Early Miocene Ostracoda from Mizunami, central Japan

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中部日本，瑞浪地域の初期中新世介形虫

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(要　　旨)

岐阜県瑞浪市周辺に分布する初期中新世の宿洞砂岩相（明世層）には保存のよい化石介形虫（甲殻類）が多産する。産出する介形虫は26属31種で，このうち16種は現生の日本太平洋岸黒潮流域の産出が知られている。新種は，*Bairdoppilata itoigawai, Trachyleberis mizunamiensis, T. shukunohorensis, Hirsutocythere? akatsukiborensis, Australimoosella hanaii, Aurila okumurai* の6種で，*Bairdoppilata* 属は現生インド洋の珊瑚礁より多産することが知られており，日本で最初の報告である。

(Abstract)

Early Miocene Ostracoda from the Shukunohora Sandstone of the Mizunami area, including thirty-one species among 26 genera, are systematically described. Six new species, *Bairdoppilata itoigawai*, *Trachyleberis mizunamiensis*, *T. shukunohorensis*, *Hirsutocythere? akatsukiborensis*, *Australimoosella hanaii* and *Aurila okumurai* are described. Eight species are left in open nomenclature. This is the first report of the genus *Bairdoppilata* from Japan.

Introduction

The Mizunami area, central Honshu, Japan (Fig. 1) is well-known place among Japanese paleontologists and fossil-collectors because many Miocene fossils occur in a well-preserved state from most formations in this area. Intensive study by Dr. J. Itoigawa for more than 30 years clarified the stratigraphy and paleontology of the early Middle Miocene of Japan. Although many systematic descriptions are published, no systematic study of Ostracoda has been reported. This paper supplements the paleontology of the Miocene Mizunami by giving a full picture of the ostracod fauna.

For the study of Miocene Ostracoda from Japan, the work of Hanai (1957, 1977) provides fundamental data. Hanai (1977) stated that "some species of living warm ostracods, such as *Hemicytherura kajiyamai*, *Aurila* sp. and *Schizocythere kishinouyei*, which first settled in Japan in the Middle Miocene, have maintained *a status quo* in phenotype up

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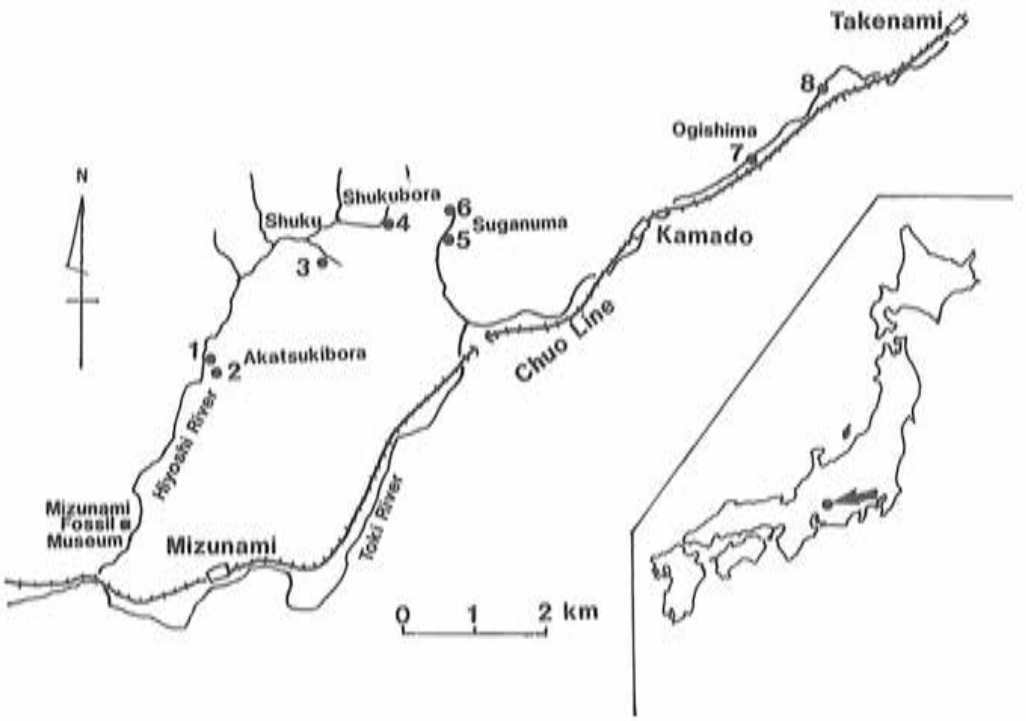


Fig.1 Index map of the surveyd area.

to the present". This statement is important because since Miocene, ostracod fauna along the Pacific coast of Japan have repeated the change of warm water fauna and cold water fauna, and warm water fauna have retained the characteristics of the Mizunami fauna.

Ishizaki(1963) described a small fauna from the Sunakosaka Member of the Yatsuo Formation, east of Kanazawa. Ishizaki(1966) also reported ostracod fauna from the Moniwa Member and from the Hatatate Formation of Sendai area. The writer(1988) preliminarily reported the Miocene Ostracoda including Mizunami Group and discussed with precious time scale and Miocene tectonics of Japan. This paper deals with ostracod systematics from the Mizunami area.

Lithology of Mizunami sampling localities

Ostracods occur only in the Shukunohora Sandstone (Blow's N 8 zone, correlated by Itoigawa, 1980), Akeyo Formation. Other formations yield many fossils but no ostracods. The Shukunohora Sandstone is patchly distributed and thin, mostly less than 10 m. The sedimentary facies vary from coarse-grained sand to silt. It is important to describe the exact sampling localities of ostracods and sedimentary facies in detail (Fig. 2). Ostracods occur from 8 localities and 11 samples (Table 1).

Loc. 1 (Akatsukibora N) : a small exposure, right bank of the Hiyoshi River, 2.5 km N of the Mizunami Fossil Museum, Hiyoshi-machi, Mizunami-shi (Lat. 35°23'29" N, Long. 137°14'27" E)(Loc. 12 of Itoigawa, 1980), Shukunohora Sandstone (25 cm+), the lower 2

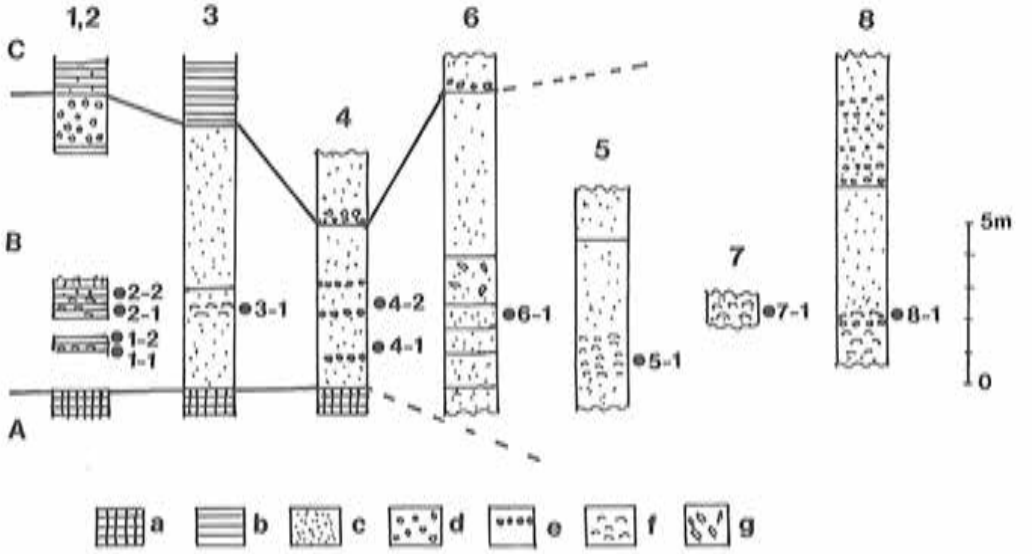


Fig.2 Columnar sections showing sampling horizon of ostracods.
a: coal-bearing bed, b:alternation of sand and silt
c: sand, d:pebbles and cobbles, e:nodules, f:shells, g:burrows
A:Toki Coal-bearing Formation, B: Shukunohora Sandstone
C: Oidawara Formation

cm of greyish fine-grained sand with abundant shells, the middle 3 cm of silt, the upper 20 cm of black silt including thin layers of bluish grey medium-grained sand.

Sample 1-1, grey fine-grained sand, the lowest layer, with molluscan shell fragments and many black plant remains.

Sample 1-2, grey fine-grained sand, the lowest layer, with abundant shell fragments, foraminifers, bryozoans, and radiolarians.

Museum Sample, sampling horizon and sedimentary facies as same as Sample 1-1, given from the Mizunami Fossil Museum, courtesy of Mr. K. Okumura.

No ostracods were found from the middle silt and the upper layer of black silt with thin layered bluish grey medium-grained sand and many plant remains.

