

Tertiary Echinoids from the Environs of the Ise-Bay

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Abstract

Several specimens of fossil echinoids from various localities of eastern parts of Setouchi (Old Seto Inland Sea) are described with their matrix or associated fauna and offered as data for seeking correlation between some formations of neighbouring districts.

Introduction

Recently many investigations about the Old Seto Inland Sea have been accomplished in view of stratigraphical, palaeontological, structural and volcanic points. It must be considered that the centre of sedimentary basin has

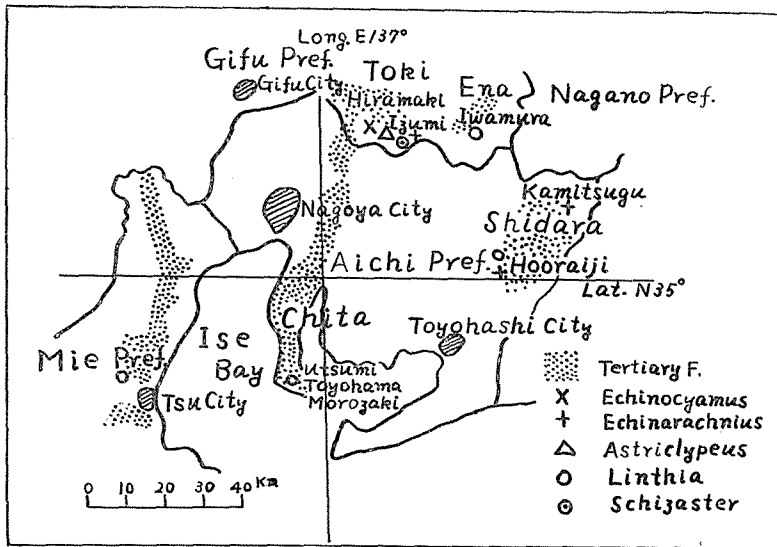


Fig. 1 A distribution map of fossil echinoids in the environs of Ise Bay.

Mie Dist.	Chita D.	Shidara D.	Iwamura D.	Toki D.
	Tohona-me G.			
Tajiri F. ○	Moroya-ri G. ○	Kadoya F. ○	Maki F. ○	Oidawa-ya F. X ○
Ishibashi F.		Ono F.	Ishiga-hora F.	Yamano-uchi F. X
Mikano F.			Kuboha-ya F.	Togari F. †
Kaiishi-yama F.		Nagashino F.	Aki F.	Takiyo-shi F. △
Hiyata-ike F.				
Kongoh F.				

Table 1 Columnar sections of some representative districts, indicating horizons of fossil echinoids. (marks of fossils are the same as in Fig. 1)

constantly shifted, so the correlation between scattered basins must be sought according to various data. The author had reported on some fossil echinoids of Mizunami-cho; afterwards several specimens of fossil echinoids have been collected by his colleagues and himself. He describes them in this paper as a datum of studies of the Old Seto Inland Sea. All the specimens were collected from rocks of the eastern part of the First Seto Inland Sea, advocated by Prof. Nobuo IKEBE of Osaka City University and its rocks are the Middle to Upper Miocene in age (F₂-G). Judging from fossil echinoids fauna, Togari-Hiramaki district and Chita-Mie district can be distinguished, and Iwamura-Shidara district may be the intermediate part between the former two districts.

Species collected from this district are as follows.

Echinocyamus crispus MAZZETTI

Echinarachnius brevis IKEDA

Astriclypeus manni VERRILL

Astriclypeus manni minoensis MORISHITA

Linthia nipponica YOSHIWARA

Schizaster sp.

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Description of Species

Family *Fibulariidae* DUNCAN

Genus *Echinocyamus* LESKE*Echinocyamus crispus* MAZZETTI

- 1914 *Echinocyamus crispus*, H. L. CLARK, Hawaiian Echini, p. 62
 1933 *Echinocyamus crispus*, S. AOKI, Iwanami-koza, p. 46, figs. 57 A-D
 1937 *Fibularia crispata*, A. JEANNET u. R. MARTIN, *Leidsche Geol. Mededeel.*, VIII, 2, p. 239
 1948 *Echinocyamus crispus*, Th. MORTENSEN, Monograph IV-2, p. 185, pl. XLVI, figs. 46, 47, 55
 1953 *Echinocyamus crispus*, A. MORISHITA, *Trans. Proc. Palaeon. Soc. Japan*, N. S., no. 11, p. 61, pl. 6, figs. 4, 5

Observations.—The specimens from Ichihara, Mizunami-Toki-machi were already described. (A. MORISHITA, 1953) Afterwards another specimen was offered by T. HAYASHI. This specimen is poor in preservation, but its general character and shape of ambulacral area are precisely like those of the former. In this specimen the radiating internal partition is observed.

