日本古生物学會
報告・紀事

Transactions and Proceedings of the Palaeontological Society of Japan

昭和 12 年　　第 9 號
1937　　No. 9

〔地質學雜誌　第 44 卷　第 529-531 號　抜刷〕
[Reprinted from Jour. Geol. Soc. Japan, Vol. 44, No. 529-531.]

日本古生物學會
Palaeontological Society of Japan

目　次 CONTENTS

報　告 Transactions

日本古生物學會報告
(Transactions of the Palaeontological Society of Japan)

48. *On the Ordovician Climate of the Northern Hemisphere deduced from the Growth Rate of Tabulate Corals*[1]

By

Ting Ying H. MA

(National Geological Survey of China. Read June 19th; received July 18th, 1937)

The annual growth rate of *Calapoecias* was measured from the figures given by several authorities in a previous work with the view of find the Ordovician climatological conditions of the Arctic regions as well as several European provinces.[2] In the present article, emphasis is laid on the development of seasonal change and annual length in growth of a number of tabulate corals as a further detailed study on the climate of the northern hemisphere during the Ordovician period.

Measurements

I. Genus *Calapoecia* BILLINGS, 1865

1. *Calapoecia canadensis* BILLINGS

1876 *Houghtonia huronica* (pars) ROMINGER: Fossil Corals, Geol. Surv. Mich., vol. 3, pt. 2, p. 18, pl. 3, fig. 3.

1908 *Calapoecia cribriformis* CUMINGS: The Stratigraphy and Paleontology of the Ordovician Rocks of Indiana, 32nd Ann. Rep. Dep. Geol. Nat. Res. Indiana, 1907, p. 701, pl. 1, figs. 3, 3a, 3b, pl. 5, fis. 1, 2.

1928 *Calapoecia huronensis* TROEDSSON: Middle and Upper Ordovician Faunas

1) Publication permitted by the permission of the Director of the National Geological Survey of China.

2) T. Y. H. MA: On the Growth Rate of *Calapoecia canadensis* BILLINGS and the Climate of the Arctic Regions During the Ordovician Period, Bull. Geol. Soc. China, vol. XVII, No. 2, 1937.

of Northern Greenland, Med. om Greenland, Bd. 72, pt. 2, p. 124, pl. 28, figs. 7-9. pl. 33, figs. 2a-b, pl. 34, fig. 3.

1928 *Calapoecia borealis* (pars) Troedsson: Ibid., p. 125, pl. 34, figs. 2, 3, pl. 36, figs. 1a-c.

1936 *Calapoecia canadensis* Cox: Revision of the Genus *Calapoecia* Billings, Nat. Mus. Canada, Bull. No. 80, Geol. Ser. No. 53, p. 7, pl. 1, figs. 1, 3, 5, pl. 2, figs. 1, 2, 5-9.

Locality	Author	Plate	Figure	Annual Length
Cape Calhoun, N. Greenland	Troedsson	33	2b	8.00 mm.
Ditto.	Troedsson	36	1b	No seasonal change
Ditto.	Cox	2	1a	Ditto.
Richmond, Indiana	Cumings	1	3c	Ditto.
Warren county, Ohio	Cox	2	7	Ditto.
Cape Smyth, Lake Huron	Cox	2	9a	Ditto.
Drummond Island, Michigan	Rominger	3	3	11.00
Akpatok Island, Canada	Cox	2	8	4.80

2. *Calapoecia canadensis* var. *anticostiensis* (Billings)

1861 *Syringophyllum organum* Roemer: Die Fossile Fauna der Silurischen Diluvial-Geschiebe von Sadewitz bei Oels in Nieder-Schlesien, p. 20, pl. 4, figs. 2a, 2b,

1928 *Syringophyllum organum* Troedsson: Loc. cit., pp. 121, 122. figs. 3-8.

1928 *Calapoecia borealis* (pars) Troedsson: Loc. cit., p. 125, pl. 35, figs. 1a-b, pl. 37. figs. 1a-b, 2a-b, pl. 38, figs. 1a-d.

1928 *Calapoecia arctica* Troedsson: Loc. cit., p. 127, pl. 39, figs. 1a-b, pl. 40, figs. 1a-b.

1936 *Calapoecia canadensis* var. *anticostiensis* Cox: Loc. cit., p. 12, pl. 1, fig. 6, pl. 3, figs. 1a-c, 3, 5-7.

1936 *Calapoecia canadensis* var. *anticostiensis* forma *arctica* Cox: Loc. cit., p. 16, pl. 4, figs. 1a-b, 2a-b, 3.

1936 *Sarcinula organum* Cox: Loc. cit., pl. 4, figs. 4-7.

Locality	Author	Plate	Figure	Annual Length
Cape Calhoun, N. Greenland	Troedsson	35	1b	13.00 mm.
Ditto.	Troedsson	37	1b	11.00
Ditto.	Troedsson	38	1a	10.00
Ditto.	Troedsson	39	1b	12.00
Cape Hilgard, Ellesmere Land	Cox	4	1	8.00
Norman Lackyer Island, Ellesmere Land	Cox	3	5a	9.00 (?)
Ditto.	Cox	3	5c	7.50
Akpatok Island, Canada	Cox	3	7	7.10

Anticosti Island, Canada	Cox	3	6	7.00 mm.
High Haume, England	Cox	4	7	5.75
Oscarskal, Herö, Norway	Cox	4	6	5.30
Oslo, Norway	Cox	4	8	5.31
Ditto,	Troedsson		7	3.10
Yamingbo, Gotland	Cox	4	4 b	3.54
Gotland	Troedsson		4	3.50
Oels, Germany	Roemer	4	2 b	2.70

II. Genus *Columnaria* Goldfuss, 1826

3. *Columnaria alveolata* Goldfuss

1876 *Columnaria alveolata* Rominger: Loc. cit., p. 90, pl. 34, figs. 1, 2, 4.
1908 *Columnaria alveolata* Cumings: Loc. cit., p. 703, pl, 1, figs. 4, 4a.

Locality	Author	Plate	Figure	Annual Length
Escanaba River, Michigan	Rominger	34	2	20.00 mm
Osgood, Indiana	Cumings	1	4	20.00

4. *Columnaria alveolata* var. *interventa* Foerste

1914 *Columnaria alveolata* var. *interventa* Foerste: The Rogers Gap Fauna of Central Kentucky, Journ. Cincinnati Soc. Nat. Hist., vol. 21, No. 4, p. 122, pl. 4, figs. 1a-j.

Locality	Author	Plate	Figure	Annual Length
Brannon near Lexington, Kentucky	Foerste	4	1 c	7.50 mm.
Ditto.	Foerste	4	1 h	9.00
Ditto.	Foerste	4	1 j	5.00

5. *Columnaria alveolata* var. *minima* Foerste

1925 *Columnaria alveolata* var. *minima* Hume: The Palaeozoic Outlier of Lake Timiskaming, Ontario and Quebec, Geol. Surv. Canada, Mem. 145, p. 60, pl. 5, figs. 2a. 2b.

Locality	Author	Plate	Figure	Annual Length
Lake Timiskaming, Ontario	Hume	5	2 a	13.00 mm.

6. *Columnaria halysitoides* Troedsson

1928 *Columnaria halysitoides* Troedsson: Loc. cit., p. 113, pl. 28, figs. 1-5b.

Locality	Author	Plate	Figure	Annual Length
Cape Calhoun, N. Greenland	Troedsson	28	5 b	13.00 mm.

7. *Columnaria parvituba* Troedsson

1928 *Columnaria parvituba* Troedsson: Loc. cit., p. 114, pl. 28, fig. 6, pl. 29, fig. 4.

Locality	Author	Plate	Figure	Annual Length
Gonoceras Bay, N. Greenland	Troedsson	28	6	No seasonal change

III. Genus *Heliolites* Dana, 1846

8. *Heliolites intricatus* var. *lamellosa* Lindström

1899 *Heliolites intricatus* var. *lamellosa* Kiaer: Die Korallenfauna der Etage 5 des norwegischen Silursystems, Palaeontogr., Bd. 46, p. 42, pl. 7, figs. 3–5.

Locality	Author	Plate	Figure	Annual Length
Asker Norway	Kiaer	7	4	3.00 mm.

9. *Heliolites parvistella* Roemer

1899 *Heliolites parvistella* Kiaer: Loc. cit., p. 39, pl. 7, figs. 6–8.

Locality	Author	Plate	Figure	Annual Length
Östre Svartö, Ringerike, Norway	Kiaer	7	8	1.20 mm.
Estland	Kiaer	7	7	1.70

IV. Genus *Proheliolites* Kiaer, 1899

10. *Proheliolites dubius* (Schmidt)

1861 *Heliolites dubia* Roemer: Loc. cit., p. 26, pl. 4, figs. 5a, 5b.

Locality	Author	Plate	Figure	Annual Length
Oels, Germany	Roemer	4	5 a	2.25 mm.

V. Genus *Propora* Milne-Edwards and Haime, 1849

11. *Propora conferta* Milne-Edwards and Heime

1899 *Propora conferta* Lindström: Remarks on the Heliolitidae, p. 93, pl. 8, figs. 32–39, pl. 9, figs. 1–23, 31, 32, 35.

1899 *Plasmopora conferta* Kiaer: Loc. cit., p. 27, pl. 4, figs. 3, 4.

Locality	Author	Plate	Figure	Annual Length
Borkholm in Estland	LINDSTRÖM	8	34	4.00 mm,
Ditto.	LINDSTRÖM	9	2	4.00
Ringerike, Norway	KIAER	4	4	3.00
Anticosti Island, Canada	LINDSTRÖM	9	12	4.25

12. *Propora tubulata* (LONSDALE)

1861 *Propora tubulata* ROEMER: Loc. cit., p. 22, pl. 4, figs. 3a, 3b.
1899 *Propora tubulata* LINDSTRÖM: Loc. cit., p. 89, pl. 8, figs. 18-21.

Locality	Author	Plate	Figure	Annual Length
Oels, Germany	ROEMER	4	3a	2.25 mm.
Borkholm in Estland	LINDSTRÖM	8	19	2.75

13. *Propora bacillifera* LINDSTRÖM

1899 *Propora bacillifera* LINDSTRÖM: Loc. cit., p. 97, pl. 10, figs. 8-21.

Locality	Author	Plate	Figure	Annual Length
Borkholm in Estland	LINDSTRÖM	10	18	5.00 mm.
Ostbjörka in Dalecarlia	LINDSTRÖM	10	9	4.50

14. *Propora* cfr. *goldfussi* BILLINGS

1932 *Propora* cfr. *goldfussi* KIAER: The Coral Fauna of the Kalstad Limestone in Medalen, The Hovin Group in the Trondheim Area, Vid.-Akad. Skr. I. M.-N. Kl. 1932, No. 4, p. 109, pl. 14, figs. 1-3.

Locality	Author	Plate	Figure	Annual Length
Kalstad, Medalen, Trondheim	KIAER	14	3	5.50 mm.

15. *Propora* sp.

1899 *Nicholsonia megastoma* KIAER: Loc. cit., p. 37, pl. 6, figs. 8, 9, pl. 7, figs. 1, 2.

Locality	Author	Plate	Figure	Annual Length
Soida, Estland	KIAER	7	2	2.00 mm.

VI. Genus *Nyctopora* NICHOLSON, 1879

16. *Nyctopora* (?) *parvotabulata* KIAER

1932 *Nyctopora* (?) *parvotabulata* KIAER: Loc. cit., p. 106, pl. 13, figs. 1-4.

Locality	Author	Plate	Figure	Annual Length
Bakkenknausen, Medalen, Trondheim	Kiaer	13	2	5.00 mm.

VII. Genus *Plasmopora* Milne-Edwards and Haime, 1849

17. *Plasmopora lambi* Schuchert

1925 *Plasmopora lambii* Hume: Loc. cit., p. 18, pl. 5, figs. 1a, 1b.
1928 *Plasmopora lambi* Troedsson: Loc. cit., p. 118, pl. 31, fig. 3a, pl. 33, figs. 1a, 1b.

Locality	Author	Plate	Figure	Annual Length
Cape Calhoun, N. Greenland	Troedsson	31	1b	10.00 mm.
Ditto.	Troedsson	32	2	8.00
Lake Timiskaming, Ontario	Hume	5	1a	9.00

VIII. Genus *Plasmoporella* Kiaer, 1899

18. *Plasmoporella convexotabulata* Kiaer

1899 *Plasmoporella convexotabulata* Kiaer: Loc. cit., p. 35, pl. 5, figs. 9-11.
1936 *Plasmoporella convexotabulata* Cox: Loc. cit., pl. 3, figs. 4a, 4b.

Locality	Author	Plate	Figure	Annual Length
Ringerike, Norway	Kiaer	5	10	Longer than 5.00 mm.
Ditto.	Kiaer	5	11	2.70
Oslo, Norway	Cox	3	4b	6.62

19. *Plasmoporella convexotabulata* var. *vesiculosa* Kiaer

1899 *Plasmoporella convexotabulata* var. *vesiculosa* Kiaer: Loc. cit., p. 36, pl. 6, figs. 1-2.

Locality	Author	Plate	Figure	Annual Length
Ringerike, Norway	Kiaer	6	1	2.70 mm.

20. *Plasmoporella* sp.

1912 *Plasmoporella* sp. Reed: Ordovician and Silurian Fossils from the Central Himalayas, Pal. Indica, ser. 15, vol. 7, No. 2, p. 160, pl. 3, figs. 1. 1a.

Locality	Author	Plate	Figure	Annual Length
Pethathali Nullah, Central Himalaya	Reed	3	1a	Somewhat less than 5 mm.

