

Original Article

Description of a new genus and a new species,
Ikeyacythereis kumejimensis (Trachyleberididae, Ostracoda),
from the upper Pliocene Aka Formation,
Kume-jima Island, Okinawa Prefecture, Japan

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Abstract : A new genus and a new species, *Ikeyacythereis kumejimensis* gen. et sp. nov., is described from the Upper Pliocene Aka Formation of Kume-jima Island, Okinawa Prefecture, Japan. This new genus is characterized by the pattern of its radial pore canal, U-shaped carina developed at the dorsoposterior area, Y-shaped carina developed behind anterior sulcus and the lack of a subcentral tubercle. On the basis of these characters *Orionina wutzushui* Hu & Tao 2008 is also include in this genus. This genus has been reported from the sediments of the Pliocene onwards from the Ryukyu Islands and Taiwan.

Key Words : Ostracoda, Trachyleberididae, new genus, new species, systematics,
Aka Formation, Maanshan Mudstone

Introduction

Since the publication of the checklist of ostracod species from the Japanese Islands (Hanai *et al.*, 1977) and from Southeast Asia (Hanai *et al.*, 1980), and the database of ostracod species described in 20th century from Japan and its adjacent seas (Ikeya *et al.*, 2003), our understanding about the ostracod fauna from East Asia has dramatically improved. However, because of the lack of transnational cooperation studies a somewhat artificial ostracod biogeography may still exist.

The Ryukyu Islands are surrounded by various oceans and islands, such as the East China Sea, the Okinawa Trough, the Pacific Ocean, Kyushu Island and Taiwan. Because of the typical geological conditions many new ostracod species have been described from that area (e.g., East China Sea, Ishizaki, 1981, Wang *et al.*, 1988; Okinawa-jima Islands, Nohara, 1987; Okinawa Trough, Ruan & Hao, 1988; Taiwan, Hu & Tao, 2008). To avoid taxonomic confusion international interaction of ostracod studies, and the research of Neogene ostracod assemblages of the Ryukyu Islands, is essential. In 1998 and 2004 Emeritus Professor Noriyuki Ikeya (c/o Shizuoka University), his student and one of us (G. T.) went to Taiwan to collect topotype fossil specimens, and Recent specimens, aided by Professor Tunyou Huang (c/o Geological Survey of Taiwan). Professor Ikeya also collected Recent ostracods along the coast of China (from 1999 to 2001), together with Professor Quanghai Zhao (Tonji University), Dr. Toshiaki Irizuki (Shimane University), Dr. Baochun Zhou (Shanghai Museum),

and their students. Recently (from 22th to 25th November, 2009), one of us (G. T.) collected topotype specimens described by Hu & Tao (2008) from the Pliocene Maanshan Mudstone, the Nanwan district, Hengchun County, Pingtung Prefecture and Southern Taiwan. Thus, the international cooperation for the systematical reexamination of ostracods, as proposed and practiced by Professor Ikeya, is now ongoing.

Here we report a new genus of trachyleberidid ostracods from the Pliocene Aka Formation, Kume-jima Island, Ryukyu Islands of Japan. Recently, Hu & Tao (2008) published a monograph, 'Studies on the ostracod fauna of Taiwan and its adjacent seas', in which they describe a species, *Orionina wutzushui*, morphologically similar to the new genus recovered by the present authors from the Pliocene Aka Formation. Because of the lack of information regarding its size, and the absence of detailed SEM photographs for the species from Taiwan, we also redescribe this morphologically similar species from Taiwan. Based on the present report, and also on the previous studies, this new genus appears to be restricted in its distribution to the Ryukyu Islands and Taiwan, from the Pliocene onwards.

