

**A comparative study of collections from the S.W. Pacific (Saipan to Tonga),
with the descriptions of *Gambiella caudata* (Brady, 1890) and a
new species of *Pterobairdia* (Ostracoda)**

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ABSTRACT—*Gambiella caudata* (Brady, 1890) and *Pterobairdia briggsae* sp. nov. are described from collections made in the S. W. Pacific (Saipan, Onotoa, Ontong-Java/Kula Gulf, Noumea, Cook Islands, Fiji, Samoa, Tonga); and the lectotypes of several species described in a major early paper by Brady (1890) are illustrated. The carbonate compensation depth in this region lies at around 4500 m. Comparison of the Ontong-Java in Kula Gulf samples reinforces consideration of depth as a factor of ecological importance. A similarity matrix for the several faunas shows factors in common at species level ranging from 22% (Onotoa/Noumea) to nearly 60% (Samoa/Onotoa); while endemism ranges from 8.5% (Samoa) to nearly 33% (Tonga). Most endemic species belong in a limited number of podocopid families, in particular Bairdiidae, Trachyleberididae, Paradoxostomatidae and Leptocytheridae. These results appear consistent with an hypothesis that continued tectonics-driven changes in the regional marine topography and sedimentation, i.e. niche development, could have triggered speciation along the regional plate margins.

INTRODUCTION

A study of Ostracoda and other microfauna from the S.W. Pacific commenced in 1980. It is based on material sampled during a number of cruises coordinated by CCOP/SOPAC (Committee for Coordination of Joint Prospecting for Mineral Resources in South Pacific Off-shore Areas). These hereafter-called SOPAC Cruises included collections from the Cook Islands (CK-76), Western Samoa (WS-76), Tonga (76, 77, 78), and Solomon Islands (SI-81). Work on the collections is part of a United Nations Development Programme (UNDP) which is monitored by a Project Office in Fiji, presently under the supervision of Dr. Cruz Matos. The SOPAC Cruise Reports and a number of Technical Reports relative to the projects can be obtained from his office. They include preliminary comments on the ostracod assemblages (McKenzie, 1981).

Most of the SOPAC offshore work between 1976–1981 was directed towards the investigation of manganese nodules, phosphorites and precious corals and to this purpose a variety of sampling devices were used. They included: free fall corer; free fall grab, Van Veen grab, gravity corer, tangle nets, rock dredge, wire lowered grab, pipe dredge, pipe and rock dredge. Often, the sediments collected were too coarse, finer material being lost as a grab was winched up. Nevertheless, much suitable material remains, particularly for stations where cores were taken or large samples were dredged up. Of the several hundred samples which have been collected, around 60 were prepared for this on-going study. They are scattered over the entire region but have the potential to provide much useful data for an area which is still relatively unknown in terms of its Ostracoda (Brady,

1890 remains the major taxonomic reference) although recently this undesirable situation has begun to improve (Whatley, 1983).

SAMPLE DESCRIPTIONS

Preliminary sample descriptions of washings provided to the author, and mostly prepared at the UNDP Project Office in Fiji, are given in Appendix A. They relate to materials recovered in the Cook Islands (CK-76), Western Samoa (WS-76) and Tonga (76, 77, 78) cruises. The ostracod taxonomic work on these samples is in progress.

OSTRACODA

Ostracods are relatively abundant in the washings examined. Fig. 1 indicates the relative diversity (genera and species) of the samples which contained ostracods as well as providing a record of the samples which lacked ostracods, both as a function of depth (see also Appendix A). The figure makes it clear that ostracods are most diverse in relatively shallow water and that they are absent from samples taken at depths greater than 5000 m. In fact, the greatest depth at which ostracods were obtained in these collections was 4534 m. This result is interpreted as confirming that the carbonate compensation depth in the southwest Pacific occurs at slightly more than 4500 m. The data set provides a fair test on which to base such an interpretation because out of the total of 54 samples, 25 were collected at depths of 4500 m or greater.

Further, in the three samples from 4534 m depth (WS-76, Station 2 – of Appendix A) which carried Ostracoda, the assemblage included at least three genera

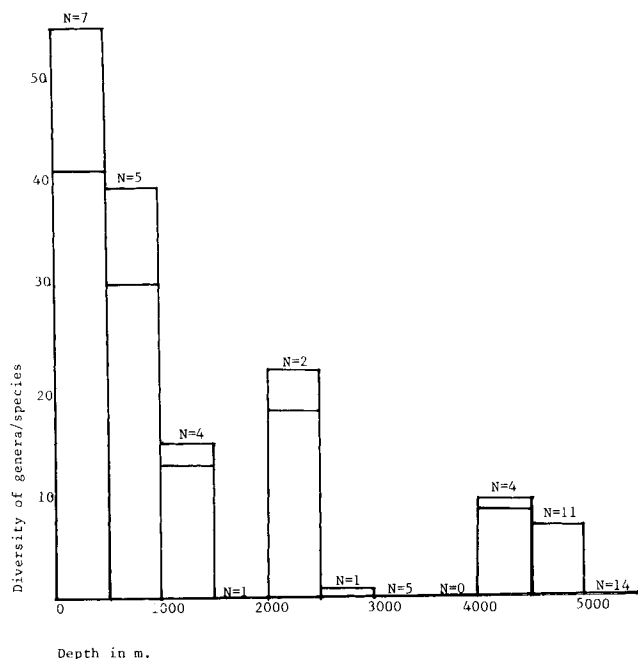


Fig. 1. Diversity of Ostracoda with depth: SOPAC cruises all samples (54). N = number of samples available in each each 500m depth interval. Of the 11 samples from the 4500–5000m interval only 3 contain ostracods (depth 4534 m).

which were probably allochthonous – *Tenedocythere*, *Parakrithella* (?), *Xestoleberis* – plus a single indeterminate juvenile and a juvenile right valve (RV) fragment, also probably allochthonous. Thus, the likely biocoenose in these samples is restricted to *Kritho*, *Bradleya*, *Echinocythereis* (?), a large indeterminate trachyleberidid and *Cytheropteron*. Such low diversities are typical of deep water sediments and the generic composition likewise is typical. Fig. 1 confirms that diversity is much greater (over 50 species in more than 40 genera) in water 500m or less deep.

Table 1 is a comparative analysis which gives the generic composition of two shallower water samples collected during the Solomon Islands cruise (SI-81) at 34m and 405m respectively. The qualitative differences between these samples are evaluated later (*cf.* Associated Fauna, under Systematic Descriptions, herein). Here it is stressed that there is little in common between these samples and those from 4534m at both the genus and species levels; and the commonality at the family level is only 5 out of 15. When all shallower water (500m depth or less) samples are considered, the familial commonality rises to 6 out of 15, or 20% – krithiids occurring in two samples from Western Samoa (at 176m and 159m depth respectively) and in a single dredged sample from Tonga, at 180–174m depth (Appendix A).

One of the taxa from these shallower water samples is the spectacular bairdiid genus, *Pterobairdia* (McKenzie & Keij, 1977) for which this paper represents only the second published record. S.E.M. micrography of the specimens shows enough variation from the previously described type species to justify description of a new species.

Several shallow water collections of S.W. Pacific Ostracoda are available for comparison with the Ontong-Java and Kula Gulf assemblages (Fig. 2). These are: firstly, the collections made by H. B. Brady in the late 19th century from Noumea, Fiji and Samoa (Brady, 1890); secondly, collections made at Onotoa, Gilbert and Ellice Islands, on behalf of the Pacific Science Board (Cloud, 1952); thirdly, collections made at Saipan, Marianas Islands, by the United States Geological Survey (Cloud, 1956); fourthly, a small collection made by the author at Fiji; and, finally, shallow water samples from Tonga and Samoa in the SOPAC material. The first-named set is part of the Brady Collection, in the Hancock Museum, Newcastle-upon-Tyne; the Onotoa and Saipan Ostracoda were picked by the author from samples held at the Smithsonian Institution, Washington, D.C.; the Fiji collection is retained by the author. The Tonga and Samoa samples were picked for ostracods by the author at SOPAC's Fiji office in 1981. Table 2 records the results as a similarity matrix.

SYSTEMATIC DESCRIPTIONS

Order Podocopida G. W. Mueller, 1894

Suborder Podocopida Sars, 1866

Family Bairdiidae Sars, 1888

Genus *Pterobairdia* McKenzie & Keij, 1977

Type species. *Pterobairdia maddocksae* McKenzie & Keij, 1977.

Diagnosis. A bairdiid genus characterised by heavy valves ornamented with prominent pustolose beaked alae, pitted surfaces and flat topped marginal spines.

Stratigraphic range. Holocene.

Pterobairdia briggsae sp. nov.

(Pl. 1, figs. 1–7)

Derivation of name. For Dr W. M. Briggs, Jnr. United States Geological Survey, Colorado, who worked years ago on Samoan material of the genus.

Description. Shell of medium size; dorsal margin more or less regularly bowshaped in the right valve (RV) and also in the distinctly overlapping left valve (LV); ventral margin inflexed medially, broadly rounded anteriorly and posteriorly and spinose at both regions, the posteroventral spines being specially large, broad and flat topped; posterior terminating in a subtruncate cauda; greatest height medial and rather more than half the length. Dorsal view dominated by the backswept alae which give the genus its name, greatest width posteromedial and about 4/3 the length.

Genera	VVG 12 % (34m)	VVG 20B % (405m)
<i>Neonesidea</i>	16.0	31.2
<i>Paranesidea</i>	0.6	27.1
<i>Triebelina</i>	—	3.4
<i>Pterobairdia</i>	0.6	0.7
<i>Bythocypris</i>	—	12.4
<i>Anchistrocheles</i>	—	0.7
<i>Saipanetta</i>	—	0.7
<i>Macrocyprina</i>	—	4.0
<i>Propontocypris</i>	1.2	2.0
<i>Paijenborchella</i>	—	0.7
<i>Keijia</i>	0.6	—
<i>Morkhovenia</i>	6.5	—
<i>Callistocythere</i>	11.2	—
<i>Aurila</i>	2.4	—
<i>Mutilus</i>	27.2	—
<i>Trachyleberis</i>	—	0.7
<i>Trachyleberidid</i> indet. 1	1.2	0.7
<i>Trachyleberidid</i> indet. 2	—	1.4
<i>Ponticocythereis</i>	6.5	—
<i>Tenedocythere</i>	11.2	5.4
<i>Quasibradleya</i>	0.6	—
<i>Xestoleberis</i>	8.3	0.7
<i>Loxocorniculum</i>	5.9	—
<i>Loxoconcha</i>	—	4.7
<i>Sclerochilus</i>	—	1.4
<i>Paracytherois</i>	—	0.7
<i>Cytherelloidea</i>	—	1.4

Table 1. Comparative ostracod analysis from Ontong-Java (VVG 12) and Kula Gulf (VVG 20B), Solomon Islands, in genera percentages.