From the obtained values of the growth length and degree of development of the seasonal change in the interior structure tabulated above, it may be said that temperatural differentiation existed already in the Ordovician coralline reef-seas. The annual length as measured above, is longer in all of the forms from the Arctic regions than in those from Northern Europe, and the development of seasonal change of growth is remarkable in the corals from the latter region and hardly observable or lacking in those from the former. This striking contrast between the Arctic and Northern Europe reef corals may certainly indicate the existence of different climatic environments during the Ordovician in the high latitudes of the northern hemisphere. From the measurements of the species in *Columnaria* and *Calapoecia* together with *Plasmopora lambi* SCHUCHERT, it is assumed that the water temperature of the Ordovician coralline seas in Timiskaming of Ontario, Warren of Ohio, Cape Smyth of Lake Huron, Drummond Island and Escanaba of Michigan and Osgood of Indiana may have been warmer than that of Lexington of Central Kentucky and may have been similar closely to that of the Arctic regions. The growth rate in the same species in *Calapoecia* and *Propora* indicate that the temperature of the Ordovician waters in Anticosti Island of Canada may have neither much warmer nor cooler than that of the British Islands and Norway, and the water for Gotland may have been slightly warmer than in Oels of Germany and more or less cooler than in Norway and British Islands. From the measurements of the forms in *Plasmoporella* it is assumed that the Ordovician water temperature of Central Himalaya may have been similar to that of Norway. From the data now at hand, it is concluded that the sea area of Northern Europe and Central Himalaya together with Anticosti Island of Canada were probably a portion of the marginal belt of the Ordovician coralline seas, and the zone combining the Arctic regions, Timiskaming of Ontario, Warren of Ohio, Cape Smyth of Lake Huron, and Osgood of Indiana as well as Drummond Island and Escanaba of Michigan belong to the inner or central zone of the coralline reef seas.

床板珊瑚の成長率より推定されたる北半球に於ける奥陶紀の氣候 (摘要)

馬 廷 英

現生及び化石造礁珊瑚類の骨骼に季候成長構造があるのみならず其年成長が海水温度の高低と一定の關係を有することは已に筆者によつて證明されたところである。

本篇は文献の挿圖より北半球各地産出八屬二十種の奥陶紀床板珊瑚の成長率及び季候成長構造發達程度を比較研究し以て當該時代に於ける北半球各地の氣候狀態を推想しやうと思ふ。是より得た結論としては北極地方及び北米の Huron 湖, Ohio, Michigan, Indiana 一帶の産地の海水温度は最も温く, 英國諾威瑞典及び獨逸等の北歐造礁珊瑚化石産地は上記の諸地方より寒い, 加拿太の Anticosti Island は英國と大差がない, 諾威及び英國は獨逸より温く中央ヒマラヤ地方は稍々諾威に近い。上記の事實より考へれば北極地方及び北米の Huron 湖, Ohio, Michigan, Indiana 諸産地の一帶は當時造礁珊瑚の內側或は內帶に屬すべく北歐の英國諾威瑞典獨逸及び亞細亞の中央ヒマラヤ地方は珊瑚海の外側又は外緣に相當するものと思はれる。

49. *Diodora in Japan*

By

Yanosuke OTUKA

(Earthquake Research Institute, Tokyo Imperial University
Received Sept. 10th; read Sept. 25th, 1937)

Eight species of the genus *Diodora* GRAY 1821 were reported from the Japanese Islands:—*D. funiculata* (REEVE), *D. sieboldii* (REEVE), *D. ticaonica* (REEVE), *D. mus* (REEVE), *D. tanneri* (VERRILL), *D. crucifera* (PILSBRY), *D. elaborata* (SOWERBY), *D. humilis* (YOKOYAMA). Beside the above written, two new forms are found from Japan. The purpose of this paper is to review these species hitherto described and undescribed, and to show their geologic range.

The genus *Diodora* was established by GRAY[1] based on *Patella apertura* MONTAGU in 1821. According to J. THIELE[2], the genus is described as follow:

"Schale kegelförmig, Mündung eiförmig, Loch klein oder mässig gross, etwas vor der Mitte gelegen, Apex der erwachsenen Schale rückgebildet, Oberfläche mit feineren oder gröberen Radialrippen und meistens mit konzentrischen Falten; an der Innenseite ist das Loch von einer hinten abgestutzten Schwiele umgeben; Rand an den Rippenenden gefaltet, in einer Ebene oder seitlich erhoben."

Followings are the description and diagnosis of *Diodorum* species found in Japan,

Description of species

Diodora funiculata (REEVE)

M. YOKOYAMA reported this species from Ehime prefecture, southwest Sikoku. But *Diodora funiculata* (REEVE) is a species found in Arabian sea near Karachi, which is different from Japanese species in its sculpture and colouration. The present writer will propose a new name for the Japanese species in following lines. (See *Diodora suprapunicea* OTUKA.)

1) GRAY, London Med. Repos., Monthly Journ. and Review, 15, p. 233, 1821.
2) J. THIELE, Handbuch der Systematischen Weichtierkunde, 1, p. 35, 1929.

Diodora sieboldii (REEVE)

Fig. 1 a, b.

1850 *Fissurella sieboldii* REEVE, Conch. Icon., 6, pl. 4, sp. 102.
1928 *Fissuridea sieboldii*, YOKOYAMA, Imp. Geol. Surv. Japan, Rep. 101, p. 124, pl. 19, fig. 4.
1934 *Diodora sieboldii*, HIRASE, Coll. Japanese Shells, pl. 62, fig. 5.
1934 *Diodora sieboldii*, NOMURA et ZINBO, Sci. Rep. Tohoku Imp. Univ. (Geology), 16, 2, p. 149.

Shell stout, conical, sculptured with about eleven almost straight prominent radial ribs; three posterior of which most prominent, defined posterior surface into two parts; between these radial ribs some less prominent intermediate ribs present; prominent ribs purple in colour; concentric sculpture fine, imbricated, almost straight between prominent radial ribs; basal shell margin angulate in plan; apical hole small, white.

Dimension of the species from central Japan:

Specimen from Tomiura, Tiba pref. No. 1.: 20.0 mm long; 14.3 mm wide; 9.4 mm high.

Specimen from Tomiura, Tiba pref. No. 2.: 26.3 mm long; 16.3 mm wide; 9.7 mm high.

Specimen from Ooiso, Kanagawa pref. 27.0 mm long; 17.3 mm wide; 10.6 mm high.

This is a most common *Diodorum* species found near the shore-line of central and western Japan.

Pleistocene: Tumuki and Hiradoko bed in Noto penin. (YOKOYAMA[1]; OTUKA)[2]; Ryûkyû limestone of Is. Kikai (-zima), Ryûkyû (NOMURA et ZINBÔ.)

Recent: Sagami bay (OTUKA)[2], South coast of Wakayama pref. (KUZE)[3], East coast of Miyasaki pref. (KURODA)[4], Amami-Oosima (KURODA)[5].

Diodora ticaonica (REEVE)

1850 *Fissurella ticaonica* REEVE, Conch. Icon., pl. 14, fig. 107.

"Shell ovate, gibbously elevated, anteriorly much inclined, slightly hooked; thickly latticed throughout with strong narrow radiating ridges and raised concentric striae; orifice elongately oblong, sides excavated in

1) M. YOKOYAMA, Imp. Geol. Surv. Jap., Rep. 101, p. 124 (1928).
2) Y. OTUKA, Bull. Earthq, Res. Inst. 13, 4 (1935).
3) Y. KUZE, Catalogue of Shells of Tatugahama, Wakayama pref. (1930).
4) T. KURODA, Catalogue of Shells of Miyasaki pref. (1935).
5) T. KURODA, Catalogue of the shell bearing mollusca of Amami-Ôshima. (1928).

the middle; greenish white sprinkled with dots and blotches of olive-green, bluish around the orifice. An extremely characteristic species, much elevated and curved anteriorly, with the same narrow oblong fissure mostly seen in the flat species." (REEVE).

Type loc.: Takao (=Ticao).

Recent: Taiwan (=Formosa) (REEVE).

According to SOWERBY[1], this species is easily distinguishable from the other species by its tripartite apical hole, the fine and rather sharp cancellation, and the nearness of the apex to the ventral margin. *Diodora elaborata* SOWERBY[2] is closely allied to this species.

Although IWAKAWA[3] reported this species from Awadi. But the writer could not find any *D. ticaonica* from Is. Aawdi except *D. sieboldii* and *D. elaborata* (SOWERBY).

Diodora mus (REEVE)

1850 *Fissurella mus*, REEVE, Conch. Icon., pl. 16, fig. 120.

"Shell ovate, somewhat attenuated anteriorly, rather compressed at the sides, much inclined anteriorly, radiately very closely finely ridged, thickly decussated with concentric striae, orifice oblong, sides irregularly rayed with ashblack." (REEVE).

T. KURODA[4] reported this species from the east coast of Miyasaki prefecture with an interrogation.

Diodora tanneri (VERRILL)[5]

M. YOKOYAMA referred a species from the Pliocene of Kosiba to this species, but his species is distinguished from VERRILL's species in its sculptures. The present writer will propose a new name for YOKOYAMA's species in following lines. (See *Diodora yokoyamai kosibensis* OTUKA.)

Diodora crucifera (PILSBRY)

1890 *Glyphis crucifera* PILSBRY in TRYON, Man. Conch., 1 ser., **12**, p. 225, pl. 32, figs. 27–30.

1935 *Fissuridea crucifera*, NOMURA, Sci. Rep. Tohoku Imp. Univ. (Geology), **18**, 2,

1) SOWERBY, Thes. Conch, III, p. 197.

2) SOWERBY, Ann. Mag. Nat, Hist., 8, **14**, (1914), p. 37.

3) T. IWAKAWA, Catalogue of mollusca found in Japan, 1919.

4) T. KURODA, op. cit. (1935).

5) VERRILL, Proc. U.S. Nat. Mus., 5, p. 333, (1882).

p. 220, pl. 10, fig. 50 a, b.

S. NOMURA reported this species from the Pliocene of Byoritz bed in Taiwan (Formosa). The specimen from Byoritz bed is a shell with about 71 radial ribs, the height of which shell is about 6.6 mm. Apical hole situated at anterior one third of the shell length.

Dimension of specimen from Byoritz bed: 18.2 mm long; 5.6 mm wide; 6.6 mm high, (All numerical values are referred to fig. 50 in NOMURA's paper.)

Type loc.: Natal, East Africa (Living).

Pliocene: Byoritz bed in Taiwan, (NOMURA).

Diodora elaborata (SOWERBY)

Fig. 2 a, b.

1914 *Fissurella elaborata* SOWERBY, Ann. Mag. Nat. Hist., Ser. 8, 14, p. 37.

1924 *Fissuridea rueppellii*, YOKOYAMA, Jour. Coll. Sci. Tokyo Imp. Univ., 45, 1, p. 36, pl. 2, fig. 9 (fide. NOMURA) (not of SOWERBY 1834)[1]

1932 *Diadora elaborata*, NOMURA, Sci. Rep. Tohoku Imp. Univ. Geol. 15, 2, p. 96.

1934 *Diodora elaborata*, HIRASE, Coll. Japanese Shells, p. 33, pl. 62, fig. 4.

Shell anteriorly concave, posteriorly convex, ornamented with radial and concentric ribs. Number of radial ribs about 64 on shell margin, which shell height about 9 mm; number of concentric ribs about 26; apical hole situated at anterior one fourth or two seventh of shell length, elongate elliptical; inner margin crenate.

Dimension of this species from central Japan:

Specimen from the sea-shore nr. Kosigoe: 18.6 mm long; 12.5 mm wide; 9 mm high; no of rodial ribs 64.

Specimen from the Upper Pliocene of Katase: 6.1 mm long; 4.1 mm wide; 2.5 mm high; no of radial ribs 36.

This species is associated with an open coastal faunule, and ranges from Upper Pliocene (or Lower Pleistocene) to Recent.

Upper Pliocene (or Lower Pleistocene): Byôbugaura bed of Katase (OTUKA)[2].

Lower Holocene: Numa coral bed of Tateyama and Onziku in Tiba pref. (YOKOYAMA; NOMURA).

Recent: Toyama bay (KIKUCHI)[3]; Sagami bay (OTUKA); South

1) SOWERBY, Proc. Zool. Soc. London, p. 128; Thes. Conch., 3, p. 107, pl. 240. figs. 107-108.

2) Y. OTUKA, Bull. Earthq. Res. Inst. 15 (1937), 4.

3) K. KIKUCHI, Catalogue of Marine Mollusca of Toyama Bay. (1936).

coast of Wakayama pref. (KUZE)[1]; East coast of Miyasaki pref. (KURODA)[2]; Amami-Oosima (KURODA)[3].

The specimen from Sagami bay in the writer's collection is rayed with olive colour cords from apical hole.

M. YOKOYAMA cited the specimen from Numa to *Diodora reuppellii* (SOWERBY)[4], but the latter is a Red Sea species.

Diodora humilis (YOKOYAMA)

Fig. 3 a, b.

1925 *Fissuridea humilis* YOKOYAMA, Jour. Coll. Sci. Tokyo, 45, 7, p. 15, pl. 3, fig. 7.

"Shell rather thin, oblong in outline, low-conical; the apex in front of the middle; anterior slope almost straight, shorter than the slightly arched posterior one which has a blunt edge in the middle; the sculpture consists of numerous, subequal, straight, radiating riblets occasionally with a finer interstitial between; the interspaces are finely latticed by growth lines."

Dimension of type specimen. 22 mm long, 13 mm wide, 5 mm high.

Type locality: Hiraiso (The lower Pliocene of Minato), Ibaraki pref.

Apical hole is situated anterior one third of the shell length; number of radial ribs is about 96 in the type specimen.

Diodora yokoyamai OTUKA n. sp.

Fig. 4 a, b.

Shell conical, ornamented with fine radial and concentric ribs; anterior surface concave, posterior slightly convex; apical hole situated about anterior one third of shell length; number of radial ribs about 138 on shell margin of type specimen.

Monotype: No. 3937 in Earthq. Res. Inst. Tokyo Imp. Univ.

Dimension of type specimen: 21.0 mm long; 14.0 mm wide; 6.8 mm high.

Type locality: Sionomisaki, Wakayama pref., about 200 m deep, living.