Loc. 2 (Akatsukibora) : an exposure facing to the rice field, 200 m SE of Loc. 1, Hiyoshi-machi, Mizunami-shi (Lat. 35°23'24" N, Long. 137°14'32" E)(very close to Loc. 13 of Itoigawa, 1980). Shukunohora Sandstone (1.2 m+), alternation of light grey coarse-grained sand with *Miogypsina kotoi* and blackish fine-grained sand with many black plant remains, about 20 cm thickness each.

Sample 2-1, light grey coarse-grained sand, the lowest layer of Loc. 2, with abundant *Miogypsina kotoi*.

Sample 2-2, blackish fine-grained sand, the second layer from the base of Loc. 2, with black leaves and common *Miogypsina kotoi*.

Loc. 3 (Shuku) : a small exposure, along the branch of the Hiyoshi River, Hiyoshi-machi, Mizunami-shi (Lat. 35°24'18" N, Long. 137°15'36" E)(very close to Loc. 57 of Itoigawa, 1980). Shukunohora Sandstone (50 cm+).

Table 1. List of early Middle Miocene ostracod species from Mizunami

Species	Locality	1		2		3	4		5	6	7	8
	Sample	1-1	1-2	2-1	2-2	3-1	4-1	4-2	5-1	6-1	7-1	8-1
Bairdoppilata itoigawai n. sp.		71	31	29	81	30	1	2	1	1	9	
Neocytherideis sp.										1		
Pontocythere subjaponica (Hanai, 1959)		1	1	2	5	4	1	3		20	10	
Parakrithella pseudadonta (Hanai, 1959)			1									
Munseyella sp.		1	1	1		1						
Callistocythere sp.					2		2			4	2	5
Cythere omotenipponica Hanai, 1959		1				4						
Schizocythere kishinouyei (Kajiyama, 1913)				2	3							
Hanaiborchella miurensis (Hanai, 1970)											1	
Neomonoceratina wendongensis (Liu, 1989)										1		
Spinileberis sp.		1										
Trachyleberis mizunamiensis n. sp.		2	2	2	3			1		12	7	
T. shukunohorensis n. sp.				1	1							
Hirsutocythere? akatsukiborensis n. sp.					1	2						
Australimoosella hanaii n. sp.								1		3		
Falsobuntonia taiwanica Malz, 1982		1	4		1							
Aurila okumurai n. sp.		52	43	18	45	81	8	5	26	14	22	
Cornucoquimba moniwensis (Ishizaki, 1966)		17	11	4	12	10	1		3	2	8	
Ambostracon ikeyai Yajima, 1978		16	26	2	18	12	1		5	6	2	
Bythocythere sp.											1	
Hemicytherura cuneata Hanai, 1957		4	11		4	7		1				
Semicytherura henryhowei Hanai and Ikeya, 1977		1			2						1	
S? miurensis Hanai, 1957		2			1							
S wakamurasaki Yajima, 1982		1	1									
Cytheropteron sp.						1			2			
Kangarina yamaguchii Tabuki, 1986		3	3			4	1				1	
Loxoconcha pulchra Ishizaki, 1968					2	2	1	8	5	13	5	2
L. sp.		6	7		4	7				2		
Loxocorniculum sp.		5										
Xestoleberis hanaii Ishizaki, 1968		11	7	1	3	1		1	2		2	
X. setouchiensis Okubo, 1975		5	6			1		1			1	
total number of specimens		201	155	62	188	167	16	23	44	79	72	7
total number of species		19	15	10	17	15	8	9	7	12	14	2
weight of sample (g)		2.5	2.5	80	20	40	5	40	80	80	80	40

Sample 3-1, bluish-grey medium- to coarse-grained sand with the eroded molluscan shell fragments.

Loc. 4 (Shukubora) an exposure, the left bank of the Hiyoshi River, 3.5 km E of the Kamado Station (J. R.), Hiyoshi-machi, Mizunami-shi (Lat.35°24'33" N, Long. 137°16'09" E) (Loc. 58 of Itoigawa, 1980 ; type lacality of the Shukunohora Sandstone). 1.6 m+ of the Toki Coal-bearing Formation and 6 m of the Shukunohora Sandstone.

Sample 4-1, bluish grey fine-grained sand, on the alternation of 30 cm of black silt and 30 cm of fine-grained sand, 70 cm from the base, with black cobble of Paleozoic rock and

abundant shell fragments.

Sample 4-2, bluish grey fine-grained sand, 1.5 m from the base, with black cobbles and abundant autochthounous articulated bivalves, and thin layered shell fragments.

Loc. 5 (Suganuma) : an exposure, along the small branch of the Toki River, 2.5 km W of the Kamado Station (J. R.), Hiyoshi-machi, Mizunami-shi (Lat. 35°24'25" N, Long. 137°16'40" E)(Loc. 60 of Itoigawa, 1980), Shukunohora Sandstone (1.5 m+).

Sample 5-1, light brown coarse-grained sand, with *Miogypsina kotoi* and scattered oyster shells and many small burrows. Burrows are almost 15 cm long and 3-4 cm in diameter. Most of them are situated horizontally and some vertically. The observation suggests autochthonous occurrence. There are many *Miogypsina kotoi* inside burrows.

Loc. 6 (Suganuma N) : an exposure, along the small branch of the Toki River, 2.5 km WNW of the Kamado Station (J. R.), Hiyoshi-machi, Mizunami-shi (Lat. 35°24'37" N, Long. 137°16'44" E)(Loc. 59 of Itoigawa, 1980), Shukunohora Sandstone (8.2 m+).

Sample 6-1, 70 cm of bluish grey coarse-grained sand, with many solitary coral *Oculina* sp. and molluscan shells.

Loc. 7 (Ogisima) : a small exposure, right bank of the Toki River, 1.75 km ENE of the Kamado Station (J. R.), Kamado-machi, Mizunami-shi (Lat. 35°24'58" N, Long. 137°19'30" E)(Loc. 07 of Itoigawa, 1980), Shukunohora Sandstone (40 cm+).

Sample 7-1, bluish grey coarse-grained sand, 20 cm from the base, with molluscan shells and barnacles.

Loc. 8 (Kamiogishima) : an exposure, the right bank of the Toki River, 2 km WSW of the Takenami Station (J. R.), Kamado-machi, Mizunami-shi (Lat. 35°25'34"N, Long. 137°20'10"E) (Loc. 06 of Itoigawa, 1980), Shukunohora Sandstone (10 m+).

Sample 8-1, bluish grey coarse-grained sand with molluscan bivalves (1 m thick) on the 70 cm of coarse-grained sand, with angular cobbles, pebbles, and many fragments of oyster fossils.

Ostracod assemblage

Thirty-one species of twenty-six genera of Ostracoda are recognized. Among them, 16 species (*Pontocythere subjaponica*, *Parakrithella pseudadonta*, *Cythere omotenipponica*, *Schizocythere kishinouyei*, *Hanaiborchella miurensis*, *Australimoosella tomokoae*, *Falsobuntonia taiwanica*, *Cornucoquimba moniwensis*, *Ambostracon ikeyai*, *Hemicytherura cuneata*, *Semicytherura henryhowei*, *S.? miurensis*, *S. wakamurasaki*, *Loxoconcha pulchra*, *Xestoleberis hanaii*, and *X. setouchiensis*) were identified as hitherto-known species originally proposed on the Recent, Pleistocene, Pliocene, and Miocene specimens. Recently, Ikeya and Itoh (1991), Ikeya and Suzuki (1992), and Ikeya, Zhou and Sakamoto (1992) investigated Recent faunal distribution of Ostracoda around Japan actively. In the results of their studies, species from the Miocene of Mizunami identified with known species are all living in the Recent marine water. On the other hand, due to the intensive study of species group among one genus invetigated by Okubo (1988), Tsukagosi and Ikeya (1987), Ikeya and Tsukagoshi (1988) and others, some of the species of the Shukunohora Sand-

stone that Yajima (1988) identified as known species may actually be new species. For example, *Spinileberis* sp. is different from *Spinileberis quadriaculeata* (Brady, 1880), as noted by Ishizaki (1990).

Samples 1-1, 1-2 and 2-1 include abundant *Bairdoppilata itoigawai* n. sp. *Bairdoppilata* is a very unique genus of Bairdiidae in having characteristic auxiliary dentition in hingement. In 1969, Maddocks revised Recent Bairdiidae and commented, in the ecology of the genus *Bairdoppilata*, that "Recent species of *Bairdoppilata* are abundant in tropical and subtropical regions in very shallow-water niches as epifauna on coralline and rocky reefs, algae, sea grasses, corals, sponges, other attached invertebrates, and associated skeltal debris." The first occurrence of *Bairdoppilata* in the Mizunami area of Japan may suggest that tropical and subtropical shallow-water coralling and rocky reefs in Early Miocene, central Japan. This suggestion is concordant with the interpretation from other fossils of molluscs and corals from the Shukunohora Sandstone.