Geological setting and the horizons containing the new genus

The Aka Formation is widely distributed on the northeastern part of Kume-jima Island (Figure 1B,C). The lowermost part of the formation is composed of medium sandstone with poorly developed parallel laminations and *Ophiomorpha* isp (Figure

1D). A pumiceous tuff layer is interbedded between the sandstone; and above the medium sandstone there are alternate layers of coarse sandstone and siltstone about 5 m in thickness. The alternate layer is divided by a pebble bed showing a trough cross-stratification structure; and the pebble bed in turn is overlain by calcareous sandy conglomerates. This formation is irregularly overlain by a poorly-sorted boulder bed containing many shell fragments. The bed shows normal grading. The upper sandy conglomerate bed, trough cross-stratification and parallel lamination are characteristically found in the very coarse sandstone of about 18 m in thickness. One white tuff (ca. 1.2 m thickness) is found in the upper part of the very coarse sandstone, and the sandstone itself shows normal grading at the

uppermost part from very coarse sandstone to siltstone. The upper part of the Aka Formation consists of well-laminated dark gray siltstone which is bioturbated along several horizons. The specimens of new genus reported in this study was recovered from four horizons (asterisks in Figure 1D) in the siltstone.

In order to examine the morphologically similar species reported from southern Taiwan, topotype specimens were collected by one of us (G.T). The type locality is situated on the southeastern part of the Tamoushan Mountain ($21^{\circ} 57' N$, $120^{\circ} 45' E$), which is figured and defined as one of the type localities of the Maanshan Mudstone assemblage by Hu & Tao (2008) as text-figure 324. Four samples were collected from the locality. The sediment in which the species were contained consists of