Diodora tanneri (VERRILL)[5] is a related species to this species but the former has a shell with narrower interstices than the latter. According to VERRILL, the radiating ribs of the former

1) Y. KUZE, op. cit.
2) T. KURODA, op. cit. (1935).
3) T. KURODA, op. cit. (1928).
4) SOWERBY, op. cit. (1834).
5) VERRILL, op. cit.

are equal to or broader than the interstices, but those of *D. yokoyamai* are narrower than the interstices.

Diodora yokoyamai kosibensis OTUKA n. subsp.

Fig. 5 a, b.

1920 *Fissuridea* cf. *tanneri*, YOKOYAMA, Jour. Coll. Sci. Tokyo Imp. Univ., **36**, 6, pp. 96-7, fig. 18.

Fissuridea tanneri of YOKOYAMA from the Pliocene of Kosiba, near YOKOYAMA may be a synonym of the preceding species. But YOKOYAMA's specimen is more concave at its anterior surface than the type species. In the preceding species, the radial ribs are alternate with large and small ones, but in YOKOYAMA's species, radiating ribs are almost equal with one another. In these distinction the writer distinguishes the YOKOYAMA's species from the living one, and give a new subspecific name—*kosibensis*—to the fossil species.

Monotype: No. Kf 501 in Geol. Inst. Fac. Sci. Tokyo Imp. Univ.

Dimension of type specimen: 9.6 mm high.

Type locality: The Pliocene of Kosiba, Yokohama city.

Diodora suprapunicea OTUKA n. sp.

Fig. 6 a, b.

1931 *Diodora funiculata*, YOKOYAMA, Catalogue of Marine, Freshwater and Land Shells of Japan, p. 18, no. 518 (not of REEVE 1850)

Shell conical; apical hole situated two fifth of shell length, tinged with purple in colour; surface vinaceous tawny in colour, almost straight, sculptured with radial ribs and concentric ribs; radial ribs about 96 in number on shell margin of type speciemen, dotted with dark brown; inner surface smooth white, translucent; inner margin crenate.

Monotype: No. 681 in the Earthquake Research Institute.

Dimension of type specimen: 20.6 mm long; 14 mm wide; 6.7 mm high.

Type locality: Onziku, southeast coast of Tiba prefecture. Shore sand.

Diodora yokoyamai OTUKA is a closely related species to this, but the former has finer sculpture than the latter. *Diodora elaborata* (SOWERBY)[1] is another allied species to this new species, but the former has gibbous shell with coarser sculpture than the latter.

1) SOWERBY, Ann. Mag. Nat. Hist., **14**, p. 37, pl. 2, fig. 8.

Diagnosis of *Diodorum* species in Japan.

Specific Name.	Radial rib.	Profile of shell.	Apical hole.
sieboldii	purple or white in colour. straight, 11-12 prominent and less prominent between.	anterior and posterior straight.	white, situate anterior 1/3.
ticaonica	about 96 in the shell 2.1mm long.	anterior concave posterior convex gibbous in form.	bluish, situate 1/4-2/7 tripartite.
mus	about 80 in the shell 20.5mm long.	anteriorly attenuated.	situate 1/3 of shell length, oblong.
crucifera	about 71 in the shell 18.2mm long.	lower than *elaborata*.	situate 1/3 of shell length.
elaborata	about 36 in the shell 6.1 mm long.	anterior concave posterior convex gibbous in form.	white, situate 1/4-2/7 elongate elliptical.
humilis	about 96 in the shell 21.2mm long.	depressed conical, anterior concave, posterior slightly convex.	situate 1/3 of shell length.
yokoyamai	very fine, about 138 in the shell 21.2 mm long, alternate with large and small.	anterior straight or concave, posterior slightly convex.	situate anterior 2/5.
yok. kosibensis	very fine, about 134 in the shell 9 mm high; equal.	anterior concave, posterior slightly convex.	situate anterior 2/5.
suprapunicea	about 96 in the shell 21 mm long,	straight or slightly concave or convex.	purple (or white), situate anterior 2/5, elliptical.

Diodora funiculata (REEVE)[1] from Karachi, Mouth of the Indus is another allied species, but the species is remarkable for the dark articulated ribs which radiate from the nearly round apical hole. Radial ribs of *suprapunicea* are finer than those of *funiculata*.

Purple colour on its apical part, elliptic apical hole, and finely latticed sculptures distinguish this new species from the other.

Explanation of Plate 30 (15)

Fig. 1. *Diodora sieboldii* (REEVE) 26.3×16.3×9.7 mm. (Living, Tomiura.)
Fig. 2. *Diodora elaborata* (SOWERBY) 18.6×12.5×9.0 mm. (Living, Kosigoe.)
Fig. 3. *Diodora humilis* (YOKOYAMA) 22.0×13.0×5.0 mm. (Pliocene, Hiraiso.) Reproduction of YOKOYAMA's original figures.
Fig. 4. *Diodora yokoyamai* OTUKA n. sp. (Monotype) 21.0×14.0×6.8 mm. (Living, Sionomisaki, 200 m deep.)
Fig. 5. *Diodora yokoyamai kosibensis* OTUKA n. subsp. (Holotype), 9.6 mm high, (Pliocene, Kosiba.) Reproduction of YOKOYAMA's original figures.
Fig. 6. *Diodora suprapunicea* OTUKA n. sp. (Holotype) 20.6×14.0×6.7 mm. (Living, Onziku.)

日本産クズヤガヒ（摘要）

大塚彌之助

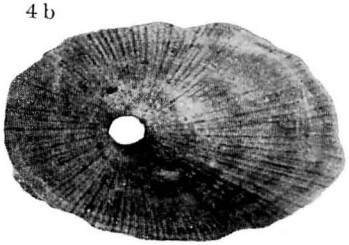
クズヤガヒ即ち *Diodora* 屬に屬する種は從來日本から次の 8 種が報告されてゐる。

D. funiculata (REEVE), *D. sieboldii* (REEVE), *D. ticaonica* (REEVE), *D. mus* (REEVE), *D. tanneri* (VERRILL), *D. crucifera* (PILSBRY), *D. elaborata* (SOWERBY), *D humilis* (YOKOYAMA). 此等の種中 *ticaonica* が淡路で採集されぬこと，日本の *funiculata* と *tanneri* と稱するものが原のものと異ることとが述べてある。日本の *funiculata* には *suprapunicea*, 同じく *tanneri* には *yokoyamai* 及び *yokoyamai kosibensis* を新に命名した。大部分 Upper Pliocene 以後に生き，*crucifera*, *humilis*, *yokoyamai kosibensis* のみが鮮新世にも生きてゐた。

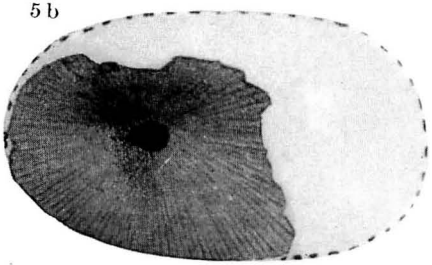
---

1) REEVE, Conch. Icon., 1850, pl. 9, fig. 65, (as *Fissurella*).

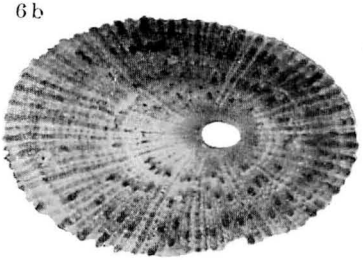

4a

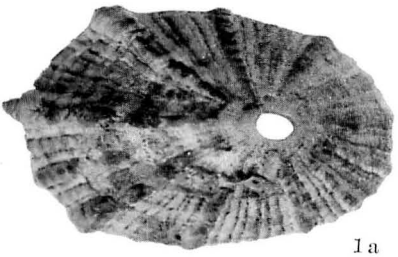

4b


5a

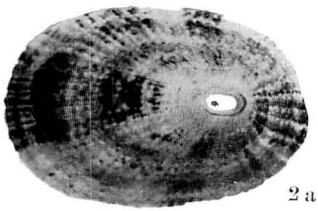

5b

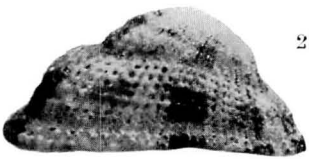

6a


6b

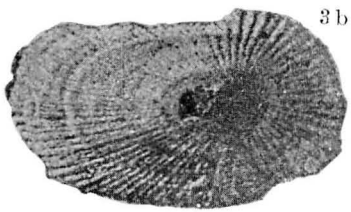

1a

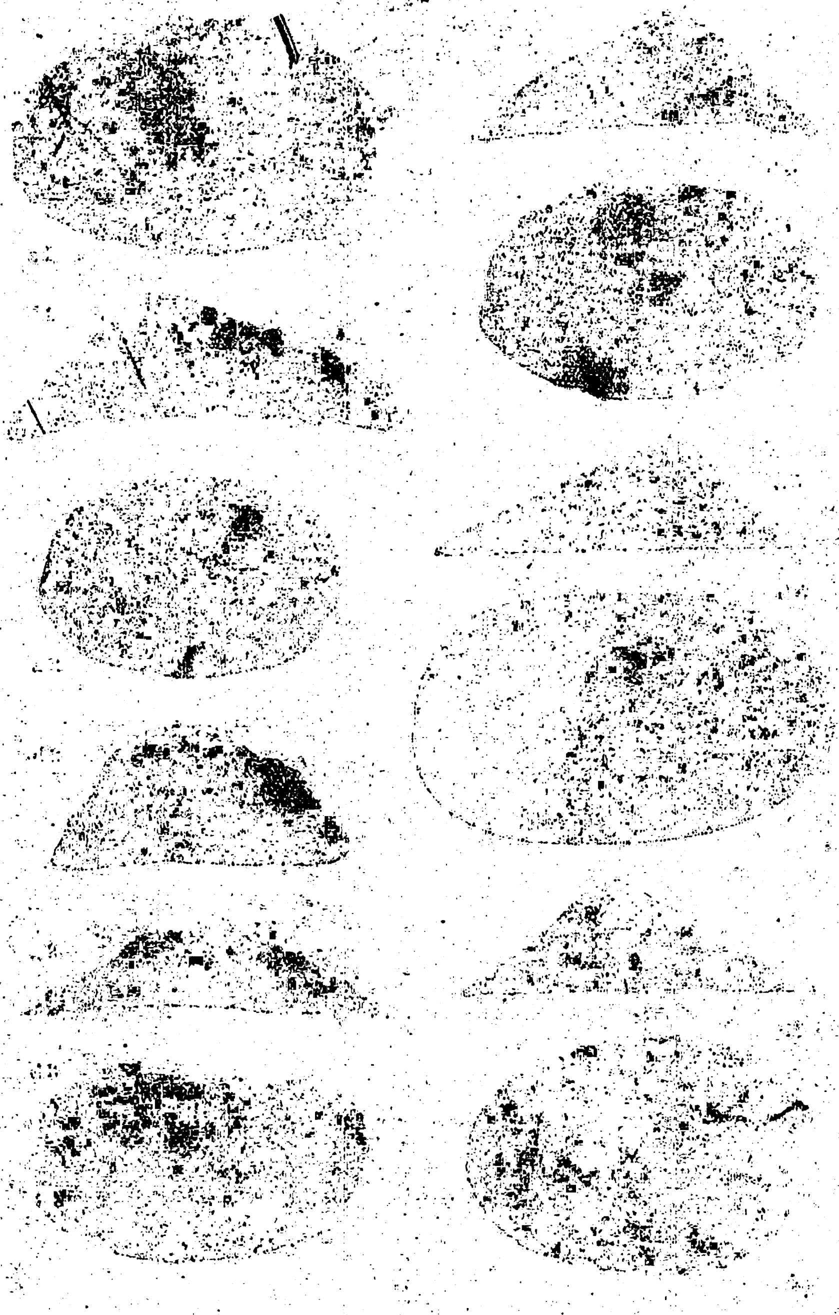

1b


2a


2b


3a


3b



日本古生物學會報告
(Transactions of the Palaeontological Society of Japan)

50. *Gotlandian Clathrodictyon from Tyôsen (Korea)*

By

Hisakatsu YABE and Toshio SUGIYAMA

(Read Sept. 25th.; received Sept. 30th., 1937)

Throughout North China, Manchuria and Tyôsen (Korea), Carboniferous deposits rest directly on Ordovician limestone in parallel unconformity, while there is discovered no Gotlandian and Devonian strata over this extensive region. It is so far true that there prevailed a long time of subaerial denudation or terrestrial condition before the deposition of Carboniferous sediments; the evidence, however, is by no means conclusive for the view that the region was never covered by sea-water during the Gotlandian and Devonian periods. For several decades past, our knowledge showed no progress on this line; hence it was sensational when Mr. K. OZAKI of the Shanghai Science Institute, reported in 1932 his discovery of a limestone with limestone boulders bearing Gotlandian fossils near Kenniho, Heian-nan-dô, Tyôsen (Korea), which he and S. SHIMIZU later called the "Kenniho limestone conglomerate[1)]".

OZAKI and two others[2)] described the fossils in the limestone boulders of the conglomeratic limestone, and distinguished 32 species in 18 genera, mostly of corals; though some of them seem to need revision, yet the associate occurrence of the corals surely belonging to the genera *Halysites*, *Propora* and *Heliolites* in many limestone boulders leaves almost no doubt about the Gotlandian age of the fauna and the limestone boulders containing it.

The "Kenniho limestone conglomerate" is a true conglomerate

1, 2) S. SHIMIZU, K. OZAKI and T. OBATA: Gotlandian deposits of Northwest Korea. Jour. Shanghai Sci. Inst., Sec. 2, Vol. 1 pp. 59–85, 1934.

with limestone boulders of various kinds, including those apparently of similar aspect with some Ordovician and Cambrian limestones well developed in the neighbourhood; on the other hand, no Gotlandian fossils were found in its calcareous cement in spite of a careful search by one of us (YABE) and Mr. T. OHSE, a former member of our Institute. In addition, Mr. T. KOBAYASHI[1] reported a find of a boulder of the Cambrian *Redlichia* shale with *Redlichia* in it. The conglomerate should be of the Mesozoic date, if it really passes upwards and laterally without any interruption into the clastic conglomerate at the base of the Lower Jurassic (?) Tudo group as pointed out by KOBAYASHI[2].

