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A FOSSIL CRAB, *HEXAPUS NAKAJIMAI* N. SP. FROM
JOBAN COAL FIELD

By

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3. A Fossil Crab, *Hexapus nakajimai* n. sp. from Joban Coal Field*

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[With Plate III]

Introduction

A new species of fossil crab from the Jôban Coal field is described here. The stratigraphical sequences of the Jôban Coal field are, in descending order, the Taga, the Shirado, the Yunagaya and the Uchigo groups (HATAI and KAMADA, pp. 61 and 62; IWAI, pp. 61 and 62). Two species of fossil crabs were described from the Jôban Coal field. *Trachycarcinus huziokai* IMAIZUMI, 1951, was reported from the Honya formation of the Yunagaya group at the northern part of Ena, Ena-machi, Iwaki-gun (IMAIZUMI, p. 38), and *Tymolus kamadai* IMAIZUMI, 1952, from the Numanouchi formation of the Taga group at Kosuganotsutsumi, Takaku-mura (type locality) and Misaki, Ena-machi, Iwaki-gun (IMAIZUMI, p. 202). The crab herein reported is from the Miocene Nakayama formation of the Shirado group, at the south-western part of Kamiyamadayashiki, Yamada-mura, Iwaki-gun, Fukushima Prefecture. This species is named in honour of Mr. Kôzo NAKAJIMA, who collected the holotype in 1952, during his field survey of the graduation thesis of the Institute of Geology and Paleontology of Tohoku University.

The writer wishes to express his gratitude to Mr. Kôzo NAKAJIMA, for placing the specimen at his disposal, and to Emeritus Professor Hisakatsu YABE and Professors Shôshiro HANZAWA, Enzô KON'NO, and Kiyoshi ASANO of the Institute of Geology and Paleontology of Tohoku University, Professor Teiichi KOBAYASHI of the Geological Institute, Tokyo University, Professor Kotora HATAI of the Department of Geology, College of Education and Professor Kenzo YAGI of the Institute of Earth Sciences, College of Arts and Sciences, Tohoku University for their encouragement.

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Family Hexapodinae ALCOCK

Genus *Hexapus* DE HAAN, 1835

Pl. I and II, Fig. 1.

DE HAAN, 1835. Fauna Japonica, Crustacea, pp. 63, 64; Taf. XI, Fig. 6; Genotype, *Hexapus sexpes* (FABRICIUS).

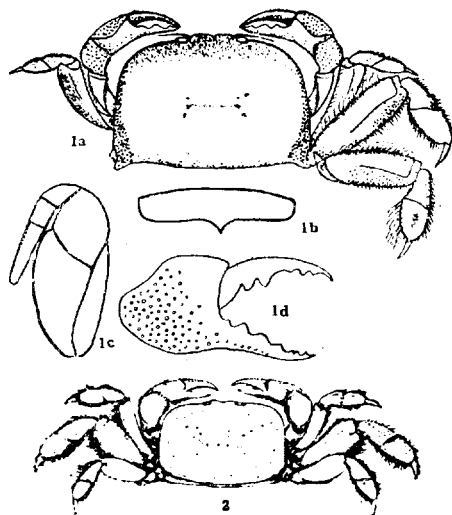
Hexapus Nakajimai, n. sp.

Preservation. A cast of the carapace showing the dorsal surface embedded in the grey siltstone with the fragments of mollusca.

The length of the carapace is almost half as the width. The shape of the carapace is quadrilateral, the antero-lateral borders broadly rounded, the lateral ones slightly arched and the corners of the postero-lateral borders made rounded angles. The posterior margin is broad and straight. Orbits are small and transversely ovoid. The frontal margin of the rostrum is sinuate in the middle. The dorsal surface is finely granulated all over. Furrows between gastric regions shallowly defined. Meso-gastric region has the median depression in the anterior part.

The chelipeds seem to be symmetrical and ornamented with the fine granules same as the one of the carapace. Ambulatory legs are ornamented with the larger granules than the ones of the carapace and chelipeds. The merus of the second ambulatory leg is much longer than the first and slightly longer than the third one. The merus of the second and the third legs are broad and have longitudinal furrows.