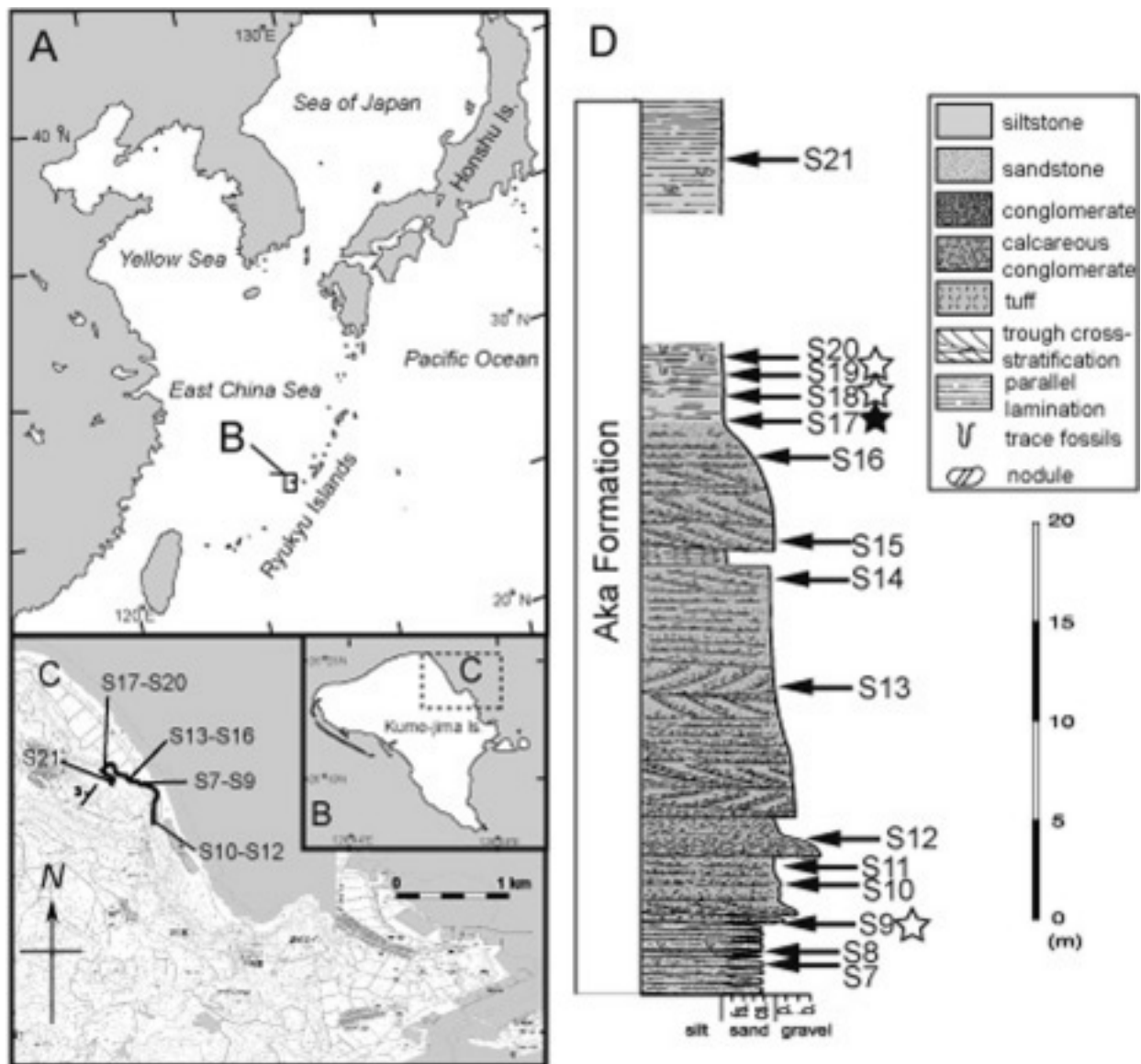


Fig. 1 Geographic and stratigraphic occurrence of the *Ikeyacythereis kumejimensis* specimen described in this paper. A, B: index map showing the type locality (Kume-jima Island), C: route map, D: stratigraphy of the site, and the horizon (S7-21) including microfossils. One pointed black star shows the occurrence horizon of the type specimen described here, and the three pointed white stars indicate the occurrence horizons of the specimen. C, D: modified from Tanaka and Nomura 2009 (figs. 2, 5).

semi-consolidated bluish gray massive very fine sandstone to mudstone with many small shells, shell fragments, spicules of sea cucumber, ostracods, and planktonic and benthic foraminifers. The dip and strike could not be determined because the Maanshan Mudstone sporadically cropped up under the thick terrace of the Quaternary limestone and the weathered Holocene soil. The other species of the new genus was recovered from two samples from the Tamoushan Mountain (21° 57' 47.50" N, 120° 45' 36.87" E; 21° 57' 49.41" N, 120° 45' 38.80" E).

Materials and Methods

Fifteen fossiliferous rock samples were collected for ostracod shells from the Aka Formation. Each of the dried rock samples (80g) was disaggregated using 5% hydrogen peroxide solution or naphtha and/or sodium sulphate solution for rock maceration (Maiya and Inoue, 1973), washed through a 235 mesh (63 μ m) sieve, and dried again. This procedure was repeated until the whole sediment sample had disaggregated. Two samples collected from the Maanshan Mudstone were oven dried and each of the dried rock samples (80g) was disaggregated using 5% hydrogen peroxide solution and washed through a 115 mesh (125 μ m) sieve and dried. Ostracod specimens were picked and identified under a stereoscopic microscope (Nikon SMZ-U) at 70 \times magnification. In order to investigate the details of the shell morphology a male right valve (Holotype) from the Aka Formation was immersed in glycerine, on a glass slide. The valve was drawn with the aid of a camera lucida mounted on a stereoscopic microscope (OLYMPUS BX41, Tokyo). All the illustrated specimens from the Aka Formation and the Maanshan Mudstone were mounted on stubs and then viewed using a HITACHI Microscope TM-1000 (Tokyo) scanning electron microscope under low vacuum with non-evaporation coating. All figured and illustrated specimens have been deposited the Gunma Museum of Natural History (GMNH-PI-number)

Systematic Palaeontology

The morphological terms follow the usage given by Scott (1961) and Athersuch *et al.* (1989). All illustrated specimens are deposited in the Gunma Museum of Natural History (GMNH-PI-3158-3164).

PODOCOPIDA Müller, 1894

PODOCOPINA Sars, 1866

CYTHEROIDEA Baird, 1850

TRACHYLEBERIDIDAE Sylvester-Bradley, 1948

IKKEYACYTHEREIS gen. nov.

Derivation of name. After the emeritus professor Noriyuki Ikeya (Shizuoka University, Japan), and the genus *Cythereis* by Jones (1848).

Type species. *Ikeyacythereis kumejimensis*

Known species. *Ikeyacythereis kumejimensis* sp. nov., *Ikeyacythereis wutzushuii* (Hu & Tao, 2008)

Occurrence. Known from the type locality, the Upper Pliocene

Aka Formation on the northeastern part of Kume-jima Island, Ryukyu Islands, Japan, the Pliocene Maanshan Mudstone of Heng-chun Peninsula, southern Taiwan, and the Plio-Pleistocene limestone in Kaohsiung City, southern Taiwan.

