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On Some Neogene Echinoids from Nagano Prefecture, Japan

By

Akira MORISHITA

Geological and Mineralogical Institute, University of Kyoto

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Abstract

On his way of stratigraphical studying in the Neogene strata of Nagano Prefecture, several specimens of fossil echinoids from the Ogawa Formation have been collected by the author himself. They are described in the present paper with the specimens from the Bessho, Aoki and Shigarami Formations, collected by his colleagues.

Introduction

Of several echinoids obtained from the Tertiary rocks in Nagano Prefecture, *Schizaster sp. nov.*, *Schizaster sp. indet.*, *Linthia nipponica* YOSHIWARA, *Sismondia sp. nov.*, Echinarachnius sp. nov., and *Echinarachnius microthyroides* NISIYAMA were identified. The last species was collected from a bed referred to the Shigarami Formation, the uppermost Tertiary member, and the others were in the lower members: the Ogawa, Aoki and Bessho Formations. *Linthia* and *Scutella* are known as very common in the Tertiary of this district, but it should be made clear that the so-called *Scutella* is truely *Echinarachnius* and that *Echinarachnius* of the Ogawa Formation differs from that of the Shigarami Formation. This fact may be a useful criterion to solve the problem about the relationship of the two formations. The local names of *Linthia* and *Echinarachnius* are "Kame-Ishi" (turtle stone) and "Kiku-Ishi" (chrynsanthemum stone) respectively.

No occurrence of fossil echinoid is known from the Uchimura that is the lowest member, but it has been recently discovered from the Bessho and Aoki Formations that are the lower members of the stratigraphical succession of the Tertiary rocks in this district. The following items about the fossil echinoids in this field will be examined: the geological horizons, geographical distributions, associated fauna, matrices and the occurrence.

The writer acknowledges Professor Jiro MAKIYAMA of our institute for reading over the manuscript, and Mr. Kunio KOBAYASHI and Mr. Kunio TANAKA of Shinshu University, Mr. Tsuneo TOMIZAWA of Nagano Kita High School and Mr. Tokushige MATSUMOTO of Naniai Middle School for their kindnesses offering the valuable specimens.

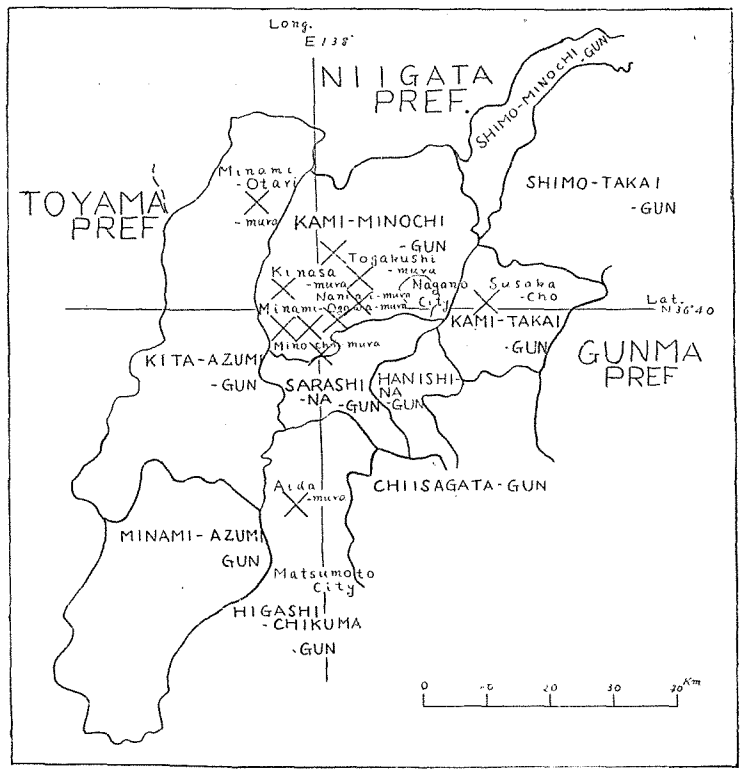

Fig. 1. A distribution map of fossil echinoids in the northern part of Nagano Prefecture.

Description of Species

Family *Fibulariidae* GRAY
Genus *Sismondia* DÉSOR

Sismondia naganoensis sp. nov.
Pl. I, Figs. 1, 2

Description.— Two specimens of this species collected by K. TANAKA are at the disposal.