The Shukunohora Sandstone includes *Neomonoceratina wendongensis* (Liu, 1989), reported from the Eocene from boring core sample from the East China Sea by Liu (1989). The Mizunami specimen suggests neither rework nor debris flow because it is well preserved although the fact the specimen is only one.

Samples 1-1, 1-2, 2-1, 2-2, and 3-1 include abundant and well-preserved ostracods. Samples 4-1, 4-2, 5-1, 6-1, 7-1, and 8-1 include rare and poorly preserved ostracods. The preservation state of ostracods is similar to that of molluscs, foraminifers, and bryozoans. Among 11 samples, 2 assemblages are recognized based on the characteristic species.

1. Samples 1-1, 1-2, 2-1, 2-2, 3-1, and 5-1, are characterised by the abundance of *Bairdoppilata itoigawai* n. sp., *Aurila okumurai* n. sp., *Cornucoquimba moniwensis*, and *Ambostracon ikeyai*. This assemblage suggests shallow-warm water fauna.

2. Samples 6-1 and 7-1 are characterized by the species of *Pontocythere* and *Loxoconcha*. The sedimentary facies of these samples are coarser sand than the above group.

Systematic paleontology

New species and species in open nomenclature are described. In the case of species in open nomenclature, remarks are only given. For the synonymies, the species after Yajima (1988)are listed if necessary.

Specimens are deposited in the collection of the University Museum, the University of Tokyo (UMUT). Specimen numbers are prefixed with CA for Cenozoic Arthropoda.

The following abbreviations are used.

Sp : Specimen measured. C : Carapace. LV : Left valve. RV : Right valve. M : Male. F : Female. A-1 : Instar of adult minus one stage.

Sa : Sample number.

Me : Measurements. L : Length. H : Height. W : Width. OR : Observed range (mm). N : Number of specimens measured.

The following expressions are used to show the abundance of each species.

Abundant : The species occurs in more than 50 % of samples and occupies more than 10 % of total individuals.

Common : The species occurs in more than 50 % of samples and occupies less than 10 % of total individuals.

Rare : The species occurs in less than 50 % of samples and occupies less than 10 % of individuals.

Systematic description

Subclass Ostracoda Latreille, 1806

Order Podocopida Sars, 1866

Superfamily Bairdiacea Sars, 1888

Family Bairdiidae Sars, 1888

Genus *Bairdoppilata* Coryell, Sample and Jennings, 1935

Bairdoppilata itoigawai n. sp.

Pl. 29, figs. 1, 2 ; Pl. 30, figs. 1, 2.

Neonesidea sp. Yajima, 1988, pl. 1, fig. 21, table 2.

Etymology. -- In honor of Dr. J. Itoigawa of Nagoya University.

Types. -- Holotype, a right valve (CA 19080, pl.29, figs. 1a, b; pl. 35, fig. 2) from Sample 1-1.

Illustrated specimens. -- A left valve (CA 19081, pl. 29, figs.2a, b; pl. 30, fig. 1) from Sample 1-1.

Diagnosis. -- Carapace moderately high, with slightly produced posterior, small frill along anteroventral and posteroventral margins. Surface smooth in central part and with abundant tiny punctations in anterior and posterior parts. Muscle scars arranged in loose spiral and consisting of ten subcircular scars.

Description. -- Carapace moderately thin, translucent; central subovate, anterior and small posterodorsal spots opaque. Surface smooth with abundant tiny punctations in anterior and posterior parts. Lateral outline of left valve with broadly and obliquely rounded anterior margin, highly arched dorsal margin, straight ventral margin, and produced posterior margin; right valve with broadly and obliquely rounded anterior margin, obscurely angulate tripartite dorsal margin, posterodorsal segment slightly concave, posterior distinctly caudate, ventral margin slightly indented with frill.

Hinge-proper simple and thin, auxiliary dentition present at anterodorsal and posterodorsal angles at location of greatest marginal concavity, consisting in right valve of 4 tiny denticles surmounting anterodorsal or posterodorsal marginal ridge, in left valve of visibly locellate grooves with ventral confining rise, located directly underneath overhang of dorsal surface.

Muscle scar pattern consisting of 10 subcircular to subquadrate scars arranged in arcuate well separated rows, scars of ventral rows subdivided.

Dimensions.-- Measurments of specimens from Sample 1-1 are listed below;

Sp	N	OR		
		L	H	W
C	3	0.949-0.961	0.632-0.645	0.474-0.510
LV	3	0.949-0.985	0.645-0.669	
RV	6	0.936-1.009	0.572-0.681	
LV A-1	1	0.827	0.542	
RV A-1	2	0.827-0.876	0.499-0.535	
RV A-2	3	0.791-0.803	0.462-0.499	
LV A-3	1	0.743	0.414	

Remarks. -- This species resembles *B.* (*B.*) *alcyonicola* Maddocks, 1969 from Recent Indian Ocean in lateral outline and hinge structure but differs slightly in muscle scar distribution.
Occurrence. --- Abundant in Samples 1-1, 1-2, 2-1, 2-2, 3-1, 4-1, 5-1, 6-1, and 7-1.

Superfamily Cytheracea Baird, 1850
Family Cytherideidae Sars, 1925
Subfamily Neocytherideinae Puri, 1957
Genus *Neocytherideis* Puri, 1952
Neocytherideis sp.
Pl. 31, fig. 2.

Illustrated specimen. -- A carapace (CA 19082 ; pl. 31, fig. 2 ; L 0.480, H 0.183, W 0.159) from Sample 6-1.
Remarks. -- One carapace occurred in Sample 6-1. It is certain that this species is belongs to the genus *Neocytherideis* on the basis of carapace size and shape. The inner parts were not observed. This species resembles *N. aoi* Yajima, 1982, but the surface ornamentation is too poorly preserved to be certain.
Occurrence. -- Very rare in Sample 6-1.

Subfamily Cushmanideinae Puri, 1973
Genus *Pontocythere* Dubowsky, 1939
Pontocythere subjaponica (Hanai, 1959)
Pontocythere subjaponica ; Yajima, 1988, pl. 1, fig. 8, table 2.
P. sp.: Yajima, 1988, table 2.
Remarks. -- The Mizunami specimens are a little smaller than the Recent and Pleistocene specimens. The ventral margin is slightly sinuated.
Occurrence. -- Abundant in Samples 6-1 and 7-1. Common in Samples 1-1, 1-2, 2-1, 2-2, 3-1, 4-1, and 4-2.

Subfamily Krithinae Mandelstam, 1958
Genus *Parakrithella* Hanai, 1959
Parakrithella pseudadonta (Hanai, 1959)
Parakrithella pseudadonta: Yajima, 1988, table 2.

Remarks. -- Muscle scar pattern and pore distribution pattern ensured the identification of this specimen to Recent species.
Occurrence. -- Very rare in Sample 1-2.

Family Eucytheridae Puri, 1954
Subfamily Pectocytherinae Hanai, 1957
Genus *Munseyella* van den Bold, 1957
Munseyella sp.
Pl. 31, figs. 5, 6.

Munseyella sp.: Yajima, 1988, table 2.
Illustrated specimens. -- A right valve (CA 19083 ; pl. 31, fig. 5 ; L 0.376, H 0.207) from Sample 1-2 and a carapace (CA 19084 ; pl. 31, fig. 6 ; L 0.407, H 0.200, W 0.163) from Sample 1-1.
Remarks. -- This species resembles to *M. hatatatensis* Ishizaki, 1966 from Miocene Hatatate Formation in having a little slender margin and having two spines at posterior margin, but differs in reticulation pattern. This species has a high anterior marginal rim with tiny reticulation and deep hollow along inner side of anterior marginal rim.
Occurrence. -- Rare in Samples 1-1, 1-2, 2-1, and 3-1.

Family Leptocytheridae Hanai, 1957
Genus *Callistocythere* Ruggieri, 1953
Callistocythere sp.

Callistocythere sp.: Yajima, 1988, pl. 1, fig. 9, table 2.
Remarks. -- This species resembles *C. tateyamensis* Frydl, 1982, from the Holocene in its surface ornamentation but differs in the lattice pattern of reticulation. This species is similar to *C. hatatatensis* Ishizaki, 1966, from the Pliocene Hatatate Formation in carapace lateral shape and homogeneous reticulation in carapace surface, but is different in having three rows of anterior and posterior ribs.
Occurrence. -- Rare in Samples 2-2, 4-1, 6-1, 7-1, and 8-1.