Diagnosis. As for the type species, *Ikeyacythereis kumejimensis* (see below).

Ikeyacythereis kumejimensis sp. nov.

Figure 2; Plate 1, figures 1-22

Gen. et sp. 1 of Tanaka and Nomura, 2009

Derivation of name. As for the type locality

Holotype. A male right valve (GMNH-PI-3158)

Dimensions. A male left valve (GMNH-PI-3159), Length = 0.526 mm, Height = 0.239 mm; a male right valve (GMNH-PI-3158), Length = 0.500 mm, Height = 0.239 mm, a female left valve (GMNH-PI-3160), Length = 0.497 mm, Height = 0.267 mm; a female right valve (GMNH-PI-3161), Length = 0.501 mm, Height = 0.263 mm.

Description. Valve subquadrate in lateral view (Pl. 1, figs. 1,2,11,12). Anterior margin protruding into ventral side with large curvature; dorsal margin straight sloping toward posterior; posterior margin truncated and caudated ventrally; ventral margin sinuate and concave at mid-ventral margin. Marginal denticles developed along anterior and posteroventral margins (Fig. 2A). Each tip of the marginal denticles with a marginal pore conuli. Subcentral tubercle absent. Eye tubercle prominent. Post-ocular and dorsomedian sulcus developed. U-shaped carina well developed: one carina, present at the posterior part of post-ocular sulcus, and the other subcentral, running parallel toward dorsoposterior area, and merging at dorsoposterior area forming a horseshoe shape. Wide sulcus developed behind the anterior and posterior marginal rim. Y-shaped carina developed behind anterior sulcus. In dorsal view, the carapace appears compressed both anteriorly and posteriorly. On dorsal surface of the carapace a V-shaped stout carina starts at anterior cardinal area, diverging towards posterior area (Pl. 1, figs. 5,6,15,16). In ventral view, marginal denticles developed along the anterior margin in left and right valves. In right valve, marginal denticles also developed along posteroventral margin (Pl. 1, figs. 7, 8, 17, 18). In posterior view, carapace wedge-shaped, and broadest at two third height from ventral (Pl. 1, figs. 9,10,19,20).

Strong sexual dimorphism. In lateral view male more elongate; in dorsal view the valves of female are more inflated than those of the male at central part (Pl. 1, figs. 5,6,15,16); in anterior view, pentagonal-shaped outline, most inflated at point near mid-height. Female more inflated than male (Pl. 1, figs.3,4,13,14).

Vestibule broad in anterior area (Fig. 2B). Radial pore canals are straight (some of them are bifurcated or trifurcated near the list of duplicature in anterior margin) and 41 in number in anterior and 10 at posterior (Fig. 2B). In several marginal pore canals three or four branches appear along the list (Fig. 2B, C). Selvage and list developed in anterior. Hinge holamphidont: in