Measurements.—

Length ca. 11mm., Width 6.8mm.

Geological Horizon.—Yamanouchi & Oidawara Formation. (Toki)

(both Upper Miocene, G)

Localities.—Otomi, Izumi-cho, Toki-gun, Gifu Prefecture.

Ichihara, Mizunami-Toki-machi, Gifu Prefecture.

Matrix.—Pumice-bearing tuffaceous mudstone.

Associated Fauna.—*Yoldia cf. sagittaria*, *Nuculana sp.*, *Acila submirabilis*, *Macoma optiva*, *Venericardia sp.*, *Cultellus sp.*, *Natica sp.*, *Nassarius sp.*

Family *Scutellidae* GRAYGenus *Echinarachnius* GRAY*Echinarachnius brevis* IKEDA

(Pl. VII, Figs. 1-3)

- 1936 *Echinarachnius brevis*, H. IKEDA, *Botany and Zoology*, 4, no. 7, p. 1231
 1940 *Echinarachnius brevis*. S. NISHIYAMA, Jub. Pub. Comm. Prof. YABE's 60th Birth., p. 843, Text-figs. 39-60, pl. 43, fig. 9

Many small scutellid echinoids can be found in Tertiary rocks in Shidara and Toki Districts, but they are incomplete and only inner mould and internal partition are observed. Only the specimen from Toki district is distinct in abactinal surface and may be referred to young of *Echinarachnius brevis*.

The Genus *Echinarachnius* has been almost unknown before the Upper Miocene (*Echinarachnius microthyroides*, Tsubono Siltstone, Toyama Prefecture), especially *Echinarachnius brevis* was unknown as fossil.

Description.—Outline of test is subpentagonal and wavy in the posterior

margin. Apical system is eccentric anteriorly.

Petaloid ambulacra are large, reaching to more than half of radius, and open at the extremities. Odd ambulacra is open most widely.

Interporiferous zones are rather narrow. Periproct is apparently supramarginal. Internal partitions developed.

Measurements.—

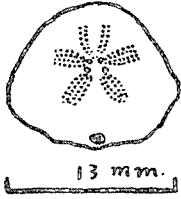


Fig. 2 *Echinarachnius brevis*
Ikeda, abactinal side.

	Kamado	Inkyoyama	Nagashino	:	
	12.4 × 13.0mm.	11.0	7.2	6.0	
	:	:	:	:	Kamitsugu :
	9.4	7.0	13.5	8.6	8.5 32.5 36.0

All specimens except one of Kamado are mould and indistinct in longitudinal, transverse directions, so only the longest diameter was measured.

Remarks.—*Echinarachnius brevis* is very much like *Echinarachnius griseus* and *Echinarachnius mirabilis*, especially in its young shape, but this species differs in lack of abactinal interambulacral depression, longer transverse diameter and supramarginal periproct from the other two. However, it is doubtful whether specimens from Shidara are of young. Though two specimens from Kita-Shidara are bad in preservation, general character is so much like *Echinarachnius brevis*, that they were treated as the adult of this species. Exact determination must be made in future when more perfect specimens are collected.

This is the same specimen as *Echinarachnius microthyroides* of S. OGOSE's list (S. OGOSE, 1952). *Echinarachnius* from Fujiwara Formation of Nara Prefecture, collected by S. KOGAWA is imperfect, but it may possibly be allied to *Echinarachnius brevis*, judging by its shape and size of test.