The typical locality of the "Kenniho limestone conglomerate" is situated near a small village of Sindô, 3 km NE of Kenniho. YABE and OHSE in their few hours visit to this locality in the spring of 1935, collected there several fragments of corals. These, thin sliced and microscopically examined, were found to be *Halysites*, *Heliolites*, *Propora*, *Favosites* and some other corals, beside two Stromatoporoids described below. A specimen of *Propora* is in excellent preservation; its transverse section is photographed and is shown on the accompanying plate (pl. 31 (16), fig. 5); it is, we believe, specifically identical with *Propora affinis* (BILLINGS)[3], which is the well known Gotlandian species, hitherto reported from Canada, Europe, Siberia and China in Asia.

1, 2) T. KOBAYASHI: Is the Kenjiho Limestone Conglomerate a Gotlandian Deposit? Jour. Geogr. vol. XLVII, no. 558, pp. 362-366.

3) *Propora* cfr. *affinis* (BILLINGS):—Corallites 1.5 mm or somewhat less in breadth, margin crenulated due to the presence of 12 minute nodulous protrusions; interspaces more or less narrower and minutely vesiculated. Section stored in the Institute of Geology and Palaeontology, Tôhoku Imperial University. References; L. M. LAMBE: A Revision of the Genera and Species of Conadian Palaeozoic Corals (as *Lyellia affinis* BILLINGS). Contr. Canad. Palaeont., vol. IV. pt. I. p. 84, pl. V., figs. 1, 1a. G LINDSTRÖM: Remarks on the Heliolithidae (as *Propora conferta* M. EDWARDS et J. HAIME). Svenska Vet. Akad. Handl., vol. XXXII, No. 1, p. 93, pl. IX., figs. 5, 6, 9-22. J. KIÄR: Revision der Mittelsilurischen Heliolithiden und neue Beiträge zur Stammesgeschicht derselben. Videnskabs-Selskabats Skrifter. I. Math-nat. V, Klasse, 1903, No. 10, p. 52.

OZAKI described two forms of *Propora*, *P.* cfr. *magnifica* POCTA and *P. yabei* OZAKI from the same locality. The two agree with ours in lacking true septa, aculae and dacilli and in having vesicular coenenchymal tissue; it is questionable whether the two forms of OZAKI are really distinct from *P. affinis*. OZAKI: Op. cit., pp 67-68, pl. X, figs. 9, 10; pl. XI, figs. 1-3.

The boulders of the Gotlandian limestone must have their origination somewhere in this neighbourhood, or at least not far distant, since they are often angular or subangular and sometimes attain more than 20 cm in diameter ; whether the erosion relics of the limestone do or do not still exist in situ may be settled only by a later, more detailed stratigraphical survey.

It is also worthy of special mention that Mr. Y. ONUKI, a graduate of our Institute discovered in 1936, richly fossiliferous Gotlandian deposits in the Kitakami Mountainland, Japan[1].

Clathrodictyon vesiculosum NICHOLSON and MURIE

Pl. 31 (16), Figs. 1, 2.

1892 *Clathrodictyon vesiculosum* NICHOLSON and MURIE : N. A. NICHOLSON, A Monograph of the british stromatoporoids. Palaeontograph. Soc. Monog. p. 147, pl. 17, figs. 10–13 ; pl. 18, fig. 12 (with synonymy).

1896 *Clathrodictyon vesiculosum* NICHOLSON and MURIE : Canadian Stromatoporoids with Reference to the Literature of each species described from Canada. Canada Rec. Sci., vol. 7, p. 134.

1908 *Clathrodictyon vesiculosum* NICHOLSON and MURIE : W. A. PARKS, Niagara stromatoporoids. Univ. Toronto Stud. Geol. Ser. no. 5, p. 14, pl. 7, figs. 1, 6 ; pl. 8, figs. 2, 4, 5.

1929 *Clathrodictyon vesiculosum* NICHOLSON and MURIE : B. YAVORSKY, Silurian stromatoporoids. p. 104, pl. 7, fig. 8 ; pl. 8, figs. 1–7.

1933 ? *Clathrodictyon vesiculosum* NICHOLSON and MURIE : W. A. PARKS, New Species of stromatoporoids, Sponges, and Corals from the Silurian Strata of Baie des Chaleurs. Univ. Toronto Stud. Geol. Ser. no. 33, p. 9, pl. 2, fig. 2.

A small piece of coral-stock, of which 2 sections could scarcely be prepared.

Form and surface feature of coenosteum unknown. Skeletal elements slender, average 0.1 mm in breadth. Horizontal elements subparallel, 9–10 counted in 1 mm, much undulated so as to be often hardly distinguished from vertical elements where both are connected to form a nearly vesicular structure. Vertical elements appear as minute dots in tangential section, here and there united by horizontal elements to short vermicular strings. Astrorhizae and mamelons not exhibited in sections. Traversed by numerous Caunopora tubes, 0.3–0.5 mm broad.

Almost indistinguishable from the typical *Clathrodictyon vesi-*

1) Y. ONUKI : On the Palaeozoic Formation near Sakamotozawa, Kitakami Mountainland. Jour. Geol. Soc. Japan, Vol. 44, No. 522, pp. 168–186, 1937 (in Japanese).

culosum as figured N. A. NICHOLSON, in so far as can be judged from the scanty material at hand.

Clathrodictyon salairicum YAVORSKY

Pl. 31 (16), Figs. 3–4.

1929 *Clathrodictyon salairicum* YAVORSKY: Silurian stromatoporoids. Bull. Com. Géol. Leningrad, vol. 168, no. 1, p. 106, pl. IX, fig. 8; p. X, fig. 1.

A few fragmental specimens; form and surface feature of coenosteum unknown. Horizontal elements very persistent, slightly undulated, parallel, up to 0.05 mm thick, 7–9 counted in 1 mm. Vertical elements well developed at both ends by two successive horizontal elements and forming oblong compartments which are horizontally elongated. Vertical elements 0.075–0.1 mm thick, appearing as distinct and irregularly distributed minute dots in tangential section. Traces of astrorhizae and mamelon visible in section. Thin sections only.

Apparently indistinguishable from *Clathrodictyon salairicum* YAVORSKY from the Gotlandian of Siberia, in so far as can be judged from the sections at hand.

Explanation of Plate 31 (16)

Clathrodictyon vesiculosum NICHOLSON and MURIE

Fig. 1. Vertical section. ×10

Fig. 2. Tangential section. ×10

Clathrodictyon salairicum YAVORSKY

Fig. 3. Vertical section. ×10

Fig. 4. Tangential section. ×10

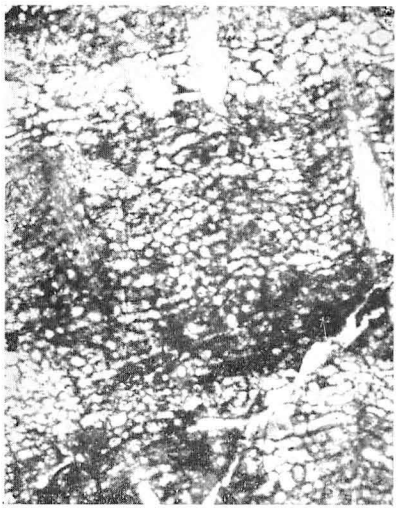
Propora cfr. *affinis* (BILLINGS)

Fig. 5. Tangential section. ×6

朝鮮産 Gotlandian の *Clathrodictyon* に就いて (摘要)

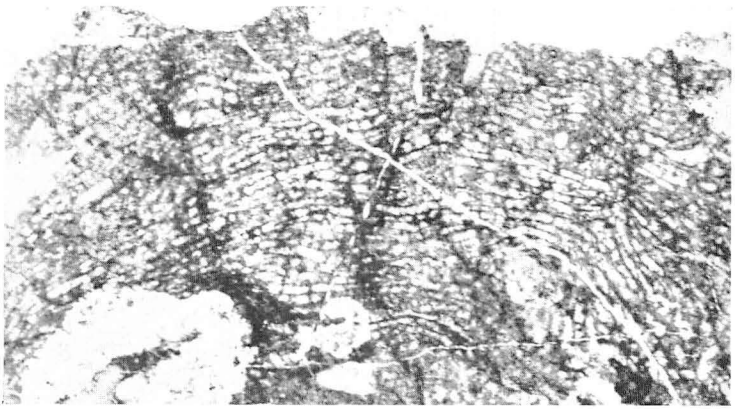
矢部長克・杉山敏郎

朝鮮黄海道黄州郡傘二浦北東約3 kmの低丘の礫質石灰岩の石灰岩礫から *Clathrodictyon* が2種類, *Propora* が1種類採集され記載したが, Gotlandian の既知種に何れも同定出來る。

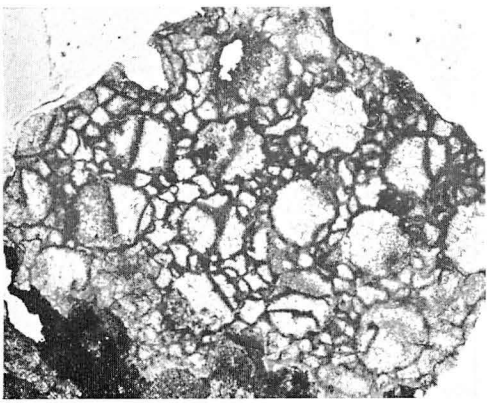


1

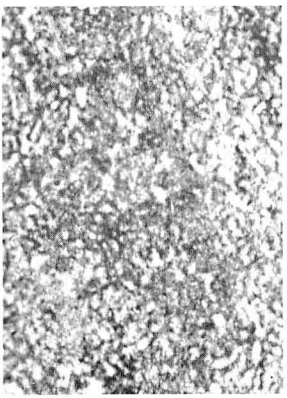
4



3



5



2

KIMURA photo.

51. *On the Stratigraphical Significance of Pecten naganumanus Yokoyama, and Its Bearing on the Japanese Neogene*

By

Hisakatsu YABE and Kotora HATAI

(Contribution from the Institute of Geology and Palaeontology, Tôhoku Imperial University, Sendai, Japan.)
Read Sept. 25th.; received Sept. 30th., 1937)

Since the well-known scallop, *Pecten naganumanus* was described and figured by Dr. M. YOKOYAMA in 1920, it was from time to time reported from many regions by different authors. At the present time its known southernmost limit in distribution is in the Philippine Islands, while its northernmost one is in the Setana series of Hokkaidô, northern Japan. The interesting geographical distribution and recent gift of several specimens of *Pecten naganumanus* from the Philippine Islands by Mr. Wataru HASHIMOTO to the senior author, has led the writers to this short note.

Pecten naganumanus YOKOYAMA, 1920

Figs. 1, 2, 3.

1920 *Pecten naganumana* YOKOYAMA, Jour. Coll. Sci. Imp. Univ. Tokyo, Vol. 39, Art. 6, p. 160, pl. 13, figs. 4-6.

1922 *Pecten naganumana* YOKOYAMA: DICKERSON, Philippine Jour. Sci., Vol. 20, No. 2, pl. 12, fig. 1.

1928 *Pecten* (*Vola*) *sinensis* SOWERBY: YOKOYAMA, Rep. Imp. Geol. Surv. Jap., No. 101, p. 97, pl. 14, fig. 1 (YOKOYAMA's species).

1931 *Pecten* (*Vola*) *naganumanus* YOKOYAMA: NOMURA and NIINO, Sci. Rep. Tôhoku Imp. Univ., Ser. 2, Vol. 15, No. 3, p. 179. (questionable)

1932 *Pecten* (*laqueatus* var. ?) *naganumanus* YOKOYAMA: KURODA, The Venus, Vol. 3, No. 3, appendix p. 103, fig. 116.

1933 *Pecten* (*Vola*) *naganumanus* YOKOYAMA: NOMURA, Sci. Rep. Tôhoku Imp. Univ., Ser. 2, Vol. 16, No. 1, p. 58.

Pecten naganumanus was first described by YOKOYAMA in 1920, upon well preserved specimens derived from the Naganuma zone at Naganuma, Sagami province, Central Japan. The original description is as follows :—

Shell medium-sized, not very thick but firm, roundish, broader than high, strongly inequivalve, nearly equilateral, the lower margin describing a semicircle with the anterior and posterior corners obtusely angulate and the antero-dorsal and postero-dorsal margins sloping and somewhat concave. Right valve convex and swollen, with broad and flatly rounded, subequal, radiating ribs separated by intervals of a less breadth; number of ribs normally twelve, but sometimes thirteen or eleven with one to three small subsidiary riblets at the anterior as well as at the posterior ends. Left valve quite flat, or even a little concave, also ornamented with flatly rounded radiating ribs which, however, are much narrower than those of the right valve, so that the interspaces become consequently wider than the ribs; their number is normally eleven, but may lessen to ten or increase to twelve and may also be accompanied by a few subsidiary riblets at both ends of the valve. Fine dense concentric elevated lines cross the ribs as well as the interspaces, most distinct on the flat valve, even obsolete on the ribs of the convex valve, on which we often observe several longitudinal striae. Ears are nearly equal especially on the flat valve, the anterior ear of the right valve being marked by a shallow byssal notch.

The largest specimen in our possession measures 82 millim. in height, 95 millim. in length and 25 millim. in depth.

The species allied to *P. naganumanus* are, *P. laqueatus* SOWERBY, *P. sinensis* SOWERBY and the Australian *P. bifidus* MENKE (or *P. fumatus* REEVE). All of these mentioned species are closely related to *P. naganumanus*, yet not one of them can be said to be specifically identical, and the differences existing between the above mentioned ones is taken to be of specific value by authors. KURODA is inclined to regard *P. naganumanus* as a possible variety of *P. laqueatus* SOWERBY, a recent and fossil species in Japan. NOMURA and NIINO believe that *P. naganumanus* is related to *P. laqueatus* SOWERBY and *P. fumatus* REEVE, but the differences between those scallops is of specific value, thus warranting their separation and not combination. NOMURA states that *P. naganumanus* is not a synonym of either *P. sinensis* or a varietal form of *P. laqueatus*, but is closely related to the Australian *P. bifidus*. Specific distinction among these mentioned forms lies in the number of normally developed ribs on both the right and left valves and also in the degree of inflatness of the umbonal region of the right valve.