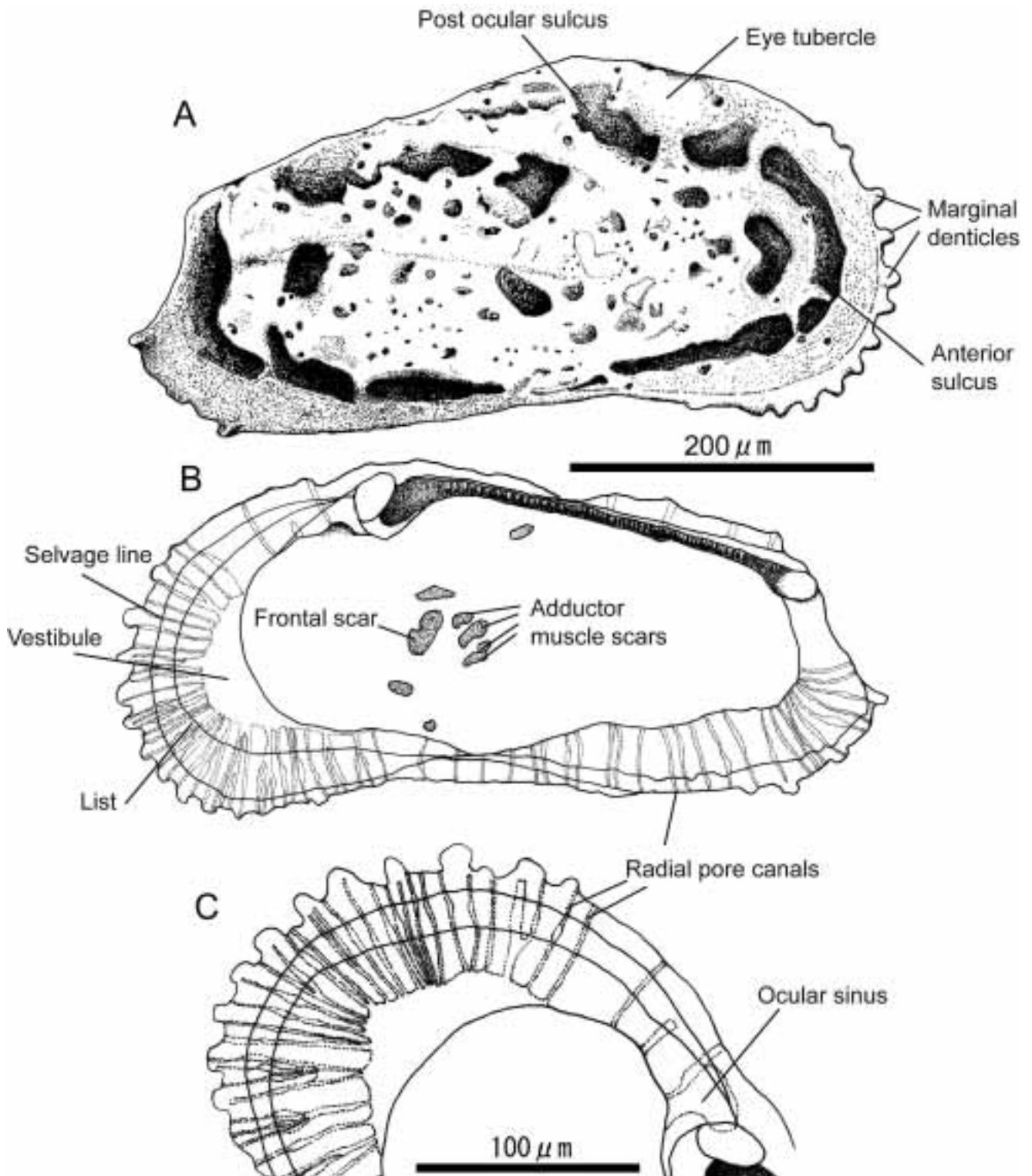


Fig. 2 Male right valve specimen (holotype: GMNH-PI-3158) of *Ikeyacythereis kumejimensis* gen. et. sp. nov. A: Outer lateral view. B: Inner lateral view under the transmitted optical microscope. C: Magnification of anterior area of B.