The test is very small, sub-pentagonal in marginal outline, very thin, and slightly tumid centrally. The apical system is rather large and subcentral.

The ambulacral petal are very long, reaching the margin of test and open in the ambitus. The forms of ambulacra are sub-elliptical and rather straight. All are equal in length and form.

The other features are not clarified with the type

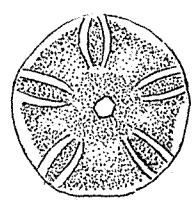

Fig. 2. *Sismondia naganoensis sp. nov.*, internal mode. ×4

specimens.

The internal mode is the same as seen in GERTH's Figure. (A. JEANNET u. R. MARTIN, 1937)

Measurements,—

	Specimen I	Specimen II
Length	6.0 mm.	4.5 mm.
Width	6.3	4.6
Length of Amb.	3.1	2.1
Width of Amb.	1.7	1.4
Width of Intpor. Zone	1.0	0.7

Remarks.— The occurrence of this genus has been reported from the Palaeogene strata of Ogasawara (Chichi-jima) by S. NISIYAMA without description.

This species resembles *Sismondia javana Gerth*, especially in it's internal mode, (Jeannet u. Martin, 1937, p. 241, abb. 25) but differs in having not arched ambulacral forms, in smaller tests and in longer ambulacra.

Matrix.— Medium or Coarse Sandstone.

Geological Horizon.— Lower Part of Aoki Formation (Middle Miocene?).

Locality.— Shimizu-sawa, Aida-mura, Higashi-Chikuma-gun.

Holotype.— No. JC750002, deposited in Geol. Inst., Kyoto Univ.

Family *Scutellidae* GRAY
Genus *Echinarachnius* GRAY

Echinarachnius microthyroides NISIYAMA
Pl. I, Fig. 3

1940 *E. microthyroides*, S. NISIYAMA: Jub. Publ. Comm. Prof. YABE's 60th Birth., p. 828, pl. 44, figs. 17–20

1949 *E. microthyroides*, A. MORISHITA: Jour. Geol. Soc. Japan, vol. 55, p. 256

Description.— The test is very thin, longitudinally elongated, wavy in the margin, and gently elevated from the margin to the apical system; the greatest width is in the posterior paired interambulacra.

The apical system is anteriorly subcentral. The petaloidal area is rather small (about 0.52 of radius). The ambulacra II, III and IV are indistinct. The ambulacra I and V are widely opened in their extremities; the interporiferous zones are broader than the poriferous zones; the number of pore-pairs is about 40; the rows of pores diverge at first, converge at the middle part, then re-diverge in the extremities.

The tubercles are larger on the actinal side than the abactinal. The actinal side is flat or slightly concave. Characters of ambulacral furrows, peristome, periproct etc. cannot be observed.

Measurements. —

Longitudinal Diameter:	62 mm.
Transverse Diameter:	57 mm.
Height:	6 mm.
Post. Paired Amb.:	Length 14 mm.; Width 5.3 mm.; Porif. Zones 2.3 mm.; Interpor. Zones 3 mm.

Remarks.— This species differs from *Echinarachnius mirabilis* (A. AGASSIZ), the ordinary species of this genus of Japanese Pliocene, Pleistocene and Recent, in the longitudinally elongated test and the smaller petaloid area. The specimens of this description are TOMIZAWA's collections of the Nagano Kita High School. The original specimen of this species reported by NISIYAMA from Suenomatsuyama Formation (Upper Miocene) of Nagamine, Fukuoka-cho, Ninohe-gun, Iwate Prefecture. (S. NISIYAMA, 1940). As the samples are hardly separated from the matrix, the description is limited to the abactinal side.

Matrix.— Granule Conglomerate.

Geological Horizon.— Shigarami Formation (Middle or Upper Pliocene).

Locality.— Kawashita, Togakushi-mura, Kami-Minochi-gun.

Associated Fauna.— *Pecten n. sp., Pecten yamasakii, Chlamys n. sp., Turritella sp., Glycymeris yamasakii.*

Echinarachnius naganoensis sp. nov.

Pl. I, Fig. 4

Description.— The test is rather thick, sub-circular, slightly notched in the ambitus of each ambulacra, wavy in the margin, and gently sloped from the ambitus to the centre. The greatest breadth is at slightly posterior to the centre.

The apical system is large and eccentric anteriorly (0.45 diameter from anterior ambitus).