From studies on the literature in concern and from the observations on specimens, we also prefer to regard *P. naganumanus*

as closely related to the mentioned forms, but at the same time, recognize it as a valid species characteristic of the Japanese Upper Pliocene or Lower Pleistocene, according to authors. We, however, are in the opinion that intermediate forms between *P. naganumanus* and the above mentioned forms must be found in order to make clear the true relationship existing between the species in question to those of close alliance.

Species related to *P. naganumanus* are found in the Tertiary deposits of western North America, and are given below briefly in order to make clear their relation to the present one.

In regard to *Pecten humphreysi* CONRAD, a Miocene species of the eastern coast Tertiary of North America, GRANT and GALE[1], state that :

> The two well-knwon forms, *humphreysi* and *laqueatus*, are so very much alike that they probably cannot be distinguished and are here tentatively considered synonymous in spite of their very distant occurrences. The variety *aletes* explains and unites these two widely separated occurrences, for it is a form probably not more than varietally distinct, being apparently a local off-shoot that separated from the main stock as it migrated from Maryland to Japan. Whether the synonymy as given above be accepted or not, the fact of primary importance cannot be doubted that this species or group of forms migrated, probably during the Miocene, between Maryland and Japan through California faunas is entirely mythological and to show that migration has occurred between this region and others, that some species must have come here from the other regions, and that therefore the faunas of the other regions must be taken account of and some of the specific names applied to California forms. Furthermore, this instance does not occur alone but is accompanied by many others. The Pectens supply the cases best known to the present writers, who have studied them more with this idea in mind, but similar cases have been noticed in other genera such as *Corbula*, *Psephaea*, *Nucula*, *Pitar* (*Amiantis*), *Mactra*, etc. Provincialism has deprived California palaeontologists of one of the most helpful aids in making correlations and has kept in the dark some of the most interesting chapters of this part of natural history.

GRANT and GALE consider *P. laqueatus* to have migrated from the Atlantic side to the Pacific side of North America and to

1) U. S. GRANT, VI and H. R. GALE : Catalogue of the Pliocene and Pleistocene Mollusca of California. Mem. San. Diego Soc. Nat. Hist., Vol. 1, pp. 221-222, 1931.

Japan under the name of *P. humphreysi*, to which it was lumped into; and that *aletes* serves in uniting and explaining the widely separated occurrences. However, in the explanation given by GRANT and GALE, *aletes* apparently neither unites nor explains the remote occurrences of *P. humphreysi* and *P. laqueatus*, as nothing is stated in regard to the occurrences of intermediate forms between those two species in the interevening area on the one hand, and *aletes* does not seem to explain their remote occurrences as it occurs only in Lower California, according to those authors.

More recently, H. I. TUCKER[1], gave the following statement:

> Comparisons of specimens of *P. laqueatus* SOWERBY from Japan with the Maryland *humphreysi* leaves no doubt that they are only generically related. There seems little basis for placing SOWERBY's species in synonymy under *humphreysi*, as GRANT and GALE.

The view held by TUCKER in regard to the relation existing between *humphreysi* and *laqueatus*, is followed by us. The main differences noted by us, aside from the remote occurrences are briefly given in the following lines.

The ribs on the left valve of *laqueatus* number 8–9, and are more closely spaced, as well as more roundly higher than in *humphreysi*, which has 7–8 ribs. The ribs on the right valve seem to be more pronounced, with less significant subsidiary ones at the sides and generally number 8, but range within 8–9, instead of only 7–8 as compared with *humphreysi*. Also the beak of the right valve as well as the umbonal region of *laqueatus* seems to be more swollen than in *humphreysi*.

Pecten naganumanus is also closely similar to *P. bellus* CONARAD[2], an extinct species occurring in the Middle and Upper Pliocene deposits of the west coast Tertiary of North America. Its description as given by GRANT and GALE is as follows:

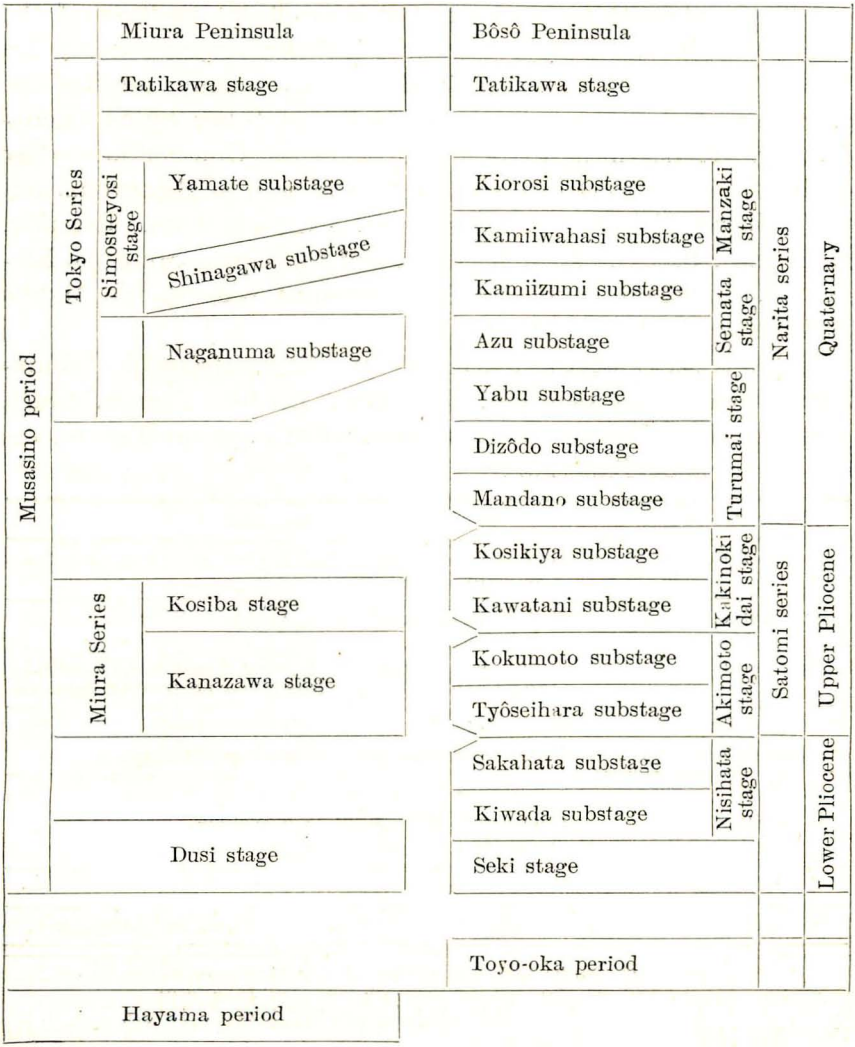
> Right (lower) valve only moderately convex, the point of greatest convexity being about one-third of the distance from the hinge- to the posterior margin of the disk., the umbo curving sharply in some specimens

1) H. I. TUCKER: The Atlantic and Gulf Coast Tertiary Pectinidae of the United States. Amer. Midl. Nat., Vol. 17, No. 2, p. 479, 1936.

2) G. H. ELDRIDGE and R. ARNOLD: Bull. 309, U.S. Geol. Surv., p. 24, pl, 35, fig. 3, 1907; WATERFALL: Univ. Calif. Publ. Geol., Vol. 18, No. 3, pp. 78, 81. 82, 1929; GRANT and GALE: Op. Cit., p. 225, 1931.

and meeting the plane of the ears perpendicularly; ribs prominent, 12 to 15 in number, broad flat-topped, with flat, steeply sloping sides, sometimes marked by one or two indistinct longitudinal grooves, growing broader, less elevated, and less sharply angled near periphery; hinge-line short; left valve only slightly convex, outline smoothly curving or varied with a depressed area just under the beaks; ribs much as in the right valve, but narrower and higher, more distant, sometimes slightly grooved in the center.

From the above description as well as from the figures of



P. bellus given by ELDRIDGE and ARNOLD, it can be noticed that the number of ribs on the right as well as left valve exceeds that of *P. naganumanus*, which varies from 11–13. Beside the difference in the number of the radial ribs, it is also recognized that the umbo is slightly more swollen and the hinge-line less straight in *P. naganumanus* than in *P. bellus*. These features are taken to be of specific value in distinguishing the species of the *Pecten laqueatus*-group.

The geological age and exact stratigraphical position of the Naganuma beds, the type horizon of *Pecten naganumanus*, has been a subject of considerable discussion, mainly because the Naganuma beds is bounded both above and below by an unconformity. It has hitherto been placed in the Upper Pliocene by such authorities as OTUKA and NOMURA as well as SAKAKURA, and in the Lower Pleistocene by MAKIYAMA, YABE and AOKI. Recently, N. IKEBE[1], brought forth his studies of the Upper Musasino Formation, in which he places the Naganuma beds in the Middle Pleistocene as shown above:

Our recently obtained material was derived from the Malumbang limestone at Samagui, Bongabon, Mindoro Islands, which occupies the following stratigraphic position, according to the classification by FAUSTINO :[2]

Formation name	Characteristic
Pleistocene	Elevated coral reefs and high-level river deposits in many parts.
Guadalupe	Tuff beds in southwestern Luzon, with teeth of deer and sharks.
Malumbang	Coralline limestone in Bondoc Peninsula, Tayabas, and Cebu. Yielding fossil marine invertebrata.
Santa Cruz	Santa Cruz, Zambales, tuffaceous marl;
Alpaco	Mount Alpaco, Cebu, tuff and sandy marl.
Vigo	Sandstones and shales with oil-seeps.
Binangonan	Limestones with large *Lepidocylinas*.
Bantan	Shales and grit with coal and marine shells.
Agno (Eocene)	Conglomerate beds of the Agno river.
Baruyen (Jurassic)	Radiolarian cherts with *Cenosphaera* and *Dictyomitra*.

1) N. IKEBE: Divisions and Age of the Upper Musasino Formation. Jour Geol. Soc. Japan, Vol. 44, No. 525, pp. 583–589, 1937 (in Japanese)

2) L. A. FAUSTINO: Proc. Third Pan-Pacific Sci. Congr., Tokyo, Vol. 2, pp. 1535–1539, 1927.

In the Island of Taiwan, *P. naganumanus* occurs at numerous localities of the upper half of the Pliocene Byôritu beds[1] of Mr. Andô[2], which occupy the following stratigraphic position :

Formation name	Characteristic
Raised coral reef	Reef building corals associated with molluscs.
Plateau gravel	Thick gravel bed free from fossils.
Ryûkyû limestone	Stratified limestone, rarely massive and porous. Fossiliferous.
Syokkozan beds	Conglomerate intercalating sandstone layers in the lower part.
Byôritu beds	Alternating layers of shale and sandstone in the lower, shale predominating in the upper. Fossils.
Kaizan beds	Sandstone and shale with ocassional thin layers of limestone and marl. Coal and oil.
Karisan beds	Black slaty shale, rarely with marl and sandstone.
Hori slate and crystalline schists	

Unconformities appear between the Plateau gravel and the Ryûkyû limestone and between the Ryûkyû limestone and the Syôkkozan beds, while the Karisan and the Kaizan beds are in fault contact.

P. naganumanus has also been reported from the Sirahama beds in the southern part of Izu Peninsula, Central Japan. It is there represented only by a left valve whose external surface is entirely covered by the calcareous matrix, and, although it may be a form of the named species, there is still room for doubting its belonging to the named one. Furthermore, there is also some data for believing in the necessity for a restudy of the stratigraphic sequence of the strata of southern Izu Peninsula, as the lithic-facies undergoes considerable lateral variation, and eruptive rocks

1) H. Yabe and S. Hanzawa : Tertiary Foraminiferous Rocks of Taiwan (Formosa), Sci. Rep. Tôhoku Imp, Univ., Ser. 2, Geol., Vol. 14, No. 1, pp. 8-9, 1930. In a former occasion it was stated that the Ryûkyû limestone unconformably overlies the Syôkkozan beds at Hôzan. However, it must be stated at this place that the so-called Syôkkozan beds at Hôzan are not of the type, and it is believed that the Upper part of the Byoritu beds and the part of the Syôkkozan beds are contemporaneous with one another, the latter being a different facies of the former ; likewise, a part of the Ryûkyû limestone is also possible to be a different facies of the Syôkkozan beds.

2) Mr. Andô in M. Nakamura : Jour. Geol. Soc. Japan, Vol. 44, No. 526, p. 673, 1937. (in Japanese)

have made complicate and difficult the tracing of the different rocks in the field.

MAKIYAMA[1], in his study of the marine stages developed in South Kwantô, Japan, has recorded *Pecten laqueatus naganumanus* YOKOYAMA, from the Kanozanian stage, whose type locality is said to be Mt. Kano-zan in Bôsô Peninsula. His stages, in descending order, are as follows :

Stage name	Substage name	Terrace	Height above sea-level
Tatikawan	—	4th, river terrace	30 to 40 m
Naritian	Kiorosi Manzaki	3rd, coastal plain	60 to 70 m
Sematian	*Erodona frequens* Kamiiwahasi Azu Kamiizumi	2nd, wanting	—
Kanozanian	Hitomi Itiziku	1st, coastal plain	80 to 100 m

All of these stages and substage names are referred to the Pleistocene age by MAKIYAMA, and the lowest, or Kanozanian stage is said to overlie the Pliocene in unconformable relationship. *Pecten naganumanus* occurs in the lowest part (Itiziku substage of the Kanozanian stage).