Dimensions. Width of carapace, 10.5 mm; length of carapace, 6 mm; fronto-orbital width, 4 mm; length of merus of second ambulatory leg,



Text-figure 1. *Hexapus sexpes* (FABRICIUS), ♂, from Jinsen, Korea, from KAMITA'S text-fig. 76 (7); 1a, dorsal view, $\times 3$; 1b, anterior view of front, $\times 10.4$; 1c, third maxilliped, $\times 9$; 1d, chela, $\times 4.7$.

Text-figure 2. *Thaumastoplax orientalis* RATHBUN, ♀, from SAKAI'S text-fig. 100 (10), $\times 1$.

5.5 mm; length of merus of third ambulatory leg, 4.5 mm.

Holotype. IGPS loc. nat. no. 79466.

Locality and geological horizon. IGPS loc. no. Fs-39, south western part of Kamiyamada-yashiki, Yamada-mura, Iwaki-gun, Fukushima Prefecture, (Onahama sheet), lat. 36°57'. 8N., long. 140°45'41''. 8E., Nakayama formation, Miocene, K. NAKAJIMA, 1952.

Remarks. The fossil species of the *Hexapus* has never been reported, but *Thaumastoplax prima* RATHBUN from the Oligocene of the Panama Canal Zone is very close to the species of the genus *Hexapus* which is herein described. Both *Hexapus* and *Thaumastoplax* are included in the Family Hexapodinae. There has been known one Recent species of the genus *Hexapus*, *Hexapus sexpes* (FABRICIUS), 1798. *Hexapus sexpes* (Pl. II, Figs. 2 and 4), is the commensal of Annelids and distributes along the Kii Peninsula, Wakayama Prefecture; Amakusa, Kumamoto Prefecture; Port Stephens, New Caledonia; Kei Island, and Amboina, South Africa.

Four species of the genus *Thaumastoplax* MIER, 1881, i. e., two Recent species and two fossil ones have been known. The former are *Thaumastoplax anomalia* MIERS, 1881 (genotype) and *Thaumastoplax orientalis* RATHBUN, 1909, and the latter are *Thaumastoplax prima* RATHBUN, 1919 and *Thaumastoplax eocenica* WOODS, 1922. *Thaumastoplax anomalia* (Pl. II, Fig. 6) has been collected from the Goree Bay, Goree Island, Senegambia, 18-28 m in depth (8). *Thaumastoplax orientalis* has been known from the Gulf of Siam (type locality) and Kii Peninsula, Okayama Prefecture and Nagasaki, Nagasaki Prefecture, as a commensal in the tube of Annelids. *Thaumastoplax prima* (Pl. II, Fig. 7) was collected from the lowest fossiliferous bed, the third bed below the lowest limestone beds separated by rows of nodules, the lower part of the upper half of the Oligocene Culebra formation at Las Cascadas of the Panama Canal Zone, by D. F. MACDONALD and T. W. VAUGHAN, 1911, with *Balanus* (*Hesperibalanus*?) sp., *Axius reticulatus* RATHBUN, *Callianassa ovalis* RATHBUN, *Callianassa elongata* RATHBUN, *Callianassa crassimana* RATHBUN, *Callianassa spinulosa* RATHBUN, *Callianassa quadrata* RATHBUN, *Callianassa abbreviata* RATHBUN, *Callianassa magna* RATHBUN, *Goniochela* ? *armata* RATHBUN, *Calapella quadrispina* RATHBUN, and *Callinectes reticulatus* RATHBUN.

According to the Fossilium Catalogus of GLAESSNER (p. 383), *Thaumastoplax eocenica* WOODS is reported from the Eocene of Peru, though the literature referring to *Thaumastoplax eocenica* (WOODS, H. in T. O. BOSWORTH, 1922, Geol. of the Tert. and Quartern. Periods in the north western part of Peru, p. 117, t. 17, fig. 11) is not accessible to the present writer.

SAKAI showed the key to the Japanese genera of Hexapodinae, as follows

(1939, p. 577).

1. Front with a median triangular projection; the ischium and merus of external maxillipeds are broad and the carpus, propodus, and dactylus are slender and cylindrical.....Hexapus.

2. Front not marked with a median projection; propodus and dactylus of external maxillipeds are broadened, the former as broad as the ischium, the latter rhomboidal.....Thaumastoplax.

