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**Decapod Crustaceans from the Miocene Mizunami Group, Central Japan**

**Part 2 Section Oxyrhyncha, Cancridea and Brachyrhyncha**

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Decapod Crustaceans from the Miocene Mizunami Group, Central Japan  
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Hiroaki Karasawa\*

瑞浪層群の中新世十脚甲殻類化石 その2  
尖頭群・イチョウガニ群・方頭群

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(要 旨)

瑞浪層群から、4種の尖頭群、5種のイチョウガニ群、21種の方頭群に属する化石を記載した。この内、*Cancer (Glebocarcinus) itoigawai*, *C. (G.) kaedei*, *C. (Cancer) tomowoi*, *Portunites minoensis*, *Parathranites shibatai*, *Charybdis quinquedentata*, *Tritodynamia globosa* は新種として記載した。新種 *Charybdis quinquedentata* のために新亜属 *Minohellenus* を設けた。

(Abstract)

A total of 31 species of 11 genera among 9 families of decapod crustaceans from the Miocene Mizunami Group, central Japan, is systematically described. Besides seven new species, *Cancer (Glebocarcinus) itoigawai*, *C. (G.) kaedei*, *C. (Cancer) tomowoi*, *Portunites minoensis*, *Parathranites shibatai*, *Charybdis quinquedentata* and *Tritodynamia globosa*, following species are recognized;

Majidae subfam. gen. et sp. indet.	<i>Carcinoplax antiqua</i> (Ristori)
<i>Tiarinia</i> ? sp. 1	<i>Paeduma</i> sp.
<i>T.</i> ? sp. 2	Xanthidae subfam. gen. et sp. indet. 1
Parthenopinae gen. et sp. indet.	Xanthidae subfam. gen. et sp. indet. 2
<i>Cancer (Glebocarcinus)</i> cfr. <i>itoigawai</i>	Xanthidae subfam. gen. et sp. indet. 3
<i>C.</i> sp.	Xanthidae subfam. gen. et sp. indet. 4
Portunidae subfam. gen. et sp. indet.	" <i>Ozius</i> " ? sp.
Portuninae gen. et sp. indet. 1	<i>Eriphia</i> ? sp.
Portuninae gen. et sp. indet. 2	" <i>Pilumnus</i> " ? sp.
<i>Scylla ozawai</i> Glaessner	Grapsidae subfam. gen. et sp. indet. 1
<i>S.</i> sp. 1	Grapsidae subfam. gen. et sp. indet. 2
<i>S.</i> sp. 2	Varuninae gen. et sp. indet.
A new species of the genus <i>Charybdis</i> is prepared for the new subgenus <i>Minohellenus</i> .	

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## Introduction

Karasawa (1989) described eight Thalassinoids, five Leucosoids and three Grapsoids of decapod crustacean fossils from the Miocene Mizunami Group, central Japan. As a result of the second study, three Majoids, one Parthenopoid, five Cancroids, eight Portunoids, nine Xanthoids, three Grapsidoids and one Pinnotheroid of brachyuran decapods which include one new subgenus and seven new species, are newly described. I apply the subgeneric classification of the genus *Cancer* which is established by Nations (1975) to fossil species in the present work. A total of 49 species distributed among 22 genera from the Early to early Middle Miocene Mizunami Group is classified and they are summarized in Table 1 in connection with the formations and the localities.

The described specimens are deposited at the Mizunami Fossil Museum.

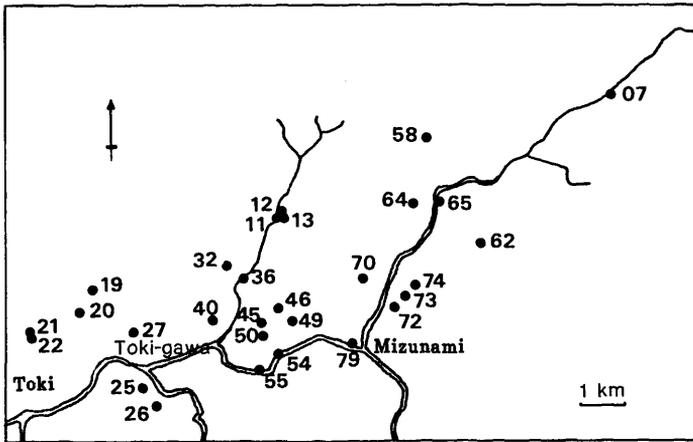


Fig. 1. Locality map of Mizunami area.

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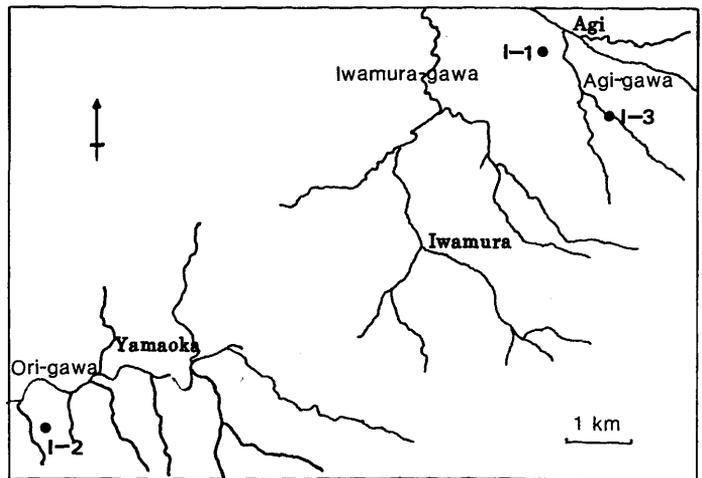


Fig. 2. Locality map of Iwamura area.

Table 1. List of decapod crustaceans from the Miocene Mizunami Group.

species	area	Mizunami basin																				Iwamura basin														
		Akeyo Formation										Oidawara Formation										Toysama Formation														
		Tsukiyoshi		Kujiri			Togari		Yamanouchi			Hazama	Shukunohora		Nataki					Oidawara	Maki	Ryodeni														
loc.	No.	32	36	70	21	19	20	40	27	46	79	25	45	46	49	50	54	55	58	11-13	07	26	62	64	65	72	73	74	49	1-11	2	1-3				
<i>Laurentiella imazumii</i> Karasawa		C																																		
<i>Laomedea praeatacina</i> Karasawa		R																																		
<i>Callinassa bona</i> Imazumi					C	C	C	F	C	R	R																									
<i>C. titaensis</i> Nagao																																				
<i>C. sp. 1</i>																																				
<i>C. sp. 2</i>																																				
<i>Upogebia mizunamiensis</i> Karasawa		C	F																																	
<i>U. sp.</i>																																				
<i>Tymolus ingens</i> Takeda and Tomida						R	R																													
<i>T. itoigawai</i> Takeda and Tomida																																				
<i>Calappa sp. 1</i>																																				
<i>C. sp. 2</i>																																				
<i>Paramursia circularis</i> Karasawa																																				
<i>Philyra nishimotoi</i> Karasawa					C				F																											
<i>P. plana</i> Karasawa																																				
Majoidea subfam. gen. et sp. indet.																																				
<i>Tiarinia</i> ? sp. 1																																				
<i>T. ? sp. 2</i>																																				
Parthenopinae gen. et sp. indet.																																				
<i>Cancer (Glebocarcinus) itoigawai</i> sp. nov.																																				
<i>C. (G.) sp. cfr. C. (G.) itoigawai</i>																																				
<i>C. (G.) kaedei</i> sp. nov.																																				
<i>C. (Cancer) tomowoi</i> sp. nov.						R	R	R	R	R																										
<i>C. sp.</i>																																				
Portunidae subfam. gen. et sp. indet.																																				
<i>Portunites minoensis</i> sp. nov.																																				
<i>Parathranites shibatai</i> sp. nov.																																				
Portuninae gen. et sp. indet. 1																																				
Portunidae gen. et sp. indet. 2																																				
<i>Scylla ozawai</i> Glaessner		R		R																																
<i>S. sp. 1</i>																																				
<i>S. sp. 2</i>																																				
<i>Charybdis (Minohellenus) quinquentata</i> sp. nov.																																				
<i>Carcinoplax antiqua</i> (Ristori)																																				
<i>Paeduma</i> sp.																																				
Xanthidae subfam. gen. et sp. indet. 1																																				
Xanthidae subfam. gen. et sp. indet. 2																																				
Xanthidae subfam. gen. et sp. indet. 3																																				
Xanthidae subfam. gen. et sp. indet. 4																																				
"Ozius" ? sp.																																				
"Eriphia" ? sp.																																				
"Pilmnus" ? sp.																																				
Grapsidae subfam. gen. et sp. indet. 1																																				
Grapsidae subfam. gen. et sp. indet. 2																																				
Varminae gen. et sp. indet.		R																																		
<i>Cyclograpsus directus</i> Karasawa																																				
<i>C. rectangularis</i> Karasawa																																				
<i>Miosesarma japonica</i> Karasawa		R	R																																	
<i>Tritodynamia globosa</i> sp. nov.																																				

C, Common ; F, Frequent ; R, Rare.

### Systematic descriptions

Superclass Crustacea  
 Class Malacostraca  
 Order Decapoda  
 Suborder Pleocyemata  
 Infraorder Brachyura  
 Section Oxyrhyncha Latreille, 1803  
 Superfamily Majoidea Samouelle, 1819  
 Family Majidae Samouelle, 1819

Majidae subfam. gen. et sp. indet.  
 (Pl. 1, Fig. 6)

*Materials*: One specimen (MFM9469).

*Description*: Fixed finger and palm of the left cheliped remain. Fixed finger elongate, gently curved upward and rounded in the cross section. Palm about four times as long as the fixed finger, long and rectangular; upper and lower margins smooth, and the upper margin armed with one conical spine proximally; outer and inner surfaces moderately convex and smooth.

*Remarks*: The specimen is closely related to the cheliped of the subfamily Acanthonychinae Alcock, Pisinae Alcock, Majinae Samouelle and Mithracinae Balss.

*Occurrence*: Oginoshima (Locality 07 of Itoigawa, 1980), Kamigiri, Kamado-cho, Mizunami City.....Shukunohora Facies.

*Measurements* (in mm) : Palm length 15.7; Palm width 7.3 (MFM9469).

Subfamily Mithracinae Balss, 1929  
 Genus *Tiarinia* Dana, 1852

*Tiarinia* ? sp. 1  
 (Pl. 1, Fig. 5)

*Materials*: One specimen (MFM9468).

*Description*: Right and posterior parts of the carapace lack. Dorsal surface of the carapace strongly ridged and covered with some tubercles which vary in size. Gastric region markedly convex; anterior part of the mesobranchial region in the middle line bearing one large conical tubercles; boundary between the proto- and mesogastric regions possessing 6 conical tubercles diminishing in size from the back forward, longitudinally. Branchial region strongly swollen, irregularly tuberculate; epibranchial region armed with two remarkable tubercles; marginal part of the mesobranchial region fringed with small tubercles. Rostrum broad and protruded anteriorly, but the apex lacks. Preorbital spine long, sharp and directed forward. Base of the postorbital spine remains but is obscure in

detail.

*Remarks:* This carapace specimen is ill-preserved but is allied to the carapace of the living species, *Tiarinia angusta* Dana in the ornamentation of the gastric region of the carapace.

In mode of life, the genus *Tiarinia* inhabits the rocky shores or coral reefs, between low and high tide marks, and is commonly distributed in Boso Peninsula southward.

*Occurrence:* Oginoshima (Locality 07 of Itoigawa, 1980), Kamigiri, Kamado-cho, Mizunami City.....Shukunohora Facies.

*Tiarinia* ? sp. 2

(Pl. 1, Fig. 15)

*Materials:* One specimen (MFM9467).

*Description:* The right branchial region of the carapace remains. Branchial region strongly ridged and covered with some tubercles which vary in size; anterior and central parts ornamented with large tubercles.

*Remarks:* The broken carapace is near to that of the living species, *Tiarinia cornigera* (Latreille).

*Occurrence:* Oginoshima (Locality 07 of Itoigawa, 1980), Kamigiri, Kamado-cho, Mizunami City.....Shukunohora Facies.

Superfamily Parthenopoidea MacLeay, 1838

Family Parthenopidae MacLeay, 1838

Subfamily Parthenopinae MacLeay, 1838

Parthenopinae gen. et sp. indet.

(Pl. 1, Figs. 1a-c)

*Materials:* One specimen (MFM9470).

*Description:* Imperfect dactylus of the right cheliped remains. Dactylus tapering distally and gently curved downward. Upper margin irregularly tuberculate and lower margin bearing broad teeth; upper part of the outer surface armed with two longitudinal rows of granulated ridge, and the granules increasing in size from the front backward.

*Remarks:* The dactylus may be identical with that of a species which belongs to the subfamily Parthenopinae.

*Occurrence:* Higashihora (Locality I - 2), Yamaoka-cho, Ena-gun.....Higashihora Member.

Section Cancridea Latreille, 1803

Superfamily Cancroidea Latreille, 1803

Family Cancridae Latreille, 1803

Genus *Cancer* Linnaeus, 1758

*Type species:* *Cancer pagurus* Linnaeus, 1758; Living species.

*Geologic range:* Miocene – Recent.

*Remarks:* Nations (1975) divided the genus *Cancer* into 4 subgenera by the characters of the carapace and the cheliped; namely, *Glebocarcinus*\* Nations, 1975 (type species: *Cancer oregonensis* Rathbun, 1898), *Romaleon* Gistel, 1848 (type species: *C. gibbosulus* Rathbun, 1898), *Metacarcinus* A. Milne Edwards, 1862 (type species: *Cancer magister* Dana, 1852), and *Cancer* Linnaeus, 1758 (type species: *Cancer pagurus* Linnaeus, 1758). The six named living species of *Cancer* around Japanese Sea are assigned to three subgenera except for *Metacarcinus* as follows;

Subgenus *Glebocarcinus*

*Cancer sakaii* Takeda and Miyake, 1972

*C. amphioetus* Rathbun, 1898

*C. tumifrons* Yokoya, 1933

Subgenus *Romaleon*

*C. gibbosulus* (De Haan, 1835)

*C. nadaensis* Sakai, 1969

Subgenus *Cancer*

*C. japonicus* Ortmann, 1893

Müller (1985) erected the new genus *Tasadia* with *Cancer carniolicus* Bittner, 1884 (including *Atelecyclops szontaghii* Lorenthey, 1929 as the synonym) from the Miocene in Europe as the type species. The diagnostic character of the new genus has a densely decorated carapace but the subgenus *Glebocarcinus* Nations also bears the same character. Therefore, the genus *Tasadia* can be synonymous with the subgenus *Glebocarcinus*. And *Cancer carniolicus* resembles the living species *C. oregonensis* and *C. sakaii*.