SAKAKURA[2] records *P. naganumanus* from the Sakahata beds at Tuzimori, where it is said to be very common, and from the lower part of the Itiziku beds at Imokumo, both in Bôsô Peninsula. Both beds are referred to the Pliocene by him. The stratigraphical positions of his *P. naganumanus*, is shown below :

Pléistocène Inf.	Turumaien		Sables et graviers de Yabu (Zone fossilifère de Yabu) Sables de Dizôdo (Zone fossilifères de Dizôdô)	
Plio-Pléistocène			Argile de Kasamori Sables et graviers de Mandano (Zone fossilifère de Mandano)	
Pliocene Sup.	Satomien		Sup. Sables d'Itiziku (Z. fossil. Itiziku)	Altern. sables et argiles, et argile
	Moy.	Moy.	Argile de Yanagawa	

1) J. MAKIYAMA, Jap. Jour. Geol. Geogr., Vol. 9, pp. 21-53, 1931.

2) K. SAKAKURA, Jour. Geol. Soc. Jap., Vol. 42, Nos. 506-507, pp. 11-13, 1935.

		Inf.	Altern. argiles et sables de Habusawa Argile de Sambonmatu Sables de Hasumi (Zone fossilifères de Hosono et Kaburai)
	Inf. Nisiha-tien		Couches de Sakahata (Zone fossilifère de Tuzimori) Argile dure de Kohiragadai
			Couches de Seki (Sables et graviers tuffacés)
Miocene			Couches de Toyooka

We have specimens of this species from the Naganuma beds (type horizon) at Naganuma, Toyoda-mura, and Muraoka-mura, both in Kamakura-gun Sagami province; from the Ninomiya beds at Ninomiya, Naka-gun, in Sagami; from the Nisihigasa beds at Nisihigasa, Akimoto-mura, Kimitu-gun, Kazusa province; and from the Mandanoyama-beds at Mandanoyama, Kimitu-gun, Kazusa. Besides, there is a questionable specimen from the Sirahama beds of southern Izu Peninsula, Izu; a questionable species from the "Ryûkyû" limestone beds in Okinawa-zima, Ryûkyû Islands, and the present one from the Malumbang limestone of the Philippine Islands.

There is also a fragmentary specimen from the Hiradoko beds of Noto, collected by the late Mr. T. MATUSIMA, a student of our Institute, who met a very unfortunate death while surveying in that region. Only a single right valve of *P. naganumanus* was found out of about 20 convex valves of *Pecten laqueatus* SOWERBY from the Hiradoko beds. Sometime ago, Mr. T. KURODA (Venus, III (2), 103, 1932), stated that very rarely *P. naganumanus* is dredged together with living specimens of *P. laqueatus*, from off Hizen, Kyûsyû. His case is strongly similar to the fossil-bearing Hiradoko beds of Noto.

To be stated at this place is the fact that the "Ryûkyû" limestone developed on Okinawa-zima in the Ryûkyû Islands, was once stated by NOMURA and HATAI[1], that "Upon the data now at hand, it seems more reasonable to consider the beds yielding these fossils (listed in their article) to be a different facies of the Simaziri beds and not a part of the Ryûkyû limestone complex". The

1) S. NOMURA and K. HATAI: Trans. Pal. Soc. Jap., No. 12, pp. 336-339, 1936.

Simaziri[1] beds are known to be stratigraphically older than the Ryûkyû limestone complex, which it underlies unconformably.

Pecten (Vola) sinensis SOWERBY, recorded by YOKOYAMA from the Upper Byoritu beds of Taiwan (Formosa) is the same as *P. naganumanus* recorded by NOMURA from the same beds.

P. nagamumanus has also been recorded from the Setana series of southwestern Hokkaidô by NAGAO and SASSA[2]. Their specimen was listed with a question mark. The stratigraphic horizon of the Setana series[3] and its generally accepted Pliocene age, more or less quite corresponds to the general occurrence of *P. naganumanus*, and probably corresponds to the Upper part of the Byoritu and Simaziri beds of southern Japanese Islands.

Thus, as has been shown in the foregoing pages, there are several horizons of *Pecten naganumanus* in the Japanese Upper Tertiary, these may be arranged in the following way.

P. naganumanus from the Byoritu beds of Taiwan approximately corresponds in age to the Malumbang limestone of the Philippine Islands, and to a part of the Simaziri beds Okinawazima, and to the Setana series of southern Hokkaidô. The one from the Naganuma beds may correspond, according to the interpretation of the stratigraphical divisions and geological age, to the Ninomiya beds of Sagami, and probably the specimen recorded both by MAKIYAMA and SAKAKURA may also belong here. However, if the Kanozanian stage of MAKIYAMA is Lowest Pleistocene and the Itiziku beds of SAKAKURA Uppermost Pliocene, and the Naganuma beds as recently reclassified by IKEBE of Middle Pleistocene, and the specimen from the Hiradoko beds of Noto either thereabout or somewhat younger in age, then it follows that the geological range of *Pecten naganumanus* is from the upper part of the Lower or the lower part of the Upper Pliocene to the Middle Plesitocene or slightly younger.

However, as may be noticed, there are several small horizons

1) S. NOMURA and Y. ZINBÔ: Sci. Rep. Tôhoku Imp. Univ., Ser. 2, Vol. 18, No. 3, p. 229, 1936.

2) T. NAGAO and Y. SASSA: Jour. Geol. Soc. Jap., Vol. 41, No. 488, p. 233, 1934.

3) T. NAGAO: Proc. Fifth Pan-Pacific Sci. Congr., Canada, A 7, 32, pp. 2461–2465, 1934.

of this species in the Japanese Upper Tertiary deposits, but broadly speaking, it is more common in the Upper Pliocene or Lower Plesitocene than in other ages. Finally, the geological age of its occurrence and the stratigraphical position it may occupy, all depends upon the association of faunal elements found in the same horizon and locality.

As the closing word of this preliminary report toward studies on the distinction between the Pliocene ond Pleistocene of Japan, it may be said that *Pecten naganumanus* from the Byoritu beds generally has about 12 ribs on the right valve, the ones from the Naganuma beds generally show but 11, those from the Ninomiya beds about 10, and the specimens from Higasa number about 12. Thus, it may be possible that the number of ribs on the right valve and their relation to the age of the beds in which they occur may yet prove to be of some aid in distinction of the Pleistocene from the Pliocene in the Kwantô region, Central Japan. However, from the number of ribs only taken into consideration, it appears as if the beds at Higasa and the Byoritu beds were of the same age, and that the Nagnuma beds were geologically older than the Ninomiya beds; providing that the decrease in number of ribs on the right valve is in accordance with the succession of strata. Previous knowledge, however, does not allow such a rash conclusion, and until the real relationship existing between the various types of *Pecten naganumanus*, that is to say, the number of ribs on the right valve and the stratigraphic horizon in which it occurs, to its associated faunal elements is known, conslusive remarks are withheld for future study.

Explanation of Plate 32 (17)

(¾ Natural Size)

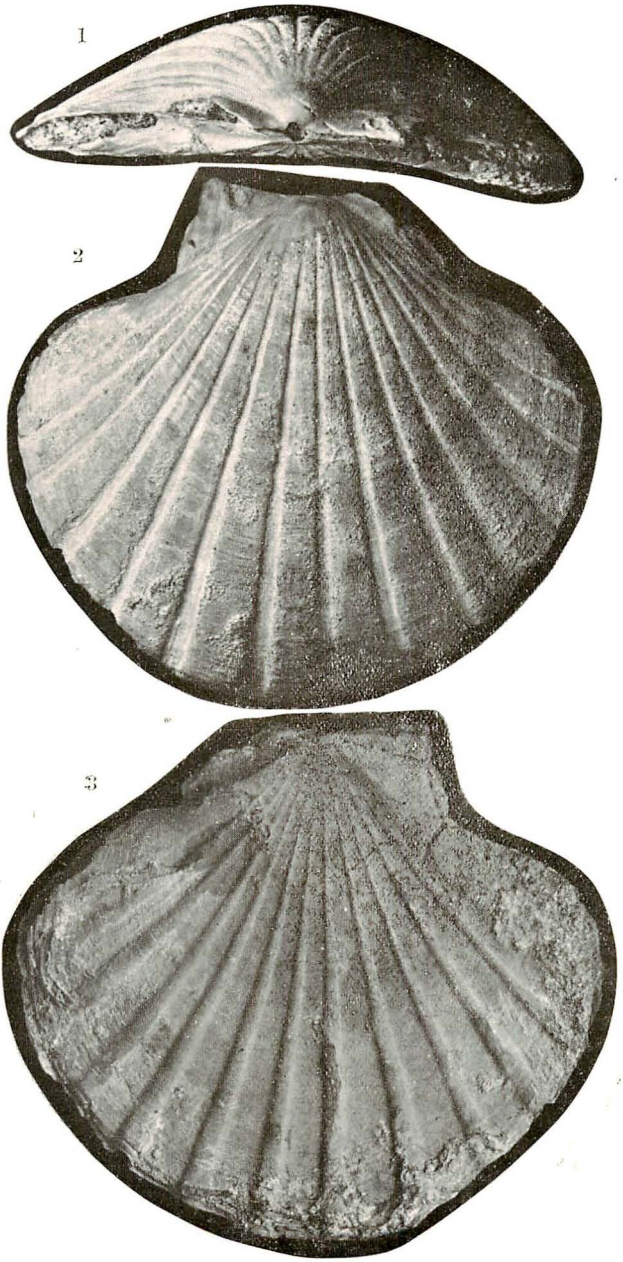
1. View of intact valves, showing their convexity.
2. Right valve, showing the typical flat ribs.
3. Left valve, showing the elevated ribs.

Pecten naganumanus YOKOYAMA の層位關係と其の價値（摘要）

矢部長克・畑井小虎

横山博士により神奈川縣長沼の長沼層より記述せられたる *Pecten naganumanus* YOKOYAMA は其後各地に見出されたるが，殊に臺灣の新第三紀層中に廣く分布すること知らるゝに至れり。フィリッピン群島の Malumbang 石灰岩に産することは既に報告あるが，最近橋本亙理學士より送附を受けたる Samagui, Bongabon, Mindoro, P. I. 産石灰岩化石中に保存良好なる標本ありて，長沼産のものと直接比較し同一種なることを確め得たり。本種は時に *Pecten laqueatus* SOWERBY に伴ひ産することあり，新しき地層よりは極めて稀なれど時に多數の *P. laqueatus* に混じ見出さるゝことあり，例へば故松島忠雄氏が最近能登珠洲郡平床介層中より採集せる *P. laqueatus* 右殻 20 個と共に *P. naganumanus* の右殻 1 個あり。

終りに本種の地質時代及地理的分布に就きて略述す。


1
2
3

52. *On a Graphularia-Like Fossil from the Pleistocene Tokyo Beds of Tokyo*

By

Hisakatsu YABE and Toshio SUGIYAMA

(Contribution from the Institute of Geology and Palaeontology, Tôhoku Imperial University, Sendai, Received Sept. 25th.; read Sept. 30th., 1937)

The interesting fossil which forms the subject of this short note was collected some thirty years ago from the Tokyo beds of Atagosita, Siba-ku, in the city of Tokyo, by the late G. YAMAKAWA, and offered by him to the senior author. It is a slender columnar calcareous body, somewhat bilaterally symmetrical, flattened on two opposite sides, and radially fibrous in cross-section. Apparently it is a fragment of an axis of a certain Alcyonaria, most likely of the Pennatulidae, and it strongly reminds us of the genus *Graphularia* by its peculiar form and structure.

The genus *Graphularia* was established by M. EDWARDS and J. HAIME[1] in 1850 on *Graphularia wetherelli* M. EDWARDS and J. HAIME from the London clay of England. It was compared by them with the similar axes of the living *Pennatula*, *Pavonaria*, *Umbellaria*, *Lithuaria*, *Veretellum*, and *Virgularia*, and it was found to disagree with all of them. The genus[2] now includes some 15 species, beside the genotype, mostly from the Palaeogene of Europe; these are, *G. ambigua* MORTON from the Senonian of New Jersey, North America, *G. grönwalli* NIELSON from the *Crania*-limestone of Denmark, *G.* sp. from the Palaeocene of Sweden, *G.*

1) M. EDWARDS and J. HAIME: A Monograph of the British Fossil Corals pp. LXXXIII and 41, pl. 7, figs. 4, 4a-e.

2) J. FELIX: Anthozoa neocretacea. Foss. Cat. Animalia, pars 7, p. 244, 1914. Anthozoa miocaenica, ibid., pars 35, p. 297. Anthozoa pliocaenica et pleistocaenica, ibid., pars 44, p. 502, 1929.

belgica VINCENT, *incerta* D'ARCHIAC, *desertorum* ZITTEL, and *perplexa* DE GREGORIO from the Eocene respectively of Belgium, the Pyrenees, Egypt, and Alabama in North America, *G. beyrichi* BRANCO, *brancoi* v. KOENEN, *brauni* BRANCO and *crecelii* ANDRÉE from the Oligocene of Germany, *G.* sp. from the Oligocene of Denmark, *G.* sp. and *barbara* POMEL from the Miocene respectively of Austria and Algeria, *G. robinae* McCOY from the Miocene of Australia and New Zealand, and finally *G. senescens* TATE from the Miocene of Australia. The last two are the only species hitherto recorded from the borderlands of the Pacific.

The generic identification of these forms are doubtful, unless the name *Graphularia* is used as a form-genus for fossil axes of the alcyonarian corals more or less similar to those of the living genus *Pennatula* and its allies. Perhaps there is need of redefining the genus *Graphularia* for the modern use based on a full knowledge on the structural features of the axes of living forms, which we are now lacking. In the original sense, *Graphularia* is characterized by its authors as, "Corallum styliform, straight, very long, cylindroid towards the lower extremity, subtetrahedral at the upper part, and presenting on one side a broad shallow furrow. Transverse section showing the existence of a thin coating, and a radiate structure in the body of coral." The genotype has on its suface "a multitude of small, longitudinal, closely-set striae, that seem to indicate a fibrous structure", under the microscope.