Generally, it is difficult to collect the fossil crabs bearing such an important part, the frontal projection or the external maxillipeds. RATHBUN, dealing with *Thaumastoplax prima*, stated as follows (p. 175), "the generic position of the species placed here has to be determined by the characters discernible in a dorsal view. As in *Thaumastoplax*, the shape of the carapace is subrectangular with the antero-lateral corners rounded off; the second ambulatory leg is stronger than the first and third. Of the other Hexapodinae or Goneplacids with only three pairs of walking legs, *Hexapus* DE HAAN is more subcylindrical and has the three legs of subequal size; *Lambdophallus* ALCOCK has smaller orbits; *Hexapus* DOFLEIN has very oblique orbits seen from above; while *Paeduma* RATHBUN (= *Amorphopus* BELL) is said to be almost cylindrical."

The holotype of *Hexapus nakajimai* is only the impression of the outer surface and more or less deformed and so it is difficult to treat of the minute differences of the shape of the fossil carapaces. The length of the holotype of *Hexapus nakajimai* is about 6 mm and its width is about 10.5 mm and so its ratio is 4: 7. The length of the carapace of *Hexapus sexpes* is measured from SAKAI's figure (Pl. CII, Fig. 4), 10.5 mm and the width is 18 mm and so its ratio is 7: 12. The length of the carapace of *Thaumastoplax prima* is approximately 12.2 mm in the paratype and the width 18 mm. The ratio of the length to the width of the carapace of *Thaumastoplax prima* is about 2: 3. The dimension of the carapace of the holotype of *Thaumastoplax prima* is described as about 19.6 mm in width but the length can not be measured as the front part of the carapace is not visible. The writer presumes that the length of the carapace of the holotype of *Thaumastoplax prima* is about 13.1 mm by the proportion of the carapace of the paratype.

The ratio of the width of the carapace of the species of the *Hexapus* and the *Thaumastoplax* as follows:

In the proportion between the length and the width of the carapace, the fossil specimen, now described is nearer to *Hexapus sexpes* than to the other three species of the *Thaumastoplax*. The shape of the carapace of *Hexapus sexpes* is transversely subcylindrical, and the lateral borders are convergent

forward. The shape of the carapace of *Thaumastoplax orientalis* RATHBUN is more regularly quadrilateral and the lateral borders imperceptibly arched, not crested nor angular as in *Hexapus sexpes*. The shape of the carapace of the fossil specimen now described, is transversely subcylindrical and the lateral borders are slightly convergent forward, with the antero-lateral corners broadly rounded off.

	<i>Hexapus nakajimai</i>	<i>Hexapus sexpes</i>	<i>Thaumastoplax prima</i>	<i>Thaumastoplax orientalis</i>	<i>Thaumastoplax anomalia</i>
length	6	10.5	12.2 (13.1)	12.5	8
width	10.5	18	18 (19.6)	17.7	13
ratio	4/7	7/12	2/3	9/13	8/13
ratio shown by a common denominator	624/1092	637/1092	728/1092	756/1092	672/1092

The Recent species, *Thaumastoplax anomalia* MIER from the Goree Bay, Senegambia, (Pl. II, Fig. 6) is nearer to *Thaumastoplax orientalis* RATHBUN than to *Hexapus nakajimai* in the shape of the carapace, as well as in the other characters. In the shape of the carapace, *Hexapus nakajimai* is near to *Hexapus sexpes*, but the lateral borders of the carapace are more convergent forward in the latter species than in the former.

As stated above, RATHBUN indicated that the second ambulatory leg of *Thaumastoplax* is stronger than the first and third. In the fossil species, *Thaumastoplax prima*, the second leg is always stronger than the first and third. Same relation can be observed on the ambulatory legs in the Recent species, *Thaumastoplax orientalis*. The Recent species, *Thaumastoplax anomalia* has the second leg which is not stronger than the others. The merus of the second leg of *Thaumastoplax anomalia* is slightly shorter than the one of the third leg. The longitudinal ridges and the furrows can be seen along the surfaces of the merus of the ambulatory legs of the Recent species, *Hexapus sexpes*. The fossil specimen now described has similar ridges and furrows in the merus of the second and the third legs. This distinguishing character is probably related to the ecology of the crab, and puts the fossil specimen now described, into the *Hexapus* rather than into the *Thaumastoplax*.