The table indicates a generic commonality of only 6 out of 27 (22.2%); and a family commonality of 5 out of 15 (40%). There is one common species, *Pterobairdia briggsae* sp. nov.

Each valve is ornamented overall by fine pittings (often obscured by aggraded calcite in the available material). The large alae are hollow and occupy about half valve length; they are coarsely pustulose, as indicated in Pl. 1 which also shows that smaller pustules ring individual muscle scars and are scattered rather generally over the valve surface especially in the dorsal region. They tend to be absent from the (anterior) leading edge of each valve. There is no trace of any eye tubercle.

The inner lamella is broad and the line of concrescence is broadly and regularly curved. Radial port canals are relatively numerous, long and flexuous. A vestibule is lacking but the marginal selvage is distinct.

The hinge as in most bairdiids is simple comprising a straight narrow RV ridge and corresponding accommodation groove in the LV. The central (adductor) muscle

scar pattern is a rosette of scars, most of them ringed by small pustules as noted earlier. Normal pore canals are scattered, small, simple and unrimmed. As both available specimens are adult females no comment can be made on sexual dimorphism or on the juveniles of this taxon. Likewise, the soft part morphology and ontogeny are unknown.

Dimensions. Holotype; NMV Reg. No. J11198 (adult female): RV length = 0.65 mm, height = 0.35 mm; LV length = 0.65 mm, height = 0.38 mm; carapace breadth = 0.87 mm.

Paratype; Aust. Mus. Reg. No. (adult female): LV length = 0.65 mm, height = 0.38 mm.

Material. Two female adult individuals, one carapace and one LV.

Locality data. Holotype; SOPAC Cruise SI-81(2), Sample VVG 12 Ontong-Java Lagoon, water depth 34 m, substrate coarse, mainly *Halimeda* debris deposited on a flat basinal floor, Lat. 5°29.6'S, Long. 159°37.1'E.

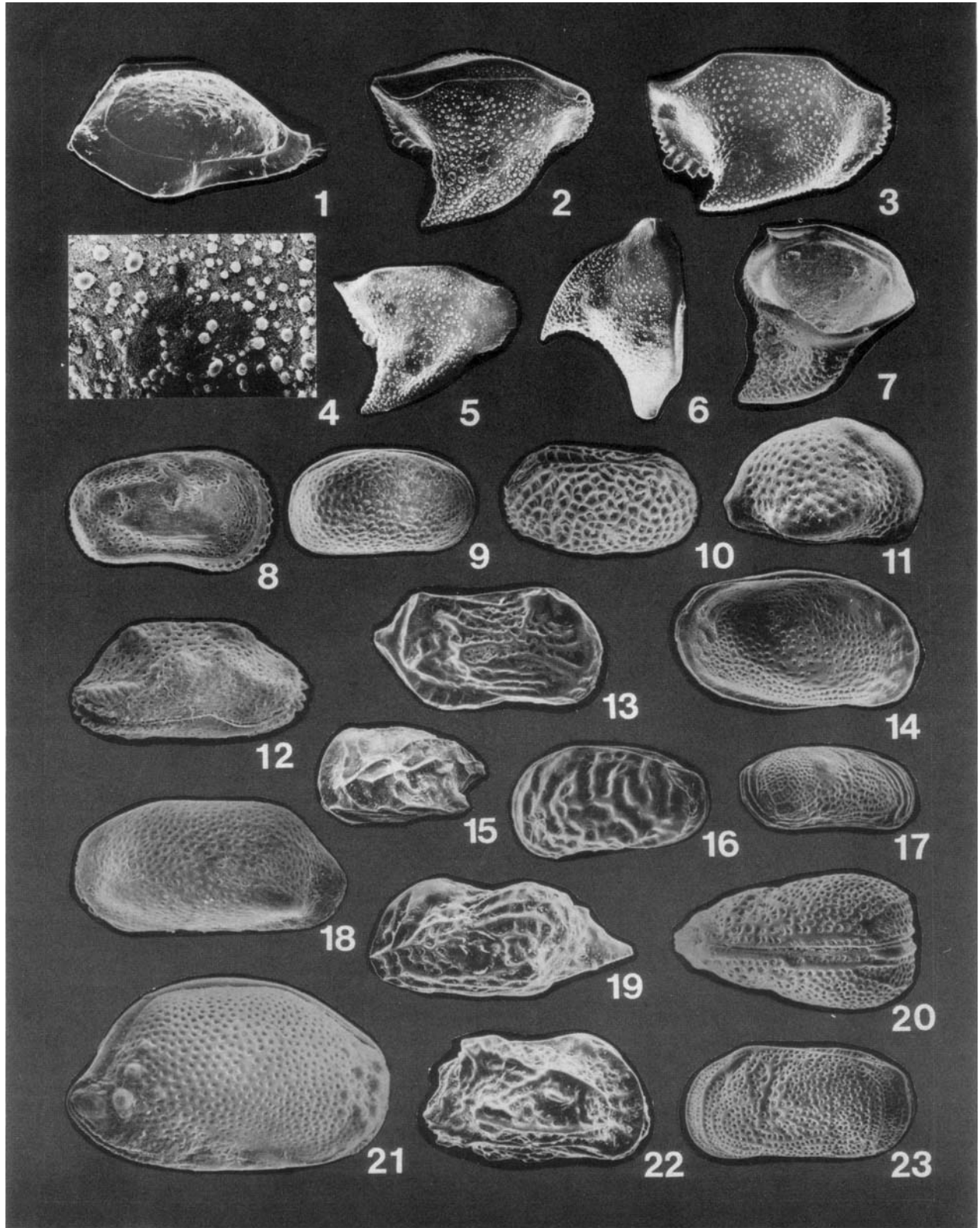
Paratype; SOPAC Cruise SI-81(2), Sample VVG 20B, Kula Gulf, water depth 405 m, substrate of silty sand with medium – coarse *Halimeda* debris and about 5% brown calcareous crusts deposited on an oceanic slope, Lat. 7°12.4'S., Long. 158°33.9'E.

Associated fauna. In the Ontong-Java Lagoon, the associated ostracods include *Neonesidea*, *Callistocythere*, *Mutilus*, *Ponticocythereis*, *Tenedocythere*, *Loxocorniculum* and *Xestoleberis*; other microfossils include foraminifera, bryozoans, echinoid spines, small gastropods, coral and pelecypod fragments. In Kula Gulf, the associated fauna is distinctly different. The ostracods include *Neonesidea*, *Paranesidea*, *Triebelina*, *Bythocypris*, *Macrocyprina*, *Propontocypris*, *Quasibradleya*, *Loxoconcha*, *Sclerochilus* and *Cytherelloidea*; the other microfauna includes foraminifera (dominantly planktic), bryozoans, small gastropods, pteropods, and radiolarians (mainly spongodiscids).

Because of the associated *Halimeda* debris (*Halimeda* is a photophilic shallow water alga) it is likely that the Kula Gulf sample is mixed and includes allochthonous elements that have moved downslope. However, this sample could not be wholly transported. Table 1 indicates that the two samples have little in common at both generic and family levels. It also shows the restriction of such shallow water taxa as *Keijia*, *Morkhovenia*, *Callistocythere*, *Ponticocythereis*, *Tenedocythere*, *Aurila*, *Mutilus*, *Loxocorniculum* to Ontong-Java Lagoon (VVG 12) whereas such typical deep water taxa as *Bythocypris*, *Macrocyprina* and *Paijenborchella* are restricted to the Kula Gulf sample (VVG 20B). Since both samples were collected using a Van Veen Grab and were prepared identically by 'floating' the fractions < .84 mm > .149 mm using CCl₄, these differences cannot be attributed to the sampling and preparation techniques. At least in part, they reflect real environmental variation attributable to difference in

Explanation of Plate 1

- Figs. 1–7. *Pterobairdia briggsae* sp. nov. [figs. 1–5, adult female holotype NMV Reg. No. J11198; figs. 6, 7, adult female paratype Aust. Mus. Reg. No. P35590]: fig. 1, internal view RV ($\times 63$); fig. 2, external view carapace showing LV overlap over RV ($\times 58$); fig. 3, external view RV ($\times 63$); fig. 4, detail of pustules in muscle scar region ($\times 260$); fig. 5, external view RV ($\times 55$); fig. 6, dorsal view LV ($\times 55$); fig. 7, oblique internal view LV ($\times 55$): Localities given in text.
- Fig. 8. *Cytherelloidea fijiensis* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B455]: external view RV ($\times 63$), Vuna Point, Taviuni, Fiji.
- Fig. 9. *Cyprideis consobrina* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B457]: external view RV ($\times 32$), shore sand Artillery Point, Noumea.
- Fig. 10. ?*Thalmanzia scotti* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B448]: slightly oblique external view RV of carapace ($\times 33$), Banc de l'aiguille, Noumea.
- Fig. 11. ?*Pseudaurila guttata* (Brady, 1890) [holotype, Hancock Mus. Reg. No. B465]: external view RV ($\times 63$), Ile Porc-Epic, New Caledonia.
- Fig. 12. *Triebelina truncata* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B441]: slightly oblique external view RV of carapace ($\times 65$), Apia, Upolu, Samoa.
- Fig. 13. *Loxocorniculum marcida* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B460]: external view RV ($\times 60$), Apia, Upolu, Samoa.
- Fig. 14. *Loxoconcha gracilis* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B458]: external view RV ($\times 62$), Porcheron's Beach, Noumea.
- Fig. 15. *Paracytheridea trilobites* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B467]: external view LV ($\times 64$), Banc de l'aiguille, New Caledonia.
- Fig. 16. *Callistocythere crenata* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B443]: external view LV ($\times 67$), Porcheron's Beach, Noumea.
- Fig. 17. ?*Tanella ochracea* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B444]: external view RV ($\times 66$), Porcheron's Beach, Noumea.
- Fig. 18. *Paranesidea ventricosa* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B440]: external view LV ($\times 65$), shore sand, Artillery Point, Noumea.
- Fig. 19. *Paracytheridea longicaudata* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B466]: external view LV ($\times 63$), Sava-Sava Bay, Vanua Levu, Fiji.
- Fig. 20. *Ishizakiella inflata* (Brady, 1890) [paralectotype female, Hancock Mus. Reg. No. B445b]: dorsal view ($\times 71$), shore sand, Lufi-Lufi, Upolu, Samoa.
- Fig. 21. *Paranesidea nodulifera* (Brady, 1890) [holotype, Hancock Mus. Reg. No. B442]: external view RV ($\times 67$), Levuka, Fiji.
- Fig. 22. *Tenedocythere deltoides* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B450]: external view RV ($\times 62$), Apia, Upolu, Samoa.
- Fig. 23. *Ishizakiella inflata* (Brady, 1890) [lectotype male, Hancock Mus. Reg. No. B445a]: external view LV ($\times 68$), shore sand, Lufi-Lufi, Upolu, Samoa.



