralline algal mats, rocky substrate
'*Macropcypris*' spp.—marine
Maddocksella spp.—estuarine, sheltered oceanic embayments; silty, muddy substrate
Maddocksella obscura (Whatley & Downing, 1983)—as for *Maddocksella* spp.
Maddocksella tumefacta (Chapman, 1914)—as for *Maddocksella* spp.
Mckenzieartia portjacksonenesis (McKenzie, 1967)—estuarine, shallow open marine; fluctuating salinity
Microcythere sp.—seagrass beds
Microcytherura australis McKenzie, 1967—seagrass beds, photic zone, shallow sheltered marine
Microcytherura? sp.
Microcytherura spp.
Munseyella punctata Yassini & Jones, 1995—inner, middle shelf, shallow open marine
Mutilus pumilus (Brady, 1866)—algal mats of intertidal zone, open marine or sheltered marine
Neobuntonia sp.
Neomonoceratina sp.
Neonesidea spp.—shallow open marine, inner/middle shelf, fine-grained substrates
Notocarinovalva sp.
Orlovibairdia sp.—sandy substrate, organic detritus
Orlovibairdia sp. cf. *O. arcaforma* Swanson, 1979—sandy substrate
Papillatabairdia sp. cf. *P. dentata* Bentley, 1981—marine, clayey to sandy substrate
Paracypria sp.—estuarine, lagoonal, seagrass beds
Paradoxostoma spp.—marine, estuarine, coastal lagoons
Parakeijia sp.—coastal lagoons
Parakrithella australis McKenzie, 1967—lagoons, intertidal zone
Paranesidea spp.—marine, calcareous algal mats
Pectocytherinid indet.
Pectocythere sp.—estuarine, marine
Pellucistoma sp.
Phlyctenophora zealandica Brady, 1880—estuarine, marine, inner shelf
Polycope spp.—marine
Ponticocythereis sp.—marine, estuarine; silty, clayey substrate rich in organic detritus
Ponticocythereis militaris (Brady, 1886)—as for *Ponticocythereis* sp.
Praemunita? sp.—peripheral embayments of coastal lagoons
Procythereis (Serratocythere) densireticulata Hartmann, 1981—algal biota of intertidal coastal lagoons and sheltered embayments
Procythereis (Serratocythere) kerguelenensis (Brady, 1880)—as above
Propontocypris spp.—estuarine, middle shelf
Pterygocythereis sp. aff. *P. velivola* Yassini, Jones & Jones, 1993—marine, subtropical
Pseudocythere sp.—marine
Quadracythere sp.—marine, estuarine
Rotundracythere sp.—shallow open marine
Rotundracythere erithensis sp. nov.
Schizocythere sp.—marine
Sclerochilus sp.—marine, rare in intertidal zone
Semicytherura spp.
Semicytherura cryptifera (Brady, 1880)—epiphytic inhabitant of intertidal zone, open and sheltered marine embayments
Semicytherura illerti Yassini, 1988—open estuaries, sheltered oceanic embayments, middle shelf
Semicytherura insularkangarooensis Hartmann, 1980—shallow marine, intertidal
Semicythrura tenuireticulata McKenzie, 1967—shallow intertidal, open or sheltered marine
Tanella gracilis Kingma, 1948—*Zostera* beds, silty, clayey substrate, large salinity fluctuations
Tasmanocypris dietmarkeyseri (Hartmann, 1979)—marine, estuarine
Trachyleberis sp.
Xestoleberis spp.—very variable. Saline lakes, coastal lagoons, open estuaries, open and sheltered marine, intertidal, inner shelf
Yassinicythere sp.
Yassinicythere sp. cf. *Y. ornata* (McKenzie, Reyment & Reyment, 1990)—estuarine, marine
'*Yassinicythere*' sp.

Table 4. Species list—ecological and geographical notes.


A
B
C
D
E
F
G
H

At the taxonomic level of family (see Table 2), the differences between the assemblages is less marked, as one would expect. Substantial differences do occur, however. Xestoleberids are more common at Erith Island and Twofold Bay than at the other two locations. Hemicytherids and bairdiids figure prominently at Port Fairy. Cytherellids are well represented at Port Fairy and Wynyard, but not at the other two main locations. In general, the identification of patterns of occurrence across the range of these assemblages is not substantiated.