The ambulacra are long, occupies about 0.8 of radius, and diverge at the centre of test, slightly converge at the middle parts of petals, and widely open at the ambitus. Number of the pore pairs is about 43.

The odd ambulacrum is the largest and most widely open at the ambitus. (width at the ambitus: odd amb. 5 mm., paired amb. 3.4 mm.) The poriferous zone is narrower (1.4 mm.) and the interporiferous zone is broader (5 mm.).

The periproct seems to be supramarginal (impossible to observe exactly for the destruction of this part).

The actinal surface is slightly concave orally. The peristome is central and sub-pentagonal (diameter 3.3 mm.).

The ambulacral furrows, the ambulacral plates and the other characters around are indistinct.

Measurements.—

	Specimen I	Specimen II
Length	40 mm.	43 mm.
Width	42	46
Height	5	6
Length & Width of Amb. III	14, 8	14.4, 8.0
Length & Width of Paired Amb.	14, 6.5	14.5, 7.0
L/W	0.95	0.93
H/L	0.13	0.14
Amb./Radius	0.82	0.79

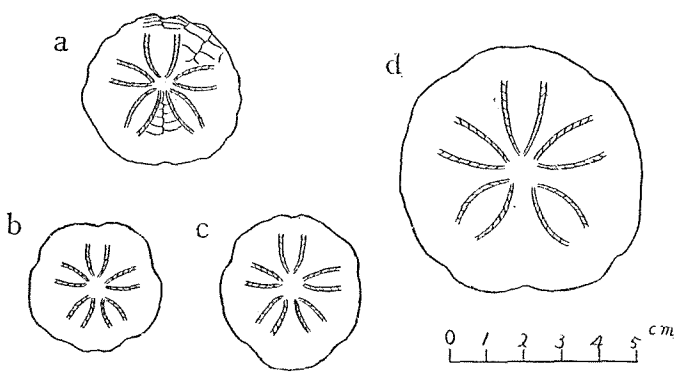

Fig. 3. The comparative figures showing the differences of four species of *Echinarachnius* on abactinal surfaces.
a : *E. naganoensis sp. nov.* b : *E. subtumidus* NISIYAMA & HASHIMOTO
c : *E. rumoensis* HAYASAKA & SHIBATA d : *E. parma obesus* CLARK

Remarks.— This species is apparently allied to *Echinarachnius subtumidus* NISIYAMA & HASHIMOTO, (S. NISIYAMA & W. HASHIMOTO, 1950) *Echinarachnius rumoensis* HAYASAKA & SHIBATA (I. HAYASAKA & M. SHIBATA, 1952) and *Echinarachnius parma obesus* H. L. CLARK, (S. NISIYAMA, 1940) but differs from them in the following respects: the apical system is more eccentric anteriorly; the odd ambulacrum and the paired ambulacra are unlike; the transverse diameter is longer than the longitudinal diameter.

The next table shows the important characters of this four species in comparison. (Fig. 3)

	E. subtumidus	*E. rumoensis*	*E. parma obesus*	*E. naganoensis*
Position of Apical System	0.51	0.47	0.53	0.45
Shape of Odd Amb.	as usual	as usual	same as ant. amb.	differ from others
L/W	0.97	1.05	0.99	0.93–0.95
H/L	0.18	0.13	0.17–0.25	0.13–0.14
Amb./Radius	0.7	0.8	0.71	0.79–0.82

Two specimens are under observation. The remainder at hand is incomplete. One of the two has a destroyed left posterior surface, but its five ambulacra are fairly well observed. The other specimen is missing the posterior half, but the actinal side is distinct.

As all matrices are indurated and hard, separation of the fossils is very difficult. This two specimens are T. MATSUMOTO's collections of Naniai Middle School and the others were collected by the author himself.

Matrices.— Granule Conglomerate, Coarse Sandstone, Medium Sandstone.

Geological Horizon.— Upper Part of Ogawa Formation. (Middle Pliocene?)

Localities.— Naniai-mura, Kami-Minochi-gun: Eastern valley of Ichiba (Doro-sawa); Southern valley of Ronji (the confluence of Higashi-sawa and Tsubone-sawa); Western valley of the Huruma Shrine (Shimizu-tani).

Sakai-mura, Kami-Minochi-gun: Southern valley of Sendo (Obayashi-no-sawa); Left bank of the Dojiri River, southwards of Tagoshi; Right bank of the Dojiri River, southwards of Ichinose; Left bank of the Dojiri River, south of Ikari.