The following species of the genus *Cancer* have been reported from the Japanese Middle Miocene formations.

*Cancer sanbonsugii* Imaizumi, 1962; Odaira Formation.

*Cancer odosensis* Imaizumi, 1962; Odose Formation.

*Cancer? imamurae* Imaizumi, 1962; Higashibessho Formation and Asagaya Formation.

*C. ? imamurae* has a granulated carapace and is closely related to *C. carniolicus*. In addition, *C. itoigawai* sp. nov., *C. kaedei* sp. nov., *C. tomowoi* sp. nov. and *C. sp.* are newly described. According to definition of Nations (1975), when I adapts the subgenus to these species, *C. sanbonsugii*, *C. imamurae*, *C. itoigawai* sp. nov. and *C. kaedei* sp. nov. are arranged on the subgenus *Glebocarcinus*, *C. tomowoi* sp. nov. is included in the subgenus *Cancer*, and *C. odosensis* may be placed on the subgenus *Romaleon*. And it is difficult to apply the division to *C. sp.* because of the ill-preserved specimen.

Though Nations (1975) indicated the migration route of each of the subgenera and presumed that all of the subgenera had the origin in Northwestern Pacific Ocean, I doubt his opinion so far as the subgenus *Glebocarcinus* is concerned.

a. Fossil species of the subgenus *Glebocarcinus* in Europe and Japan appeared at the Early Miocene respectively, while that in Northwestern America had at the Middle

\* See addendum.

Miocene. Fossil records from Europe to Indo-West Pacific Area are older than one from Northwestern America.

b. There are 4 species from the Japanese Miocene formations and 3 living species around Japanese Sea. A number of species from the Japanese Miocene formations is more than the other areas.

c. *C. guezei* Crosnier was reported from Yuryak Seamount, Northwestern Pacific Ocean, and Madagascar, Southwest Indian Ocean (Sakai, 1980). *C. luzonensis* Sakai was recently discovered from the offshore of Luzon Island (Sakai, 1983). These species may be placed on the subgenus *Glebocarcinus*, based on Nation's definition.

Judging from these facts, it seems that the subgenus *Glebocarcinus* has the origin in Indo-West Pacific Ocean. As Nations (1975) suggested, the genus *Cancer* has a trend of increasing in size with reduction of the ornamentation, symbolized by the *Romaleon-Metacarcinus-Cancer* lineage. And the subgenus *Glebocarcinus* does not belong to the lineage. Probably, the genus *Cancer* derived phylogenetically from the genus *Labocarcinus* in Tethys Sea during Eocene to Oligocene and the subgenus *Glebocarcinus* appeared in Indo-West Pacific Ocean at the Early Miocene time.

Subgenus *Glebocarcinus*\* Nations, 1975

*Type species*: *Cancer oregonensis* Rathbun, 1898; Living species.

*Geologic range*: Miocene—Recent.

*Cancer* (*Glebocarcinus*) *itoigawai* sp. nov.

(Pl. 1, Fig. 10)

*Materials*: One specimen (MFM9025).

*Holotype*: MFM9025 (carapace).

*Type locality*: Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City, Gifu Prefecture.

*Formation*: Yamanouchi Member, Akeyo Formation, Mizunami Group (Early to early Middle Miocene).

*Diagnosis*: Carapace small size for the genus and transversely oval. Dorsal surface of the carapace vaulted and the regions well-defined. Protogastric, metagastric and cardiac regions moderately convex. Protogastric region ornamented with one large granule on the central part. Epibranchial region strongly elevated, tuberculate and subdivided into two by a shallow oblique groove. Mesobranchial region gently vaulted; anterior part of the mesobranchial region fringed with three irregular transverse tubercles below the furrow. Anterolateral border cut into 9 teeth; the first (= postorbital tooth) to third teeth low, obscure and broad; the third to ninth teeth triangular directed forward and laterally; the third, fifth and seventh notches deep. Posterolateral border granulate and bearing three notches anteriorly.

*Description of the holotype*: Carapace well-preserved. Carapace transversely oval, and the carapace length about three-fourths times as long as the width. Dorsal surface of the carapace moderately vaulted and the region well-defined. Frontal region subdivided into

\* See addendum.

two by a deep median groove. Protogastric region strongly convex, possessing one large granule on the central part and also subdivided into two by a longitudinal triangular mesogastric region which reaches the median furrow of the frontal region. Metagastric region transversely rectangular. Metagastric region separated from the mesogastric region by a shallow and narrow groove and from the cardiac region by an inconspicuous one. Cardiac region hexagonal and moderately vaulted and bearing very shallow median groove. Hepatic region gently swollen; furrow between the hepatic and branchial regions reaching to the third anterolateral tooth. Furrow separating the branchial region from the gastric and cardiac regions distinct. Epibranchial region strongly elevated, subdivided into two by a shallow oblique groove and covered with some conical tubercles. Mesobranchial region gently vaulted; furrow between the epi- and mesobranchial regions shallow; anterior part of the mesobranchial region fringed with three irregular transverse tubercles below the furrow. Metabranchial region longitudinal triangular, separated shallowly from the mesobranchial region. Intestinal region distinct. Front border about one-fourth times as long as the width, with 4 teeth including the supraorbital teeth but more details obscure. Orbit narrow. Anterolateral border extremely arched and cut into 9 teeth; the first (= postorbital tooth) to third teeth low, obscure and broad; the third one separated from the fourth one by a deep notch; the fourth and the fifth ones triangular, directed forward; boundary between the fifth and the sixth ones having a deep notch; the sixth and the seventh ones also triangular and directed forward; groove between the seventh and the eighth ones deep; the eighth and the ninth ones triangular and directed laterally. Posterolateral border convergent posteriorly, gently concave inward, granulate and bearing three notch anteriorly.

*Remarks:* The present new species is easily distinguished from *C. (G.) sanbonsugii* Imaizumi from the Miocene Odaira Formation, for the anterolateral border of the former is formed by the teeth united in some pairs, the broad first to third teeth and the sharp fourth to ninth teeth, while the anterolateral border of the latter is composed of 9 separated teeth. *C. (G.) itoigawai* is related to the living species, *C. (G.) amphioetus* Rathbun, however is different in following points. The carapace regions of the present species is well-defined, but they became more convex in *C. amphioetus*. The anterolateral border of *C. itoigawai* bears the broad first to third teeth.

This species is named in honor of Professor Junji Itoigawa of School of Science, Nagoya University.

*Occurrence:* Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City ..... Yamanouchi Member.

*Measurements* (in mm): Carapace length 15.3 ; Carapace width 20.5 (MFM9025, holotype).

Associated forms: Decapod crustaceans; -*Tymolus ingens* Takeda and Tomida, *Carcinoplax antiqua* (Ristori), *Miosesarma japonica* Karasawa. Pelecypods; -*Saccella meisensis* Araki, *Macoma izurensis* (Yokoyama), *Macoma optiva* (Yokoyama), *Lucinoma acutilineatum* (Conrad). Gastropods; -*Euspira meisensis* Makiyama, *Phos minoensis* Itoigawa, *Psephaea ? yanagidaniensis* (Araki). Elasmobranchs; -*Carcharhinus priscus* (Agassiz), *Rhinoptera* sp.

*Cancer (Glebocarcinus) sp. cfr. C. (G.) itoigawai*

(Pl. 1, Figs. 11, 12)

*Materials*: 3 specimens (MFM9372-9374).

*Description*: Carapace ill-preserved. Carapace transversely oval, and the carapace length about three-fourths times as long as the width. Dorsal surface of the carapace moderately convex and the regions well-defined. Protogastric and mesogastric regions moderately swollen. Metagastric region rectangular and separated from the mesogastric, branchial and cardiac regions by a shallow groove. Cardiac region vaulted and hexagonal. Branchial region also convex; epibranchial region irregularly tuberculate. The detail of front-orbital border obscure. Anterolateral border with 9 teeth; the first to third teeth broad and the fourth to ninth ones triangular directed forward.

*Remarks*: This species is similar to *C. itoigawai*, in its size, the carapace ornamentation and the character of the anterolateral border. However, this species differs from *C. itoigawai* because the dorsal surface of the carapace is covered with fine granules but imperfect preservation prevents a more confident identification.

*Occurrence*: Oginoshima (Locality 07 of Itoigawa, 1980), Kamigiri, Kamado-cho, Mizunami City ..... Shukunohora Facies.

*Measurements* (in mm):

	MFM9372	MFM9373
Carapace length	19.6	18.3
Carapace width	27.0+	25.5

*Cancer (Glebocarcinus) kaedei sp. nov.*

(Pl. 1, Figs. 4a-c, 7a, b, 13, 14)

*Materials*: 5 specimens (MFM9026-9029, 9340).

*Holotype*: MFM9026 (carapace).

*Paratype*-(1): MFM9027 (cast of carapace).

*Paratype*-(2): MFM9028 (right cheliped).

*Paratype*-(3): MFM9029 (left cheliped).

*Type locality*: Matsugase (Locality 54 of Itoigawa, 1980), Togari, Akeyo-cho, Mizunami City, Gifu Prefecture.

*Formation*: Yamanouchi Member, Akeyo Formation, Mizunami Group (Early to early Middle Miocene).

*Diagnosis*: Carapace small size for the genus and transversely oval. Dorsal surface of the carapace strongly elevated and the sculptures of the carapace very deep. Mesogastric, protogastric, cardiac and epibranchial regions strongly vaulted. Metagastric region covered with small granules which vary in size. Cardiac region armed with two large conical granules. Hepatic region ornamented with one remarkable granule. Epibranchial region irregularly tuberculate. Mesobranchial region possessing two granulated tubercles. Front border cut into 5 teeth including the supraorbital teeth; a median tooth small; a pair of the

second teeth acute triangular; a pair of the third also triangular but larger than one of the second. Orbital border inconspicuous and the supraorbital fissure deep. Anterolateral border strongly arched and being beset in 9 teeth which are spisoform and acute triangular. Posterolateral border fringed with 3 small spine anteriorly. Palm of the cheliped very short; outer surface with 6 longitudinal carinae; the first consisting of three distinctly separated coarse spines; the second and the third ornamented with three coarse granulated tubercles; the fourth to sixth carinae composed of many small granules. Outer surface of the carpus with 4 longitudinal carinae consisting of tubercles.

*Description of the holotype:* Posterior part of the carapace lacks. Carapace transversely oval, and the carapace length about four-fifths times as long as the width. Dorsal surface of the carapace strongly elevated and the sculptures of the carapace very deep. Mesogastric region transversely ridged. Protogastric region strongly elevated and divided into two by the mesogastric region. Metagastric, cardiac and intestinal regions lack and their characters obscure. Hepatic region armed with one remarkable granule. Epibranchial region vaulted, irregularly tuberculate. Mesobranchial region ornamented with one granulose tubercle. Front border narrow and cut into 5 teeth including the supraorbital teeth; a median tooth small; a pair of the second teeth of both side acute triangular; a pair of the third larger than one of the second and broad triangular. Orbital border inconspicuous and the outer supraorbital fissure deep. Anterolateral border strongly arched and cut into 9 teeth; their teeth spisoform and acute triangular. Posterolateral border fringed with 3 small spine anteriorly.

*Description of the paratype-(1):* Cast of the outer surface of the holotype specimen. Characters of metagastric, cardiac and mesobranchial regions which are indistinct in the holotype specimen, remain. Metagastric region covered with small granules which vary in size. Cardiac region well separated from the gastric and branchial regions, strongly convex and armed with two large conical granules. Mesobranchial region ornamented with two small granules.

*Description of the paratype-(2):* Palm and carpus of the right cheliped show the outer surface. Palm very short and about three-fourths times as long as the broad; outer surface with 6 longitudinal carinae; the first (= upper margin) consisting of three distinctly separated coarse spines; the second and the third ornamented with three coarse granulated tubercles; the fourth to sixth carinae of a row of many small granules diminishing in size downward; lower margin smooth. Carpus about four-fifths times as long as the palm, triangular and tapering distally; outer surface with 4 longitudinal carinae; carinae consisting of tubercles and the first and the second carinae possessing spines distally.

*Description of the paratype-(3):* Palm and carpus of the left cheliped remain. Left cheliped slightly longer than the right one and the ornamentation of the outer surface similar to one of the right. Outer surface of palm with 3 carinae. Inner surface of the palm smooth.

*Remarks:* The present new species differs from *C. (G.) imamurae* Imaizumi from the Miocene Higashibescho Formation in having the dorsal surface of the carapace strongly elevated and is covered sparsely with granules. The present species is allied to the living

Japanese species, *C. (G.) sakaii* Miyake and Takeda, while it is distinguishable from *C. sakaii*, for *C. sakaii* is the densely decorated carapace.

This species is named after Mr. Tatsuya Kaede who collected the type specimen.

*Occurrence*: Matsugase (Locality 54 of Itoigawa, 1980), Togari, Akeyo-cho, Mizunami City; Bogahora (Locality 50 of Itoigawa, 1980).....Yamanouchi Member.

*Measurements* (in mm):

	MFM9026 (holotype)	MFM9028 (paratype-2)	MFM9029 (paratype-3)
Carapace length	16.1	—	—
Carapace width	21.6	—	—
Palm length	—	11.3	12.7
Palm width	—	10.2	11.1
Carpus length	—	8.4	8.3
Carpus width	—	7.2	7.1

*Associated forms* (at the type locality): Decapod crustaceans;-*Scylla* sp. Pelecypods;-*Saccella miensis* Araki, *Patinopecten egregius* (Itoigawa), *Cyclocardia siogamensis* (Nomura), *Lucinoma acutilineatum* (Conrad). Gastropods;-*Phos minoensis* Itoigawa, *Euspira meisensis* Makiyama, *Ancistrolepis togariensis* Naruse. Elasmobranchs;-*Carcharhinus acanthodon* (Le Hon), *C. priscus* (Agassiz), *Rhinoptera* sp.

Subgenus *Cancer* Linnaeus, 1758

*Type species*: *Cancer pagurus* Linnaeus, 1758; Living species.

*Geologic range*: Miocene—Recent.

*Cancer (Cancer) tomowoi* sp. nov.

(Pl. 1, Figs. 2a-d, 3a-d, 8, 16a, b)

*Materials*: 74 specimens (MFM9022-9024, 9341, 9342-1-10, 9343-1-4, 9344-1-12, 9345-1-20, 9346, 9347, 9348-1-15, 9349-1-5, 9493, 9495).