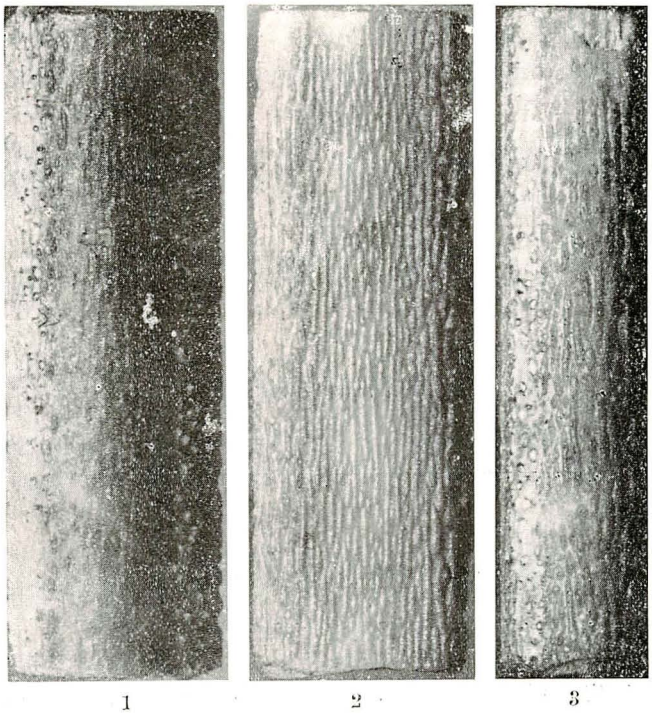
At least, the fossil from the Tokyo beds now in concern diverges not little from the *Graphularia* in several detailed features as the following description shows; as much as there is a great possibility of its belonging to one of the living genera or even living species, being derived from a Pleistocene deposit, it is merely provisional to assign it to *Graphularia* and only for practical need to apply a new specific name to it.

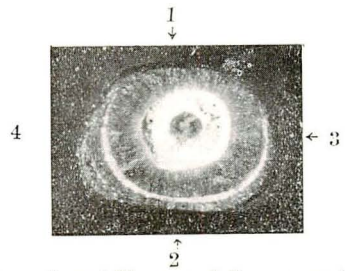
Graphularia (?) *yamakawai*, n. sp.

Figs. 1–4.

A calcareous columnar body, broken at both ends and 13 mm long. Straight, almost bilaterally symmetrical, flattened on two opposite sides, 1.9 and 2.7 mm in shorter and longer diameter respectively; radial and

zonal structure distinct in cross-section, outermost zone thickest on inflated sides and almost disappearing on flattened sides. Flattened sides almost smooth on surface, though exhibiting under magnification numerous, extremely fine, slightly elevated, longitudinal striae; those on inflated sides more prominent, being broader and higher, often culminating to tubercles pitted on tip, mostly longitudinal, but occasionally oblique.





Graphularia yamakawai YABE and SUGIYAMA from the Pleistocene Tokyo beds of Tokyo. ×10

Fig. 1. One of flattened sides. Fig. 2. The opposite side.
Fig. 3. One of inflated sides. Fig. 4. Transverse section; the radial structure is more distinct on the specimen than in this figure.

the former species from a shore sand of Miyazu, Wakasa bay, and the latter in an off-shore material from Kannoura, the southeast coast of Sikoku.

Secondly, this foraminifera fauna is quite different in its composition from those prevailing in the younger Neogene marine

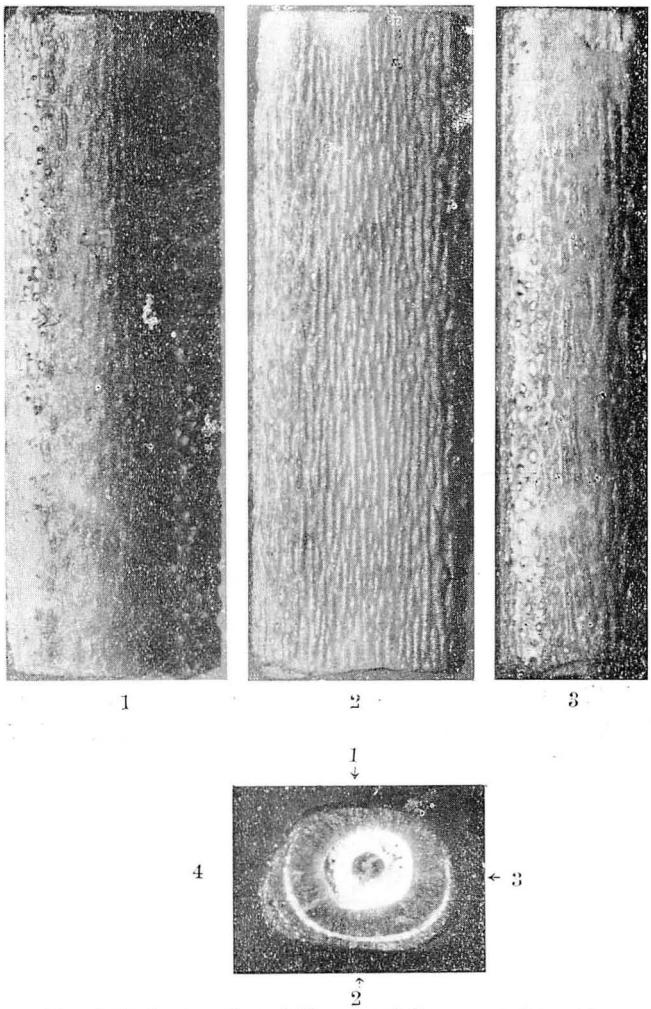
Remarks: It is a question whether the flattened sides are a primary feature of the corallum or due to erosion; the sides are not only parallel to each other, but are also provided with short,

formations of this district. Thirdly, it is significant in lacking *Cassidulina*, a genus with a very characteristic distribution of its species in the Japanese Neogene formations, and the absence of its species in this deposit suggests 1) the warm 2) shallow-water condition and 3) a complicated migration of the foraminifera in this district during the latest geological ages. The abundance in individual and specific numbers of the three genera, *Quinqueloculina*, *Spiroloculina*, and *Elphidium* in the deposit is also another indication of its shoal water origin.

The specifically determined forms are given in the following list.

Family Textulariidae :—	
Textularia gramen d'ORBIGNY	common
T. conica d'ORBIGNY	few
T. hauerii d'ORBIGNY	few
T. candeiana d'ORBIGNY	rare
T. uedai ASANO	rare
Family Verneuilindae :—	
Gaudryina (*Siphogaudryina*) *matusimai* n. sp.	rare
Family Miliolidae :—	
Quinqueloculina subarenaria CUSHMAN	common
Q. seminulum (LINNÉ)	few
Q. vulgaris d'ORBIGNY	few
Q. dutemplei d'ORBIGNY	rare
Q. linnaeana d'ORBIGNY	rare
Spiroloculina antillarum d'ORBIGNY	common
S. canaliculata d'ORBIGNY	common
Hauerina fragilissima (BRADY)	few
Triloculina trigonula (LAMARCK)	abundant
T. tricarinata d'ORBIGNY	few
T. terquemiana (BRADY)	rare
Family Lagenidae :—	
Lagena striata d'ORBIGNY	very rare
L. squamosa MONTAGU	very rare
L. hexagona WILLIAMSON	very rare
Family Polymorphinidae :—	
Guttulina orientalis CUSHMAN & OZAWA	few
Pseudopolymorphina ishikawaensis CUSHMAN & OZAWA	few
P. okuwaensis CUSHMAN & OZAWA	few
P. indica japonica CUSHMAN & OZAWA	rare
Sigmoidella kagaensis CUSHMAN & OZAWA	few

zonal structure distinct in cross-section, outermost zone thickest on inflated sides and almost disappearing on flattened sides. Flattened sides almost smooth on surface, though exhibiting under magnification numerous, extremely fine, slightly elevated, longitudinal striae; those on inflated sides more prominent, being broader and higher, often culminating to tubercles pitted on tip, mostly longitudinal, but occasionally oblique.



Graphularia yamakawai YABE and SUGIYAMA from the Pleistocene Tokyo beds of Tokyo. ×10

Fig. 1. One of flattened sides. Fig. 2. The opposite side.
Fig. 3. One of inflated sides. Fig. 4. Transverse section; the radial structure is more distinct on the specimen than in this figure.

Remarks: It is a question whether the flattened sides are a primary feature of the corallum or due to erosion; the sides are not only parallel to each other, but are also provided with short, slightly elevated longitudinal striae, though considerably finer than those on the opposite sides; we took the feature as of primary nature.

The specific name is dedicated to Gordon YAMAKAWA, who contributed very much to our knowledge on the younger Cenozoic fossils of the Kwantô region, during his very short but exceedingly successful career. His works will show his remarkable ability and his much regretted death at a young age was a great shock to the Japanese palaeontology.

The holotype is now stored in the Institute of Geology and Palaeontology, Tôhoku Imperial University, Sendai, Japan. Reg. No. 7149.

Locality: Atagosita, Siba-ku, city of Tokyo.

Geological formation: Tokyo beds, Pleistocene.

東京産 *Graphularia* (?) の化石に就いて (摘要)

矢部長克・杉山敏郎

東京市芝區愛宕下の東京層から昔 M. EDWARDS 及 J. HAIME が創設した *Graphularia* に近似の化石が採集されてた。此屬には同定出來る種はないから新種名を與へたが,現棲の海鰓目 (Pennatularia) の axis の研究が充分に行はれてないので正確なる屬の決定は出來ない。

53. *Pleistocene Foraminifera from the Hiradoko Shell Beds, Noto Peninsula, Japan*

By

Kiyosi ASANO

(Contribution from the Institute of Geology and Palaeontology, Tôhoku Imperial University, Sendai, Japan, Received Oct. 20th.; read Dec. 18th., 1937)

The material of the present article was collected by the late Tadao MATUSIMA of our Institute from Hiradoko, Syôin-mura, Syuzu-gun, Isikawa prefecture (Noto peninsula), where a marine fossiliferous deposit of sandy mud forms a terrace some 25–40 meters high. The deposit is rich in fossil shells in its upper half, and is known under the name of the "Hiradoko shell bed". It has a more extended distribution in the environs of the village Syôin. The fossil content seems to vary greatly according to the kind of sediment, fossils being fragmental in the marginal part of deposition and abundant and well preserved at Hiradoko.

The deposit contains a rich foraminifera fauna, beside mollusca, bryozoa, sponge-spicules and diatoms. Its molluscan fauna has already been treated by Dr. M. YOKOYAMA, Messrs. K. MOTIZUKI and Y. ÔTUKA independently; the latter author enumerated as many as 99 species of mollusca from Hiradoko.

The foraminifera fauna to which I am solely in concern is interesting in several respects. Firstly it comprises many warm-water forms; especially *Amphistegina radiata* (FICHTEL & MOLL) and *Sorites marginalis* (LAMARCK). These two are now common in tropical and subtropical seas, but seldom living in the seas bordering Honsyû; it is as exceptional cases that I lately obtained the former species from a shore sand of Miyazu, Wakasa bay, and the latter in an off-shore material from Kannoura, the southeast coast of Sikoku.

Secondly, this foraminifera fauna is quite different in its composition from those prevailing in the younger Neogene marine

formations of this district. Thirdly, it is significant in lacking *Cassidulina*, a genus with a very characteristic distribution of its species in the Japanese Neogene formations, and the absence of its species in this deposit suggests 1) the warm 2) shallow-water condition and 3) a complicated migration of the foraminifera in this district during the latest geological ages. The abundance in individual and specific numbers of the three genera, *Quinqueloculina*, *Spiroloculina*, and *Elphidium* in the deposit is also another indication of its shoal water origin.

The specifically determined forms are given in the following list.

Family Textulariidae :—	
Textularia gramen d'ORBIGNY	common
T. conica d'ORBIGNY	few
T. hauerii d'ORBIGNY	few
T. candeiana d'ORBIGNY	rare
T. uedai ASANO	rare
Family Verneuilindae :—	
Gaudryina (*Siphogaudryina*) *matusimai* n. sp.	rare
Family Miliolidae :—	
Quinqueloculina subarenaria CUSHMAN	common
Q. seminulum (LINNÉ)	few
Q. vulgaris d'ORBIGNY	few
Q. dutemplei d'ORBIGNY	rare
Q. linnaeana d'ORBIGNY	rare
Spiroloculina antillarum d'ORBIGNY	common
S. canaliculata d'ORBIGNY	common
Hauerina fragilissima (BRADY)	few
Triloculina trigonula (LAMARCK)	abundant
T. tricarinata d'ORBIGNY	few
T. terquemiana (BRADY)	rare
Family Lagenidae :—	
Lagena striata d'ORBIGNY	very rare
L. squamosa MONTAGU	very rare
L. hexagona WILLIAMSON	very rare
Family Polymorphinidae :—	
Guttulina orientalis CUSHMAN & OZAWA	few
Pseudopolymorphina ishikawaensis CUSHMAN & OZAWA	few
P. okuwaensis CUSHMAN & OZAWA	few
P. indica japonica CUSHMAN & OZAWA	rare
Sigmoidella kagaensis CUSHMAN & OZAWA	few

Family Nonionidae :—	
Nonion boueanum (d'ORBIGNY)	rare
Pseudononion japonica ASANO	few
Elphidium advenum (CUSHMAN)	common
E. crispum (LINNÉ)	few
E. jenseni (CUSHMAN)	rare
E. subgranulosa ASANO	rare
Family Peneroplidae :	
Sorites marginalis (LAMARCK)	few
Family Buliminidae :—	
Loxostoma karreriana (BRADY)	rare
Reussella spinulosa (REUSS)	rare
Chrysalidinella dimorpha (BRADY)	rare
Siphogenerina raphana (PARKER & JONES)	few
Family Rotaliidae :—	
Discorbis orbicularis (TERQUEM)	rare
Eponides repandus (FICHTEL & MOLL)	rare
Rotalia japonica HADA	rare
Family Amphisteginidae :—	
Amphistegina radiata (FICHTE & MOLL)	few
Family Cymbaloporidae :—	
Cymbalopora bradyi (CUSHMAN)	rare
Family Globigerinidae :—	
Globigerina bulloides d'ORBIGNY	rare
G. triloba REUSS	very rare
G. inflata d'ORBIGNY	very rare
Orbulina universa d'ORBIGNY	very rare
Family Anomalinidae :—	
Planulina wuellerstorfi (SCHWAGER)	very rare
Cibicides lobatulus (WALKER & JACOB)	few
C. refulgens (MONTFORT)	rare
C. pseudoungerianus (CUSHMAN)	very rare
Family Planorbulinidae :—	
Acerbulina inhaerens SCHULTZE	rare

Besides 51 species enumerated in the above list, there are several indeterminable ones belonging to the genera, *Quinqueloculina, Textularia, Triloculina, Guttulina* and *Discorbis.*

Remarks to the Foregoing List

Family *Textulariidae*

5 species were discriminated of genus *Textularia,* and the

commonest one is *T. gramen* d'ORBIGNY. It is a species common in the shallow waters of the adjacent seas of Japan. *T. uedai* ASANO was originally described from the Pliocene of Muraoka-mura, Kanagawa prefecture.