Minochi-mura, Kami-Minochi-gun: North-eastern part of Shin-Machi (east of Chiharada).

Associated Fauna.— *Ostrea gigas*, *Cardium sp.*, *Anadara sp.*, *Dosinia sp.*

Holotype.— No.JC750003, deposited in Geol. Inst., Kyoto Univ.

Family *Hemiastridae* H. L. CLARK

Genus *Linthia* E. DÉSOR

Linthia nipponica YOSHIWARA

Pl. I. Figs. 5–7

1899 *L. nipponica*, S. YOSHIWARA: Jour. Geol. Soc. Tokyo, vol. 6, no. 65, p. 2

1903 *L. nipponica*, S. TOKUNAGA: Jour. Coll. Sci., Imp. Univ. Tokyo, vol. 17, art. 12, p. 18, pl. 1, Figs. 5–7, pl. 3, fig. 1

1933 *L. nipponica*, S. AOKI: IWANAMI-Koza (Manual Geol. Palaeon.), p. 51, fig. 66

Description.— The test is very thick, cordiform; the highest point is nearly at the apical system; the line between the medium part of interambulacra I and IV is the broadest; the abactinal surface is abruptly elevated from the margin to the centre and especially the anterior part is remarkable.

The apical system is slightly eccentric anteriorly at the centre.

All the ambulacra are straight, parallel and open at the extremities.

The odd ambulacrum is the longest and the posterior paired ambulacra are the shortest. The odd one is in the deep furrow. The paired ambulacra are broad in the poriferous zone and narrow in the interporiferous zone.

The peripetalous fasciole is narrow, connecting each the ambitus of ambulacra and entering at the posterior part of anterior paired ambulacra, and a little sinking at the interambulacrum V. The lateral fasciole is straight from the ambitus of anterior paired ambulacra to the periproct.

The actinal side is flat, but concaved at the peristome. The peristome is at about 1/4 diameter anteriorly, semi-circular transversely. The periproct situates at the postero-marginal part and elliptical. The tubercles are larger on the actinal side than on the abactinal side.

Measurements.—

Longitudinal Diameter 66 mm.
Transverse Diameter 68 mm.
Height 36 mm.

	Amb. I	Amb. II	Amb. III	Amb. IV	Amb. V
Length	21 mm.	32	38.5	33	21
Width	5	6	7	6	5

Angle of Amb. II & IV : 110°
Angle of Amb. I & V : 80°

Remarks.— This species differs from *Linthia praenipponica* from the Palaeogene of Kyusyu (T. NAGAO, 1928) in that the depression of anterior ambitus is very small; the anterior ambulacra do not reach the margin; and that the groove of odd anterior ambulacrum is shallow.

This species has been known from Shinshu, Hokuriku, Tohoku and Hitachi regions. The author has collected one or several specimens in Nagano Prefecture.

Occurrences.— The occurrence is different at places, but this species is found in the alternations of sand and mud, or in the massive coarse or medium sandstones. In some places the individuals scattered irregularly or crouded, and in other places they be flatly upon the bedding plane. The former may indicate a sudden sedimentation and the latter a quiet.

Geological Horizon.— Upper Part of Ogawa Formation (Middle Pliocene?).

Localities.— Sakai-mura, Kami-Minochi-gun: West of Ichinose (Sakai-no-sawa).
Minami-Ogawa-mura, Kami-Minochi-gun: The Dojiri River, near the Primary School of Inari; Doai; Shimo-Ichiba; The Dojiri River, east of the Inari Shrine.
Naniai-mura, Kami-Minochi-gun: The road, south of Shio.
Togakushi-mura, Kami-Minochi-gun: Shimokusugawa.
Minami-Otari-mura, Kita-Azumi-gun: Near a crossing, north of the Primary School of Uchu.

Associated Fauna.— *Pecten yessoensis*, *Anadara amicula*, *Dosinia sp.*.

Genus *Schizaster* L. AGASSIZ

Schizaster kinasaensis sp. nov.

Pl. I. Fig. 8

Description.— The test is depressed, thin, and cordiform. The anterior groove is shallow. The apical system is posterior at the 1/4 of diameter.

The odd ambulacrum is very wide and in the deep groove. The anterior paired ambulacra are long, narrow, straight and closed in the extremities. The posterior paired ambulacra are very short, straight, round, closed in the extremities and make an obtuse angle with each other.