The ecological characteristics of the species and genera represented in the four main assemblages (see Table 4) fall into two categories: 1. Generalised characteristics such as 'shallow open marine', 'open estuaries', 'intertidal', 'sheltered oceanic embayments', 'inner shelf'—such terms are not mutually exclusive, and because of their broad reference, are unsuitable for discriminating amongst the components of assemblages or even between assemblages at all but the most general level; and 2. Specific characteristics such as 'inlet channels', seagrass beds', 'epiphytal', 'silty, sandy substrate', 'fluctuating salinity'—whilst such terms would enable some discrimination to be made within or between assemblages, the rarity of examples and/or the conjunction of characteristics which seem to be mutually exclusive, makes it difficult to draw valid inferences from these data. For example, even though two species which prefer a rocky substrate occur in the Wynyard assemblage, so do three preferring a silty, clayey substrate and one preferring a sandy substrate.

It is not possible to distinguish depth changes—intertidal, inner, middle or outer shelf; salinity—marine, estuary, lagoon or lake (stable or fluctuating) or substrate—fine or coarse, hard or soft, since species and genera adapted to almost all of these variations occur in each of the assemblages. Furthermore, even the characteristics of the rare species do not allow us to discriminate meaningfully when comparing the assemblages with one another. For instance, one perfectly preserved myodocopid (cypridinid) carapace with soft parts intact scarcely warrants any general inference about pelagic forms and the Erith Island assemblage.

DISCUSSION

There is a wide range of abundance amongst the south-eastern Australian assemblages from Port Fairy, Wynyard, Erith Island and Twofold Bay when particular species are considered (see Table 3). No species occurs in all four assemblages except *Procythereis (Serratocythere) kerguelenensis* which is fairly common in three and rare in the other, and *Munseyella punctata*, which is rare to very rare in three and common in the other. Such variations are evident also for *Phlyctenophora zealandica*, *Cletocythereis rastromarginata* and *Yassinicythere* sp. cf. *Y. triornata*, which occur in three of the four assemblages. Even greater variation of occurrence is evident for *Rotundracythere phaseolus* and *Cytheralison cosmetica*. Only *Mutilus pumilus*, *Tanella gracilis* and *Keijcyoidea keiji* occur with any frequency in more than one assemblage. At the level of species, then, little pattern is evident.

Even when families are considered as the unit of comparison, little pattern is evident beyond the commonness of xestoleberids, loxoconchids and leptocytherids.

When the assemblages from Robe and Goode Beach are added, the additional data on species and genera (see Neil 1993) add little to the general picture discussed above, and do not give evidence of patterns any more clearly than a consideration of the four more eastern assemblages, even though the east–west range is more than doubled.

Given the ecological and geographical factors influencing these assemblages, and the absence of marked patterns in the composition and abundances of the ostracode species and genera, there is support for the view that these ostracode communities represent chance associations of species with overlapping ecological requirements (Jackson et al. 1996). The data provided here do not support van Harten (1988), who claims that organic species all have their own and unique set of ecologic requirements which fit into, and define, a single ecologic niche. However, the existence of a species pool to maintain diversity (Buzas & Culver 1994) cannot be inferred from a series of contemporaneous Recent assemblages. A study of

Fig. 3. Rotundracythere phaseolus sp. nov.: A. ventral surface of juvenile carapace, showing ridges, × 175; B. right valve interior, × 175; C. left valve interior, × 175; D. left valve, showing hinge elements and muscle scars, × 260; E. right valve, showing hinge elements, × 230; F. carapace (holotype), exterior showing reticulation and ridges, × 140; G. detail of reticulation (holotype), × 350; H. puncta and shallow ridges of reticulation (holotype), × 1750.

a sequence of assemblages over geological time will be required in order to test this hypothesis.

SYSTEMATICS

Phylum CRUSTACEA Pennant, 1777

Class OSTRACODA Latreille, 1806

Order PODOCOPIDA Müller, 1804

Suborder PODOCOPINA Sars, 1866

Family EUCYTHERIDAE Puri, 1954

Rotundracythere Mandelstam, 1958

Type species. **Eucythere rotunda** Hornibrook, 1952.

Rotundracythere phaseolus sp. nov.

Etymology. From the Latin diminutive of *phaselus* (Greek *phaselos*)—a kidney bean, in reference to the distinctive bean shape of the carapace.