Family Cytheridae Baird, 1850
Subfamily Cytherinae Baird, 1850
Genus *Cythere* O. F. Müller, 1785
Cythere omotenipponica Hanai, 1959

Cythere omotenipponica: Yajima, 1988, table 2.
Remarks. -- Specimens are all juveniles and do not show distinct differences from Recent *C. omotenipponica*.
Occurrence .-- Very rare in Samples 1-1 and 3-1.

Subfamily Schizocytherinae Mandelstam, 1960
Genus *Schizocythere* Triebel, 1950
Schizocythere kishinouyei (Kajiyama, 1913)

Schizocythere kishinouyei: Yajima, 1988, pl. 1, fig. 14, table 2.
Remarks. -- This species was preserved well enogh to show sieve type pores in SEM photographs.
Occurrence. -- Rare in Samples 2-1 and 2-2.

Genus *Hanaiborchella* Gründel, 1976
Hanaiborchella miurensis (Hanai, 1970)
Pl. 31, fig. 4

Paijenbochella miurensis: Lee, 1990, p. 205, 206, pl.11, figs. 4-9.
Illustrated specimen. -- A carapace (CA 19085, L 0.549, H 0.293, W 0.280) from Sample 7-1.
Remarks. -- This species resembles *P. triangularis* of Liu, 1989 from Recent East China Sea, although the surface ornamentation is not well preserved.
Occurrence. -- Very rare in Sample 7-1.

Genus *Neomonoceratina* Kingma, 1948
Neomonoceratina wendongensis (Liu, 1989)
Pl. 31, fig. 3.

Paijenborchella wendongensis Liu, 1989, p. 151-152, pl. 167, figs. 3, 4, 8-11.
Illustrated specimen. -- A carapace (CA 19086, L 0.732, H 0.354, W 0.261) from Sample 6-1.
Remarks. -- This species was originally proposed in the genus *Paijenborchella* from the Eocene boring core from the East China Sea. As this species has oblique central crest and box-shaped outline, assignment to the genus *Neomonoceratina* is appropriate.

Surface ornamentation of this species resembles that of the genus *Spinileberis* but the lateral shape is more slender. Inner features, especially the hingement cannot be observed, because the specimen was a closed carapace. This species resembles *S. rhomboidalis* Chen, 1982 of Lee (1990) from Pleistocene Korea in the lateral shape and broad ornamentation but differs in the ornamentation of central part of the valve. This species may be very important for understanding the origin of the genus *Spinileberis*.
Occurrence. -- Very rare in Sample 6-1.

Subfamily uncertain
Genus *Spinileberis* Hanai, 1961
Spinileberis sp.
Pl. 32, fig. 5.

Spinileberis quadriaculeata (Brady, 1880), Yajima, 1988, pl. 1, fig. 20, table 2.
Illustrated specimen. -- A right valve (CA 17704 ; L 0.615, H 0.387) from Sample 1-1.
Remarks. -- Ishizaki (1990) commented that this species is not *S. quadriaculeata*, because "the anterior marginal area is much narrower, the anterodorsal marginal ridge runs much more marginally, and the posteromedian ridge runs toward the postero-ventral corner". This species has no acurate spines.

Occurrence. -- Very rare in Sample 1-1.

Family Trachyleberididae Sylvester-Bradley, 1948
Subfamily Trachyleberidinae Sylvester-Bradley, 1948
Genus *Trachyleberis* Brady, 1898
Trachyleberis mizunamiensis n. sp.
Pl. 32, figs. 7-10.

Trachyleberis sp. 1 : Yajima, 1988, pl. 1, fig. 1, table 2.

Etymology. -- This species occur from Mizunami, central Japan.

Types. -- Holotype, female carapace (CA 19087, pl. 32, fig. 8) from Museum Sample.

Illustrated specimen. -- A female left valve (CA 19088, pl. 32, fig. 7), a male carapace (CA 19089, pl. 32, fig. 9), a male carapace (CA 19090, pl. 32, fig. 10) from Museum Sample.

Diagnosis. -- Wedge-shaped lateral outline with reticulation and tubercles in surface ornamentation.

Description. -- Carapace wedge-shaped. Sexual dimorphism distinct. Male carapace is longer and narrower than female carapace. Ventral margin of male carapace sinuated strongly and posteroventral margin of male carapace armoured more heavily than female carapace. Anterior margin broadly and obliquely rounded with tiny spines; dorsal margin straight with five to six tubercles; ventral margin slightly sinuated; posterior margin protruded, posterodorsal margin oblique and straight, posteroventral margin broadly and obliquely rounded with small spines.

Surface reticulated with spines on intersections of lattice. Eye nodule distinct, prolonged with anterior oblique ridge. Three to five tubercles arranged along anteroventral margin. Anterior plain with several spines. Posterior plain smooth with two tubercles in dorsal part and five tubercles along ventral margin. Subcentral node with median complex tubercles.

Inner features typical of the genus *Trachyleberis*. Inner margin parallel to outer margin. Vestibule very narrow. Hingement amphidont. Muscle scars in central muscle node consisting of a subcircular frontal scar and a vertical row of four adductor scars. The upper second adductor scar prolonged to anteroventrally.

Radial pore canals numerous, straight, and with slight bulbous enlargement at mid-length. Normal pores simple type.

Dimension. -- Measurements of specimens from Museum Sample are given below;

		OR		
Sp	N	L	H	W
C M	5	0.915-0.951	0.402-0.427	0.354-0.390
C F	7	0.839-0.915	0.450-0.474	0.415-0.450
LV F	2	0.780-0.864	0.415-0.474	

Remarks. -- Placing this species into genus *Trachyleberis* is very difficult because of the reticulate ornamentation of carapace surface. Diagnosis of genus *Acanthocythereis* depends

on the reticulation surface, but the lateral outline of genus *Acanthocythereis* is rather subrectangular. The frontal scar of this species is subcircular, although the species of *Trachyleberis* have commonly heart-shaped frontal scars.

This species resembles *Trachyleberis scabrocuneata* of Ishizaki, 1963 from the Miocene Sunakosaka Member of the Yatsuo Formation in having strongly sinuated ventral margin and heavily armoured posteroventral margin, but surface ornamentation is not clearly visible to compare.

This species resembles *T. volubilis* Liu, 1988 from Paleocene and Eocene boring cores near the East China Sea in carapace outline and surface ornamentation, but this species has a clear centrodorsal ridge.

This species resembles *Costa perfornata* Ornellas, 1981 of Bertels and Martinez (1990) from the Holocene of Argentina in having reticulation but differs in having tubercles on the cross of reticulation mesh.

Occurrence. -- Common in Samples 1-1, 1-2, 2-1, 2-2, 4-2, 6-1, and 7-1.

Trachyleberis shukunohorensis n. sp.

Pl. 32, figs. 1-4.

Trachyleberis sp. 2 : Yajima, 1988, pl. 1, figs. 2, 5, table 2.

Etymology. -- This species occur commonly in the Shukunohora Sandstone of Mizunami area.

Types. -- Holotype, a female carapace (CA 19091, pl. 32, fig. 2) from Museum Sample.

Illustrated specimen. -- A female carapace (CA 19092, pl. 32, fig.1) and a male carapace (CA 19093, pl. 32, fig. 3) from Museum Sample. A right male valve (CA 19094, pl. 32, fig. 4) from Sample 2-1.

Diagnosis. -- Small carapace, with reticulation and small tubercles in surface ornamentation.

Description. -- Carapace small and wedge-shaped. Sexual dimorphism distinct. Male carapace is more slender and narrower than female carapace.

Anterior margin broadly and obliquely rounded with small spines; dorsal margin oblique and straight with tubercles; anterior cardinal angle distinct; posterior margin broadly protruded with small spines; ventral margin slightly sinuated.

Surface reticulated with tubercles on the cross of reticulation. Central node distinct with irregular large tubercles. Eye node distinct with prolonged straight ridge.

Inner feature typical of the genus *Trachyleberis*. Hinge holamphidont. Muscle scars consisting of a heart-shaped frontal scar and a vertical row of four adductor scars.

Dimensions .-- Measurements of specimens of Museum Sample are given below;

		OR		
Sp	N	L	H	W
C M	4	0.695-0.742	0.305-0.328	0.268
C F	11	0.695-0.732	0.341-0.365	0.293-0.317

Remarks. -- This species resembles *T. mizunamiensis* n. sp. in surface ornamentation, but this species is small and has complex subcentral node and heart-shaped frontal scar.
Occurrence. -- Rare in Samples 2-1 and 2-2.

Genus *Hirsutocythere* Howe, 1951
Hirsutocythere? akatsukiborensis n. sp.
Pl. 32, figs. 12-14.