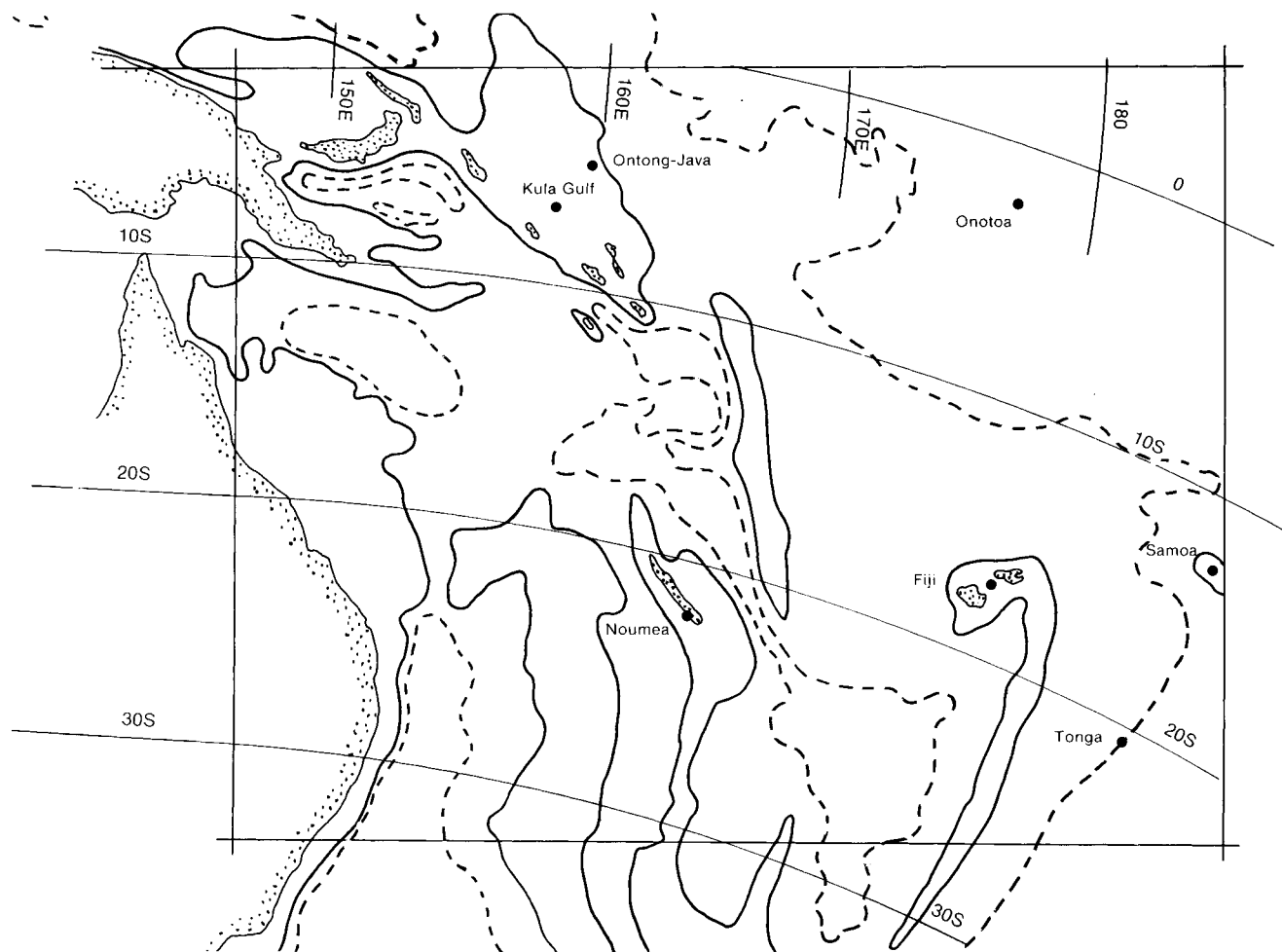


Fig. 2. Map of the S.W. Pacific indicating most of the localities compared in Table 2. Saipan is off the map at about 15°N. Lat. and 146°E. Long. Solid line = 2000m isobath; dashed line = 4000m isobath.

depth (34m for Ontong-Java lagoon, 405m for Kula Gulf) and to the fact that Ontong-Java lagoon is a relatively protected environment compared with Kula Gulf.

Comparison. The new species differs from the type species, *P. maddocksae* in several shell ornamentation features. *P. maddocksae* is densely and coarsely pitted over the entire surface except for the pustulose alae; in *P. briggsae* this surface pitting is fine. In *P. maddocksae* only the alae and the regions near the base of the alae are pustulose, and the alar pustules are more or less uniformly coarse; but in *P. briggsae* smaller pustules ring the adductor muscle scars (on the alae), and other pustules are scattered rather generally over the valves especially in the dorsal areas, additional to the coarse alar pustules. As far as their respective sizes are concerned, *P. maddocksae* averages about 0.71 mm (range 0.70 – 0.73 mm) in length, based on specimens from

Onotoa, and the total material included a single adult valve from the Flores Sea which measured 0.76 mm (McKenzie & Keij, 1977, pp. 371–372). *P. briggsae* is 0.65 mm in length, so is smaller than *P. maddocksae* in this parameter; but it is relatively broader. In *P. briggsae* the carapace width is about 4/3 the length; while in *P. maddocksae* the (inferred) carapace width is about 5/4 the length. Finally, in *P. briggsae* the LV overlap appears to be much more prominent than in the type species.

Family Leptocytheridae Hanai, 1957
Subfamily Pectocytherinae Hanai, 1957
Genus *Gambiella* Witte, 1985

Type species. *Gambiella caleata* Witte, 1985.

Diagnosis. A pectocytherine genus, small and subtrapezoidal in lateral view, with LV overlapping RV slightly in anterodorsal region; there is a well defined

Noumea	44					
Fiji	22	51				
Tonga	15	17	61			
Samoa	21	22	26	47		
Ontong-Java	14	12	17	18	47	
Onotoa	15	17	29	28	21	68
Saipan	15	17	18	17	18	31 58

Table 2. Comparative shallow water ostracod assemblages from the S.W. Pacific – similarities. Total number of species in the analysis is 177. The table records similarities; i.e. of the 44 species from Noumea, 22 also occur in Fiji, 15 in Tonga.

eye tubercle and a surface ornament characterised by a prominent transverse posterior ridge and numerous deep pits. These pits are absent from the posterior behind the ridge and from the central muscle scars region. Internally, there are broad anterior and posterior vestibules, sieve type normal pore canals, small central muscle scars and a pentodont hinge with a crenulate median element.

Comparison. *Gambiella* has the typical pectocytherine valve overlap, hinge, vestibules, and small central muscle scars, but it differs from all previously described genera in the family in its general shape and surface ornament. Thus, *Munseyella* van den Bold, 1957, *Pectocythere* Hanai, 1957, *Kotoracythere* Ishizaki, 1966 and *Morkhovenia* Teeter, 1975 are all subrectangular in shape while *Arcacythere* Hornibrook, 1952 and *Keijia* Teeter, 1975 are both elongate subrectangular in lateral view. Finally, several as yet undescribed pectocytherid genera from the Australasian region, recorded in a thesis by

Labutis (1977, unpublished) also have subrectangular shapes. Unlike all these genera, *Gambiella* is subacuminate posteriorly giving it a subtrapezoidal lateral profile. The surface ornament of deep pits is also unique to *Gambiella* in my experience.

Stratigraphic range. Holocene.