Geological Horizon.—

- (1) Togari Tuffaceous Sandstone. (Toki)
- (2) Nagashino Formation. (Shidara)

(both Middle Miocene, F₂~F₃)

Localities.—

- (1) East of Haginoshima and Inkyo-yama, Kamado-mura, Toki-gun, Gifu Prefecture.
- (2) Yoshimura, Nagashino-mura, Minami-Shidara-gun, Aichi Prefecture.
- (3) North of Kaigarahuchi, Kamitsugu-mura, Kita-Shidara-gun, Aichi Prefecture.

Matrices.—

- (1) Tuffaceous Coarse Sandstone. (Toki)
- (2) Arkose Granule Conglomerate. (Minami-Shidara)
- (3) Arkose Granule Conglomerate. (Kita-Shidara)

Associated Fauna.—

- (1) *Bryozoa*, *Siliqua* sp., *Dentalium* sp., *Chlamys* sp., *Volsella* sp., *Anadara* sp., *Glycymeris* sp., *Haliotis* sp. (Toki)
 (2) *Volsella* sp., *Mytilus* sp., *Chlamys* sp. (Minami-Shidara)

Genus *Astriclypeus* VERRILL*Astriclypeus manni* VERRILL

- 1885 *Astriclypeus manni*, L. DÜDERLEIN, *Arch. f. Naturgesch.*, **LI**, 1, p. 35
 1900 *Astriclypeus manni*, S. YOSHIWARA, *Zool. Mag.*, **12**, p. 393, pl. 16, figs. 11, 12
 1938 *Astriclypeus manni*, K. ONODA, *Jap. Jour. Zool.*, **3**, no. 1, p. 8
 1939 *Astriclypeus manni*, H. IKEDA, *Jour. Dep. Agr. Kyusyu Univ.*, **6**, pls. 2 (8-11), 3 (6-7), 12 (9), 13 (4-6)
 1947 *Astriclypeus manni*, I. HAYASAKA, *Acta Geologica Taiwanica*, **1**, no. 2, p. 116, pls. 12(2), 13(1), 14(1), 15(1)
 1948 *Astriclypeus manni*, Th. MORTENSEN, Monograph IV-2, p. 416, pls. 59, figs. 1-3; 62, fig. 1; 72, figs. 17, 18, 20, 21
 1949 *Astriclypeus manni*, A. MORISHITA, *Jour. Geol. Soc. Japan*, **55**, p. 256
 1952 *Astriclypeus manni*, A. MORISHITA, *Mem. Coll. Sci., Kyoto Univ.*, Ser. B, **20**, no. 2, art. 7, p. 109, table 1, pl. 11, fig. 2
 1953 *Astriclypeus manni*, A. MORISHITA, *Trans. Proc. Palaeon. Soc. Japan*, N. S., no. 11, p. 62, pl. 6, fig. 3

Geological Horizon.—Shukunohora Sandstone (Middle Miocene, F₂-F₃).

Locality.—Shukunohora, Hiyoshi-mura, Toki-gun, Gifu Prefecture.

Astriclypeus manni minoensis MORISHITA

- 1952 *Astriclypeus manni minoensis*, A. MORISHITA, *Mem. Coll. Sci., Kyoto Univ.*, Ser. B, **20**, no. 2, art. 7, p. 111, pl. 11, fig. 1
 1953 *Astriclypeus manni minoensis*, A. MORISHITA, *Trans. Proc. Palaeon. Soc. Japan*, N.S., no. 11, p. 63, pl. 6, figs. 1, 2

Geological Horizon.—Shukunohora Sandstone (Middle Miocene, F₂-F₃).

Locality.—Shukunohora, Hiyoshi-mura, Toki-gun, Gifu Prefecture.

Family *Hemiastridae* H. L. CLARKGenus *Linthia* E. DÉSOR*Linthia nipponica* YOSHIWARA

(Pl. VII, Figs. 4-8)

- 1899 *Linthia nipponica*, S. YOSHIWARA, *Jour. Geol. Soc. Tokyo*, **6**, no. 65, p. 2
 1903 *Linthia nipponica*, S. TOKUNAGA, *Jour. Coll. Sci., Univ. Tokyo*, **17**, art. 12, p. 18, pl. 1, figs. 5-7, pl. 3, fig. 1
 1933 *Linthia nipponica*, S. AOKI, Iwanami-koza (Manual Geol. Palaeon.), p. 51.

fig. 66

1953 *Linthia nipponica*, A. MORISHITA, *Mem. Coll. Sci., Univ. Kyoto*, Ser. B, 20, no. 4, p. 222, pl. 1, figs. 5-7

Observations.—Some specimens from Iwamura, Shidara, Chita and Mie districts are under examination. All the specimens are badly preserved, but they are no doubt allied to *Linthia nipponica*.