Hirsutocythere? sp.: Yajima, 1988, pl. 1, figs. 10, 13, table 2.
Etymology. -- This species occur from Akatsukibora, Mizunami-shi.
Types. -- Holotype, a male carapace (CA 17695, pl. 32, fig. 13) from Museum Sample.
Illustrated specimen. -- A female carapace (CA 17694, pl. 32, fig. 12), a female carapace (CA 19095, pl. 32, fig. 14) from Museum Sample.
Diagnosis. -- Large rectangular carapace with distinct tubercles in surface. Among tubercles, carapace surface is flat.
Description. -- Carapace large, rectangular laterally. Sexual dimorphism distinct. Male carapce is longer and larger than female carapace.

Anterior margin broadly rounded with two rows of tiny spines, the outer row protruded anteriorly, the second row protrude laterally. Dorsal margin straight with six spines. Anterior cardinal angle distinct. Ventral margin slightly sinuated at midlength, with tiny spines. Posterior margin broadly rounded with six spines.

Surface ornamented with tubercles. Subcentral tubercle armoured with six tiny tubercles. Distinct row of tubercles running from anteroventral corner to posterocentrally.

Innerfold moderately developed. Hingement holamphidont. Muscle scars consisting of a large heart-shaped frontal scar and a vertical row of four adductor scars, the upper large and oblong, the second prolonged anteroventrally.

Eye tubercle not distinct. Radial pore canals numerous, straight, with slight bulbous enlargement at midlength. Normal pores opening at the top of tubercles and simple type.
Dimensions. -- Measurements of pooled specimens are given below;

Sp	Sa	N	OR		
			L	H	W
C F	Museum Sample	2	0.976-1.022	0.584	0.535-0.584
LV M	〃	1	1.143	0.572	
LV F	〃	1	0.985	0.572	
C F	2-1	1	1.022	0.572	0.584
C F	2-2	1	1.022	0.596	0.596
RV M	〃	1	1.143	0.535	

Remarks. -- Including this species into genus *Hirsutocythere* is questionable, because this species has rectangular lateral outline and distinct, separate tubercles on lateral surface. The surface ornamentation of this species suggests a similarity with *Actinocythereis* from Miocene of Florida.

Occurrence. -- Rare in Samples 2-2 and 3-1.

Genus *Australimoosella* Hartmann, 1978

Australimoosella hanaii n. sp.

Pl. 32, figs. 15, 16.

Etymology. -- In honor of Dr. T. Hanai of the University of Tokyo.

Types. -- Holotype, a carapace (CA 19096, pl. 32, fig. 15, L 0.789, H 0.395, W 0.363) from Museum Sample.

Illustrated specimen. -- A carapace (CA 19097, pl. 32, fig. 16, L 0.710, H 0.363, W 0.354) from Museum Sample.

Diagnosis. -- Large carapace with reticulation in surface ornamentation. Weak ridges along anterior and posterior margins, and two longitudinal ridges running obliquely in central part.

Description. -- Carapace large and oblog ovate. Anterior margin obliquely and broadly rounced. Dorsal margin straight. Anterior cardinal angle distinct, posterior cardinal angle moderate. Ventral margin slightly convex. Postrior margin slightly concave dorsally, and convex with tiny spines ventrally.

Surface ornamented with reticulation. Several ridges running parallel to anterior and posterior margins. Two longitudinal ridges distinct and running obliquely. Subcentral node ornamented with irregular reticulation.

Innerfold moderately developed. Hingement holamphidont.

Eye tubercle indistinct. Radial pore canals many. Normal pore openings mostly at intersections of reticulate ridges and sunken sieve type.

Dimensions. -- Measurements of pooled specimens are given below;

			OR	
Sp	Sa	N	L	H
C, broken	4-2	1	0.805	0.439
R	6-1	1	0.780	0.390
L	〃	1	0.852	0.442

Remarks. -- Muscle scars are not observed because specimens are closed, broken, or with sediments in the valve.

This species resembles *A. tomokoae* (Ishizaki, 1968) from Recent Uranouchi Bay in the carapace outline and having longitudinal ridges in the central part, but *A. hanaii* is ornamented with reticulation. This species resembles *Alocopocythere goujoni* of Liu, 1989 from Recent East China Sea, but this species has a clear posterocentral vertical ridge.

Occurrence. -- Rare in Samples 4-2 and 6-1.

Subfamily Buntoniinae Apostolescu, 1961

Genus *Falsobuntonia* Malz, 1982

Falsobuntonia taiwanica Malz, 1982

Falsobuntonia taiwanica: Yajima, 1988, pl. 1, fig. 7, table 2; Ikeya and Suzuki, 1992, pl. 4, fig. 9.

Remarks. -- Ventral rim is strong. Specimens obtained are carapaces or broken valves so that checking inner features, especially hingement could not be done.

Occurrence. -- Rare in Samples 1-1, 1-2 and 2-2.

Family Hemicytheridae Puri, 1953
Subfamily Hemicytherinae Puri, 1953
Genus *Aurila* Pokorný, 1955
Aurila okumurai n. sp.
Pl. 29, figs. 3, 4; pl. 30, figs. 3-6.

Aurila sp.: Yajima, 1988, pl. 1, fig. 19, table 2.

Etymology. -- In honor of Mr. Koji Okumura of the Mizunami Fossil Museum.

Types. -- Holotype, a right valve (CA 19098, pl. 29, figs. 3a, b;pl. 30, figs. 4, 5, L 0.756, H 0.439) from Museum Sample.

Illustrated specimen. -- A left valve (CA 19099, pl. 29, figs. 4a, b; pl. 30, figs. 3, 6, L 0.756, H 0.500) from Museum Sample.

Diagnosis. -- Almond-shaped *Aurila* with weakly and coarsely reticulated surface and muscle scars consisting of two frontal scars and seven adductor scars.

Description. -- Valves asymmetrical; left valve higher and overreaches right valve along dorsum. In lateral view, left valve almond-shaped, greatest height near midlength. Anterior margin broadly and obliquely rounded. Dorsal margin broadly arched. Ventral margin smoothly arched, slightly convex anteriorly. Posterior margin rather narrowly ended; upper half straight, lower half convex. Posterior cardinal angle distinct.

Right valve narrower, subtrapezoidal. Anterior margin, the upper slightly concave, the lower broadly and obliquely rounded. Dorsal margin nearly straight to slightly arching middle. Anterior and posterior cardinal angle distinct. Ventral margin slightly arched. Posterior margin protruded.

Surface coarsely and weakly reticulated. Four anterior radial ribs weak. Posteroventral radial ribs somewhat distinct.

Marginal infold moderate. Vestibule very narrow. Inner crest distinct. Hinge holamphidont; deep anterior socket, small anterior tooth, smooth median bar, and somewhat elongated posterior socket with rounded small subordinate tooth in its left valve. In right valve, hingement concomittent with left valve except for weak posterior tooth.

Muscle scars arranged in the wall of subcentral node, consisting of two frontal scars and seven adductor scars. Frontal scars arranged in a vertical row. Adductor scars consisting of the upper two subcircular small scars, the second layer two oblong scars, the third layer two elongated scars, and the most ventral subtriangular scars. Ventromedian scar prolong into the center of subcentral node. One mandibular scar distinct and one large and one small dorsal scars distinct. Eye tubercle not distinct. Radial pore canals numerous and straight. Normal pores with lip and sieve.

Dimensions. -- Measurements of the specimens of Samlpe 1-1 are listed below;

Sp	N	OR		
		L	H	W
C l-form	3	0.730-0.766	0.486-0.499	0.389
C s-form	9	0.632-0.705	0.389-0.438	0.316-0.340
LV s-form	2	0.608-0.645	0.426	
RV l-form	1	0.730	0.438	
LV A-1	7	0.535-0.596	0.340-0.377	
RV A-1	7	0.547-0.608	0.316-0.389	
LV A-2	2	0.401-0.406	0.260	
RV A-2	3	0.426-0.450	0.248-0.292	
LV A-3	2	0.345	0.202-0.207	
RV A-3	2	0.328-0.333	0.199	

See *Remarks* for discussion of l-form and s-form.

Remarks. -- This species may be synonimous with *Aurila* sp. of Hanai, 1977.

The genus *Aurila* has mucle scars usually consisting of a vertical row of three frontal scars and a vertical row of four adductor scars, median two subdivided. This species has a total of nine scars in subcentral node, but the configuration is very different from the one typical of the genus.

A. okumurai is similar to *A. miii* in lateral outline and surface ornamentation, but differs distinctly in muscle scar configuration and weak reticulation in surface ornamentation.

Adult specimens can be subdivided into large form (l-form) and small-form (s-form), based on carapace measurements. Two forms are very similar in carapace shape and ornamentation. Although sexual dimorphism is obscure among both large-form and small-form, two separate forms are not based on sexual dimorphism. Two carapace size groups are often observed in Recent *Aurila* species from Japan. Sexual dimorphism is recognizable both two groups in Recent specimens.

Occurrence.-- Abundant in Samples 1-1, 1-2, 2-1, 2-2, 3-1, 4-1, 4-2, 5-1, 6-1, and 7-1.