Family *Verneuilinidae*

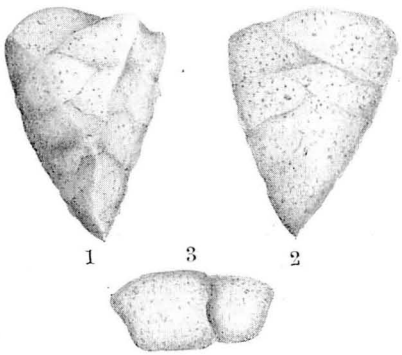
Genus *Gaudryina* d'ORBIGNY, 1839

Subgenus *Siphogaudryina* CUSHMAN, 1935

Gaudryina (Siphogaudryina) matusimai n. sp.

Text-figs. 1-3.

Test wedge-shaped, early portion triserial and triangular, later portion biserial and somewhat compressed; one edge divided, resulting to a generally quadrangular aspect of test; chambers indistinct, not inflated; sutures oblique, very slightly depressed in later ones; wall very finely arenaceous; aperture a small, low opening of inner margin of last-formed chamber. Length up to 0.5 mm.



Gaudryina (Siphogaudryina) matusimai n. sp.

Holotype (Reg. No. 21443, Institute of Geology and Palaeontology, Tôhoku Imperial University, Sendai, Japan) from the Hiradoko shell beds, Hiradoko Syôin-mura, Noto Peninsula, Japan. Coll. by the late T. MUTUSIMA.

This species somewhat resembles *G. (S.) wrightiana* MILLETT from the Malay Archipelago, but has less numerous chambers with less prominent edges.

Family *Miliolidae*

4 genera and 11 species of this family were distinguished in the present material. These species live mostly in warm, shallow, clear water, and are present in abundance in some deposits laid down under those conditions.

Quinqueloculina: Of the 5 identified species, *Q. suberenaria* CUSHMAN is most common. It is a subtropical species originally described from off Singapore in 13 fathoms, and sometimes found in the Neogene deposits of Japan. The two striated forms *Q.*

dutemplei d'ORBIGNY and *Q. linnaeana* d'ORBIGNY are rather rare in the present material, although they are now common in warm shallow waters.

Spiroloculina: 2 species, namely *S. canaliculata* d'ORBIGNY and *S. antillarum* d'ORBIGNY were distinguished. These two forms are very common in the Plio-Pleistocene and recent faunas of Japan, as well as in the present collection.

Hauerina: *H. fragilissima* (BRADY) only was found.

Triloculina: 3 species were found. *T. trigonula* (LAMARCK) is most abundant in the present material. The others *T. tricarinata* d'ORBIGNY and *T. terquemiana* (BRADY) are rather rare, although they are common in the seas adjacent to Japan.

Family *Ophthalmidiidae*

Vertebralina: *V. striata* d'ORBIGNY only was found. This is one of the common species of foraminifera from the Byôritu beds of Taiwan.

Family *Lagenidae*

The material from Hiradoko beds has only *Lagena* of this family.

Lagena: 3 species of this genus were rarely found. These species are more common in moderately deep oceanic waters than in shallow waters. In the adjacent seas of Japan, there is a notable increase in both individuals and species in depths exceeding 100–200 meters.

Family *Polymorphinidae*

3 genera and 5 different forms were distinguished.

Guttulina: *G. orientalis* CUSHMAN and OZAWA was only found; this is a species originally described from the Upper Pliocene of Sawane, Island of Sado.

Pseudopolymorphina: 3 species, namely *P. ishikawaensis* CUSHMAN and OZAWA, *P. okuwaensis* CUSHMAN and OZAWA, and *P. indica japonica* CUSHMAN and OZAWA were present. All are characteristic of the Japanese Plio-Pleistocene.

Sigmoidella: *S. kagaensis* CUSHMAN and OZAWA is the only species found. It is very common in the Pliocene and recent

faunas of Japan.

Family *Nonionidae*

Of this family, 3 genera and 6 species were found.

Nonion: *E. boueanum* (d'ORBIGNY) which is common in the Japanese Neogene is also present.

Pseudononion: This genus was based upon a material from the Pliocene of Sagami, Japan. Its genotype, *P. japonicum* ASANO, is often found in the Hiradoko beds.

Elphidium: Among the 4 species of this genus, *E. advenum* (CUSHMAN) and *E. crispum* (LINNÉ) were most common; both are abundent in the Japanese Neogene. On the other hand, *E. jenseni* (CUSHMAN) and *E. subgranulosa* ASANO are not common in the collection.

Family *Peneroplidae*

According to NORTON, "members of the Peneroplidae are almost never found below 60 fathoms and are restricted to warm, shallow water zone". In the present material, *Sorites marginalis* (LAMARCK) belonging to this family, was found. This species has not yet been known from the Japan Sea, both fossil and recent.

Family *Buliminidae*

Loxostoma: *L. karreriana* (BRADY) is the single representative of this genus.

Reussella: *R. spinulosa* (REUSS).

Chrysalidinella: One species, *C. dimorpha* (BRADY).

Siphogenerina: *S. raphana* (PARKER and JONES) was found. Its distribution ranges from the Kerimba Archipelago across the Indian Ocean to the Pacific where it extends northward to Japan, Guam and the Hawaiian Islands, and southward to New Zealand.

Family *Rotaliidae*

Discorbis: Only one species, *D. orbicularis* (TERQUEM).

Eponides: Only one species, *E. repandus* (FICHTEL & MOLL). This is very abundant in Siogama Bay, Japan.

Rotalia: *R. japonica* HADA, first described from Mutu Bay, Japan was found.

Family *Amphisteginidae*

Amphistegina: Foraminifera of this genus are often abundant on coral reefs aud in warm shallow waters of the Indo-Pacific, but less abundant elsewhere. In Japan, *A. radiata* (FICHTEL & MOLL) is known from Miyazu, Wakasa Bay, Kannoura on the south-east coast of Tosa and Sagami Bay. The presence of this species, together with *Sorites marginalis* (LAMARCK) above noted, is a good indication of warm, shallow water deposits.

Family *Cymbaloporidae*

Only *Cymbalopora bradyi* (CUSHMAN) was found.

Family *Globigerinidae*

The genera of this family comprise pelagic species. Though carried by oceanic currents every directions, there is a marked decrease in number of the foraminifera of the Globigerinidae in the cold regions or embayments. The rare occurrence of these forms in the present material is by no means an indication of its deposition under open-sea conditions.

Family *Anomalinidae*

Planulina: *P. wuellerstorfi* (SCHWAGER).

Cibicides: 3 species wer sdistinguished in the collection. *C. lobatulus* (WALKER & JACOB) is rather common, but *C. refulgens* (MONTFORT) and *C. pseudoungerianus* (CUSHMAN) are rare, these species are abundant in the adjacent seas of Japan.

Finally I wish to offer my warmest thanks to Prof. H. YABE of the Institute of Geology and Palaeontology, Tôhoku Imperial University, Sendai, Japan, for the permission to publish this short note on the one hand and for the various suggestions given me during the preparation of this article on the other.

能登半島平床層の化石有孔蟲類（摘要）

淺野 清

卒業論文作成中，不幸にしてフキールドに急焉玉砕されし故松島君が，筆者に，平床貝層の有孔蟲類研究を依頼されたのは，5月初旬であつた。而して今や君への報告が，靈前に捧げなければならなくなつた。

平床貝層の有孔蟲類は可成り暖海性の要素を含み，且つ同地方の第三紀層のものとは，明に區別され得る。本有孔蟲群の中に新種（*Gaudryina matusimai* n. sp.）を發見せる外，日本海沿岸にて始めて，*Amphistegina radiata* (F. & M.) 及び *Sorites marginalis* (LAM.) の如き熱帶性有孔蟲化石産地を知ることが出來た。

日本古生物學會記事

Proceedings of the Palaeontological Society of Japan

昭和 12 年 9 月 25 日　日本古生物學會第 8 回例會を北海道帝國大學理學部地質學鑛物學教室に於て開催す（參加者 29 名）。講演者並に講演題目次の如し。

On a *Graphularia*-like Fossil from Tokyo. (代讀)
Hisakatsu YABE and Toshio SUGIYAMA

A Gotlandian *Clathrodictyon* from Korea. (代讀)
Hisakatsu YABE and Toshio SUGIYAMA

北支產第四紀非海棲介化石（第 2 報）(代讀)　鈴木好一

BRAUNS, 德永兩氏採集横濱附近の介化石に就いて (代讀)　鈴木好一・池邊展生

On the Stratigraphical Significance of *Pecten naganumanus* YOKOYAMA, and its Bearing on the Japanese Neogene. (代讀)
Hisakatsu YABE and Kotora HATAI

日本產 *Diodora* に就いて　大塚彌之助

A Note of "*Tapes*" *ezoensis* YOKOYAMA from the Poronai Series.　Takumi NAGAO

新生界對比に於ける軟體動物の價値に關する一考察　大塚彌之助

On the Limbs of *Nipponosaurus sachalinensis*.　Takumi NAGAO

On Some Remains of *Desmostylus* recently acquired from Japan.　Takumi NAGAO

A Schematized Faunal Succession of the Japanese Neogene. (代讀)　Kotora HATAI

岩手縣久慈第三紀層いてふ葉の表皮細胞組織　大石三郎

北海道瀨棚町虻羅產第三紀植物化石　大石三郎

植物化石命名規約に就いて　大石三郎

昭和 12 年 7 月 1 日以降 11 月 30 日迄の入會會員氏名次の如し。

アイ. ワイ. スタファー：　スタンダード　ヴアキユーム石油會社

Leonhard Riedel　中村慶三郎

SYSTEMATIC INDEX

[Note: Every reference is to the number of article.]

PALAEOZOOLOGY

Protozoa

Coelenterata

Echinodermata

Molluscoidea

PALAEOBOTANY

GENERAL PALAEONTOLOGY

INDEX OF FOSSIL

Note: Every reference is to the number of article; words in italics are names of genera and species; words in heavy type, names of new families, genera and species.

日本古生物学會
報告・紀事

第 1 號—第 9 號

昭和 10 年—昭和 12 年

Transactions and Proceedings of the Palaeontological Society of Japan

No. 1—No. 9

1935–1937

日本古生物學會

Palaeontological Society of Japan

(The heading in Japanese commemorates the handwriting of Prof. M. YOKOHAMA, father of Japanese Palaeontology, who was Professor of Stratigraphy and Palaeontology at the G ological Institute, Imperial University of Tokyo.)

CONTENTS

NUMBER 1

Transactions

NUMBER 2

Transactions

NUMBER 3

Transactions

NUMBER 4

Transactions

NUMBER 5

Transactions

NUMBER 6

Transactions

NUMBER 7

Transactions

NUMBER 8

Transactions

NUMBER 9

Transactions

日本古生物學會規則

1. 本會ハ日本地質學會ノ部會ニシテ日本古生物學會ト稱ス
2. 本會ハ古生物學及ビ之レニ關スル諸學科ノ進歩ヲ助ケ斯學ノ普及ヲ圖ルヲ以テ目的トス
3. 本會ハ第2條ノ目的ヲ達スルタメニ總會及講演會ヲ開ク
4. 本會ノ紀事及ビ會員ノ寄稿ハ地質學雜誌ニ揭載シ，其ノ別刷ヲ日本地質學會々員ニアラザル本會々員ニ配布ス
5. 本會ノ會費ハ年額3圓トシ，日本地質學會々員ハ年額1圓トス，但シ一時ニ金100圓以上ヲ寄附セル者ヲ賛助會員ニ推ス
6. 本會ニ次ノ役員ヲ置ク

會長	1	名
評議員	數	名

7. 役員ノ任期ヲ1年トシ會員中ヨリ總會ニ於テ選擧ス

日本古生物學會役員

會長	中村新太郎		
評議員	伊木常誠	井上禧之助	*大炊御門經輝
*大塚彌之助	大村一藏	加藤武夫	金原信泰
木村六郎	*小林貞一	立岩巖	*德永重康
中村新太郎	長尾巧	早坂一郎	*藤本治義
村上鈑藏	山根新次	矢部長克	(* 常務委員)

事務所——編輯所

東京帝國大學理學部地質學教室

日本古生物學會

(振替口座東京第84780番)

Constitution of the Palaeontological Society of Japan.

Article 1. The Society shall be known as the Palaeontological Society of Japan. It forms a section of the Geological Society of Japan.

Article 2. The object of the Society is the promotion of palaeontology and related sciences.

Article 3. This Society to execute the scheme outlined under Article 2, shall hold annual meetings and discussions.

Article 4. Proceedings of the Society and articles for publication shall be published through the Journal of the Geological Society of Japan. Separates and circulations will be sent to members of the Palaeontological Society who are not members of the Geological Society of Japan.

Article 5. The annual dues of this Society is two dollars for the foreign members of the Society.

Article 6. This Society shall hold the following executives. President one person, Councillors several persons.

Article 7. The President and Councillors shall be elected annually. The President and Councillors shall be elected from the Society body by vote of its members. All elections shall be ballot.

All communications relating to this Journal should be addressed to the

PALAEONTOLOGICAL SOCIETY OF JAPAN

Geological Institute, Faculty of Science, Imperial University of Tokyo, Japan