The fascioles are indistinct. The peristome is eccentric antero-marginally.

This species is characterized as follows: the apical system is eccentric posteriorly; the odd ambulacrum is in the deep furrow; the posterior paired ambulacra make an obtuse angle with each other.

Measurements.—

Longitudinal Diameter 37.5 mm.
Transverse Diameter 35 mm.
Height 4.6 mm. (depressed)

	Amb. I	Amb. II	Amb. III	Amb. IV	Amb. V
Length	6 mm.	17.8	20	18.5	5.7
Width	3.5	4.2	6.4	4.0	3.4

An angle of Amb. I and V: 155°
An angle of Amb. II and IV: 60°

Remarks.— The specimen of this new species has been discovered by K. KOBAYASHI and the author himself at Ichinosaka, Kinasa-mura, in November, 1952. This is the first discovery of the genus *Schizaster* in Nagano Prefecture. Although the material is deformed and depressed, its ambulacral area is fairly well preserved. There have been known many occurrences of this genus at various localities in Japan. A careful examination of the genus is expected in near future.

This species differs from *Schizaster recticanalis* (S. YOSHIWARA, 1899) in the anteriorly eccentric peristome, the odd ambulacrum in the deep furrow, the short and straight posterior paired ambulacra, and the apical system at much posteriorly abactinal surface.

Occurrence.— This form occurs at the base of a graded conglomeratic sandstone (medium to fine grain) parallel to the bedding plane in the main.

Geological Horizon.— Middle Part of Ogawa Formation (Lower Pliocene?).

Locality.— A place of construction, southwest of Ichinosaka, Kinasa-mura, Kami-Minochi-gun.

Associated Fauna.— *Solemya tokunagai*, *Cyclammina sp.*.

Holotype.— No.JC750004, deposited in Geol. Inst., Kyoto Univ.

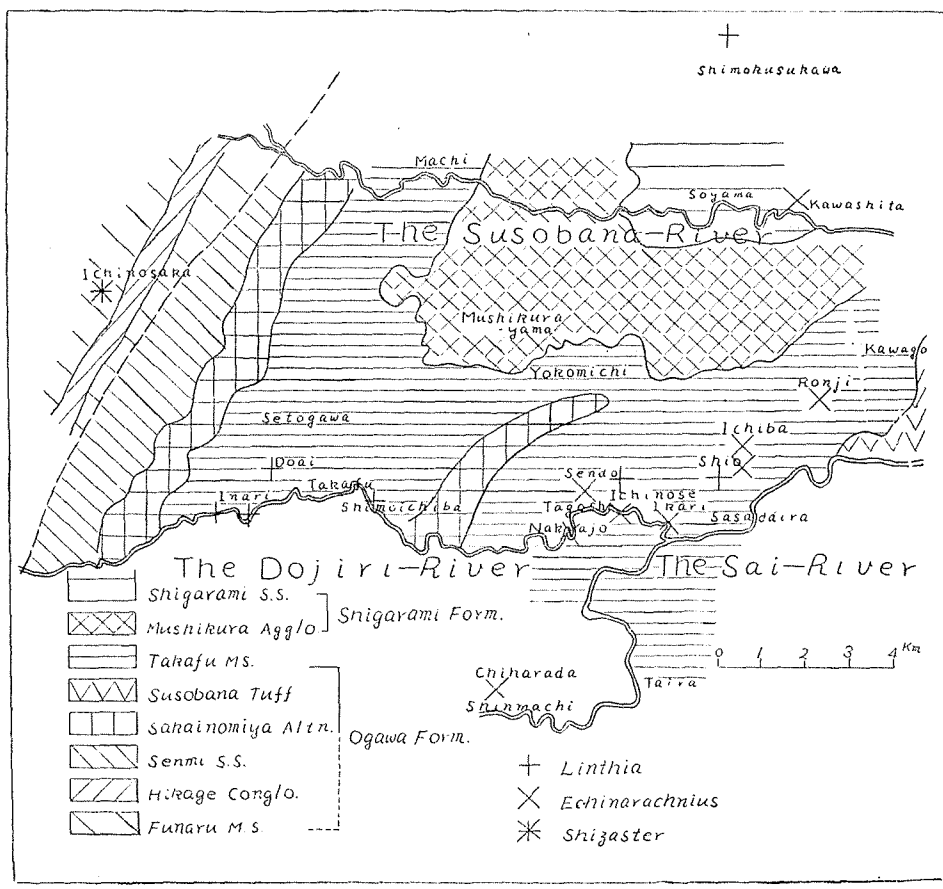

Fig. 4. A geological map marked localities of fossil echinoids in the Dojiri River, west of Nagano City

Schizaster sp. indet.