Gambiella caudata (Brady, 1890)

(Pl. 2, fig. 2; Figs. 3, 4)

Description. A species of *Gambiella* characterised by a small (0.44 – 0.45 m in length) subtrapezoidal carapace with the LV overlapping the RV slightly, especially in the anterodorsal region. There is a distinct eye tubercle. The surface ornament consists of numerous deep elongate pits (muri) with microspinose inner margins and a transverse dog-leg posterior ridge, behind which the shell surface is smooth. Dorsal margin straight, anterior broadly rounded, ventral margin inflexed anteromedially, posterior subacuminate. Height is about 45% of the length. In dorsal view, the posterior valve ridges give a weakly subhastate profile but greatest breadth remains medial and is about 1/3 the length. Internally, both anterior and posterior inner lamellae are broad and both have large vestibules; marginal pore canals can be short or flexuous and tend to be branched; normal pore canals are sieve-type; the central muscle scars are small and comprise 4 adductors, a frontal scar and at least one mandibular scar (the shell surface in the central muscle scars region is non-pitted); the hinge is typically pentodont consisting in the LV of a relatively large anterior socket and smaller posterior socket with a crenulate ridge in between the termini of which are

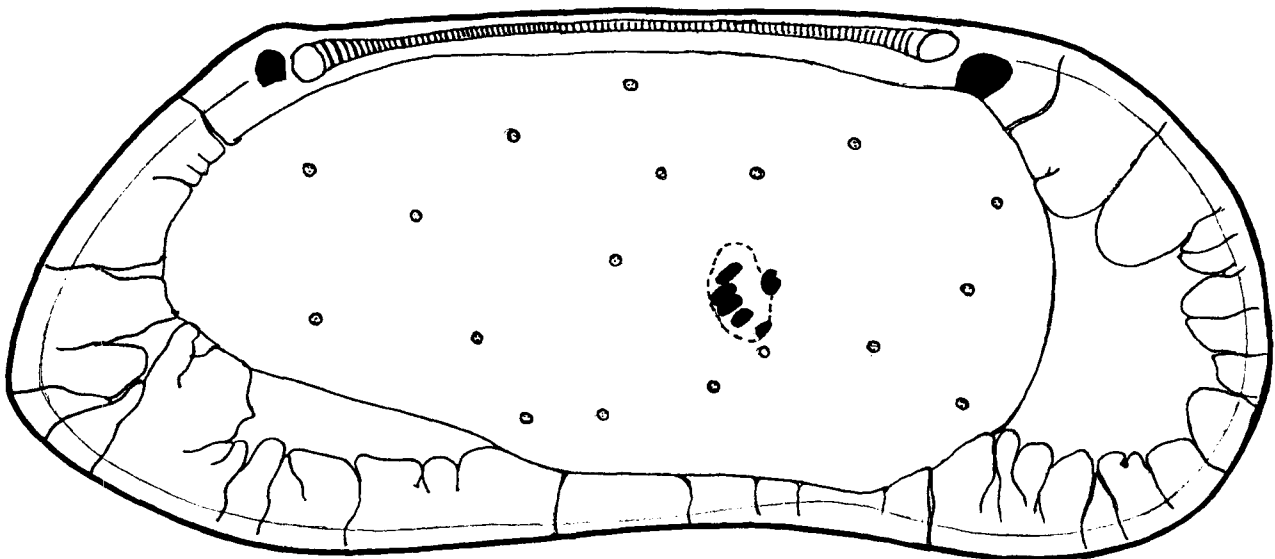
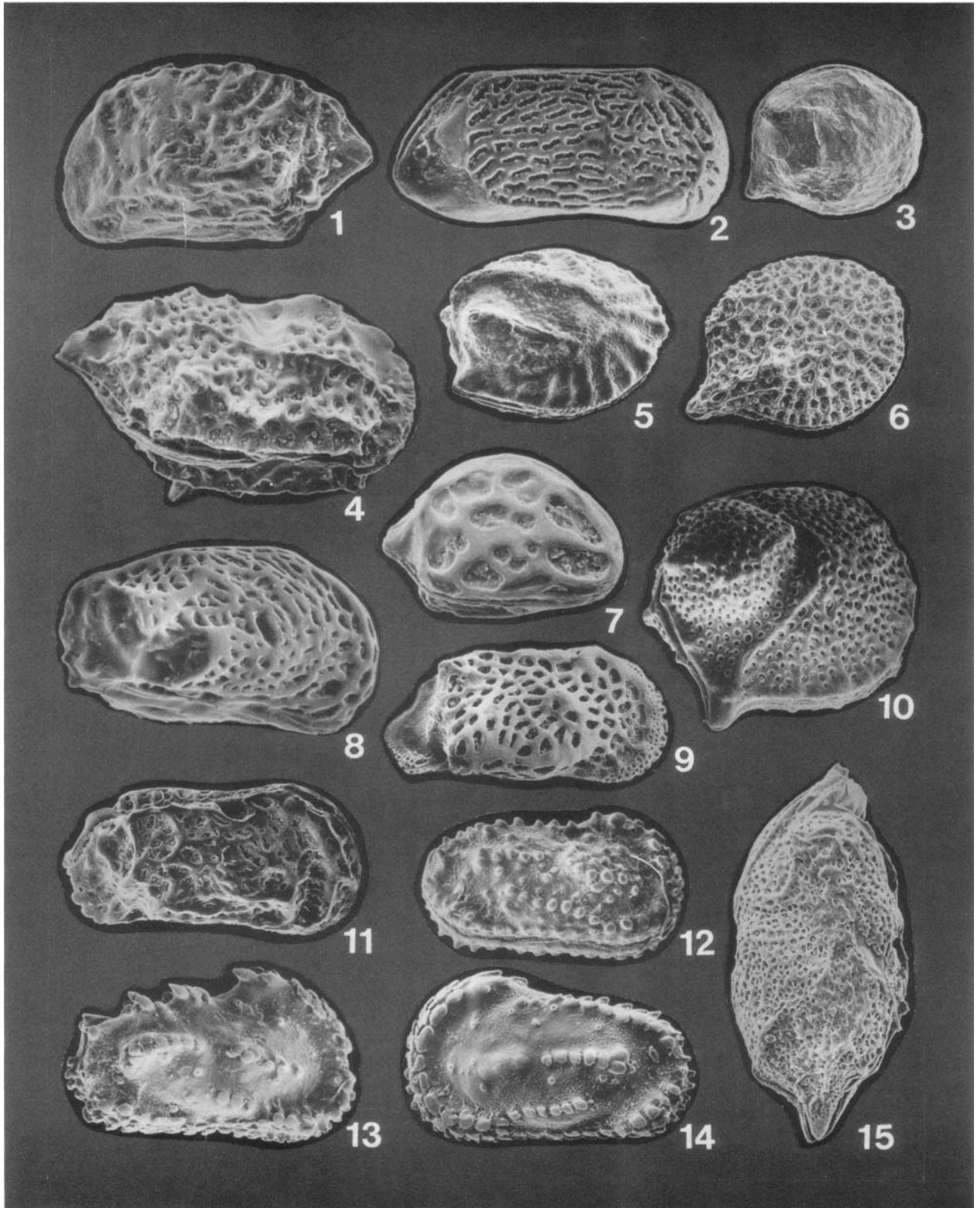


Fig. 3. Internal lateral view of adult female LV of *Gambiella caudata* (Brady, 1890) lectotype, Hancock Mus. Reg. No. B447a (Brady Collection). Camera lucida drawing of valve immersed in glycerin (× 200).

Explanation of Plate 2

- Fig. 1. *Cytheropteron rude* Brady, 1890 [lectotype, Hancock Mus. Reg. No. B464]: external view LV ($\times 130$), Sava-Sava Bay, Vanua Levu, Fiji.
- Fig. 2. *Gambiella caudata* (Brady, 1890) [lectotype adult female, Hancock Mus. Reg. No. B447a]: external view RV ($\times 130$), Sava-Sava Bay, Vanua Levu, Fiji.
- Fig. 3. *Sarsiella rudis* Brady, 1890 [lectotype, Hancock Mus. Reg. No. B481]: external view RV ($\times 32$), Rambe Island, Fiji.
- Fig. 4. *Neomonoceratina entomon* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B461]: slightly oblique external view RV of carapace ($\times 127$), Port of Noumea, 3–4 fathoms.
- Fig. 5. *Rutiderma (Alternatochelata)* sp. [non *Sarsiella sculpta* Brady, 1890]: external view RV ($\times 32$), off Cap Bon Louis, 4 fathoms, near Noumea.
- Fig. 6. *Sarsiella foveata* Brady, 1890 [lectotype, Hancock Mus. Reg. No. B482]: external view RV ($\times 32$), Banc de l'aiguille, Noumea.
- Fig. 7. *Hemicytherura scutellata* (Brady, 1890) [holotype, Hancock Mus. Reg. No. B462]: external view RV ($\times 127$), Levuk., Fiji.
- Fig. 8. *Morkhovenia cuneola* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B446]: external view RV ($\times 134$), Loma-Loma, Vanua Mbalavu, Fiji.
- Fig. 9. *Alatahermaniites infundibulata* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B451]: external view RV ($\times 65$), Vuna Point, Fiji.
- Fig. 10. *Sarsiella sculpta* Brady, 1890 [lectotype, Hancock Mus. Reg. No. B479]: external view RV ($\times 33$), off Cap Bon Louis, 4 fathoms, near Noumea.
- Fig. 11. “*Cythere*” *torticollis* Brady, 1890 [lectotype, Hancock Mus. Reg. No. B449]: external view RV ($\times 61$), Banc de l'aiguille, Noumea.
- Fig. 12. ?*Ponticythereis labiata* (Brady, 1890) [holotype, Hancock Mus. Reg. No. B452]: slightly oblique external view RV carapace ($\times 64$), Levuka, Fiji.
- Fig. 13. *Ponticythereis quadriserialis* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B454]: external view RV ($\times 64$), shore sand, Artillery Point, Noumea.
- Fig. 14. *Ponticythereis ichthyoderma* (Brady, 1890) [lectotype, Hancock Mus. Reg. No. B453]: external view LV ($\times 64$), Sava-Sava Bay, Vanua Levu, Fiji.
- Fig. 15. *Streptoleberis crenulata* Brady, 1890 [lectotype juvenile, Hancock Mus. Reg. No. B478]: external view RV anterior end uppermost ($\times 64$), off Cap Bon Louis, 4 fathoms, near Noumea.