Subfamily Thaerocytherinae Hazel, 1967

Genus *Cornucoquimba* Ohmert, 1968

Cornucoquimba moniwensis (Ishizaki, 1966)

Pl. 32 fig. 6.

Cornucoquimba moniwensis: Yajima, 1988, pl. 1, fig. 6, table 2 ; Lee, 1990, p. 261, 262, pl. 20, fig. 7 ; Ikeya and Itoh, 1991, p. 113, fig. 13D.

Illustrated specimen. -- A carapace (CA 19100, pl. 37, fig. 6, L 0.632, H 0.354, W 0. 359) from Sample 1-1.

Remarks. -- In dorsal view, this species has lateral protrudences like wing.

Ocurrence. --- Common in Samples 1-1, 1-2, 2-1, 2-2, 3-1, 4-1, 5-1, 6-1, and 7-1.

Genus *Ambostracon* Hazel, 196

Ambostracon ikeyai Yajima, 1978

Pl. 32, fig. 11

Ambostracon ikeyai: Yajima, 1988, pl. 1, fig. 4, table 2 ; Ikeya and Itoh, 1991, p. 108, fig. 10A.

Cornucoquimba ikeyai: Lee, 1990, p. 264, 265, pl. 20, figs. 1-4.

Illustrated specimen. -- A male carapace (CA 19101, pl. 37, fig. 11, L 0.628, H 0.341, W 0.254) from Sample 1-1.

Remarks. -- In dorsal view, this species is rather flatter than *Cornucoquimba moniwensis*.

Occurrence. -- Common in Samples 1-1, 1-2, 2-1, 2-2, 3-1, 4-1, 5-1, 6-1, and 7-1.

Family Bythocytheridae Sars, 1866

Genus *Bythocythere* Sars, 1866

Bythocythere sp.

Pl. 31, fig. 1

Illustrated specimen. -- A carapace (CA 19102, L 0.538, H 0.343, W 0.354) from Sample 7-1.

Remarks. -- Species identification is very difficult due to the broken carapace and poorly preserved surface ornamentation.

Occurrence. -- Very rare in Sample 7-1.

Family Cytheruridae G. W. Müller, 1894

Subfamily Cytherurinae G. W. Müller, 1894

Genus *Hemicytherura* Elofson, 1941

Hemicytherura cuneata Hanai, 1957

Hemicytherura cuneata: Yajima, 1988, pl. 1, fig. 18, table 2.

Remarks. -- Hanai (1957) reported *H. kajiyamai* from Miocene of Mizunami. The diagnosis between *H. kajiyamai* and *H. cuneata* is lateral shape and reticulation pattern in lateral surface. I recognize only *H. cuneata* among Miocene specimens and I have never encountered with *H. kajiyamai*.

Occurrence. -- Common in Samples 1-1, 1-2, 2-2, 3-1, and 4-2.

Genus *Semicytherura* Wagner, 1957

Semicytherura wakamurasaki Yajima, 1982

Semicytheurura wakamurasaki: Yajima, 1988, table 2 ; Lee, 1990, p. 327, pl. 28, figs. 3, 4 ; Ikeya and Itoh, 1991, p. 124, fig. 23C.

Remarks. -- This species was originally reported from Pleistocene sediment, but recently it has been found living off Japan.

Occurrenc. -- Rare in Samples 1-1 and 1-2.

Subfamily Cytheropterinae Hanai, 1957
Genus *Kangarina* Coryell and Fields, 1937
Kangarina yamaguchii Tabuki, 1986
Pl. 31, figs. 7-9.

Kangarina sp.: Yajima, 1988, pl. 1, fig. 17, table 2.

Illustrated specimens. -- A right valve (CA 19103, pl. 31, fig. 7, L 0.367, H 0.222), a left valve (CA 19104, pl. 31, figs. 8a, b, L 0.372, H 0.240), a right valve (CA 19105, pl. 31, fig. 9, L 0.367, H 0.225).

Remarks. -- This species resembles *Kangarina* sp. reported by Mckenzie 1974, (Pl. 3, fig. 7) from Australian Tertiary but different in surface ornamentation at anterior part. This species also resembles *K. abyssicola* (G. W. Müller, 1894) of Lee (1990) from the Pleistocene of Korea in surface ornamentation and is probably same species.

Occurrence. -- Rare in Samples 1-1, 1-2, 3-1, 4-1, and 7-1.

Family Loxoconchidae Sars, 1925
Subfamily Loxoconchinae Sars, 1925
Genus *Loxoconcha* Sars, 1866
Loxoconcha sp.

Loxoconcha sp.: Yajima, 1988, pl. 1, fig. 16, table 2.

Remarks. -- This species has clear and distinct ridges along posteroventral margin in SEM photograph, but in binocular observation, this species very similar with *L. pulchra*.

Occurrence. -- Rare in Samples 1-1, 1-2, 2-2, 3-1, and 6-1.

Genus *Loxocorniculum* Benson and Coleman, 1963
Loxocorniculum sp.

Loxocorniculum sp.: Yajima, 1988, pl. 1, fig. 15, table 2.

Remarks. -- This species resembles *Loxocorniculum* sp. 2 of Tabuki and Nohara (1990) from Recent coral reefs of Okinawa, Japan, in the shape of anterodorsal and posterodorsal nodes, but differs in surface fine ornamentation of central part and having posteroventral marginal ridge.

Occurrence. -- Rare in Sample 1-1.

Family Xestoleberididae Sars, 1928
Genus *Xestoleberis* Sars, 1866
Xestoleberis hanaii Ishizaki, 1968

Xestoleberis sp.:Yajima, 1988, table 2.

Remarks. -- Among Mizunami specimens, two species of *Xestoleberis* are recognized. One species is identified as *X. hanaii* based on the bulging posterior part in dorsal view and posteroventral margin meeting with ventral margin in acute angle.

Occurrence. -- Rare in Samples 1-1, 1-2, 2-1, 2-2, 3-1, 4-2, 5-1, and 7-1. Most specimens are fragmentary. Juveniles (A-1, A-2, A-3) are recognized.

X. setouchiensis Okubo, 1979

Remarks. -- Among two species of *Xestoleberis*, the other species identified is *X. setouchiensis* based on the acute anteroventral margin, the flat ventral margin in posterior view, and latitudinally slender lateral shape.

Occurrence. -- Rare in Samples 1-1, 1-2, 3-1, 4-2, and 7-1. Some specimens occurred in closed carapaces. Some are fragmental. Juveniles of A-1 and A-2 stages are recognized.

Addendum: *Semicytherura henryhowei*, *S.? miurensis*, and *Loxoconcha pulchra* were listed and SEM photographs of these species were shown in Yajiam, 1988. No important imformation has been added since 1988 so that the above three species are not described. *Propontocypris* sp. and *Cytheropteron* sp. were listed in table 2 of Yajima, 1988. The specimen identified with *P.* sp. is only one fragment from Sample 2-1. Specimens identified as *Cytheropteron* sp., consist of three broken valves listed in table 1 of this report.

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Plate 29

a: lateral view; b: inner view

Figs. 1, 2. *Bairdoppilata itoigawai* n. sp.

1. Right valve (holotype, CA 19080, Sample 1-1), × 56.
2. Left valve (CA 19081, Sample 1-1), × 56.

Figs. 3, 4. *Aurila okumurai* n. sp.