*Holotype*: MFM9022 (right cheliped and thoracic sterna).

*Paratype-1*: MFM9023 (dactylus).

*Paratype-2*: MFM9024 (fixed finger).

*Type Locality*: Higashihora (Locality I -2), Yamaoka-cho, Ena-gun, Gifu Prefecture.

*Formation*: Higashihora Member, Toyama Formation, Mizunami Group (Early to early Middle Miocene).

*Diagnosis*: Dactylus rounded in the cross section; upper margin covered with granules diminishing in size from the back forward, in the proximal half. Lower margin bearing 4 granulated teeth. Fixed finger triangular; Upper margin with 5 granulated teeth; Outer and inner surfaces possessing granulated median and lower ridges, separated by a shallow groove. Outer surface of the palm with 6 longitudinal carinae and covered with granules which vary in size, especially, ornamented with coarse meshy granules in the upper half; the first carina marked by 3 large sharp granulated tubercles; the second to fourth carinae

formed by densely coarse granules; the fifth and sixth carinae composed of fine granules. Outer surface of the carpus ornamented with coarse reticulated granules; distal part of the outer surface possessing three granulated tubercles.

*Description of the holotype:* Dactylus strongly curved downward and tapering from the broad base to the sharp apex; upper margin rounded and covered with granules which increase in size from the front backward, in the proximal half. Fixed finger tapering distally and triangular; upper margin of the cutting edge obscure; lower margin smooth; lower part of the inner surface possessing a shallow longitudinal groove. Palm about 1.6 times as long as the dactylus, about 1.2 times as long as the broad, rectangular and convergent proximally; outer surface with 6 longitudinal carinae and covered with granules which vary in size, especially, ornamented with coarse meshy granules in the upper half; the first carina (= upper margin) marked by 3 large sharp granulated tubercles; the second to fourth carinae formed by densely coarse granules; the fifth and the sixth carinae composed of fine granules; inner surface covered with very fine reticulated granules. Carpus about three-fourths times as long as the palm and tapering proximally; outer surface ornamented with coarse meshy granules; distal part of the outer surface possessing three granulated tubercles; that of the inner angle sharp and large; that of the outer angle conspicuous; that of the upper articulation obscure. Remaining thoracic sterna narrow and covered with fine granules.

*Description of the paratype-(1):* Dactylus sharp, moderately curved downward and rounded in the cross section. The base of the upper margin covered with small granules and the granules diminishing in size from the back forward. Lower margin bearing 4 granulated teeth. Upper margin and the upper part of the outer surface and the middle part of the inner surface ornamented with a row of small holes longitudinally.

*Description of the paratype-(2):* Fixed finger triangular and the sharp apex gently curved upward. Upper margin with 5 granulated teeth; 3 teeth in the distal half large and 2 ones in the proximal half small. Outer surface possessing granulated median and lower ridges, separated by a shallow groove. Median and lower ridges of the inner surface more rising than ones of the outer surface, separated by a deep groove.

*Remarks:* The present new species is different from *C. sanbonsugii*, *C. imamurae* and *C. kaedei* included in the subgenus *Glebocarcinus*, for the palm of the present species is covered with meshy granules. *C. tomowoi* is similar to the Pleistocene-Recent Northeastern Pacific species, *C. productus* Randell, the Pliocene-Pleistocene West American species, *C. chaneyi* Nations and the living Japanese species, *C. japonicus* Ortman in the same subgenus *Cancer*. The present species is near to *C. productus* and *C. chaneyi* than to *C. japonicus* because of the palm covered with reticulated granules. But it differs from *C. productus* in having the palm which bears three granulated spine on the upper margin, and from *C. chaneyi* by the dactylus ornamented with small granules on the upper margin, and the palm and carpus covered with meshy granules.

This species name is dedicated to Dr. Tomowo Ozawa of School of Science, Nagoya University.

*Occurrence:* Higashihora (Locality I -2), Yamaoka-cho, Ena-gun ..... Higashihora

Member. Nanamagari (Locality 19 of Itoigawa, 1980), Jorinji, Izumi-machi, Toki City; Inkyoyama (Locality 22 of Itoigawa, 1980), Kujiri, Izumi-machi, Toki City; Anabora (Locality 40 of Itoigawa, 1980), Kawai, Izumi-machi, Toki City; Obora (Locality 27 of Itoigawa, 1980), Kawai, Izumi-machi, Toki City..... Kujiri Facies. Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City..... Yamanouchi Member. Akatsukibora (Localities 11 to 13 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City. Nakahida (Locality 26 of Itoigawa, 1980), Hida-cho, Toki City; Okuna (Locality 62 of Itoigawa, 1980), Toki-cho, Mizunami City; Dan (Locality 64 of Itoigawa, 1980), Toki-cho, Mizunami City..... Nataka Member.

*Measurements* (in mm):

	MFM9022 (holotype)	MFM9023 (paratype-1)	MFM9024 (paratype-2)
Dactylus length	20.5	8.7	—
Dactylus width	8.1	3.9	—
Fixed finger length	15.6	—	4.2
Fixed finger width	9.3	—	3.4
Palm length	34.3	—	—
Palm width	23.7	—	—
Carpus length	25.1	—	—
Carpus width	18.9	—	—

*Associated forms* (at the type locality): Decapod crustaceans;- *Upogebia* sp., *Miosesarma japonica* Karasawa, *Philyra nishimotoi* Karasawa. Pelecypods;- *Saccella miensis* (Araki), *Cyclocardia siogamensis* (Nomura), *Chlamys iwamurensis* Itoigawa. Gastropods;- *Euspira meisensis* Makiyama, *Tachyrhynchus yamaokaensis* Itoigawa and Shibata. Brachiopods;- *Terebratalia radiata* Hatai.

*Cancer* sp.

(Pl. 1, Fig. 9)

*Materials*: One specimen (MFM9375).

*Description*: Palm of the right cheliped ill-preserved. Outer surface ornamented with 6 longitudinal carinae; the carinae formed by coarse tubercles. Lower part of the outer surface covered with fine granules.

*Remarks*: This species is clearly distinguished from the former species *C. tomowoi*, for the palm of this species is not covered with reticulated granules. It is alien to *C. kaedei* in having the lower part of the palm ornamented with fine granules.

*Occurrence*: Oginoshima (Locality 07 of Itoigawa, 1980), Kamigiri, Kamado-cho, Mizunami City..... Shukunohora Facies.

*Measurements* (in mm): Palm length 20.5; Palm width 14.2 (MFM9347).

Section Brachyrhyncha Borradaile, 1907  
 Superfamily Portunoidea Rafinesque, 1815  
 Family Portunidae Rafinesque, 1815

Portunidae subfam. gen. et sp. indet.  
 (Pl. 6, Figs. 1a, b)

*Materials*: 32 specimens (MFM9494-1-32).

*Description*: Dactylus small, elongate, tapering from the broad base to the sharp apex and gently curved downward. Upper margin smooth. Lower margin irregularly denticulate, possessing large teeth on the middle part and the base. Upper part of the outer surface and the middle part of the inner surface having a row of small holes.

*Remarks*: This species based on the dactylus differs from Portuninae gen. et sp. indet. 2 in having small dactylus which bears no conical teeth on the lower margin.

*Occurrence*: Okuna (Locality 62 of Itoigawa, 1980), Toki-cho, Mizunami City………  
 Nataki Member.

Subfamily Carcininae MacLeay, 1838  
 Genus *Portunites* Bell, 1858

*Type species*: *Portunites incertus* Bell, 1858; Eocene species.

*Geologic range*: Eocene—Miocene.

*Portunites minoensis* sp. nov.  
 (Pl. 2, Figs. 1a, b, 3-5)

*Materials*: Three specimens (MFM9035-9037).

*Holotype*: MFM9035 (carapace).

*Paratype*-(1): MFM9036 (carapace).

*Paratype*-(2): MFM9037 (carapace and cheliped).

*Type locality*: Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City, Gifu Prefecture.

*Formation*: Yamanouchi Member, Akeyo Formation, Mizunami Group (Early to early Middle Miocene).

*Diagnosis*: Carapace hexagonal in the outline. Dorsal surface of the carapace slightly convex, covered with fine granules, and the regions well-defined. Boundary between the frontal and protogastric regions moderately ridged. Cervical groove discernible. Branchio-cardiac furrow distinct anteriorly. Branchial region more convex in the dorsal surface; branchial lobe well-defined; moderately ridge running from the epibranchial spine to the branchial lobe. Front border narrow and cut into 2 small sharp teeth except for supraorbital teeth. Anterolateral border gently convex outward and cut into 5 teeth; the first (postorbital tooth) to fourth teeth which increase in size from the front backward, triangular and directed forward; the fifth one small protruded laterally.

*Description of the holotype:* Carapace absent in the anterior and right marginal parts. Carapace hexagonal in the outline. Dorsal surface of the carapace slightly convex, covered with fine granules, and the regions well-defined. Proto-, meso- and metagastric regions gently swollen; boundary between the frontal and protogastric regions moderately ridged; furrow between the proto- and mesogastric regions distinct; urogastric region discernible. Cervical groove conspicuous and deep, becoming shallower anteriorly. Branchio-cardiac furrow indistinct posteriorly. Branchial region more convex in the dorsal surface of the carapace; branchial lobe well-defined; moderately ridge running from the epibranchial spine to the branchial lobe. Front border narrow about one-fifth times as long as the width; the teeth of the front border indistinct in the preservation. Orbital border also narrow and rounded. Anterolateral border gently convex and cut into 5 teeth; the details of the first to fourth teeth obscure; the fifth one small and triangular and protruded laterally. Posterolateral border about 1.5 times as long as the anterolateral border, nearly straight and convergent posteriorly.

*Description of the paratype-(1):* Carapace smaller than the holotype and the ornamentation of the carapace similar to one of the holotype. Anterolateral border formed by 5 teeth: the first (postorbital tooth) and the second teeth small, triangular and directed forward; the third and the fourth ones large, broad, triangular and directed forward; the fifth teeth protruded laterally.

*Description of the paratype-(2):* Carapace larger than one of the holotype. Anterior half of the carapace remains. Front border narrow cut into 2 small acute triangular teeth, but the supraorbital teeth lack. Anterolateral border only cut into two small triangular teeth directed forward. Fixed finger and dactylus of the left cheliped show the outer surface. Dactylus sharp, slender and slightly curved downward; upper margin smooth and lower margin irregularly denticulate; upper and middle parts bearing longitudinal grooves with small holes. Fixed finger triangular and tapering from the broad base to the sharp apex; upper margin armed with 9 small irregular teeth and lower margin smooth; longitudinal groove running on the upper and middle parts.

*Remarks:* The present new species is clearly distinguished from the Eocene species, *Portunites incerta* Bell, 1858, *P. triangulum* Rathbun, 1928, *P. grancifer* Glaessner, 1960 and *P. hexagonalis* Nagao, 1941, for the present species has the carapace which bears no long epibranchial spine and is ornamented with some tubercles. From the Eocene species, *P. alaskaensis* Rathbun, 1928 and *P. subovata* Quayle and Collins, 1981, *P. minoensis* differs in having the anterolateral border cut into 5 teeth. The present species is closely resemble to the Eocene species, *P. insculpta* Rathbun, 1928 and *P. sylviae* Quayle and Collins, 1981, but the carapace of the former has no long epibranchial spine, while the carapaces of the two Eocene species are developed strong ridges on the branchial regions and have cardiac regions well defined. Though one Miocene species, *Portunites kuhni* Bachmayer, 1953 has been described from Austria, the species has the dorsal surface of the carapace covered with transverse and setose ridges, and it belongs to the genus *Liocarcinus* Stimpson, 1871.

On ornamentation of the carapace, the present species is allied to the living species, *Carcinus maenas* Leach, 1814, but the front border of the former is cut into 4 teeth and that

of the latter is composed of 3 lobes.

*Occurrence:* Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City  
.....Yamanouchi Member.

*Measurements* (in mm):

	MFM9035 (holotype)	MFM9036 (paratype-1)	MFM9037 (paratype-2)
Carapace length	22.1	14.6+	14.7+
Carapace width	22.0+	21.3	34.3+
Dactylus length	—	—	10.8

*Associated forms:* Decapod crustaceans;- *Tymolus ingens* Takeda and Tomida, *Carcinoplax antiqua* (Ristori), *Miosesarma japonica* Karasawa. Pelecypods;- *Saccella miensis* Araki, *Macoma izurensis* (Yokoyama), *Macoma optiva* (Yokoyama), *Lucinoma acutilineatum* (Conrad). Gastropods;- *Euspira meisensis* Makiyama, *Phos minoensis* Itoigawa, *Psephaea? yanagidaensis* (Araki). Elasmobranchs;- *Carcharhinus priscus* (Agassiz), *Rhinoptera* sp.

Subfamily Polybiinae Ortmann, 1893

Genus *Parathranites* Miers, 1886

*Type species:* *Parathranites orientalis* Miers, 1886; Living species.

*Geologic range:* Miocene—Recent.

*Parathranites shibatai* sp. nov.

(Pl. 6, Figs. 5, 6)

*Materials:* 2 specimens (MFM9032, 9041).

*Holotype:* MFM9032 (carapace and left cheliped).

*Type locality:* Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City, Gifu Prefecture.

*Formation:* Yamanouchi Member, Akeyo Formation, Mizunami Group (Early to early Middle Miocene).

*Diagnosis:* A species of *Parathranites* characterized by having the dorsal surface of the carapace which covered with some tubercles and prominences including two tubercles on the protogastric region, two close tubercles on the mesogastric region, two prominences on the cardiac region, one well definite tubercle on the branchial lobe, and one prominence on the mesobranchial region below the branchial lobe.

*Description of the holotype:* Carapace well-preserved, except for marginal part anteriorly. Carapace hexagonal in the outline. Dorsal surface of the carapace gently convex and the regions with some tubercles and prominences, poorly defined. Protogastric region gently vaulted and covered with two tubercles. Mesogastric region with two close tubercles, also gently vaulted and longitudinal triangular. Furrow between the meso- and metagastric regions conspicuous; metagastric region rectangular and nearly flat. Cervical groove distinct, becoming broader and shallower toward the lateral margin. Cardiac region gently

convex and armed with two prominences posteriorly. Branchio-cardiac furrow discernible. Branchial region transversely vaulted. Boundary between the epi- and mesobranchial regions moderately ridged; branchial lobe with a well definite tubercle; mesobranchial region bearing one prominence below the branchial lobe. Front border about one-fifth times as long as the width and cut into 4 acute triangular teeth including the supraorbital teeth. Orbital border wide and rounded and the postorbital teeth sharp. Details of the anterolateral border obscure. Left cheliped shows the inner surface. Dactylus and fixed finger sharp, elongate and tapering distally. Occulusal margins irregularly denticulate. Lower part of the fixed finger possessing a longitudinal groove. Palm slightly shorter than the dactylus, about 1.2 times as long as the broad and convergent distally; upper margin armed with sharp spines at the proximal and distal parts.