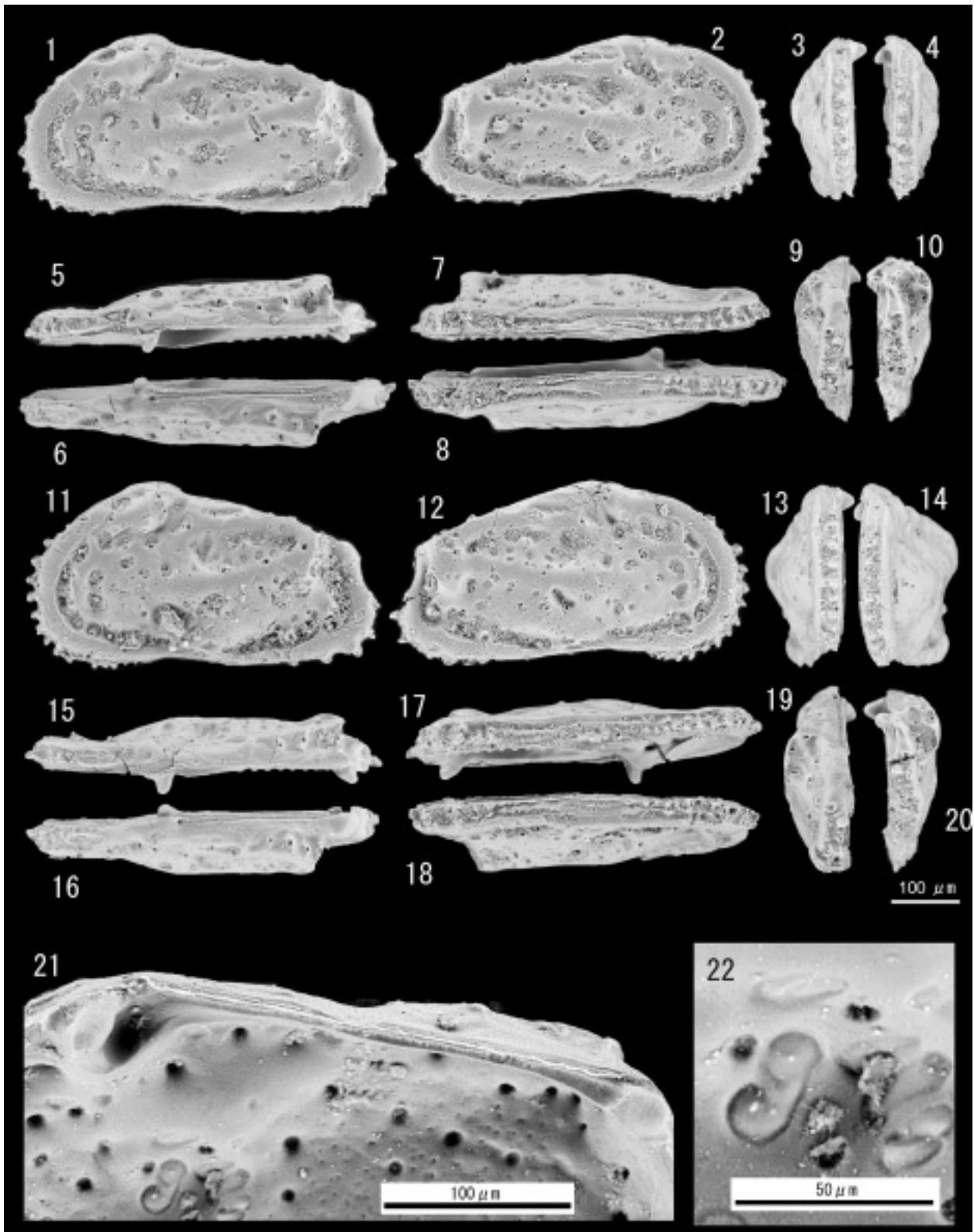


Plate 1 Electron microphotographs of the valves of *Ikeyacythereis kumejimensis* gen. et. sp. nov. 1,4,6,8,9: male, left valve (paratype: GMNH-PI-3159). 2,3,5,7,10,21,22: male, right valve (holotype: GMNH-PI-3158). 11,14,16,18,19: female, left valve (paratype: GMNH-PI-3160). 12,13,15,17,20: female, right valve (allotype: GMNH-PI-3161).

left valve, anterior hinge area has an auxiliary tooth in a large socket and a smooth tooth; interangular hinge area has dentate socket; posterior hinge area has quadrangular tooth. One J-shaped frontal scar. Four elliptical adductor; uppermost one is boomerang-shaped, second one is elongated, third and fourth ones are pear-shaped. Ocular sinus conspicuous (Fig. 2C).

Remarks. The Present genus somewhat resembles *Occultocythereis* Howe, 1951 in that it has a very small and compressed carapace, and a similar pattern of radial pore canal. However, *Ikeyacythereis* has an U-shaped carina developed at the dorsoposterior area, Y-shaped carina developed behind anterior sulcus and lacks subcentral tubercle. Hu and Tao (2008) described a new species *Orionina wutzushuii* from sediments of the Pliocene to the Recent of Taiwan. The genus *Orionina* is defined by having three longitudinal ridges of which the lower one divides into two branches in the anterior half which join again near the anterior margin (Van Den Bold, 1963). However, *O. wutzushuii* does not have such a ridge. Therefore, we consider *O. wutzushuii* as belonging to the new genus *Ikeyacythereis*. The genus *Ikeyacythereis* differs from the genus *Orionina* in having four elliptical adductor muscle scars (*Orionina* also has four elliptical scars, but the two middle ones are subdivided) and one J-shaped frontal scar (*Orionina* has three frontal scars) (Van Den Bold, 1963). *Ikeyacythereis wutzushuii* (Hu & Tao, 2008) also has four elliptical adductor muscle scars and a J-shaped frontal scar (Plate 2, figure 13).