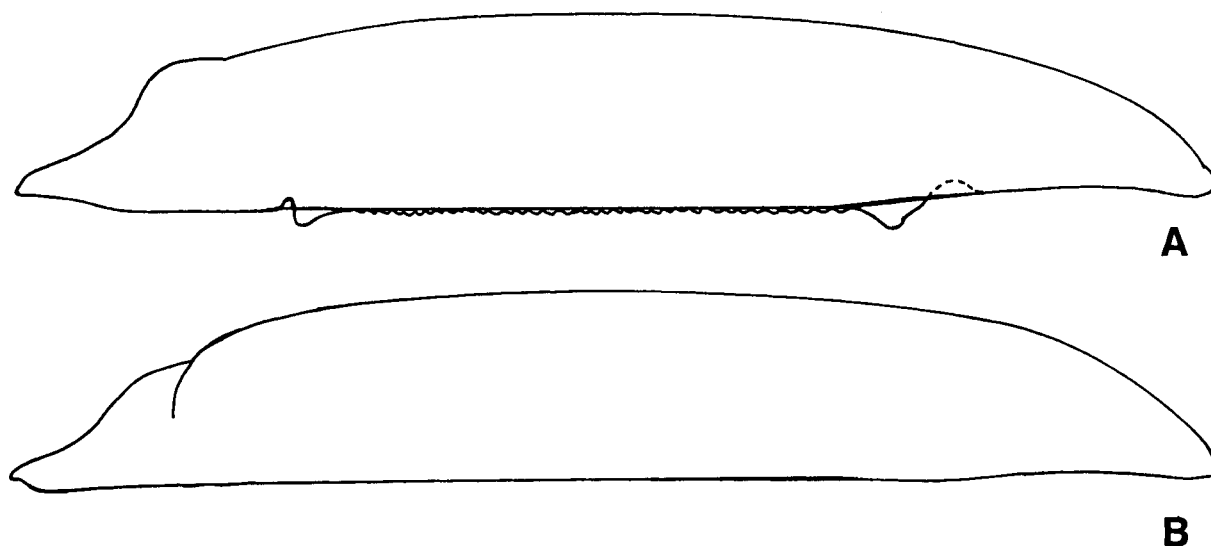


Fig. 4. *Gambiella caudata* (Brady, 1890). Adult male, paralectotype, Hancock Museum Reg. No. B447b (Brady Collection): A, Dorsal view LV; B, Ventral view RV ($\times 200$).

strengthened into knob-like projections. Sexual dimorphism distinct with females relatively higher than males.

Dimensions. Lectotype, Hancock Mus. Reg. No. B447a (Brady Collection), adult female carapace separated for SEM micrography and illustration of the internal features.

LV length = 0.45 mm. h = 0.20 mm; RV length = 0.44 mm, H = 0.20 mm Paralectotype, Hancock Mus. Reg. No. B447b (Brady Collection), adult male carapace L = 0.44 mm, H = 0.20 mm, B = 0.15 mm.

Material. 2 adult carapaces, 1 male the other female (both separated into LV and RV for illustration purposes).

Type locality. Savu-Savu Bay, Vanua Levu, Fiji (Brady, 1890).

Comparison. *Gambiella caudata* is readily distinguished from an as yet undescribed species from Darwin because the latter has rounded rather than elongate deep pits.

Stratigraphic Range. Holocene.

Distribution. *G. caudata* is known only from shallow water environments of Fiji (Brady, 1890) and Manila Bay (Keij, 1954).

DISCUSSION

The explanation for the occurrence of a second species of *Pterobairdia* within the known range of *P. maddocksae*, which extends from Sipura Island, off Sumatra, to Eniwetok and Samoa (*cf.* Fig. 2) may well lie in an appreciation of the regional tectonics. The localities for *P. briggsae* lie immediately east of the small Solomon Plate, which formed during the Early Tertiary and has been active especially from Miocene – Quaternary (Davies, Symonds and Ripper, 1984). It seems likely that continued tectonics-driven changes in the regional marine topography and sedimentation, i.e. niche development, could have triggered speciation at the developing plate margins. A similar idea was put forward to account for the evolution of a new paracypridid subfamily in the same regional setting (McKenzie, 1980).

An independent indication of the plausibility of the hypothesis is provided by Whatley (1983). The author's data were obtained from many regional D.S.D.P. sites, including three from the Ontong-Java Plateau of which one (D.S.D.P. 288) is close to the *P. briggsae* localities. One of the aspects considered was the common occurrence of species at several sites for Miocene, Pliocene and Quaternary ostracod faunas. The results show that the Ontong-Java Plateau sites were faunally more similar to each other than to sites from other areas to the south and that their commonality with these other

areas was 1–3 species in the Miocene (out of 22 Ontong-Java species), 3–8 species in the Pliocene (out of 46 Ontong-Java species), and 7–18 species in the Quaternary (again out of 46 Ontong-Java species). Further, to the north of the Ontong-Java Plateau, the ostracod fauna of the Ita Mai Tai guyot (D.S.D.P. 200) is distinguished by greater than 80% endemism at the species level (Whatley, 1983, figs. 10–13). Unfortunately, all these faunas are deep water ones from the bathyal and abyssal zones. A test for depths from 0–500m remains desirable (Table 2).

The first point to be made in discussion of Table 2 is that the sample sets are not equivalent at all locations. Thus, Ontong-Java and Tonga are represented by only two samples each whereas the Onotoa and Saipan collections each comprise over 50 samples. The sampling at other locations is more equitable: seven samples for Noumea, 10 at Fiji and six for Samoa. Secondly, the environments represented by these sample sets are mainly nearshore – tide pools, beaches, mangroves, shallow lagoonal. Exceptions to this generalisation are the sets from Tonga and Ontong-Java/Kula Gulf which were collected at depths from about 35–400m. This environmental factor accounts satisfactorily for the diversity difference between Tonga and the other locations represented by small sample sets – Noumea, Fiji, Samoa – because several bythocytherids and distinctive trachyleberids, also *Argilloceia* and *Krithe*, all deep water indices, are exclusive to the deeper (405 m) Tonga samples. Otherwise, diversities at all locations are about equal (45–55 species) with the exceptions of Onotoa and Saipan which were more thoroughly sampled (55 and 58 samples respectively). A third important factor to be considered is that each of the locations cited is separated from the others by intervening abyssal and bathyal deeps, as Fig. 2 makes clear.

Inspection of the similarity matrix (Table 2) indicates that Ontong-Java/Kula Gulf has about 45% similarity with Onotoa, about 40% similarity with Saipan, Samoa and Tonga, and is least similar to Fiji and Noumea (somewhat more than 25%).

Table 3 records the obverse aspect of the relationships between these shallow water assemblages i.e. the number of species exclusive to each. While recorded as “endemics” in the table, it is not implied that they all evolved at the particular locations because sampling is clearly incomplete, both with respect to environments and to a sufficiency of samples. But, when analysed in greater detail, some patterns of distinctiveness emerge that are worth further comment. It is known that certain families are prone to more rapid speciation (greater diversity) than others; these include Cytherellidae, Bairdiidae, Leptocytheridae, Cytheruridae, Paradoxostomatidae, Hemicytheridae and Trachyleberididae. For Ontong-Java/Kula Gulf, the sample depths are too great for much diversity in Leptocytheridae, Cyther-

	Total spp.	No. of “endemics”	%
Noumea	44	10	22.7
Fiji	51	14	27.4
Tonga	61	20	32.8
Samoa	47	4	8.5
Ontong-Java	47	14	29.8
Onotoa	68	14	20.5
Saipan	58	16	27.6

Table 3. Comparative shallow water ostracod assemblages from the S.W. Pacific – distinctiveness.

uridae here excluding Cytheropteroninae. Further, Cytherellidae and Hemicytheridae are minor groups in the total species list (seven and five species respectively in a total of 177). But, out of 27 bairdiids, five are exclusive to Ontong-Java/Kula Gulf; and of 29 trachyleberidids (including thaerocytherines) six are exclusive to Ontong-Java/Kula Gulf. For Bairdiidae and Trachyleberididae at least, Table 4 indicates that, given the sampling constraints, the families are more distinctive at the margins of the Solomons Plate than elsewhere in the southwest Pacific.

Other work in progress on the shallow water benthic ostracods of the Solomon Islands also supports an hypothesis of considerable endemism in the area of the Solomons Plate. In a preliminary study, Whatley & Titterton (1981) note that they are working on a very large fauna of around 160 species – but do not specify the number of samples from which this fauna was recovered, although they tabulate or refer to 21 samples (*op. cit.*, p. 158). These authors estimate that there are about 130 new species, i.e. 75% of the fauna. This estimate is much greater than that recorded in Table 3 (based on only two samples). Possibly, some of their new species will turn out to be already described, e.g. *Ponticocythereis spinosa* Whatley & Titterton, 1981 is a junior synonym of *Ponticocythereis quadriserialis* (Brady, 1890) and *Alatahermanites* sp. Whatley & Titterton, 1981 is the same species as *Alatahermanites infundibulata* (Brady, 1890). On the other hand, my species determinations

	CL	BA	LE	CR	PA	TR	HE
Noumea	–	1	2	–	1	4	–
Fiji	–	1	1	1	–	2	1
Tonga	1	1	2	1	1	4	–
Samoa	–	–	1	–	1	–	–
Ontong-Java	1	5	–	–	1	6	–
Onotoa	2	2	2	1	2	2	–
Saipan	1	2	2	1	1	2	2

Table 4. Assemblage distinctiveness at the species level for selected ostracod families.

CL = Cytherellidae; BA = Bairdiidae; LE = Leptocytheridae; CR = Cytheruridae; PA = Paradoxostomatidae; TR = Trachyleberididae; HE = Hemicytheridae.

may be less narrow than those of Whatley and his colleague. Despite such subjective considerations, however, the Solomons Plate fauna is obviously very distinctive and, as hypothesized here, the regional tectonics since the Miocene affords a convenient and satisfying explanation for that fact.

Indeed, returning to Tables 2 and 3, it seems evident that the pattern of considerable endemism near plate margins bordered by trenches is a common one in the S.W. Pacific so that the hypothesis put forward here and in McKenzie (1980) could also be used to explain the ostracod faunas of Fiji, Noumea, Tonga and Saipan. Some other factor, possibly isolation, is likely significant for assessing ostracod assemblages from Onotoa; and a paucity of samples allied to restricted environmental sampling probably accounts for lack of distinctiveness in the Samoan fauna.

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APPENDIX A – Description of SOPAC Samples (based on washings)

Cook Islands

CK-76; Station 2; 5010m; Lat. 18° 09.5'S., Long. 159° 38.0'W.; 12.6.'76.

FFC-1B: *sediment* yellowish-brownish; comprising mainly yellowish or reddish stained small grains (non-quartzose, but calcitic); some larger pieces which are aggregates of small rounded grains cemented by a paler limey clay; manganiferous and haematite-stained grains; pyroxene (olivine-peridot) grains; mica flakes; and small angular quartz grains.

microfauna includes rare globigerine and rotaliform forams; occasional dentiform pieces possibly referable to cephalopods; *nil* OSTRACODA.