*Remarks:* A fossil species of the genus *Parathranites* is the first record from the Japanese Miocene formations. The present new species is closely related to the living Indo-West Pacific species, *P. orientalis* Miers, but is different in following points. There are two close tubercles on the mesogastric region. The Mesobranchial region near the metagastric region bears three tubercles. There are no longitudinal row of tubercles on the metabranchial region along the cardiac region.

The present species is similar to *Portunites triangulum* Rathbun, 1928, from the Oligocene in Washington and Oregon, America, in the carapace ornamentation but the epibranchial spine of the carapace of *P. triangulum* is long and strongly protruded laterally. However, on the ornamentation of carapace, the phylogenetic relationship may exist between the genus *Portunites* and the genus *Parathranites*.

In the mode of life, *Parathranites orientalis* inhabits in 80 to 230 m deep of the bottoms of sands, pebbles or shell fragments in the tropical to subtropical sea.

This species is named in honor of Professor Hiroshi Shibata of College of General Education, Nagoya University.

*Occurrence:* Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City; Asano (Locality 25 of Itoigawa, 1980), Tokitsu-cho, Toki City.....Yamanouchi Member.

*Measurements* (in mm):

	MFM9033 (holotype)	MFM9348
Carapace length	26.7	17.7
Carapace width	29.9+	21.2
Dactylus length	10.5	—
Palm length	9.2	—
Palm width	7.3	—

*Associated forms:* Decapod crustaceans;- *Tymolus ingens* Takeda and Tomida, *Carcinoplax antiqua* (Ristori), *Miosesarma japonica* Karasawa. Pelecypods;- *Saccella miensis* Araki, *Macoma izurensis* (Yokoyama), *Macoma optiva* (Yokoyama), *Lucinoma acutilineatum* (Conrad). Gastropods;- *Euspira meisensis* Makiyama, *Phos minoensis* Itoigawa, *Psephaea? yanagidaniensis* (Araki). Elasmobranchs;- *Carcharhinus priscus* (Agassiz), *Rhinoptera* sp.

## Subfamily Portuninae Rafinesque, 1815

## Portuninae gen. et sp. indet. 1

(Pl. 6, Figs. 3, 4)

*Materials*: 13 specimens (MFM9462, 9463, 9464, 9465-1-10).*Description*: Fragments of the fixed finger. Upper margin bearing irregular triangular teeth. Outer surface possessing longitudinal grooves with small holes on the upper and middle parts. Inner surface also having longitudinal grooves on the upper and middle parts.*Remarks*: It is difficult to decide with the genus, because of the imperfect fixed finger. These specimen are similar to the dactylus of the genera, *Charybdis* or *Thalamita*, considering to have the upper margin bearing irregular triangular teeth.*Occurrence*: Oginoshima (Locality 07 of Itoigawa, 1980), Kamigiri, Kamado-cho, Mizunami City.....Shukunohora Facies. Okuna (Locality 62 of Itoigawa, 1980), Toki-cho, Mizunami City; Dan (Locality 64 of Itoigawa, 1980), Toki-cho, Mizunami City; Sakurado (Locality 74 of Itoigawa, 1980), Toki-cho, Mizunami City.....Nataki Member. Higashihora (Locality 1-2), Yamaoka-cho, Ena-gun.....Higashihora Member.

## Portuninae gen. et sp. indet. 2

(Pl. 6, Figs. 2a-c)

*Materials*: 10 specimens (MFM9446-1-10).*Description*: Lower margin of the broken dactylus composed of irregular broad teeth, with large conical tooth at the base.*Remarks*: Though these specimens resemble the dactylus of the genera, *Scylla*, *Portunus*, *Charybdis* and *Thalamita*, further discussion is difficult.*Occurrence*: Okuna (Locality 64 of Itoigawa, 1980), Toki-cho, Mizunami City.....Nataki Member.Genus *Scylla* De Haan, 1833*Type species*: *Cancer serratus* Forskal, 1775; Living species.*Geologic range*: Eocene? – Recent.*Scylla ozawai* Glaessner, 1933

(Pl. 2, Figs. 6, 7; Pl. 3, Figs. 1a, b)

1933 *Scylla ozawai* Glaessner, p. 20, pl. 4, fig. 2.1938 *Scylla miocenica* Inagaki, p. 1, pl. 3, figs. 1, 2.1985 *Scylla* cfr. *ozawai* Glaessner: Tomida, p. 60.1986 *Scylla ozawai* Glaessner: Fujiyama et al., p. 370, fig. 1833.*Materials*: Two specimens (MFM9388, 9389).*Description*: Carapace well-preserved. Carapace transversely oval, and the carapace

length about three-fourths times as long as the width. Dorsal surface of the carapace covered with microscopical granules, slightly swollen, smooth and the regions poorly defined. Metagastric region separated from the mesobranchial region by a shallow groove, and from the cardiac and branchial regions by deep grooves, relatively. A transverse fine granulated ridge running from the branchial lobe to the epibranchial spine on the branchial region. Front border about one-fifth times as long as the width and cut into 4 blunt teeth and the sharp acute triangular supraorbital teeth. Anterolateral margin formed by 9 sharp and triangular teeth; the first to eighth teeth directed forward and the ninth teeth directed laterally and forward. All of the fused first to fourth, and the fifth to eighth sterna separated from them by shallow grooves. Abdomen broad, triangular, and consisting of 3 somites. Dactylus of the cheliped slender, sharp and gently curved downward; upper margin smooth; lower margin irregularly denticulate bearing 8 teeth; 3 teeth in the distal half small and triangular, the following one back tooth large and triangular, 3 teeth from the middle part to the base small and triangular, and the base very large and rounded. Outer surface possessing two longitudinal grooves on the upper and the middle parts. Fixed finger elongate, tapering from the broad base to the sharp apex; upper margin with irregular coarse teeth; lower margin smooth; a longitudinal groove running the middle line of the outer surface. Palm about as long as the dactylus, rectangular and massive; upper distal margin with one small spine. Carpus and merus of the cheliped, and legs remain but the details obscure.

*Remarks:* *Scylla ozawai* was first described by Glaessner (1933). As he wrote in his articles that the specimen was obtained from "probably *Vicarya*-beds (Lower Miocene)" in "Near Akita, North Japan", it is unknown to the details of the locality and the stratigraphic position bearing the type specimen. However, Imaizumi (1963) noted that "Glaessner locality is Yuda, Fukuoka-machi, Ninohe-gun, Iwate Prefecture, which is well known for the abundant yield of fossil crabs".

Inagaki (1938) described *S. miocenica* from the Kadonosawa Formation but the carapace ornamentation of *S. miocenica* is quite identical with *S. ozawai*. Therefore, it is synonymous to *S. ozawai*. *S. ozawai* is similar to the living Indo-West Pacific species, *S. serrata* (Forsk.), *S. tranquebarica* (Fabricus) and *S. oceanica* (Dana) (Estampador, 1949; Serene, 1952) but the carapace of *S. ozawai* is broader than ones of the living three species.

The living species of the genus *Scylla* is the characteristic decapod of the intertidal water in the tropical Indo-West Pacific area and it is called "Mangrove crab" by South-East Asian peoples. It is distributed in Boso Peninsula southward around Japanese Sea.

*Occurrence:* Shomasamahora (Locality 32 of Itoigawa, 1980), Tsukiyoshi, Hiyoshi-cho, Mizunami City.....Tsukiyoshi Member.

*Measurements* (in mm):

	MFM9375	MFM9376
Carapace length	56.6	37.8
Carapace width	92.9	61.6
	Left	Right
Dactylus length	20.3+	— 18.8

Palm length	29.0	20.6+	14.4+
Palm width	15.2	—	14.7

*Scylla* sp. 1

(Pl. 2, Fig. 8; Pl. 4, Fig. 1; Pl. 5, Fig. 1)

*Materials*: One specimen (MFM9350).

*Description*: Carapace very large and transversely oval. Dorsal surface of the carapace deformed by pressure and covered with microscopical granules. Proto- and mesogastric regions discernible. Furrow between the proto- and mesogastric regions shallow. Cervical groove conspicuous. A granulated ridge running from the branchial lobe to the epibranchial spine on the branchial region, inconspicuous. The details of the front, orbital and anterolateral border obscure, except for sharp supraorbital teeth and a short epibranchial spine on the right side. Pterygostomian region remains and covered with fine granules; pleural suture composed of medium granules and gently convex anteriorly. Thoracic sterna covered with fine granules; all of the third to eighth sterna separated from them by shallow grooves. Some ischium, basis and merus of the legs remain but the details obscure. Right cheliped very large; dactylus, fixed finger and the palm in the distal half well-preserved, and the total length about two-thirds times as long as the carapace length. Dactylus stout, tapering distally and gently curved downward; upper margin smooth and rounded; lower margin irregularly denticulate, possessing a large blunt board tooth at the base. Fixed finger about as long as the dactylus, stout, tapering from the broad base to the sharp apex and the apex gently curved upward; upper margin bearing 6 teeth composed of small rounded one, a very large broad rounded one, two large board triangular ones, two small board triangular ones from the back forward.

*Remarks*: This species differs from *S. ozawai* in having the large carapace and the stout cheliped. It is near to the living species, *S. serrata* (Forskål), *S. tranquebarica* (Fabricus) and *S. oceanica* (Dana). Das-Gupta (1924) described the specimen which consists of the sternum and the cheliped, of *Scylla* cfr. *serrata* Forskål from the Early Miocene Hathab Formation in India. His species is alien to *S. sp. 1* by having the outer surface of the palm of the cheliped which is distinctly keeled along the lower margin.

*Occurrence*: Matsugase (Locality 55 of Itoigawa, 1980), Akeyo-cho, Mizunami City .....Yamanouchi Member.

*Measurements* (in mm): Carapace length 108.7; Carapace width 157.3; Dactylus length 58.7; Palm length 52.4+ (MFM9350).

*Scylla* sp. 2

(Pl. 2, Figs. 2a, b)

*Materials*: Two specimens (MFM9411, 9412).

*Description*: The imperfect dactylus and fixed finger have been collected. Lower part of the dactylus of the right cheliped remains. Lower margin with 7 blunt teeth, bearing a

large teeth at the base. Fixed finger of the right cheliped shows the outer surface. The apex sharp and gently curved upward; upper margin bearing 9 irregular broad teeth, and one in the middle part larger than the others; outer surface fringed with a longitudinal groove.

*Remarks:* As the specimens are imperfectly preserved, further identification is difficult though the dactylus and fixed finger are large and show the characters of the genus *Scylla*.

*Occurrence:* Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City; Matsugase (Locality 54 of Itoigawa, 1980), Akeyo-cho, Mizunami City……Yamanouchi Member.

Genus *Charybdis* De Haan, 1833

*Type species:* *Cancer feriatus* Linnaeus, 1758; Living species.

*Geologic range:* Oligocene–Recent.

Subgenus *Minohellenus* subgen. nov.

*Type species:* *Charybdis (Minohellenus) quinquedentata* sp. nov.

*Diagnosis:* A subgenus of *Charybdis* characterized by having the anterolateral border cut into 5 separated teeth.

*Remarks:* The present new subgenus differs from any subgenera *Charybdis* De Haan, *Gonihellenus* Alcock, *Gonioneptunus* Alcock, *Gonioinfradens* Leene and *Goniosuprandens* Leene in the genus *Charybdis* by the anterolateral border formed by 5 well separated teeth of the carapace. On the character of the anterolateral border of the carapace, the present subgenus is closely related to the genus *Thalamita* Latreille, while *Minohellenus* has the narrow front border of the carapace.

*Geologic range:* Miocene.

*Charybdis (Minohellenus) quinquedentata* sp. nov.

(Pl. 6, Figs. 7a-c, 8a, b)

*Materials:* 4 specimens (MFM9030, 9031, 9459, 9460).

*Holotype:* MFM9030 (carapace and a part of left cheliped).

*Paratype:* MFM9031 (carapace, right and left cheliped, and right legs).

Type locality: Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City, Gifu Prefecture.

*Formation:* Yamanouchi Member, Akeyo Formation, Mizunami Group (Early to early Middle Miocene).

*Diagnosis:* Carapace transversely hexagonal. Dorsal surface of the carapace slightly convex and the regions poorly defined. Protogastric region bearing a transverse ridge anteriorly. Cervical groove distinct. Branchial region tumid; strongly arched ridge running on the branchial region between the branchial lobe and epibranchial spine. Front border narrow. Orbital border rounded and the outer supraorbital fissure deep. Anterolateral border convex outward and cut into 5 separated teeth directed forward. Cheliped subequal; outer surface of the palm, carpus and merus covered with fine reticulated granules.

*Description of the holotype:* Carapace transversely hexagonal, and the carapace length about three-fifths times as long as the width and transversely hexagonal. Dorsal surface of the carapace slightly convex and the regions ill-defined. Proto- and mesogastric regions slightly swollen; protogastric region bearing a transverse ridge anteriorly. Furrow between the meso- and metagastric regions inconspicuous. Cervical groove distinct. Cardiac region vaulted and shallowly separated by the branchial region by a groove. Branchial region more convex on the dorsal surface; strongly arched ridge running on the branchial region between the branchial lobe and the epibranchial spine. Front border about one-fourth times as long as the width and the teeth don't remain, except for the sharp triangular supraorbital teeth. Orbital border rounded and the outer supraorbital fissure deep. Anterolateral border convex outward and cut into 5 teeth including the postorbital tooth; the first (= postorbital tooth) and the second teeth broad and triangular, and the third to fifth ones acute triangular; the first to fourth ones directed forward, and the fifth one directed forward and laterally. The fused first to third sterna rounded; the fourth sterna wider than the fifth and the sixth sterna; all of the fourth to sixth sterna separated from them by narrow grooves. Three segments of the abdomen remain; Each segment increasing in width and length from the front backward. Outer surface of the palm and merus of the left cheliped smooth.