Recently several fragments of fossil echinoids from Bessho Formation have been collected by K. TANAKA. It is impossible to identify these fragmental specimens, but reliable belonging to *Schizaster*. Although their ambulacral features are very much allied to *Schizaster kinasaensis sp. nov.*, the identification to this species must be reserved.

Matrix.— Black Mudstone or Shale.

Geological Horizon.— Bessho Formation? (Middle Miocene?).

Locality.— Garyu-yama, Susaka-cho, Kami-Takai-gun.

Associated Fauna.— *Sagarites*, Fish Scale.

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Explanation of Plate

Plate. 1. Fig. 1 *Sismondia naganoensis sp. nov.*, Shimizusawa, Aida-mura, Higashi-Chikuma-gun. Abactinal side. × 1/3

Fig. 2 ——— Internal mode. × 5/3

Fig. 3 *Echinarachnius* microthyroides NISIYAMA, Kawashita, Togakushi-mura, Kami-Minochi-gun. Abactinal side. × 2/3

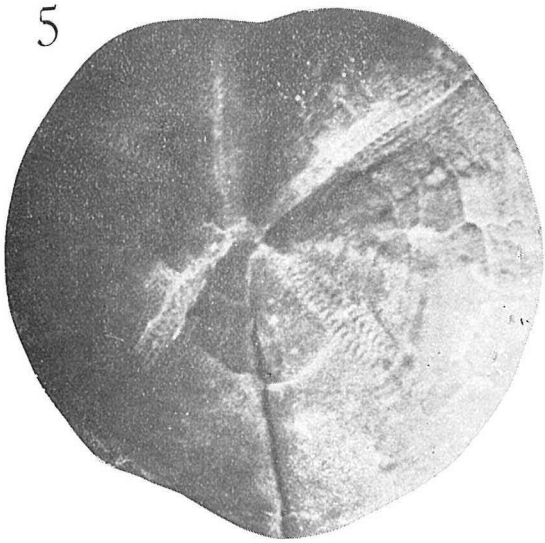
Fig. 4 *Echinarachnius naganoensis sp. nov.*, Ichiba, Naniai-mura, Kami-Minochi-gun. Abactinal side. × 3/4

Fig. 5 *Linthia nipponica* YOSHIWARA, Sakai-mura, Kami-Minochi-gun. Abactinal side. Nat. size.

Fig. 6 ——— × 7/10

Fig. 7 ——— × 7/10

Fig. 8 *Schizaster kinasaensis sp. nov.*, Ichinosaka, Kinasa-mura, Kami-Minochi-gun. Abactinal side. × 5/6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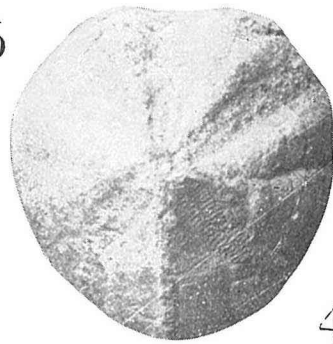
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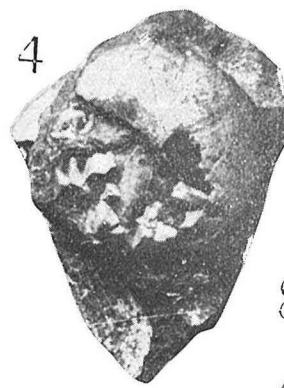
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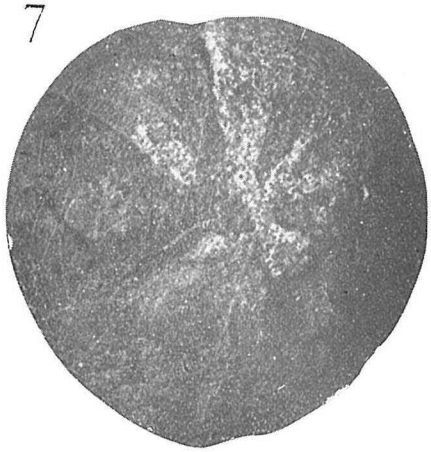
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