Types. Holotype—J47023 (carapace); Paratypes—J47024 (carapace), J47025 (RV), J47026 (LV), J47027 (LV). All specimens are housed in the Invertebrate Zoology Collection of Museum Victoria.

Figured specimens. Fig. 3A, G, H (J47023); B (J47024); C, E (J47026); D, F (J47025).

Type locality. West Cove, Erith Island (Kent Group), Bass Strait at a depth of 15 m.

Diagnosis. A tumid *Rotundracythere* species with a smoothly rounded dorsal margin, a reticulate pattern formed by lines of small punctae associated with very low rounded ribs, a narrow anterior inner lamella and with an apical flexure at the anterior end of the median hunge element.

Description. Small, thick-shelled, with a pearly lustre. Carapace tumid, subtriangular to subovate in lateral view, ovate in ventral view. Dorsum smoothly rounded with greatest height mid-length. Venter straight, with a slight oral concavity. Greatest length below mid-height. Anterior broadly rounded to subvertical in ventral half. Posterior smoothly but more narrowly rounded. Females higher and more tumid than males. RV with a slight ventral overhang on LV, but valves of equal size. Reticulate pattern defined by lines of small, circular puncta, bordered by very low, rounded ribs more defined anteriorly than laterally. Narrow low rounded ribs without, or with very small, puncta on flattened ventral surfaces.

Normal pores few and scattered. Inner lamella narrow anteriorly, with very narrow vestibule. In some specimens lamella is broader posteriorly than anteriorly. Six or seven marginal pore canals in anterior, mostly straight and unbranched. Hinge antimerodont, with long terminal elements of four or more teeth, and a crenulate median element. An oblique row of four subquadrate and clearly separate adductor scars, dorsal scar divided. Frontal scar subtriangular; single dorsal scar small.

Affinities. R. phaseolus is distinguished from other Australasian *Rotundracythere* species, both Recent and fossil, by its smoothly rounded dorsum and relatively narrow anterior inner lamella. It differs from the type species *R. rotunda* (Hornibrook 1952) in lacking a median sulcus and its subtriangular shape. *R. pseudosubovalis* Whatley & Downing, 1983 differs from *R. phaseolus* in having a marked dorsal apex, puncta enclosed within the reticulation of low ribs and a large, heart-shaped frontal scar. Swanson (1969) shows *R. mytila* and *R. ovalis* to be smooth-surfaced and *R. gravepuncta* to be ornamented, though he also figures this last species as smooth-surfaced (1979). The genus *Eorotundracythere* Bate, 1972 displays a much more elongate lateral valve shape than *Rotundracythere* (see Bate 1972; Neale 1975). McKenzie et al. (1990) refer to, but do not describe or figure, a Recent species of *Rotundracythere* which may be conspecific with *R. phaseolus*. They refer to it as 'unlike any previously described Quaternary eucytherid species'.

Remarks. R. phaseolus sp. nov. is placed in *Rotundracythere* because of the crenulate median element of the hinge, even though the lateral shape of the valves lacks the characteristic asymmetry of the other species referred to above. The importance of the hinge structure as a taxonomic factor has been stressed by Pokorny (1955), Sylvester-Bradley (1956) and more recently Tsukagoshi & Kamiya (1996), who studied heterochrony in ostracode hingement and distinguished two kinds of hinge ontogeny—'gradual' and 'leap' types. As no juvenile specimens were available in this assemblage, it is not possible to categorise the hingement of this species in this way. The antimerodont hinge is the adult form, though Tsukagoshi & Kamiya (1996) illustrate *Hemicythere quadrinodosa* which has an antimerodont hinge in the A-1 instar and an amphidont hinge in the adult form. The abundance of *R. phaseolus* in this assemblage is the most marked of any species in the assemblages studied here, though *Mutilus pumilus* is almost equally abundant in the assemblage from Port Fairy.

Measurements (in millimetres)

Holotype. Carapace (J47023): L = 0.39; H = 0.24; W = 0.26.

Paratypes. Juvenile carapace (J47024): L = 0.34; H = 0.23; W = 0.26. Right valve (J47025): L = 0.36; H = 0.22. Left valve (J47026): L = 0.37; H = 0.20; (J47027): broken specimen.

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