*Description of the paratype:* The anterior half of the carapace lacks. The ornamentation of the dorsal surface of the carapace similar to one of the holotype but more convex. Two narrow segments of the abdomen remain. Right and left cheliped well-preserved. Dactylus slender, elongate and gently curved downward; upper margin smooth and rounded; lower margin irregularly denticulate bearing a large conical tooth on the base; outer surface fringed with a longitudinal shallow groove possessing some small holes dorsally. Fixed finger slightly shorter than the dactylus, slender, triangular and tapering distally; upper margin possessing irregular triangular teeth with well-developed ones near the base and the middle part; outer surface with a longitudinal groove in the middle line. Palm slightly longer than the dactylus, about twice as long as the broad, subrectangular and tapering proximally; upper margin distinctly keeled at the inner and outer angles; lower margin rounded; outer surface covered with fine meshy granules. Carpus short and convergent proximally; outer surface with fine reticulated granules; distal margin armed with 3 sharp spines on the inner and outer angles, and the upper articulation. Merus with fine meshy granules about two-thirds times as long as the broad; upper margin armed with one spine distally. Merus of the right first to third legs remain, long and flat.

*Remarks:* The present new species of the genus *Charybdis* is first described from the Miocene Mizunami Group in Japan. The new species is closely related to the living Indo-West Pacific species, *Charybdis* (*Goniosuprandens*) *erythroductyla* (Lamarck), *C. (G.) obtusifrons* Leene and *C. (G.) acutifrons* (De Man), but it is different from them in the anterolateral border which is cut into 5 separated teeth with no small teeth of the carapace and the upper margin with no spine of the chelipeds. The present species is alien to the Oligocene species, *Charybdis antiqua* (A. Milne Edwards) in Europe, which has the anterolateral margin composed of 6 teeth.

A species of the genus *Charybdis* is an inhabitant in the tropical to subtropical shallow seas.

*Occurrence:* Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City  
 .....Yamanouchi Member.

*Measurements* (in mm):

	MFM9030		MFM9031
	(holotype)		(paratype)
Carapace length	35.1		30.0+
Carapace width	57.0		55.6
	right	left	right
Dactylus length	—	—	19.1
Palm length	—	19.2	20.8
Palm width	—	10.5	12.6
Carpus length	—	11.7	10.8
Merus length	16.7	17.1	16.3

*Associated forms:* Decapod crustaceans;- *Tymolus ingens* Takeda and Tomida, *Carcinoplax antiqua* (Ristori), *Miosesarma japonica* Karasawa. Pelecypods;- *Saccella miensis* Araki, *Macoma izurensis* (Yokoyama), *Macoma optiva* (Yokoyama), *Lucinoma acutilineatum* (Conrad). Gastropods;- *Euspira meisensis* Makiyama, *Phos minoensis* Itoigawa, *Psephaea? yanagidaniensis* (Araki). Elasmobranchs;- *Carcharhinus priscus* (Agassiz), *Rhinoptera* sp.

Superfamily Xanthoidea MacLeay, 1838

Family Goneplacidae MacLeay, 1838

Subfamily Carcinoplacinae H. Milne-Edwards, 1852

Genus *Carcinoplax* H. Milne-Edwards, 1852

*Type species:* *Cancer longimanus* De Haan, 1833; Living species.

*Geologic range:* Miocene—Recent.

*Carcinoplax antiqua* (Ristori, 1889)

(Pl. 7, Figs. 1a, b-8)

1889 *Crutonotus antiquus* Ristori, p. 4-6.

1933 *Carcinoplax antiqua* (Ristori), Glaessner; p. 17, pls. 4, fig. 3.

1961 *Carcinoplax antiqua* (Ristori), Imaizumi; p. 164, pls. 12-17.pls.

1969b *Carcinoplax antiqua* (Ristori), Imaizumi; pl. N-8, fig. 1

1975 Decapod D, Nishikawa, p. 3, figs. 12a, b, 13.

1985 *Carcinoplax* sp., Tomida; p. 61.

1986 *Carcinoplax antiqua* (Ristori), Fujiyama et al.; p. 370, pl. 185, figs. 1834, 1835.

*Materials:* 38 specimens (MFM9550-9587).

*Description:* Carapace transversely hexagonal. Carapace length about seven-tenths to three-fourths times as long as the width. Dorsal surface of the carapace moderately convex, smooth and the regions poorly defined. Furrow between the proto- and mesogastric regions indistinct. Furrow between the gastric and cardiac regions conspicuous. Anterior part of

the branchial region transversely ridged; the posterior part of the branchial region possessing a weak keel with fine granules along the posterolateral border. Front border about one-third times as long as the width, nearly straight. Orbital border broad and rounded. Anterolateral border moderately convex outward and armed with 3 sharp spines including the postorbital spine; the first (= postorbital spine) and the second spine directed forward, and the third one longer than the others and protruded forward and laterally. Posterolateral border about twice as long as the anterolateral border and convergent posteriorly. Eye stalk short. Suborbital crest finely granulate. Pterygostomian region covered with fine granules anteriorly and the pleural suture formed by fine granules. Merus and ischium of the third maxilliped remain; merus short and broad; ischium broad and longitudinally keeled inward. Chelipeds subequal. Dactylus sharp, slender and gently curved downward; upper margin smooth and lower margin irregularly denticulate. Fixed finger about as long as the dactylus, slender and tapering from the broad base to the sharp apex directed upward; upper margin bearing irregular teeth and lower margin smooth; lower part of the outer surface distinctly keeled along the lower margin, and the keel reaching to the proximal part of the palm. Palm slightly longer than the dactylus, subrectangular and convergent proximally; upper and lower margins smooth; outer surface moderately convex and ornamented with a granulated ridge on the proximal lower part; inner surface possessing longitudinal ridges on the upper and middle parts. Carpus short, and the distal margin armed with 3 sharp spines on the upper, middle and lower parts; the upper one longer than the others. Merus long, slightly shorter than the palm and possessing sharp spine distally.

*Remarks:* *Carcinoplax antiqua* is one of the well-known fossil decapod in the Japanese Miocene formations and is commonly found in the Early to Middle Miocene formations such as the Kadonosawa Formation, Nijukutoge Formation, Yanagawa Formation, Nakayama Formation, Numanouchi Formation, Chichibumachi Group, Higashibessho Formation, Kawaminami Formation, Hosotsubo Formation, Mizunami Group, Uchiura Group, Hokutan Group, Katsuta Group, Fujina Group and Bihoku Group (Imaizumi, 1961; Nishikawa, 1975; Nakagawa and Takeyama, 1984; Karasawa in this paper). *C. antiqua* is a dominant species of the Yamanouchi Member. In mode of life, the living species is an inhabitant of muddy to sandy bottom in tropical to subtropical shallow seas.

*Occurrence:* Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City; Hesoyama (Locality 46 of Itoigawa, 1980), Togari, Akeyo-cho, Mizunami City; Asano (Locality 25 of Itoigawa, 1980), Tokitsu-cho, Toki City.....Yamanouchi Member. Saku-radonishi (Locality 73 of Itoigawa, 1980), Toki-cho, Mizunami City.....Nataki Member.

*Measurements* (in mm):

	MFM9553		MFM9557		MFM9558	MFM9569	
Carapace length	21.4		18.7		16.1	22.7	
Carapace width	31.2		24.6		22.7	20.8	
	left	right	left	right	left	left	right
Dactylus length	10.5	11.4	—	8.2	6.4	—	—
Palm length	15.5	14.6	12.5	12.9	10.3	14.7	15.5
Palm width	9.7	10.3	8.0	—	6.2	9.6	10.6

Carpus length	—	—	7.9	8.7	6.7	9.8	9.2
Merus length	—	—	—	—	6.9	—	—
Merus width	—	—	—	—	6.1	—	—

## Family Hexapodidae Miers, 1886

Genus *Paeduma* Rathbun, 1897

*Type species: Amorphopus cylindraceus* Bell, 1859; Living species.

*Geologic range: Miocene—Recent.*

*Paeduma* sp.

(Pl. 8, Fig. 14)

*Materials:* One specimen (MFM9500).

*Description:* Carapace ill-preserved and the posterior margin lacks. Carapace rectangular, and the carapace length about four-fifths times as long as the width. Dorsal surface of the carapace slightly convex, covered with fine granules and the regions poorly defined. Furrow between the gastric and branchial regions distinct and the furrow becoming shallower anteriorly. Cardiac region separated from the gastric region by a deep groove and the branchial region by a shallow groove. Front border narrow, about one-fifth times as long as the width and subdivided into two by a median groove. Orbital border also narrow and rounded. Anterolateral border strongly convex outward in the anterior half and nearly straight in the dorsal half. Posterolateral and posterior borders obscure. Pterygostomian regions absent in oblique striae.

*Remarks:* It is possible to assign the present species to the genus *Paeduma* in the family Hexapodidae which is represented by the genera, *Hepapinus* Manning and Holthuis, *Hexapus* De Haan, *Paeduma* Rathbun, and *Hexaplex* Doflein around Japanese sea, by having the pterygostomian region lacking oblique striae. It differs from the living Japanese species, *Paeduma orientale* (Rathbun) (this living species is recently transferred from the genus *Taumastoplax* to *Paeduma* by Manning and Holthuis, 1981) in having the dorsal surface of the carapace slightly convex and covered with microscopical granules.

*Paeduma orientale* is a parasitic crab who occurs as a commensal in the tube of *Annelida* on muddy bottom of shallow seas in Kii peninsula southward.

*Occurrence:* Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City  
.....Yamanouchi Member.

*Measurements* (in mm): Carapace length 10.8; Carapace width 13.9 (MFM9500).

## Family Xanthidae MacLeay, 1838

Xanthidae subfam. gen. et sp. indet. 1

(Pl. 8, Figs. 3a-d, 5a-d, 9a-d)

*Materials:* Six specimens (MFM9490-1-4, 9491-1-2).

*Description:* Fixed finger small, short, triangular and tapering from the broad base to the sharp apex. Cutting edge of the upper margin composed of 4 teeth; the tooth at the base larger than the others, conical. Lower margin smooth. Outer surface moderately ridged; middle part of the outer surface and the lower part of the inner surface possessing a longitudinal shallow groove.

*Remarks:* These broken fixed finger can belong to the fixed fingers of a species which are included in the subfamily Xanthinae Alcock, Actaeinae Alcock, Chlorodinae Alcock, Mennipinae Ortmann and Piluminae Ortmann. As Xanthidae consists of a great number of species, further identification is difficult.

*Occurrence:* Akatsukibora (Localities 11, 12 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City.....Shukunohora Facies. Okuna (Locality 62 of Itoigawa, 1980), Toki-cho, Mizunami City.....Nataki Member.

Xanthidae subfam. gen. et sp. indet. 2  
(Pl. 8, Figs. 1a-c)

*Materials:* Four specimens (MFM9502-1-2, 9503-1-2).

*Description:* Fixed finger small, triangular, tapering distally. Upper margin irregularly denticulate; the two proximal teeth large and triangular. Outer surface convex, bearing a longitudinal groove along the lower margin. Lower part of the inner surface distinctly keeled along the lower margin, and the keel becoming more weak to the proximal part.

*Remarks:* This species is distinguished from Xanthidae subfam. gen. et sp. indet. 1, for the fixed finger of the former is narrower than one of the latter, and the cutting edge of the former is formed by sharp triangular teeth, while that of the latter is composed of broad conical teeth.

*Occurrence:* Akatsukibora (Localities 11, 12 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City.....Shukunohora Facies.

Xanthidae subfam. gen. et sp. indet. 3  
(Pl. 8, Figs. 7a, b, 10a-d)

*Materials:* 92 specimens (MFM9504-1-35, 9505-1-27, 9506-1-5, 9507, 9508-1-14).

*Description:* Dactylus small to very small, gently curved downward and rounded in the cross section, and the sharp apex directed inward. Upper margin smooth. Lower margin bearing cutting edges at the outer and inner angles; outer cutting edge armed with 5-7 conical teeth diminishing in size from the back forward; inner one sharp near the apex.

*Remarks:* These specimens closely resemble the dactylus of a species belonging to the subfamily Xanthinae Alcock, Actaeinae Alcock, Chlorodinae Alcock, Mennipinae Ortmann and Piluminae Ortmann.

*Occurrence:* Akatsukibora (Localities 11, 12 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City; Shukubora (Locality 58 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City.....Shukunohora Facies.

## Xanthidae subfam. gen. et sp. indet. 4

(Pl. 8, Figs. 8a-d)

*Materials:* One specimen (MFM9509).*Description:* Fixed finger elongate and triangular; the sharp apex directed upward. Upper margin sharp and irregularly denticulate. Lower margin smooth. Lower part of the outer surface distinctly keeled along the lower margin. Inner surface ridged, possessing a longitudinal groove on the lower part along the lower margin.*Remarks:* The dactylus differs from one of Xanthidae subfam. gen. et sp. indet. 1, Xanthidae subfam. gen. et sp. indet. 2, "*Ozius*" ? sp. and "*Pilumnus*" ? sp. by having the slender and elongate outline.*Occurrence:* Akatsukibora (Locality 11 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City  
.....Shukunohora Facies.

Subfamily Menippinae Ortmann, 1893

Genus *Ozius* H. Milne Edwards, 1834*"Ozius"* ? sp.

(Pl. 8, Figs. 13, 16a-d)

*Materials:* 20 specimens (MFM9471-1-4, 9472-1-6, 9473-1-3, 9474-1-3, 9475-1-3, 9476, 9477-1-3).*Description:* Dactylus having a blunt apex, elongate, rounded in the cross section, strongly curved downward and slightly directed inward. Upper margin smooth and lower margin bearing 7-8 conical teeth including the large proximal tooth than the others below the outer surface. Fixed finger triangular and tapering distally; upper margin wide and possessing 3 or 4 broad and wide teeth diminishing in size from the back forward, and lower margin smooth; inner and outer surfaces flat and smooth.*Remarks:* These specimens may be identical with the dactylus and the fixed finger of the genus *Ozius*, considering to the dactylus which is rounded in the cross section and bears large conical teeth at the base on the lower margin.In mode of life, each species of the genus *Ozius* inhabits the crevices of coral reefs or rocky beaches, below low tide mark, in tropical to subtropical seas.*Occurrence:* Nanamagari (Locality 19 of Itoigawa, 1980), Jorinji, Izumi-cho, Toki City; Anabora (Locality 40 of Itoigawa, 1980), Kawai, Izumi-cho, Toki City.....Kujiri Facies. Oginoshima (Locality 07 of Itoigawa, 1980), Kamigiri, Kamado-cho, Mizunami City; Akatsukibora (Localities 11, 12, Itoigawa, 1980), Hiyoshi-cho, Mizunami City; Shukubora (Locality 58 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City.....Shukunohora Facies. Okuna (Locality 62 of Itoigawa, 1980), Toki-cho, Mizunami City; Sakuradonishi (Locality 73 of Itoigawa, 1980), Toki-cho, Mizunami City.....Nataki Member.