The present species (*I. kumejimensis* sp. nov.) resembles *I. wutzushuii* (Hu & Tao, 2008) from the Pliocene Maanshan Mudstone, Taiwan, although the outline of the anterior margin of the new species protrudes more into ventral side with large curvature. *I. kumejimensis* sp. nov. also differs from *I. wutzushuii* (Hu & Tao, 2008) in the pattern of ornamentation on posterior area. Furthermore, the size of the valves of the *I. kumejimensis* sp. nov. is larger than that of the *I. wutzushuii* (Hu & Tao, 2008).

Ikeyacythereis wutzushuii (Hu & Tao, 2008)

Plate 2, figs. 1-13

Orionina wutzushuii Hu & Tao, 2008, p. 280, pl. 67, figs. 11, 18, pl. 154, figs. 4, 9, 13.

non *Orionina wutzushuii* Hu & Tao, 2008, pl. 210, fig. 14.

Topotypes. A male right valve (GMNH-PI-3162), A female right valve (GMNH-PI-3163), and a female carapace (GMNH-PI-3164). The holotype specimen has been deposited in the Palaeontological Museum, Nanjing (Nanjing Institute of Geology and Palaeontology) (NIPM-037743, a male carapace and a female right valve. Hu & Tao, 2008 did not specify the holotype and paratype specimens in the explanation of pl. 67, figs. 11, 18. Therefore, we could not ascertain which one of the specimens is the holotype or the paratype.)

Dimension. A male right valve (GMNH-PI-3162), Length = 0.465 mm, Height = 0.264 mm; a female carapace (GMNH-PI-3164), Length = 0.436 mm, Height = 0.248 mm, Width = 0.147 mm.

Description. Valve subquadrate in lateral view (Pl. 2, figs. 1,6,7). Anterior margin evenly round with small curvature; dorsal margin straight sloping toward posterior; posterior margin truncated and caudated ventrally; ventral margin sinuate and concave at mid-ventral margin. Marginal denticles developed along anterior margin and posteroventral margin (Pl. 2, figs. 1,2,4-5,6-11). Each tip of marginal denticle with pore conuli. Subcentral tubercle absent. Eye tubercle prominent. Post-ocular and dorsomedian sulcus developed. U-shaped carina well developed: one carina at the posterior part of post-ocular sulcus and the other at the subcentral part, running parallel toward dorsoposterior area and merged at dorsoposterior area with shape like a horseshoe. Wide sulcus developed behind the anterior and posterior marginal rim. Y-shaped carina developed behind anterior sulcus. In dorsal view, the carapace compressed anteriorly and posteriorly. On dorsal surface of carapace a V-shaped stout carina starts at anterior cardinal area and diverging toward posterior area (Pl. 2, fig. 9). In ventral view, marginal denticles developed along anterior margins in both left and right valves (Pl. 2, fig. 10). In anterior and posterior view, asymmetrical carapace outline: broadest at two third height from ventral in left valve, broadest at middle height in right valve in female carapace (Pl. 2, figs. 8,11).

Strong sexual dimorphism; in lateral view, male forms more elongate (Pl. 2, figs. 1,7).