FFG-3A & 3B (2 vials): *sediment* yellowish-brownish; carrying occasional bipyramids of high-temperature quartz; rare (and larger) grains of frosted quartz; numerous grains of dark-coloured minerals (probably pyroxenes or granules of lava – origin in lahars, lava flows, ash rain, etc); mafics (one part-octahedron of magnetite identified); plus numerous reddish-brown manganiferous grains and granules.

microfauna includes rare globigerine forams (none in 3B); sponge spicules (hyaline); rare nannoplankton, mainly actinomid radiolarians; dentiform pieces possibly representing cuttlefish rostra or cephalopod jaws; *nil* OSTRACODA.

CK-76, Station 4; 5130m; Lat. 15° 16.0'S., Long. 159° 08.5'W.; 14.6.'76.

FFC-3B: *sediment* uniformly dark-brownish; comprising mainly a manganiferous clay; pieces of nodular manganese; occasional rounded grains of frosted quartz and some small grains of high temperature quartz; plus an occasional piece of bright greenish glauconitic clay, sometimes with dispersed small manganese granules.

microfauna almost exclusively of dentiform pieces referable to cephalopods; except for a single long, slender, hollow hyaline tube (pteropod); *nil* OSTRACODA.

FFC-3C: *sediment* brownish, comprising mainly small granules of clay aggregates; many larger manganiferous pieces; some small usually frosted angular quartz grains; rare lime green glauconite granules; and occasional mica flakes.

microfauna exclusively of dentiform pieces referable to cephalopods; *nil* OSTRACODA.

FFC-3D: *sediment* uniformly yellowish-brownish; comprising mainly small clay aggregates, with occasional dark manganiferous pieces, rarely haematite-stained; quartz rare, subangular to angular, occasionally frosted.

microfauna not recorded; *nil* OSTRACODA.

FFC-4B: *sediment* similar to that described below for FFC-4D.

microfauna exclusively of dentiform pieces referable to cephalopods; *nil* OSTRACODA.

FFC-4C: *sediment* brownish; consisting of small clay aggregates; some dark manganiferous grains often haematite-stained; a single larger piece of frosted quartz and some pieces of small angular quartz.

microfauna mainly referable to cephalopods but including three small globigerine forams; *nil* OSTRACODA.

FFC-4D: *sediment* brownish to reddish-brownish; comprising small granules of clay aggregates; numerous larger manganiferous pieces, many haematite-stained; small quartz grains, often haematite-stained; rare mica flakes.

microfauna mainly dentiform pieces referable to cephalopods; rare sponge spicules; *nil* OSTRACODA.

CK-76; Station 6; 5109m; Lat. 14° 04.9'S., Long. 158° 59.0'W.; 15.6.'76.

FFC-5A: *sediment* brownish; very similar to that described in FFC-5B for this station; additionally a few small grains of yellowish-green glauconite(?) were noted.

microfauna mainly of dentiform pieces referable to cephalopods, plus rare sponge spicules and two globorotalid forams; *nil* OSTRACODA.

FFC-5B: *sediment* brownish; comprising mainly small granules of clay aggregates; manganiferous pieces, some haematite-stained; occasional frosted larger pieces of quartz (one stained with haematite) and small angular grains of frosted quartz; a few small flakes of mica, rare gypsiferous clay-coated crystal aggregates.

microfauna includes a lagenid foram; but consists mainly of dentiform pieces referable to cephalopods; *nil* OSTRACODA.

FFC-5C: *sediment* uniformly dark-brownish; with many 'granules' composed of compacted clay particles; numerous manganese particles; frequent grains of haematite-stained quartz; very rare flakes of mica, some reddish-brown granules (associated with manganiferous encrustations).

microfauna mostly dentiform pieces referable to cephalopods; and a few sponge spicules; *nil* OSTRACODA.

CK-76; Station 7; 5310m; Lat. 12° 24.0'S., Long. 158° 44.0'W.; 16.6.'76.

FFG-10: *sediment* purplish black, oxidised in part to a rich reddish brown; consisting mainly of large (about 2mm diameter) manganese nodules and pieces of nodules; plus finer material consisting of small manganese grains.

microfauna mainly of monaxonid sponge spicules; dentiform pieces referable to cephalopods; and rare globigerine forams; *nil* OSTRACODA.

CK-76; Station 8; 5297m; Lat. 10° 38.0'S., Long. 158° 31.5'W.; 17.6.'76.

FFC-6C: *sediment* uniformly yellowish to pale yellowish; with granular clay aggregates; black manganiferous nodular granules; occasional haematite-stained, angular grains of quartz; rare mica flakes; clay-stained crystal aggregates.

microfauna rare dentiform pieces referable to cephalopods; rare globigerine, globorotalid and two miliolid forams; *nil* OSTRACODA.

FFC-6B & 6D (2 vials): *sediment* uniformly pale-yellowish; most grains and pieces are clay-coated; frequent grains of dark-coloured minerals – mafics, some pyroxenes (including peridot and one larger, clear clinopyroxene of prismatic habit) – a few reddish-brown granules; many rounded manganiferous granules; abundant crystal aggregates of various types all coated with the pale-yellowish clay.

microfauna rare; of dentiform pieces possibly referable to cephalopods; *nil* nannoplankton, forams, OSTRACODA.

CK-76; Station 12; 4920m; Lat. 17° 58.0'S., Long. 160° 54.8'W.; 25.6.'76.

FFC-9B: *sediment* yellowish-brownish (honey-coloured); consisting mainly of yellow or reddish-stained grains; greenish pyroxene grains; some pieces of manganiferous sediment; numerous small quartz grains (usually angular).

microfauna more varied than in other deep water samples, including dentiform pieces referable to cephalopods; sponge spicules; echinoid spines; two rotaliform forams; *nil* OSTRACODA.

FFC-9C: *sediment* as described for this station below (FFC-9D); additionally a few mica flakes and a small angular prismatic fragment of greenish pyroxene (probably olivine) were noted.

microfauna usually dentiform and referable to cephalopods; one globorotalid foram; *nil* OSTRACODA.

FFC-9D: *sediment* uniformly yellowish-brownish; consisting mainly of small clay aggregates; with occasional manganiferous pieces; some haematite-stained granules; and some small angular quartz grains.

microfauna usually dentiform, referable to cephalopods, *nil* OSTRACODA.

Western Samoa

WS-76; Station 1; 176m; Lat. 13° 46.3'S., Long. 171° 41.1'W.; 15.3.'76.

FFC-1: *sediment* whitish; predominantly abraded very coarse detritus of organic carbonate; comprising fragments of corals; pelecypods; gastropods (including the egg cowrie); bryozoans; worm tubes; large forams, smaller benthic forams (arenaceous taxa, miliolids, rotaliines, textulariids), rare globigerine planktonic forams; occasional holothurian sclerites; echinoid spines; sponge spicules; pteropod tubes; the finer grades in the sample are simply the comminuted debris of such organisms; plus numerous polished brown granules (? phosphatic); OSTRACODA common (especially bairdiids) including *Neonesidea* (4 spp.); *Paranesidea* (1 juv. sp.), *Parakrithe*, *Bishopina*, *Paracytheridea*, *Keijia*, *Morkhovenia*, *Callistocythere*, *Oculocytheropteron*, *Propontocypris* (juvs.), *Ponticythereis*, *Tenedocythere*(?), indet. gen. (juv.), *Macrocyprina*, *Loxocorniculum*, *Loxoconchella*, *Xestoleberis* (2 spp.).

WS-76; Station 2; 4534m; Lat. 13° 32.1'S., Long. 171° 27.3'W.; 16.3.'76.

FFC-1B: *sediment* greyish; a melange of calcaereous detritus; angular, frosted quartz grains; and volcanic derived grains (which include green-black volcanic glass, high temperature quartz, pumice, olivine); plus some manganese-rich nodular grains.

microfauna rare, mainly of planktonic forams – less common are rotaliines, miliolines, *Spirillina* and an agglutinated taxon –; plus some echinoid spines; *nil* OSTRACODA, except for single indet. juvenile.

FFC-2B: *sediment* whitish; predominantly a foraminiferal ooze comprising globigerinids and globorotalids with occasional agglutinated forams plus some bulminaceans, milioliaceans, lagenids etc; sponge spicules common; occasional echinoid spines; and circular bryozoans; rare OSTRACODA: *Krithe*, *Cytheropteron*, *Echinocythereis*, large trachyleberidid, (fragment of juv. RV), *Tenedocythere*, *Parakrithe*(?), *Xes-*

toleberis – the three latter probably washed down from above.

FFC-2D: Similar to FFC-2B, OSTRACODA: *Bradleya*, *Krithe*, *Echinocythereis*.

WS-76; Station 5; 2426m; Lat. 14° 10.2'S., Long. 171° 31.8'W.; 18.3.'76.

FFG-6: *sediment* volcanic detritus, including volcanic glass, olivine, high temperature quartz; manganese grains; also land derived quartz and some rounded calcite clasts.

microfauna mainly foraminiferal including planktonics, larger forams, miliolids and other groups; a few pteropods; sponge spicules; echinoderm spines; gastropods and pelecypods; rare OSTRACODA: *Neonesidea*, *Paranesidea*, *Krithe*, *Loxocorniculum*, *Paracytheridea*, *Morkhovenia*, *Ishizakiella*, *Macrocyprina*, *Argilloecia*, *Xestoleberis*, *Tenedocythere*, *Ponticythereis*, '*Eucytherura*', all mainly as juveniles; also one cirriped cypris larva.

WS-76; Station 7; 2040m; Lat. 14° 07.9'S., Long. 171° 36.5'W.; 18.3.'76.

FFC-7: *sediment* predominantly microfaunal with a few clasts of blackish vesicular basalt and some olivine grains.

microfauna mostly planktonics (globigerines dominant), plus bulminaceans, miliolaceans, nodosariaceans, rare larger forams; rare gastropods and pelecypods; echinoid spines and shell fragments; sponge spicules; rare pteropods; rare holothurian sclerites; rare OSTRACODS: *Poseidonamicus* (adult RV), deepsea gen. nov. (adult RV); *Echinocythereis*(?); *Krithe* (3 spp.); *Xestoleberis* (juv.); *Neonesidea* (juv.); *Loxoconcha* (juv.); *Paracypris* (adult RV); *Paracytheridea* (juv.); *Cardobairdia* (juv.), *Argilloecia* (2 spp.).