Genus *Eriphia* Latreille, 1817*Eriphia* ? sp.

(Pl. 8, Figs. 2a-c)

*Materials*: 11 specimens (MFM9496, 9497, 9498-1-8, 9499).

*Description*: Dactylus small, elongate, tapering from the broad base to the sharp apex, moderately curved downward. Upper margin sharp; lower margin bearing fine serrations with one large conical tooth at the base. Longitudinal grooves running on the upper, middle and lower parts of the outer surface; upper and middle grooves deeper than the lower one. Inner surface smooth, but ornamented with longitudinal rows of small holes on the upper, middle and lower parts.

*Remarks*: This species differs from "*Ozius*" ? sp. in having the outer and inner surfaces of the small dactylus which are not smooth. It is possible to identify the specimens to the dactylus of the genus *Eriphia*.

A species of the genus *Eriphia* shows the same mode of life of one of the genus *Ozius*.

*Occurrence*: Akatsukibora (Localities 11, 12 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City.....Shukunohora Facies. Okuna (Locality 62 of Itoigawa, 1980), Toki-cho, Mizunami City.....Nataki Member.

## Subfamily Pilumninae Ortmann, 1893

Genus *Pilumnus* Leach, 1815*"Pilumnus"* ? sp.

(Pl. 8, Figs. 6a-d)

*Materials*: Two specimens (MFM9492-1, 2).

*Description*: Fixed finger small, triangular, tapering distally, and the sharp apex slightly directed upward. Upper margin wide, armed with 3 broad conical teeth diminishing in size from the back forward. Lower margin irregularly granulate. Outer and inner surfaces covered with many granules which vary in size.

*Remarks*: The specimen is close to the fixed finger of the genus *Pilumnus*, having to the upper margin formed by conical broad teeth and the surface covered with many granules.

In the mode of life, the genus *Pilumnus* is an inhabitant of rocky beaches, reef corals and shallow seas of the bottoms of rock, sands, and muds in Sagami Bay southward.

*Occurrence*: Shukubora (Locality 58 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City.....Shukunohora Facies.

## Superfamily Grapsidoidea MacLeay, 1838

## Family Grapsidae MacLeay, 1838

## Grapsidae subfam. gen. et sp. indet. 1.

(Pl. 8, Figs. 4a-d)

*Materials:* 27 specimens (MFM9478-1-5, 9479, 9480-1-3, 9482-1-5, 9489-1-10).*Description:* Fixed finger small, tapering distally. Upper margin bearing the cutting edges from the base to the apex at the outer angle, and near the apex at the inner angle; the cutting edge at the outer angle formed by coarse serrations. Lower margin smooth. Outer surface possessing a longitudinal groove in the middle line. Inner surface transversely ridged and ornamented with longitudinal shallow grooves on the upper and middle lines.*Remarks:* It is distinguished from the cheliped of Varuninae gen. et sp. indet., for the fixed finger of the former is larger than that of the latter. It is closely related to the fixed finger of a species of Grapsidae.*Occurrence:* Akatsukibora (Localities 11, 12 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City.....Shukunohora Facies.

## Grapsidae subfam. gen. et sp. indet. 2

(Pl. 8, Figs. 11a-d)

*Materials:* 39 specimens (MFM9483-1-6, 9484, 9485-1-24, 9486-1-4, 9487-1-3, 9488).*Description:* Dactylus small, elongate, tapering distally and gently curved downward; the sharp apex directed outward. Upper margin smooth. Lower margin having the cutting edge at the outer and inner angles; outer cutting edge bearing fine broad teeth from the base to the apex and the inner one sharp near the apex. Longitudinal grooves running on the upper and middle lines of the outer and inner surfaces; the grooves on the outer surface deeper than ones on the inner surface.*Remarks:* These dactylus is accompanied with the fixed finger of Grapsidae subfam. gen. et sp. indet. 1 from Locality 11, 12 and 58. This species based on the dactylus may be the same species, Grapsidae subfam. gen. et sp. indet. 1.*Occurrence:* Akatsukibora (Localities 11, 12 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City; Shukubora (Locality 58 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City.....Shukunohora Facies. Okuna (Locality 62 of Itoigawa, 1980), Toki-cho, Mizunami City; Sakurado (Locality 74 of Itoigawa, 1980), Toki-cho, Mizunami City.....Nataki Member.

## Subfamily Varuninae H. Milne Edwards, 1852

## Varuninae gen. et sp. indet.

(Pl. 8, Figs. 17a-c)

*Materials:* One specimen (MFM9458).

*Description:* Left cheliped large. Fixed finger, palm and carpus show the outer surface. Fixed finger triangular, tapering from the broad base to the sharp apex. Upper margin bearing the cutting edge on the inner and outer angles; outer cutting edge cut into 7 broad teeth from the base to the apex; inner one sharp and only developed at the apex. Outer surface fringed with two longitudinal rows of small holes on the lower part. Palm slightly longer than the fixed finger and convergent proximally; upper proximal margin distinctly granulate. Outer surface smooth and convex; lower part of the outer surface possessing a weak granulated ridge along the lower margin. The details of the carpus obscure.

*Remarks:* The single specimen is the large fixed finger and the palm. It resembles the cheliped of the genus *Gaetice* Gistel, *Hemigrapsus* Dana, *Ptychognathus* Stimpson and *Varuna* H. Milne Edwards.

*Occurrence:* Shomasamahora (Locality 32 of Itoigawa, 1980), Hiyoshi-cho, Mizunami City.....Tsukiyoshi Member.

*Measurements* (in mm): Fixed finger length 17.7; Palm length 25.1 (MFM9458).

Superfamily Pinnotheroidea De Haan, 1833

Subfamily Asthengnacthinae Stimpson, 1858

Genus *Tritodynamia* Ortmann, 1894

*Type species:* *Tritodynamia japonica* Ortmann, 1894; Living species.

*Geologic range:* Miocene—Recent.

*Tritodynamia globosa* sp. nov.

(Pl. 8, Figs. 12a-c, 15)

*Materials:* 3 specimens (MFM9033, 9034, 9461).

*Holotype:* MFM9033 (carapace).

*Paratype:* MFM9034 (carapace).

*Type locality:* Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City, Gifu Prefecture.

*Formation:* Yamanouchi Member, Akeyo Formation, Mizunami Group (Early to early Middle Miocene).

*Diagnosis:* Carapace length about seven-tenths times as long as the width. Carapace subrectangular and divergent posteriorly. Dorsal surface of the carapace strongly vaulted, covered with microscopical granules and the regions ill-defined. Furrow between the gastric and branchial regions shallow. Cardiac region shallowly separated by the gastric, branchial and instinal regions by narrow grooves. Front border about one-fifth times as long as the width and smooth. Orbital border very narrow. Anterolateral border strongly convex outward, sharp and smooth. Posterolateral border convergent posteriorly.

*Description of the holotype and the paratype:* as for the diagnosis.

*Remarks:* The present new species of the genus *Tritodynamia* is the first record from the Japanese Miocene formations. The carapace is surely close to the known recent species of the genus *Tritodynamia* which is represented by three Japanese species—*Tritodynamia*

*japonica* Ortmann, *T. rathbuni* Shen, and *T. harvathi* Nobili. The present species is distinguished from the living species, for it is the strongly swollen carapace having the small orbital border.

The living species of the genus *Tritodynamia* are known as parasitic crabs associated with Polychaeta; namely, *T. harvathi* Nobili is found as a commensal of *Loimia medusa*, *T. rathbuni* occurs in a commensal of *Chaetopterus variopedatus* and *Balanoglossas misakiensis* on the mud flat, and *T. japonica* is found on the muddy shore, associated with *Arenicola cristata*.

*Occurrence*: Yamanouchi (Locality 45 of Itoigawa, 1980), Akeyo-cho, Mizunami City; Hesoyama (Locality 46 of Itoigawa, 1980), Togari, Akeyo-cho, Mizunami City ..... Yamanouchi Member.

*Measurements* (in mm):

	MF9033 (holotype)	MF9034 (paratype)
Carapace length	10.1	10.5
Carapace width	13.9	16.6

*Associated forms* (at the type locality): Decapod crustaceans; -*Tymolus ingens* Takeda and Tomida, *Carcinoplax antiqua* (Ristori), *Miosesarma japonica* Karasawa. Pelecypods; -*Saccella miensis* Araki, *Macoma izurensis* (Yokoyama), *Macoma optiva* (Yokoyama), *Lucinoma acutilineatum* (Conrad). Gastropods; -*Euspira meisensis* Makiyama, *Phos minoensis* Itoigawa, *Psephaea ? yanagidaensis* (Araki). Elasmobranchs; -*Carcharhinus priscus* (Agassiz), *Rhinoptera* sp.

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## Addendum

After this paper was accepted, I knew that Takeda (1977) suggested *Glebocarcinus* Nations, 1975 was a subjective synonym of *Platepistoma* Rathbun, 1906. His species described from Hawaii is clearly settled in the genus *Cancer*, while I doubt whether it is identified with *Platepistoma macrophthalmum* Rathbun, 1906. I think difference in generic rank exists between *Cancer* and *Platepistoma*.

Rathbun, M. J. (1906), The Brachura and Macrura of the Hawaiian Islands. *Bull. U. S. Fish Comm.*, no. 23, 827-930.

Takeda, M. (1977), Two interesting crabs from Hawaii. *Pacific Sci.*, **31**(1), 31-38.

## Explanation of Plate

## Plate 1

Figs. 1 a-c. Parthenopinae gen. et sp. indet. Dactylus. Locality I-2. a, outer; b, inner; c, upper view.

Figs. 2 a-d, 3a-d, 8, 16a, b. *Cancer (Cancer) tomowoi* sp. nov. Locality I-2.

Figs. 2a-d. Paratype (1) (MFM9023). Fixed finger. a, inner; b, outer; c, upper; d, lower view.

Figs. 3a-d. Paratype (2) (MFM9024). Dactylus. a, outer; b, inner; c, lower; d, upper view.

Fig. 8. Holotype (MFM9022). Thoracic sterna.  $\times 1.0$  ventral view.

Figs. 16a, b. Holotype (MFM9022). Right cheliped.  $\times 1.0$ . a, outer; b, inner view.

Figs. 4 a-c, 7a, b, 13, 14. *Cancer (Glebocarcinus) kaedei* sp. nov. Locality 54.

Figs. 4a-c. Paratype (3) (MFM9029). Left cheliped. a, inner; b, outer; c, upper view.

Figs. 7a, b. Paratype (2) (MFM9028). Right cheliped. a, outer; b, upper view.

Fig. 13. Holotype (MFM9026). Carapace. dorsal view.

Fig. 14. Paratype (1) (MFM9027). Cast of carapace.

Fig. 5. *Tiarinia* ? sp. 1. Carapace. Locality 07. dorsal view.

Fig. 6. Majidae subfam. gen. et sp. indet. Palm. Locality 07. inner view.

Fig. 9. *Cancer* sp. Palm. Locality 07. outer view.

Fig. 10. *Cancer (Glebocarcinus) itoigawai* sp. nov. Holotype (MFM9025). Carapace. Locality 45. dorsal view.

Figs. 11, 12. *Cancer* sp. cfr. *C. (G.) itoigawai*. Carapace. Locality 07. dorsal view.

Fig. 15. *Tiarinia* ? sp. 2. Carapace. Locality 07. dorsal view.

All figures  $\times 1.5$  otherwise stated.

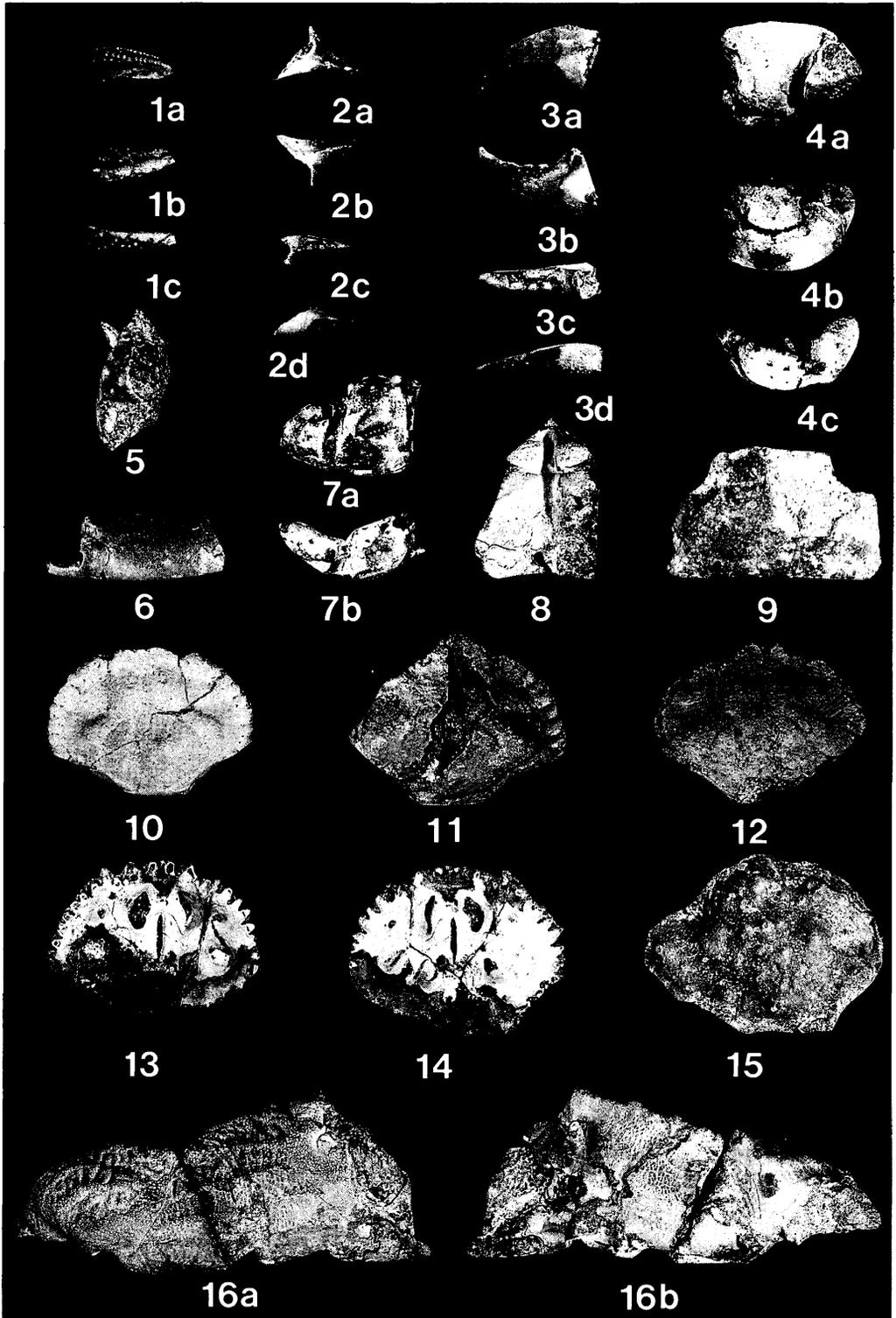


Plate 2

Figs. 1 a, b, 3 - 5. *Portunites minoensis* sp. nov.  $\times$  1.5. Locality 45.