3. Right valve (holotype, CA 19098, Museum Sample). × 76.
4. Left valve (CA 19099, Museum Sample). × 76.

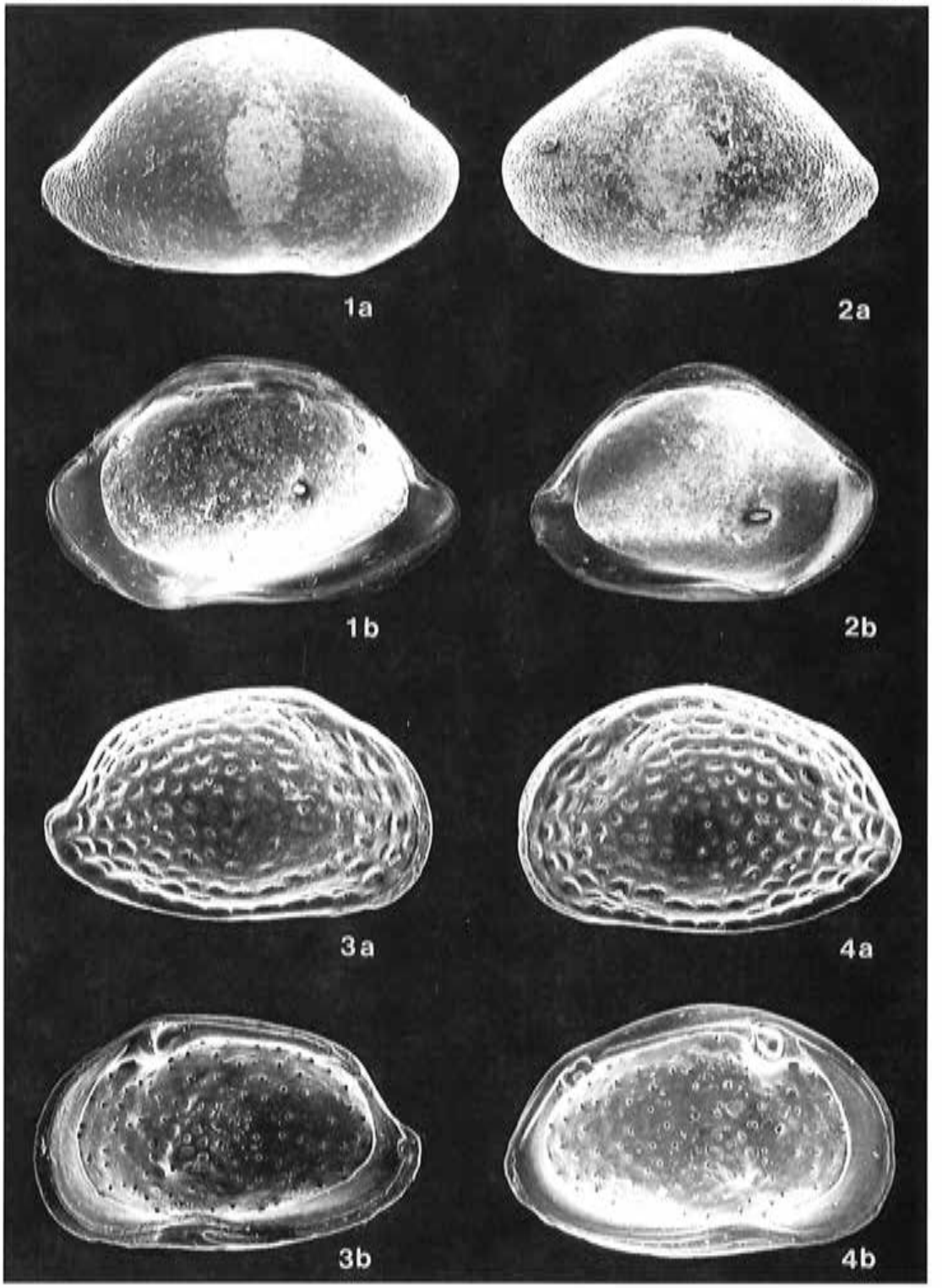

1a
2a
1b
2b
3a
4a
3b
4b

Plate 30

Figs. 1, 2. *Bairdoppilata itoigawai* n. sp.

1. Muscle scars on left valve (CA 19081), × 370.
2. Muscle scars on right valve (holotype, CA 19080), × 370.

Figs. 3-6. *Aurila okumurai* n. sp.

3. Muscle scars on left valve (CA 19099), × 460.
4. Muscle scars on rigt valve (holotype, CA 19098), × 460.
5. Pore distribution at posteroventral part of right valve (CA 19098), × 280.
6. Normal pore with lip and sieve at anterocentral part of left valve (CA 19099), × 2800.

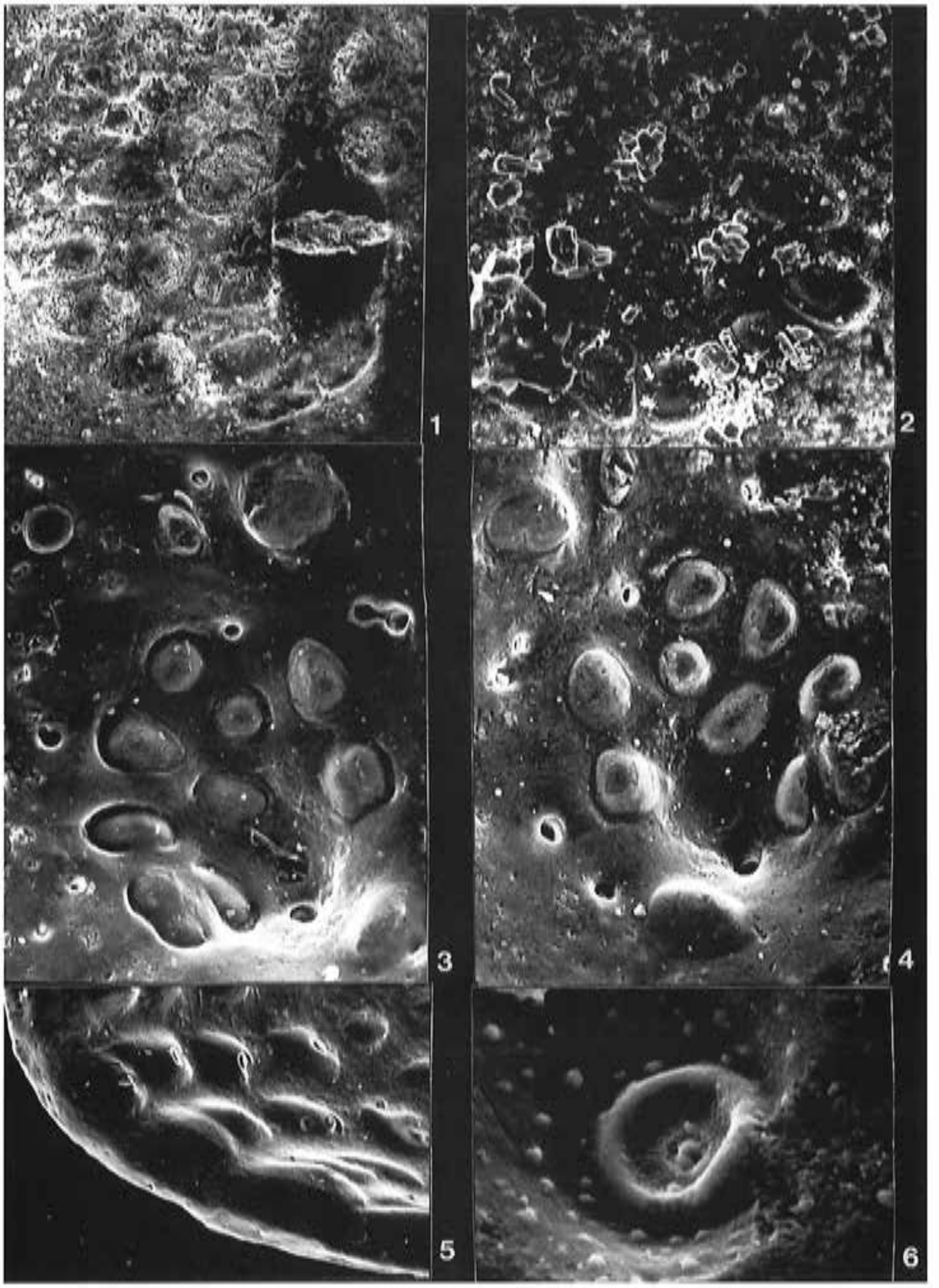

1
2
3
4
5
6

Plate 31

Fig. 1. *Bythocythere* sp.
Right valve view of carapace (CA 19102, Sample 7-1). × 94.
Fig. 2. *Neocytherideis* sp.
Left valve view of carapace (CA 19082, Sample 6-1). × 94.
Fig. 3. *Neomonoceratina wendongensis* (Liu, 1989)
Right valve view of carapace (CA 19086, Sample 6-1). × 76
Fig. 4. *Hanaiborchella miurensis* (Hanai, 1970)
Left valve view of carapace (CA 19085, Sample 7-1). × 94.
Figs. 5, 6. *Munseyella* sp.
5. Lateral view of right valve (CA 19083, Sample 1-2). × 146.
6. Left valve view of carapace (CA 19084, Sample 1-1). × 146.
Figs. 7-9. *Kangarina yamaguchii* Tabuki, 1986
7. Inner view of right valve (CA 19103, Sample 1-2). × 186.
8 a. Inner view of left valve (CA 19104, Sample 3-1). × 186.
8 b. Outer view of left valve (CA 19104). × 186.
9. Lateral view of right valve (CA 19105, Sample 1-1). × 186.