WS-76; Station 9; 75m; Lat. 14° 02.2'S., Long. 171° 47.5'W.; 19.3.'76.

FFC-6B: *sediment* whitish; predominantly abraded, very coarse detritus of organic carbonate; combining fragments of corals; pelecypods; gastropods; bryozoans; worm tubes; coloured and white holothurian sclerites; echinoid spines; large forams, smaller benthic forams (rotaliines, textulariids, miliolids, elphidiids, nodosariids etc); rare pteropod fragments; the finer material of the sample being merely a comminuted aggregate of bits of these organisms plus rare grains of volcanic origin (basalt).

microfauna as indicated above; OSTRACODA frequent, including *Keijia*, *Callistocythere*, *Xestoleberis* (2 spp.), *Neonesidea* (2 spp.), *Paranesidea*, *Cletocythereis*, gen. nov. aff. *Cristatella* Brady, *Anchistocheles*, *Ponticythereis*, *Loxocorniculum*, *Propontocypris*, gen.

nov. pontocypridid, *Gambiella caudata* (Brady), *Paracytheridea*, *Paijenborchella iocosa*, *Morkhovenia*.

FFC-6C: *sediment* predominantly carbonate detritus; poorly sorted, smaller particles mainly carbonate with some olivines, etc. but land derived material comparatively rare and usually worn.

microfauna of corals; bryozoans; barnacle plates; pelecypods; gastropods; holothurian sclerites; larger forams and small forams (non-planktonic); OSTRACODA frequent, including *Morkhovenia inconspicua* (Brady), indet. LV, *Parakrithella* sp., *Xestoleberis* sp., *Paijenborchella iocosa* Kingma, *Cletocythereis rastromarginata* (Brady), *Callistocythere* sp., pontocypridid indet. (juv.), *Neonesidea*.

WS-76; Station 12; 159m; Lat. 13° 56.1'S., Long. 172° 07.5'W.; 20.3.'76.

FFC-7B: *sediment* of carbonate detritus; fine-medium grade; predominantly fragmental but including a thanatocoenose of bryozoans; holothurian sclerites; foraminiferans (mainly benthic families, but with some globigerines); pteropods; pelecypods; gastropods; rare sponge spicules; and brown faecal pellets; and yellowish worn multi-cycled organic detritus; OSTRACODA frequent including *Microcythere*, *Xestoleberis*, *Propontocypris*, gen. nov., pontocypridid, *Neonesidea* (2 spp.), *Paranesidea* (3 spp.), *Tenedocythere*, *Macrocyprina*, *Platella*, *Anchistrocheles*, gen. nov. (= *Cristatella*), gen. nov. (small bythocytherine), *Xiphichilus*, *Cytheropteron*, *Callistocythere*, *Paracytheridea* (rather squat form – not as elongate as usual).

FFC-7C: *sediment* mainly finer carbonate debris; fragments of larger forams; smaller benthic and planktonic forams; bryozoans; holothurian sclerites; sponge spicules; the fine calcite fragments all organic in origin and rather angular.

microfauna open shelf type; mainly planktonic foraminiferans, but with many other foram groups represented, including pieces of larger forams; occasional bryozoans; gastropods; pteropods; juvenile pelecypods (spats); OSTRACODA rare, including *Xestoleberis*, *Neonesidea*, *Paijenborchella*, *Pontocythereis*, *Callistocythere*, *Krithella*, *Cardobairdia*, *Propontocypris* (2 spp.).

WS-76; Station 15; 3156m; Lat. 13° 36.1'S., Long. 172° 55.1'W.; 24.3.'76.

FFC-8B: *sediment* greenish-brown to black; dominantly pieces of fresh vesicular basalt.

microfauna of planktonic forams (mainly globigerinids), plus rare buliminaceans; rare sponge spicules; one gastropod fragment; *nil* OSTRACODA.

FFC-8C: *sediment* black to brownish black; clasts of vesicular basalt (average diameter about 5mm) and grains of olivine, zeolites.

microfauna almost exclusively of globigerine forams with rare globorotaliids, nodosariaceans and buliminaceans; *nil* OSTRACODA.

WS-76; Station 17; 4194m; Lat. 13° 12.3'S., Long. 172° 38.9'W.; 25.3.'76.

FFC-11A: *sediment* pepper and salt coloured; comprising substantial volcanic debris including volcanic glass, olivine, high temperature quartz.

microfauna globigerine-rich; also with numerous spongodiscid radiolarians (looking like 3-bladed aeroplane propellers); OSTRACODA rare, include *Zabythocypris* (adult ♀), *Krithella*, *Echinocythereis*(?) (2 adult valves, 1 juv.), *Loxocorniculum*, *Argilloecia*, indet. trachyleberidids (2 spp.).

FFC-11B: *sediment* similar to previous sample.

microfauna abundant; mainly globigerine forams; with occasional spicules; and echinoid spines; OSTRACODA rare, including *Krithella*, *Cytheropteron*, *Ambocythere*, indet. trachyleberidid (all juveniles).

FFC-11C: *sediment* pepper and salt coloured; comprising volcanic debris and white globigerine forams, the volcanic material including pieces of glass, olivine, zeolites.

microfauna apart from *Globigerina*, *Orbulina*, buliminaceans and others, includes occasional agglutinated forams; also present are a few echinoderm spines; and sponge spicules; *nil* OSTRACODA, except for a single juvenile valve of *Krithella*.

FFC-11D: *sediment* much more freely microfaunal than FFC-11A, B, C and dominated by globigerines; sponge spicules include monaxons, triaxons (anchors) and polyaxons; OSTRACODA rare, including *Krithella*, *Zabythocypris* (all juveniles).

Tonga

T-76; Station 7; 956m; Lat. 21° 5.5'S., Long. 174° 49.1'W.; 22.4.'76.

FFC-1A: *sediment* volcanic detritus; including pumice, vesicular greenish-black basalt, pilli, olivines, high temperature quartz; with an abundant carbonate detritus (incl. microfossils) so that the overall sample colour is pepper and salt-like.

microfauna abundant; gastropods; pelecypod spats; pteropods; echinoid spines; forams, comprising mainly globigerines and globorotaliids; radiolarians, including spongodiscids, actinommids; OSTRACODA rare, including *Argilloecia* (3 spp.), *Krithella*, *Neonesidea*, *Orlobairdia*, *Bythocypris* (2 spp. juv.), *Cardobairdia*

(broken valve); *Paracythere*(!); *Propontocypris* (3 spp.), *Xestoleberis* (4 spp.); *Microxestoleberis* (1 sp.); *Ornatoleberis* (1 sp.), 8 spp. divers (all juvs.), *Paracytherois* (2 spp.); *Rotundracythere* (adult LV), *Abyssocypris* (= *Australoecia* sp. 1 Maddocks); *Javanella*; *Poseidonamicus* (juv.); *Bythoceratina* (adult LV); *Pseudocythere* (juv. fragment RV).

FFC-1B: *sediment* volcanic detritus; including pumice, vesicular greenish black basalt, high temperature quartz, olivines; all rather fresh so that the overall colour of the sample (incl. microfauna) remains greenish-black.

microfauna abundant, similar to above sample, plus a few sponge spicules; OSTRACODA rare, including *Pseudocythere*, *Paracytherois* (2 spp.), *Argilloecia* (2 spp.); *Abyssocypris* (= *Australoecia* sp. 1 Maddocks) *Neonesidea*, *Krithe* (2 juvs.-LV, RV); *Polycope* (2 spp.); *Tenedocythere* (juvs.); *Xestoleberis* (mainly juvs.); indet. spp. (2, both juvs.), *Propontocypris*, *Bradleya*.

FFC-1C: *sediment* volcanic detritus; including pumice, pillie, vesicular basalt (some pieces weathered greenish), high temperature quartz, olivines; plus rare grains of glauconite; sufficient weathered materials occur to give the sample a greenish cast.

microfauna predominantly planktonic foraminiferans – globigerines (including *Orbulina*), globorotaliids – plus other forams as in FFC-1D below; also gastropods; pelecypod spats; pteropods; rare sponge spicules; and radiolarians (actinommids); OSTRACODA: rare, including *Xestoleberis*, *Argilloecia* (2 spp.), *Bythocypris* (2 spp.), *Polycope*, *Microcythere*, *Poseidonamicus*, *Krithe*, *Rotundracythere*, *Microcytherura*, *Paijenborchella*, indet. juv., *Atjehella* sp. nov., *Cytheropteron*.

FFC-1D: *sediment* volcanic detritus; including pumice, vesicular basalt, high temperature quartz, olivines, zeolites, fragments of ignimbrite – mostly fresh but often displaying weathering giving the sample an overall greenish cast.

microfauna abundant; predominantly planktonic foraminiferans – globigerines and globorotaliids –, plus other forams – buliminaceans, rotalines, miliolids, nodosariaceans, arenaceous taxa –; also gastropods; rare pelecypod spats; and a variety of pteropods; spongodiscid radiolarians; echinoid spines; and sponge spicules; OSTRACODA rare (single juvenile LV of *Xestoleberis* and a RV of *Loxoconcha*).

T-76; Station 2; 556m; Lat. 20° 26.5'S., Long. 174° 27.4'W.; 24.4'76.

FFG-7: *sediment* of volcanic detritus, vesicular basalt, olivines, high temperature quartz; mixed with ferruginised grains; and rather worn yellowish carbonate

detritus, including worn larger forams also of a yellowish tinge; numerous bryozoans; coral fragments; barnacle plates.

microfauna rich and diverse foram fauna typical of slope assemblages with admixtures from shallow water (larger foraminiferans); some gastropods; pteropods; echinoid spines common; sponge spicules, holothurian sclerites; OSTRACODA rare including *Tenedocythere*(?) *Loxoconcha*, *Loxocorniculum*, *Callistocythere*, 'Mutilus', *Anchistrocheles*, *Neonesidea*, *Paranesidea* (all these are typical of shallow water and support the hypothesis of admixtures into this sediment from the shelf).