Figs. 1 a, b. Paratype (1) (MFM9036). Carapace. a, dorsal; b, ventral view.

Fig. 3. Holotype (MFM9035). Carapace. dorsal view.

Fig. 4. Paratype (2) (MFM9037). Carapace. dorsal view.

Fig. 5. Paratype (2) (MFM9037). Left cheliped. outer view.

Figs. 2 a, b. *Scylla* sp. 2. Dactylus. Locality 54.  $\times$  1.0. a, lower; b, outer view.

Figs. 6, 7. *Scylla ozawai* Glaessner. Locality 32.

Fig. 6. Left cheliped.  $\times$  1.5. outer view.

Fig. 7. Carapace.  $\times$  1.0. dorsal view.

Fig. 8. *Scylla* sp. 1. Right cheliped. Locality 54.  $\times$  1.0.

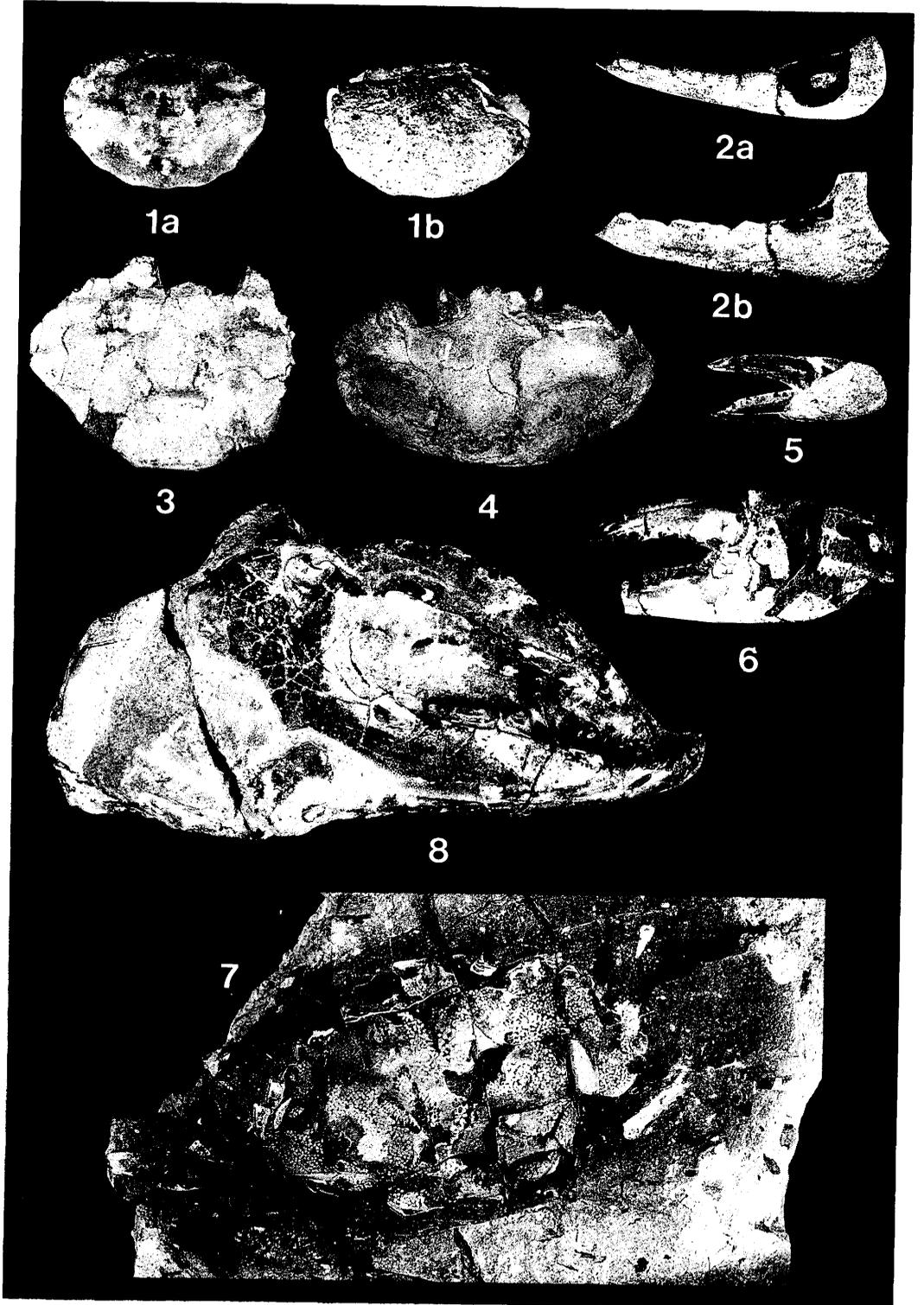
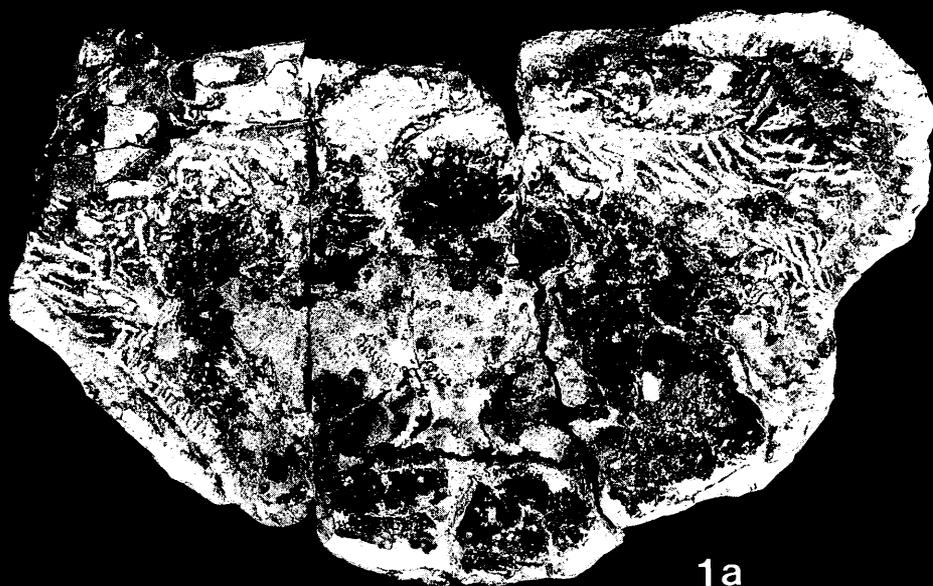
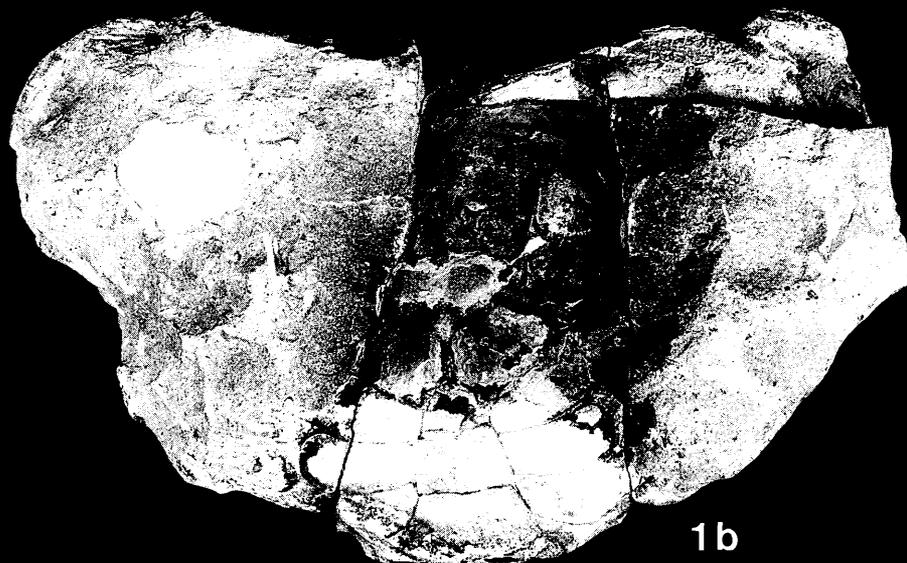


Plate 3

Figs. 1 a, b. *Scylla ozawai* Glaessner. Locality 32.  $\times 1.0$ . a, dorsal; b, ventral view.



1a



1b

Plate 4

Fig. 1. *Scylla* sp. 1. Locality 54. × 1.0. dorsal view.

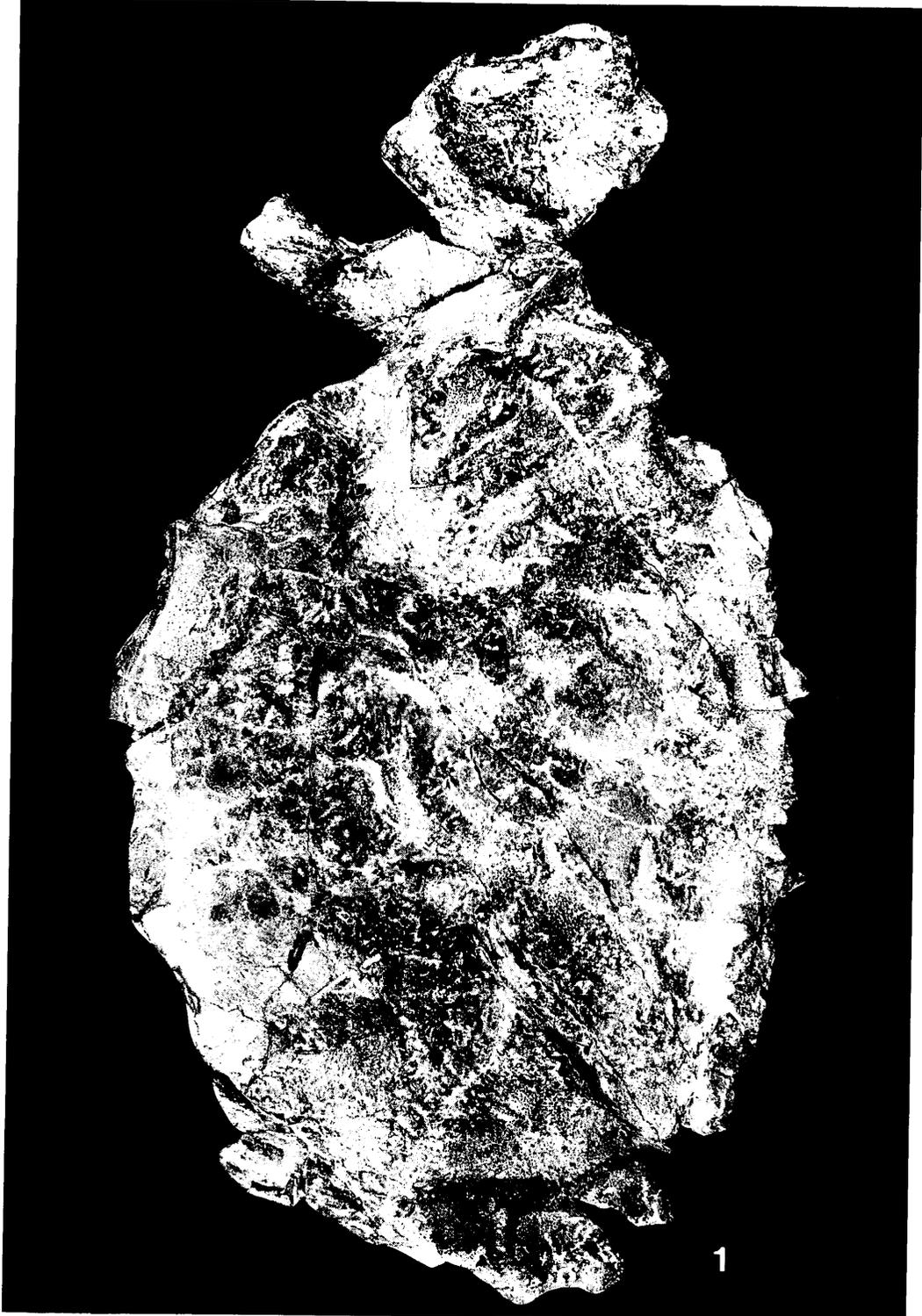


Plate 5

Fig. 1. *Scylla* sp. 1. Locality 54.  $\times 1.0$ . ventral view.