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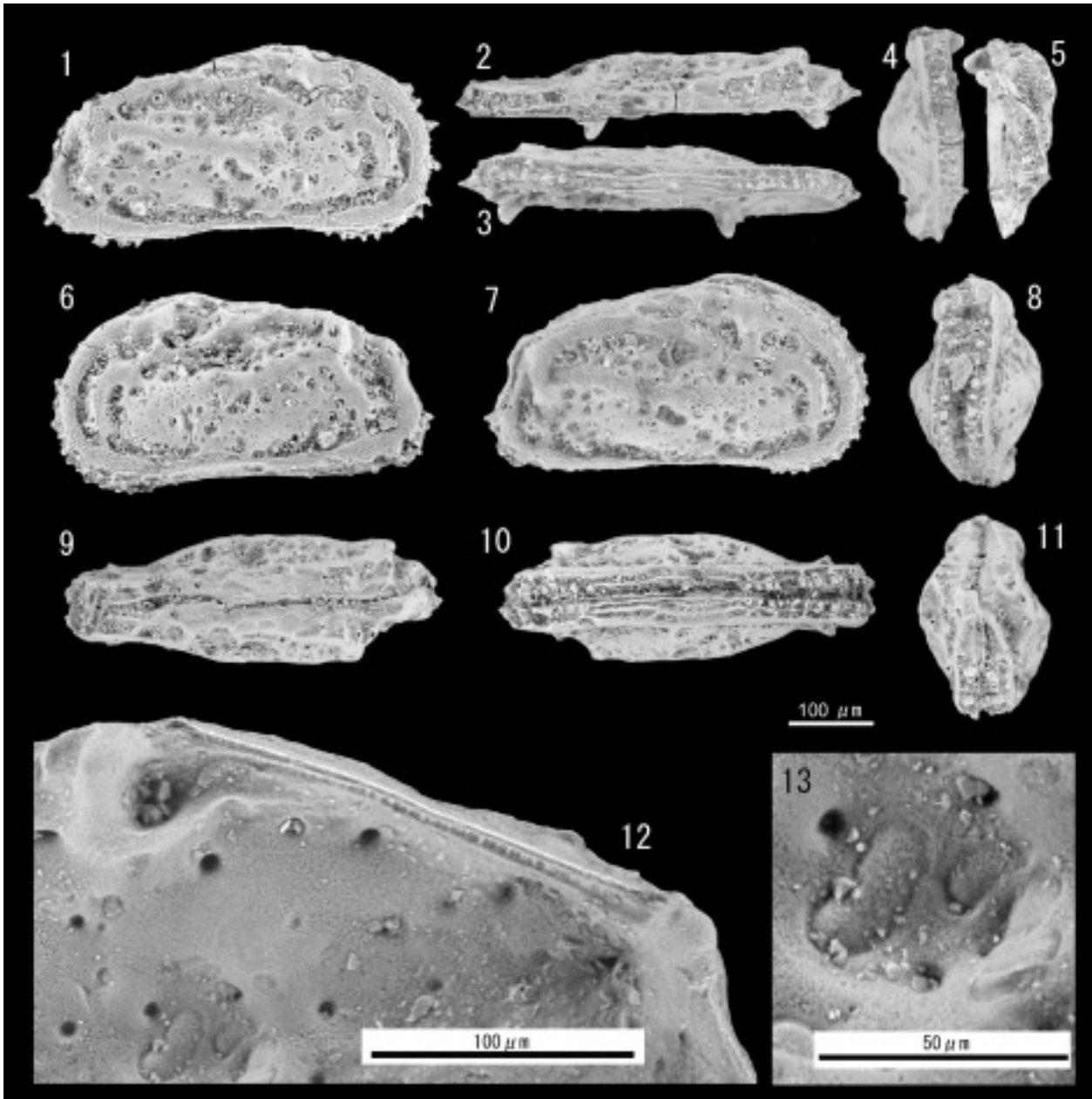


Plate 2 Electron microphotographs of the valves and carapace of *Ikeyacythereis wutzushui* (Hu & Tao, 2008). 1-5: male, right valve (topotype: GMNH-PI-3162). 6-11: female, carapace (topotype: GMNH-PI-3164). 12: scale up of the hingement of female right valve (topotype: GMNH-PI-3163). 13: zoomed part of the adductor muscle scars of female right valve (topotype: GMNH-PI-3163).

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沖縄県久米島の上部鮮新統阿嘉層から トラキレベリス科介形虫類の新属新種、 イケヤシセレイス クメジメンシスの記載

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要旨：沖縄県久米島の上部鮮新統阿嘉層から新属新種の介形虫類 *Ikeyacythereis kumejimensis* を記載する。本新属は放射状感覚孔のパタン，背後部に発達するU字型の梁，前部溝の背後に発達するY字型の梁，そして中央瘤を欠くことで特徴づけられる。これらの背甲の諸形質に基づくと，*Orionina wutzushuii* Hu & Tao, 2008 は本属に含まれることになる。本属は琉球列島および台湾の鮮新統以降の堆積物中から報告されている。

キーワード：介形虫，トラキレベリス科，新属，新種，分類学，阿嘉層，馬鞍山泥岩層