T-76; Station 7; 2582m; Lat. 18° 25.4'S., Long. 173° 48.7'W.; 2.5.'76.

FFC-6: *sediment* greenish-greyish; bits of pumice, volcanic pilli, shards, occasional grains of olivine, vesicular basalt.

microfauna predominantly planktonic and globigerine, occasional globorotaliids, miliolaceans and buliminaceans; rare sponge spicules and very rare OSTRACODA: 1 juv. indet. trachyleberidid.

T-76; Station 8; 3281m; Lat. 18° 47.7'S.; Long. 173° 17.2'W.; 3.5.'76.

FFC-5A: *sediment* volcanic detritus, including straw-greenish particles of pumice, pilli, olivines, ignimbrite, vesicular basalt, plus rare crimson grains (zeolite?); with an abundant carbonate component (microfossils); overall colour pepper and salt.

microfauna abundant; mainly planktonic foraminifera, including *Orbulina*, other globigerines, globorotaliids, rare miliolids, buliminaceans, arenaceous forms; no other microfaunal groups observed except for rare echinoid spines and radiolarians.

FFC-5B: *sediment* volcanic detritus; including pumice, pilli, vesicular basalt, olivine crystals, high temperature quartz; mingled with about an equal or slightly smaller quantity of carbonate debris and planktonic forams giving a pepper and salt overall colour.

microfauna mainly planktonic forams (globigerines, globorotaliids) lagenids, miliolids, buliminaceans; rare sponge spicules; numerous theoperid, actinommid and spongodiscid radiolarians.

T-76; Station 10, 4765m; Lat. 19° 36.4'S., Long. 173° 14.2'W.; 5.5.'76.

FFC-7: *sediment* of volcanic detritus; pumice, pilli, olivine crystals, vesicular basalt – overall greenish black; mixed with the whitish microfauna; some reddish-brown oxidised grains (non-manganiferous, maybe carbonate).

microfauna very small foraminiferans, usually planktonics but including polymorphinids, miliolids, nodosariids, textulariids, rotaliids, etc; spongodiscid radiolarians; OSTRACODA confined to single valve of *Xestoleberis* (probably washed down from shallower water).

T-76; Station 12; 4768m; Lat. 19° 29.7'S., Long. 173° 38.4'W.; 8.5.'76.

FFC-9: *sediment* greenish-black overall; fine volcanic detritus; pumice, pilli, vesicular basalt, olivines; high-temperature quartz; most slightly abraded.

microfauna rare, mainly small planktonic foraminiferans, but including arenaceous forms, rare elphidiids, rotaliids, buliminaceans, lagenids, miliolids, cibicidids, etc; abundant radiolarians, including numerous spongodiscids; *nil* OSTRACODA.

T-76; Station 13; 1382m; Lat. 19° 54.2'S., Long. 174° 10.1'W.; 9.5.'76.

FFC-10: *sediment* predominantly volcanic detritus greenish-greyish to blackish; including pumice, olivines, pyroxenes, high temperature quartz, zeolites(?); vesicular basalt; ignimbrite; all about medium grade.

microfauna rare: predominantly foraminiferans, mostly globigerinids with globorotaliids common, plus occasional miliolaceans, arenaceous forms include textulariids; and rare gastropods; and pteropods; *nil* OSTRACODA.

T-77; Station 6; 1770m; Lat. 19° 35.7'S., Long. 174° 50.7'W.; 19.9.'77.

DRG-4: *sediment* of volcanic debris and foraminiferal tests; the volcanic material includes a large whitish clast of pumice; plus volcanic glass, zeolites, rare high temperature quartz, numerous fragments of greenish pumice.

microfauna abundant; mainly planktonic forams (usually globigerines), also cibicids, miliolids and rotaliids; occasional echinoid spines; and fragments of molluscs, *nil* OSTRACODA.

T-77; Station 9; 1456m; Lat. 18° 48.2'S., Long. 174° 22.8'W.; 22.9.'77.

DRG-6: *sediment* predominantly greenish-blackish; mainly volcanic detritus, including pumice, ejectamenta, pilli, vesicular basalt, olivine crystals, high temperature quartz (all looking very fresh) – medium sand sized with occasional large clasts.

microfauna rather sparse; includes foraminiferans, mostly globigerines (e.g. *Orbulina*), globorotaliids, rare arenaceous forams (textulariids, ammodiscids), polymorphinids, miliolids; OSTRACODA very rare, restricted to *Argilloecia*.

T-77; Station 11; 1290-1284m; Lat. 17° 29.0'S., Long. 173° 59.0'W.; 24.9.'77.

DRG-7: *sediment* pepper and salt mixture; of volcanic detritus-pumice, pilli, vesicular basalt, olivines, high temperature quartz; and carbonate detritus.

microfauna of pelecypods; gastropods; pteropods; planktonic and benthic forams; including arenaceous taxa, miliolids, etc; rare echinoid spines. OSTRACODA very rare – lone shell of *Paranesidea* (juv.).

T-77; Station 12; 1495-1490m; Lat. 15° 33.9'S., Long. 173° 28.2'W.; 25.9.'77.

DRG-8: *sediment* predominantly composed of globigerine forams, but volcanic pilli are common and also occasional clasts of basalt.

microfauna of planktonic forams plus some miliolids, cibicidids, nodosariids, rotaliids, polymorphinids; pteropods abundant; some echinoid spines; radiolarians; OSTRACODA rare, comprising *Paracytheridea* (juv.), *Loxocorniculum* (6 juvs., 1 adult), *Argilloecia* (2 spp.), *Propontocypris* (juvs.), *Xestoleberis*, *Microxestoleberis*(?), *Neonesidea* (2 spp.), *Krithe*, *Cytheropteron* (2 spp.), gen. nov. (adult LV), *Bythocypris*, *Pseudocythere*, *Poseidonamicus*, *Trachyleberis*, indet trachyleberidids (2 spp., juvs.), gen. nov. Pontocyprididae(?). Also present: small gastropods and pelecypods.

T-77; Station 15; 125-88m; Lat. 19° 00.1'S., Long. 174° 04.8'W.; 29.9.'77.

DRG-11: *sediment* yellowish; predominantly an abraded, yellowish carbonate detritus; comprising fragments of pelecypods; gastropods; large forams; bryozoans; sponge spicules; the small forams include miliolids, rotaliines, nodosariaceans, textulariids etc plus some globigerine planktonics; holothurian sclerites; echinoid spines; faecal pellets; associated with whitish organic carbonate detritus and grains of olivine, high temperature quartz and zeolite.

microfauna as indicated above; plus rare OSTRACODA including *Bradleya*, *Anchistrocheles*, *Havanardia*, *Paranesidea* (2 spp.), *Neonesidea* (4 spp.), *Macrocypriina*, *Tenedocythere*, *Xestoleberis* (3 spp.), *Microxestoleberis*; *Foveoleberis*, gen. nov. campylocytherid; *Propontocypris*, *Paracytheridea* (2 spp.), *Loxononcha* (1 sp.), *Loxocorniculum* (2 spp.), *Bythoceratina*, *Echinocythereis*(?), *Platella*, *Oculocytheropteron*, *Pseudocythere*(?) (posterior broken).

T-77; Station 16; 180-174m; Lat. 18° 59.5'S., Long. 174° 04.6'W.; 29.9.'77.

DRG-12: *sediment* predominantly a carbonate detritus much of it unidentifiable to group but clearly including fragments of gastropods; pelecypods; fragments of pteropods; bryozoans; and sponge spicules; holothurian sclerites; echinoid spines; small foraminiferans

(miliolids, arenaceous taxa, rotaliines, nodosariaceans, elphidiids, etc); large foraminiferans; rare planktonic forams (usually broken); actinommid radiolarians; ostracods; plus volcanic detritus including pumice and vesicular basalt and shiny brownish rounded granules.

microfauna as indicated above, OSTRACODA common including *Neonesidea* (4-5 spp.), *Paranesidea* (1 sp.), *Anchistrocheles*, gen. nov. pontocypridid, *Propontocypris* (2 spp.), *Loxocorniculum* (2 spp.), *Loxochoncha*, *Rotundracythere*, *Cytherelloidea*, *Triebelina*, *Xestoleberis* (4 spp.), *Oculocytheropteron* (2 spp.), 'Pterygocythereis', *Mutilus*, gen. nov. small bythocytherid, *Callistocythere*, *Ishizakiella*, *Foveoleberis*, *Argilloecia*, *Macrocyprina*, *Cardobairdia*, *Tenedocythere* (3 spp.), *Bradleya*, *Velibythere velivola* (Brady), *Bythoceratina*, *Trachyleberis*, *Ponticocythereis*, myodocopid fragments, *Krithe*, *Sclerochilus*, *Loxoconchella* (bullate), *Pseudocythere*, *Xiphichilus*, *Polycope*, indet. spp. (2-3).

T-78(2); Station 4; 3220-3180m; Lat. 18° 44.3'S., Long. 173° 11.8'W.; 9.11'78.

DPP-2: *sediment* pepper and salt coloured; volcanic detritus including pumice, vesicular basalt, olivine crystals, high temperature quartz, with some large fragments but mostly the same grade as the microfossils.

microfauna abundant, mainly globigerine planktonic foraminifera, other foram groups include lagenids, miliolids, globorotaliids; rare echinoid spines; plus theoperid, spongodiscid and actinommid radiolarians; OSTRACODA rare including *Argilloecia* (juv.), *Krithe*, *Poseidonamicus*.

T-78(2); Station 7; 4870m; Lat. 19° 40.0'S., Long. 173° 26.9'W.; 12.11.'78.

DPP-3: *sediment* greenish-black; volcanic detritus mainly pumice and vesicular basalt; the fragments often carrying zeolites, olivine, high temperature quartz.

microfauna rare consisting of five species of arenaceous foraminiferans; plus numerous spongodiscid, actinommid, coccodiscid, and theoperid radiolarians; and a few sponge spicules; *nil* OSTRACODA.