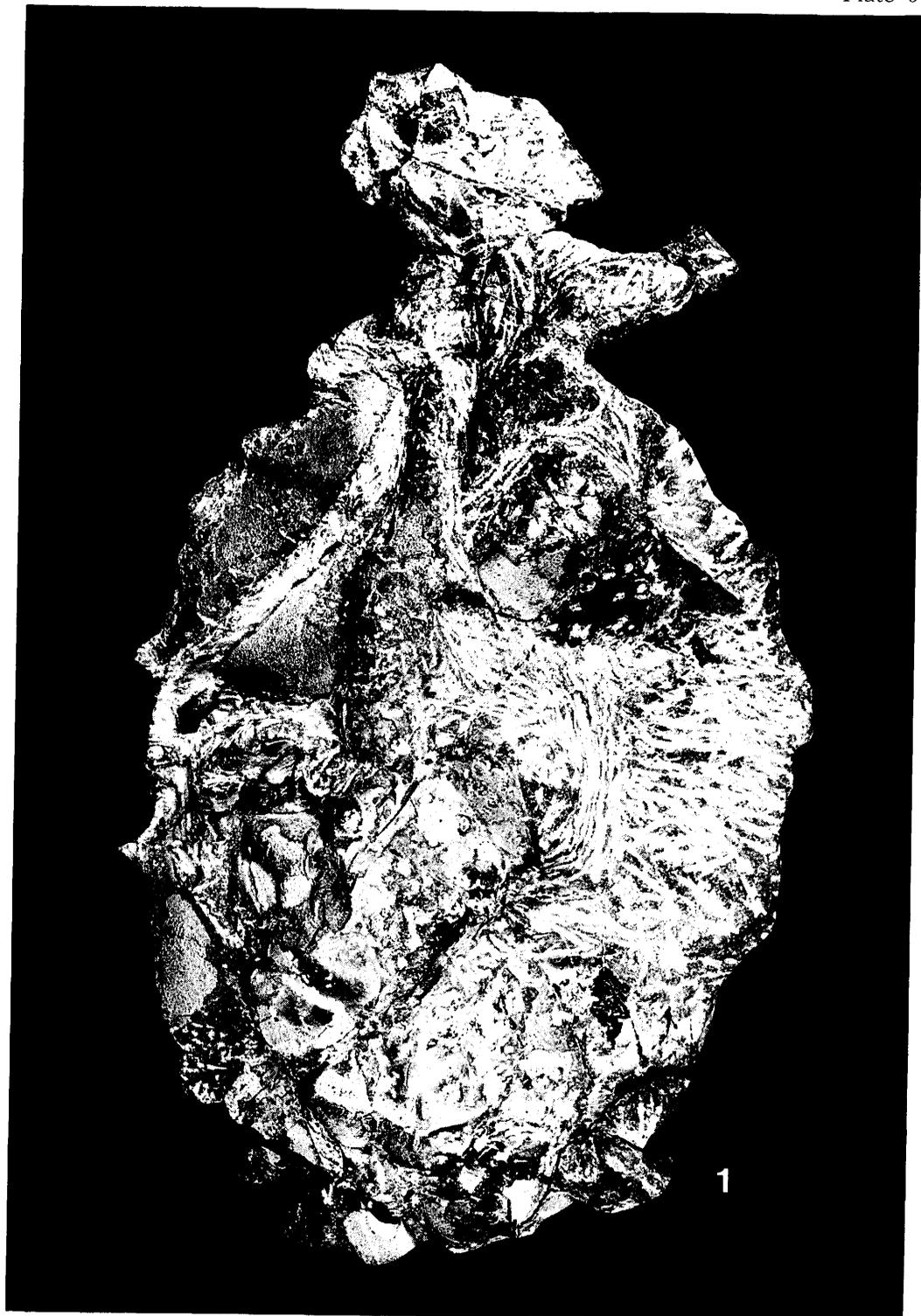


Plate 6

- Figs. 1 a, b. Portunidae subfam. gen. et sp. indet. Dactylus. Locality 62.  $\times 2.0$ . a, outer; b, inner view.
- Figs. 2 a-c. Portuninae gen. et sp. indet. 2. Dactylus. Locality 62. a, inner; b, outer; c, lower view.
- Figs. 3, 4. Portuninae gen. et sp. indet. 1. Fixed finger.  $\times 1.5$ .
- Fig. 3. Locality 64. outer view.
- Fig. 4. Locality 07. outer view.
- Figs. 5, 6. *Parathranites shibatai* sp. nov.
- Fig. 5. Carapace. Locality 25.  $\times 1.5$ . dorsal view.
- Fig. 6. Holotype (MFM9032). Carapace and left cheliped.  $\times 1.0$ . dorsal view.
- Figs. 7 a-c, 8 a, b. *Charybdis (Minohellenus) quinquedentata* subgen. et sp. nov. Locality 45.  $\times 1.0$ .
- Figs. 7 a-c. Paratype (MFM9031). a, dorsal; b, ventral; c, frontal view.
- Figs. 8 a, b. Holotype (MFM9030). a, dorsal; b, ventral view.

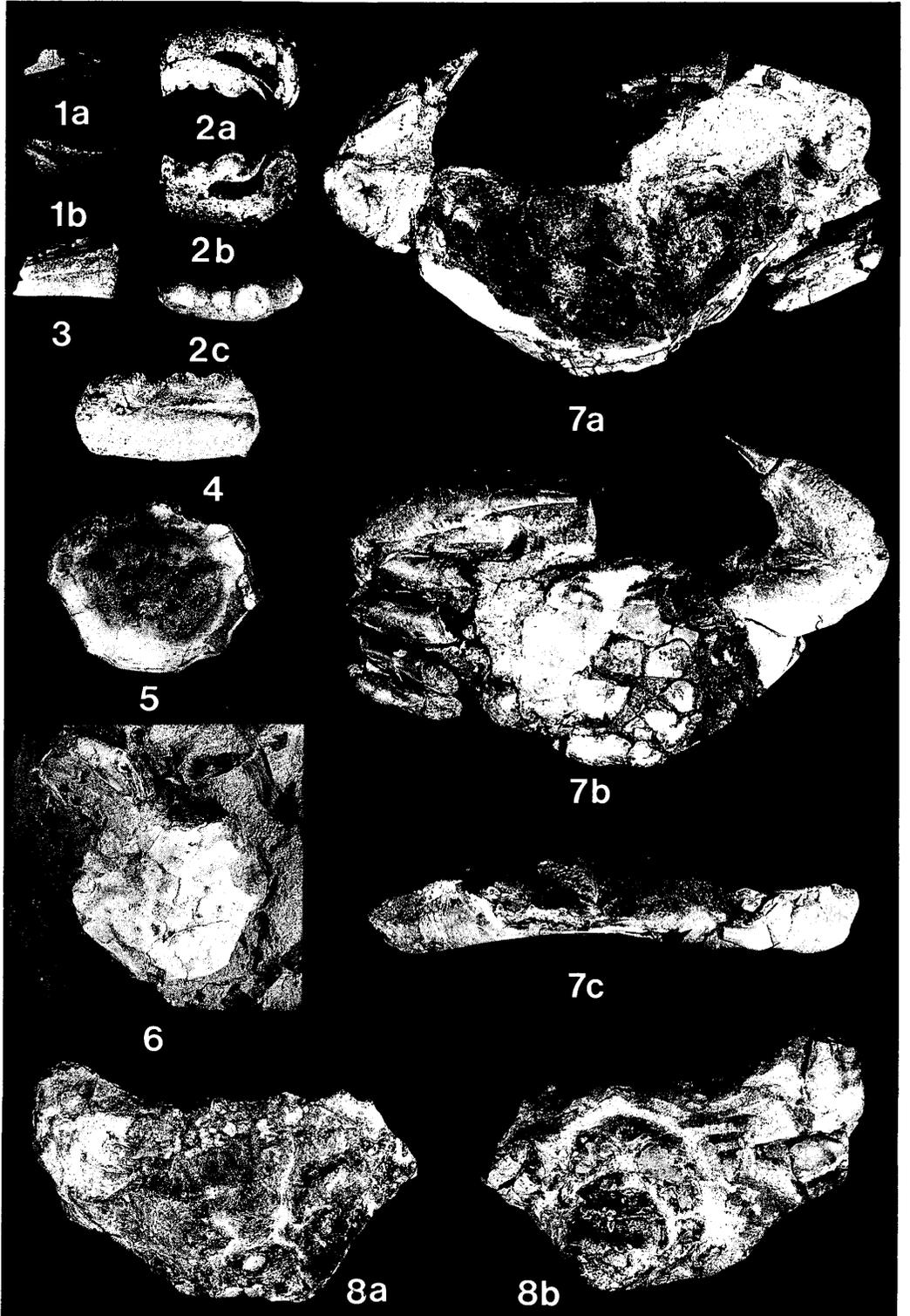


Plate 7

Figs. 1 a, b- 8. *Carcinoplax antiqua* (Ristori). Locality 45.

Figs. 1 a, b. Carpus and merus of right cheliped.  $\times 1.5$ . a, upper; b, outer view.

Figs. 2 a, b. Fixed finger and palm of right cheliped.  $\times 1.5$ . a, inner; b, outer view.

Fig. 3.  $\times 1.0$ . dorsal view.

Figs. 4 a, b.  $\times 1.5$ . a, dorsal; b, ventral view.

Figs. 5 a, b.  $\times 1.5$ . a, dorsal; b, ventral view.

Figs. 7 a, b.  $\times 1.5$ . a, dorsal; b, ventral view.

Fig. 8.  $\times 1.5$ . dorsal view.

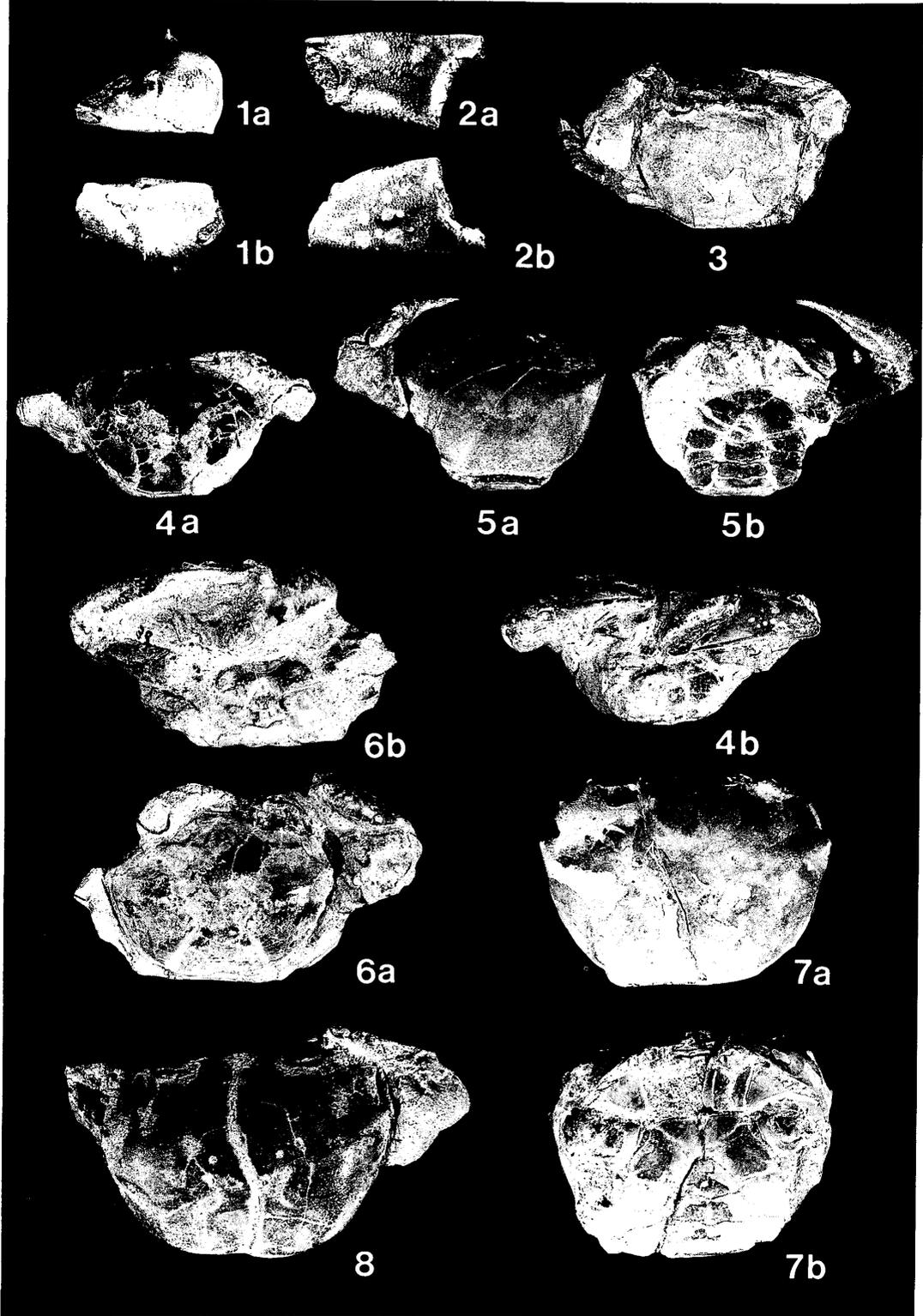


Plate 8

- Figs. 1 a-c. Xanthidae subfam. gen. et sp. indet. 2. Fixed finger. Locality 12. a, outer; b, inner; c, upper view.
- Figs. 2 a-c. *Eriphia* ? sp. Dactylus. Locality 12. a, inner; b, outer; c, lower view.
- Figs. 3 a-d, 5a-d, 9a-d. Xanthidae subfam. gen. et sp. indet. 1.  
Figs. 3 a-d. Fixed finger. Locality 12. a, outer; b, inner; c, upper; d, lower view.  
Figs. 5 a-d. Dactylus. Locality 12. a, outer; b, inner; c, lower; d, upper view.  
Figs. 9 a-d. Dactylus. Locality 62. a, outer; b, inner; c, lower; d, upper view.
- Figs. 4 a-d. Grapsidae subfam. gen. et sp. indet. 1. Dactylus. Locality 12. a, outer; b, inner; c, lower; d, upper view.
- Figs. 6 a-d. "*Pilumnus*" ? sp. Fixed finger. Locality 58. a, outer; b, inner; c, upper; d, lower view.
- Figs. 7 a, b, 10a-d. Xanthidae subfam. gen. et sp. indet. 3. Dactylus. Locality 12. 7a, 10a, outer; 7b, 10b, inner; 10c, lower; 10d, upper view.
- Figs. 8 a-d. Xanthidae subfam. gen. et sp. indet. 4. Fixed finger. Locality 12. a, outer; b, inner; c, upper; d, lower view.
- Figs. 11a-d. Grapsidae subfam. gen. et sp. indet. 2. Fixed finger. Locality 12. a, inner; b, outer; c, upper; d, lower view.
- Figs. 12a-c, 15. *Tritodynamia globosa* sp. nov. Locality 45.  $\times$  1.5.  
Figs. 12a-c. Holotype (MFM9033). Carapace. a, dorsal; b, ventral; c, frontal view.  
Fig. 13. Paratype (MFM9034). Carapace. dorsal view.
- Figs. 13, 16a-d. "*Ozius*" ? sp. Dactylus. Locality 07.  $\times$  1.5. 13, 16b, outer; 16a, inner; 16c, lower; 16d, upper view.
- Fig. 14. *Paeduma* sp. Carapace. Locality 45.  $\times$  1.5. dorsal view.
- Figs. 17a-c. Varuninae gen. et sp. indet. Left cheliped. Locality 32.  $\times$  1.0. a, c, upper; b, outer view.

All figures  $\times$  2.0 otherwise stated.