Specimens from Mie can be observed both actinally and abactinally, but are much depressed. Some features, for instance, position of apical system or length of posterior paired ambulacra are distinctly differ from those of *Schizaster*. Remarkable amphisternous plastron and prominent labrum are developed. Specimens from Chita are very much like those from Mie in its depressed forms, and widened in ambulacral area. Abactinal side of specimens from Toyohama-cho are in good preservation. Two specimens from Shidara are inner mould of abactinal side. Depression of anterior margin, ambulacral area and position of apical system are observed on these specimens. Specimens from Iwamura is in worst preservation, but interambulacral plate, a part of ambulacra and outline of test are observed. Till the present time this species has never been discovered from the northern region (Togari and Hiramaki districts).

Measurements.—

Mie-1	M.-2	M.-3	M.-4	Chita-1	C.-2	C.-3	Shidara-1	S.-2	Iwamura-1
60mm.	56	<u>61</u>	54	43	55	48	<u>41</u>	<u>36</u>	50

All except underlined are approximate length.

Remarks.—*Linthia nipponica* has been known from Tertiary Formation of north of Nagano Prefecture, but it was made clear that this species can be found in south-western Japan. Its geological age descends to the Middle Miocene.

Recently it was discovered in Uchimura Formation of Nagano Prefecture (Lower or Middle Miocene). This species is said to be found in lower to upper part of Tertiary rocks of Chita district.

Geological Horizon.—

- (1) Tajiri Formation. (Mie)
 - (2) Middle part of Kadoya Formation. (Shidara)
 - (3) Maki Formation. (Iwamura)
 - (4) Morozaki Formation. (Chita)
- (all Middle and Upper Miocene, F₂-G)

Localities.—

- (1) Tajiri, Takaoka-mura, Itsushi-gun, Mie Prefecture.
- (2) Kadoya and Kurose, Hooraiji-mura, Minami-Shidara-gun, Aichi Prefecture.
- (3) Kamaya and Maki, Tooyama-mura, Ena-gun, Gifu Prefecture.
- (4) Ooi of Morozaki-cho, Utsumi-cho and Toyohama-cho, Chita-gun, Aichi

Prefecture.

Matrices.—

- (1) Tuffaceous Mudstone. (Mie)
- (2) Tuffaceous Mudstone. (Shidara)
- (3) Coarse Sandstone and Mudstone. (Iwamura)
- (4) Tuffaceous Mudstone. (Chita)

Associated Fauna.—

- (1) *Lucina* sp., *Macoma* sp. (Mie)
- (2) *Yoldia tokunagai*, *Yoldia thraciaeformis*, *Palliolium peckhami*, *Turritella* sp., *Macoma* sp., *Acila* sp., *Venericardia orbica* (Shidara)
- (3) *Phaxus izumoensis*, *Dentalium* sp., *Venericardia tokunagai*, *Nuculana* sp., *Lucinoma* sp., *Patinopecten* sp., *Acila submirabilis*, *Yoldia* sp., *Fulgoraria* sp., (Iwamura)
- (4) *Nuculana pennula*, *Palliolium peckhami*, *Acila submirabilis*, *Natica janthostoma*, *Yoldia tokunagai*, *Propeamussium* sp., *Periploma* sp. (Chita)

Genus *Schizaster* L. AGASSIZ*Schizaster* sp.

1953 *Schizaster* sp., A. MORISHITA, *Trans. Proc. Palaeon. Soc. Japan*, N. S. no. 11, p. 63, pl. 6, fig. 6

Geological Horizon.—Oidawara Tuffaceous Mudstone. (Upper Miocene, G)

Locality.—Dan, Mizunami-Toki-machi, Toki-gun, Gifu Prefecture.