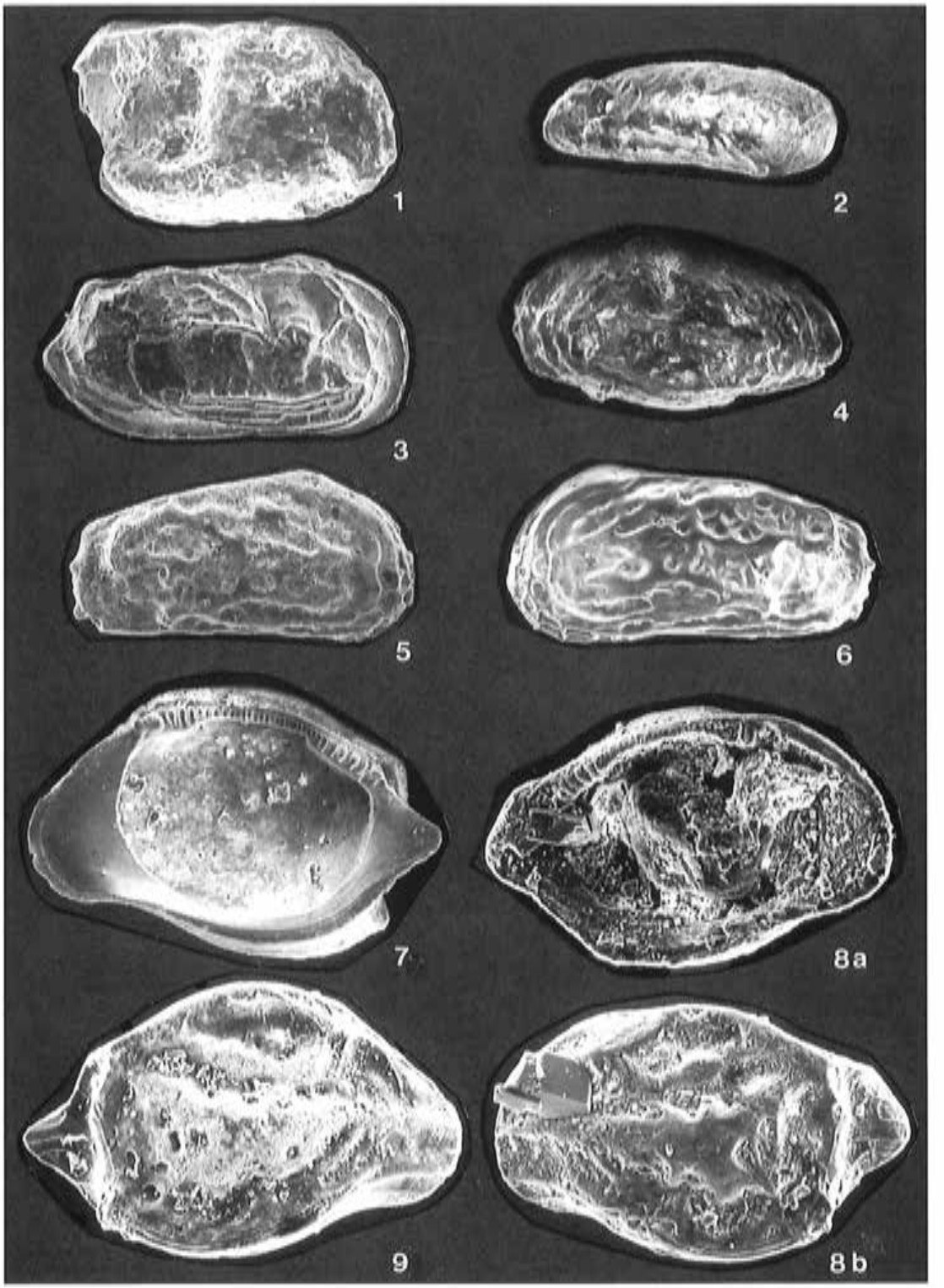

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Plate 32

Figs. 1-4. *Trachyleberis shukunohorensis* n. sp.

1. Right valve view of female carapace (CA 19092).
2. Left valve view of female carapace (holotype, CA 19091).
3. Right valve view of male carapace (CA 19093).
4. Inner view of male right valve (CA 19094, Sample 2-1).

All specimens from Museum Sample except for CA 19094 × 63.

Fig. 5. *Spinileberis* sp.

Lateral view of right valve (CA 17704, Sample 1-1). × 63.

Fig. 6. *Cornucoquimba moniwensis* (Ishizaki, 1966)

Dorsal view of carapace (CA 19100, Sample 1-1). × 67.

Figs. 7-10. *Trachyleberis mizunamiensis* n. sp.

7. Inner view of female left valve (CA 19088). × 59.
8. Left valve view of female carapace (holotype, CA 19087). × 63.
9. Right valve view of male carapace (CA 19089). × 63.
10. Left valve view of male carapace (CA 19090). × 63.

All specimens are from Museum Sample.

Fig. 11. *Ambostracon ikeyai* Yajima, 1978

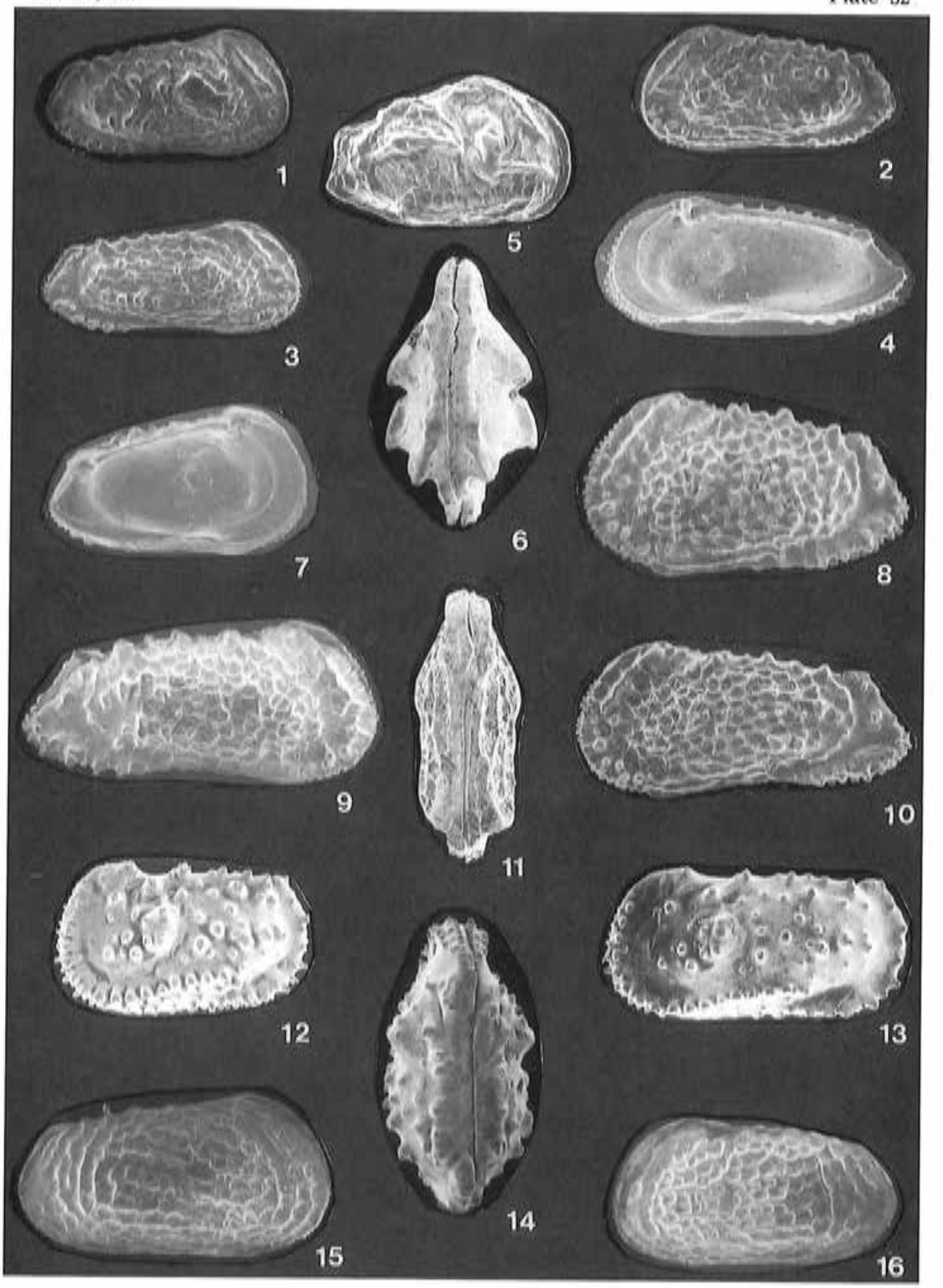
Dorsal view of male carapace (CA 19101, Sample 1-1). × 67.

Figs. 12-14. *Hirsutocythere? akatsukiborensis* n. sp.

12. Lateral view of female left valve (CA 17694, Museum Sample). × 40
13. Lateral view of male left valve (holotype, CA 17695, Museum Sample). × 42.
14. Dorsal view of male carapace (CA 19095, Museum Sample). × 46.

Figs. 15, 16. *Australimoosella hanaii* n. sp.

15. Right valve view of carapace (holotype, CA 19096, Museum Sample). × 63.
16. Left valve view ofcarapace (CA 19097, Museum Sample). × 63.


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