Thaumastoplax prima RATHBUN has a carapace, of which the lateral borders are convergent forward, and moreover has ambulatory legs with ridges and furrows. These characters of *Thaumastoplax prima* are the *Hexapus* type, but the ratio of the length to the width of the carapace in *Thaumastoplax*

prima indicates that the species belongs not to the *Hexapus* but to the *Thaumastoplax*. *Thaumastoplax prima* from the Oligocene formation of the Panama canal zone is an intermediate species between the *Thaumastoplax* and the *Hexapus*. It is astonishing that the descendants from *Thaumastoplax prima* have not been recorded in the Recent species of the sea of the Panama region. *Hexapus nakajimai* is nearer to *Hexapus sexipes* than to *Thaumastoplax orientalis*. The earliest genes is of the crab with three pairs of ambulatory legs in the Oligocene age, and it existed around Japan in the Miocene age.

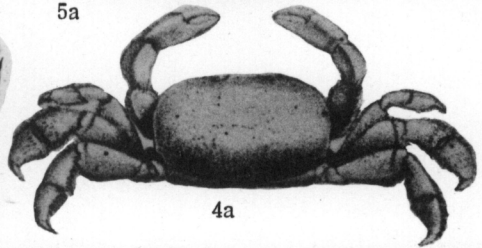
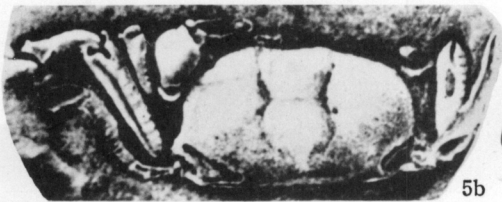
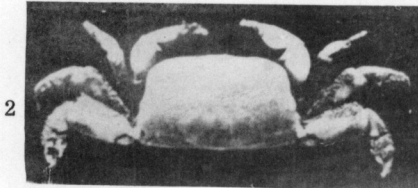
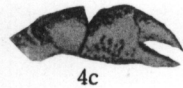
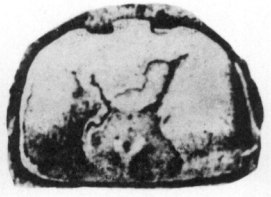
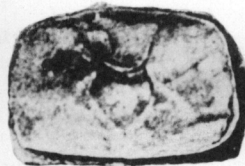
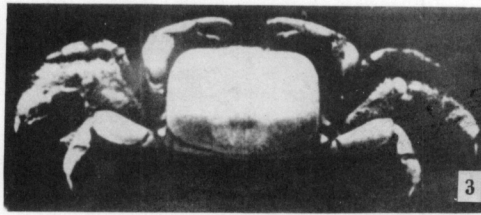
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Plate III

Explanation of Plate III

- Figure 1. *Hexapus Nakajimai*, n. sp., holotype, IGPS coll. cat. no. 79466, from the south western part of Kamiyamada-yashiki, Yamada-mura, Iwaki-gun, Fukushima Prefecture, (Onahama Sheet), IGPS loc. no. Fs-39, Nakayama Formation, Miocene, K. NAKAYAMA coll., 1952; 1a, $\times 2$; 1b, $\times 7$.
- Figure 2. *Hexapus sexpes* (FABRICIUS), ♀, from Kii Peninsula, Wakayama Prefecture; from SAKAI'S Pl. CII, Fig. 4 (11), $\times 1, 2$.
- Figure 3. *Thaumastoplax orientalis* RATHBUN, ♀, from Nagasaki, Nagasaki Prefecture, from SAKAI'S Pl. CII, Fig. 3 (11), $\times 1, 2$.
- Figure 4. *Thaumastoplax anomalia* MIER from the Goree Bay, Senegambia, from MIER'S Pl. XIV, Fig. 2 (8); 4a, dorsal view, $\times 1. 8$; 4b, anterior view of front; 4c, chela.
- Figure 5. *Thaumastoplax prima* RATHBUN, from RATHBUN'S Pl. 66, Figs. 15-18 (a); 5a, impression of the holotype, $\times 1. 7$; 5b, holotype, $\times 1. 7$; 5c, paratype, $\times 1. 7$; 5d, impression of paratype, $\times 1. 7$.



1b