References

- CLARK, H. L. (1914): Hawaiian Echini, *Clypeastridae-Scutellidae*
- DÖDERLEIN, I. (1885): Seeigel von Japan u. d. Liukiu Inseln, *Arch. f. Naturgesch.*, 51, 1
- FUJITA, K. & OGOSE, S. (1950): Lithologic Classification of the Cenozoic Strata in the Northern Area of Mizunami-machi, Toki-gun, Gifu Prefecture, *Japan, Jour. Geol. Soc. Japan*, 56; 662, 57; 666
- HAYASAKA, I. (1947): Notes on Some Fossil Echinoids of Taiwan-3, *Acta Geologica Taiwanica*, 1, 2
- IKEDA, H. (1936): Note on a New *Echinarachnius* from Japan, *Botany and Zoology*, 4, 7
- (1939): Studies on the Pseudofasciole of the Scutellids, *Jour. Dep. Agr. Kyusyu Imp. Univ.*, 6, 2
- JEANNET, A. u. MARTIN, R. (1937): Ueber Neozoische Echinoidea aus dem Niederländisch-Indischen Archipel, *Leidsche Geologische Mededeelingen*, 8, 2
- MORISHITA, A. (1949): Neogene Echinoids from Ishikawa and Toyama Prefectures, *Jour. Geol. Soc. Japan*, 55
- (1952): Fossil *Astriclypeus* from Japan, *Mem. Coll. Sci., Kyoto Univ.*, B, 20, 2, art. 7
- (1953): On Some Neogene Echinoids from Nagano Prefecture, Japan, *Mem. Coll. Sci., Kyoto Univ.*, B, 20, 4, art. 1
- (1953): Neogene Echinoids from Gifu Prefecture, Japan, *Trans. Proc. Palaeon. Soc.*

Japan, N. S., 11

- MORTENSEN, Th. (1948): A Monograph of Echinoidea, IV-2 (*Clypeastroida*)
- NISIJAMA, S. (AOKI) (1933): Echinodermata, Iwanami-koza (Manual of Geology and Palaeontology)
- (1940): On the Japanese Species of *Echinarachnius* from Japan, Jubilee Publication in the Commemoration of Prof. H. Yabe's 60th Birthday
- OGOSE, S. (1952): On the Mode of Occurrence of Fossils in the Mizunami Group in the Eastern Mino, Japan, *Jour. Geol. Soc. Japan*, **58**, 685
- ONODA, K. (1938): Notes on the Development of Some Japanese Echinoids, *Japanese Jour. Zool.*, **8**, 1
- TAKIMOTO, K. (1935): The Cainozoic Strata in the Isshi District, Ise Province, *Chikyū*, **23**, 5
- TOKUNAGA, S. (YOSHIWARA) (1899): On Some New Fossil Echinoids of Japan, *Jour. Geol. Soc. Tokyo*, **6**, 65
- (1900): Japanese Echini, *Zool. Mag.*, **12**
- (1903): On Some Fossil Echinoids of Japan, *Jour. Coll. Sci., Imp. Univ. Tokyo, Japan*, **17**, 12

Plate VII

Explanation of Plate VII

(All figures in natural size)

Echinarachnius brevis IKEDA

- Fig. 1 Specimens from Yoshimura, Nagashino-mura, Minami-Shidara-gun, Aichi Prefecture.
a: Internal partition, b: cast of actinal side.
- Fig. 2 Specimen from Kaigarahuchi, Kamitsugu-mura, Kita-Shidara-gun, Aichi Prefecture.
Cast of actinal side.
- Fig. 3 Specimen from Inkyo-yama, Kamado-mura, Toki-gun, Gifu Prefecture. Abactinal side.

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- Fig. 4 Specimen from Kadoya, Hooraiji-mura, Minami-Shidara-gun, Aichi Prefecture. Cast of abactinal side.
- Fig. 5 Specimen from Kurose, Hooraiji-mura, Minami-Shidara-gun, Aichi Prefecture. Cast of abactinal side.
- Fig. 6 Specimen from Toyohama-cho, Chita-gun, Aichi Prefecture. Abactinal side.
- Fig. 7 Specimen from Tajiri, Takaoka-mura, Itsushi-gun, Mie Prefecture. Actinal side.
- Fig. 8 ditto.

