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8. On the Occurrence of *Temnotrema rubrum* in the Pleistocene of Turumi, Kwantô Region

By

SYÔZÔ NISIYAMA.

(Contribution from the Geological Institute, Tohoku Imperial University, Sendai, Japan.) [Read November 30th, 1935]

Some years ago, Mr. F. UEDA, then a member of our Institute, collected a small sea-urchin from the Namamugi fossil zone at Kagetu-en, Turumi-si Kanagawa-ken, which is referable to *Pleurechinus ruber* L. DÖDERLEIN, a species first founded on living specimens from "Katsiyama," Japan. This is the first record in fossil.

Genus *Temnotrema* AL. AGASSIZ, 1863.

Temnotrema AL. AGASSIZ, 1863, Proc. Acad. Nat. Sci. Phila., p. 358.

Genohaplotype: *Temnotrema sculptum* AL. AGASSIZ, 1863, op. cit., p. 358. -H. L. CLARK, 1912, Mem. Mus. Comp. Zool., Harvard, 34, p. 321, pl. 112, f. 1, 2. (Type figured: Kagosima Bay; W. STIMPSON Coll.: Mus. Comp. Zool.) Type by monotypy at the time.

Metonyms. Genus *Pleurechinus* AL. AGASSIZ, 1872.

Pleurechinus AL. AGASSIZ, 1872, Mem. Mus. Comp. Zool., Harvard, 3, p. 167, (subgenus ad *Temnopleurus* L. AGASSIZ, 1841).

Genohaplotype: *Temnopleurus bothryoides* L. AGASSIZ and E. DESOR, 1846, Ann. Sci. Nat., sér. 3, 6, p. 360. (Galapagos Island; MICHELIN. Coll.: in L'école des mines in Paris. Type by monotypy at the time.

(non *Pleurechinus* L. AGASSIZ, 1841, Intr. Mn. Scut., Mon. Ech., 2, p. vii.)

Genohaplotype: *Cidaris bothryoides* N. G. LESKE, 1778, Addit. ad KLEIN nat. Disposit. Ech., p. 154. (Probably the Cretaceous of Germany: Dresden Mus.) Type by monotypy at that time.

Genus *Dicoptella* J. LAMBERT et P. THIÉRY, 1911.

Dicoptella J. LAMBERT and P. THIÉRY, 1911, Ess. nomencl. rais. Ech., 3, p. 232.

Genorthotype: *Dicoptella agassizi* LAMBERT and THIÉRY, 1911, op. cit., p. 232. = *Pleurechinus bothryoides* AL. AGASSIZ, 1881, Rep. Challenger, 3, Ech., p. 108, pl. xa, f. 1, 2. (Kobe, Japan: 8-50 fathoms: Brit Mus.) Type by original design.

nation¹⁾.

Homonym. Genus *Temnotrema* N. A. POMEL, 1883.

Temnotrema N. A. POMEL, 1883, Thèses Class. méthod. Gen. Ech., p. 87.

Genohaplotype: *Temnopleurus hardwickii* AL. AGASSIZ, 1872, op. cit., p. 166. (N. E. end of Japan: W. STIMPSON Coll.: Mus. Comp. Zool.) Type by monotypy at the time.

(non *Temnotrema* AL. AGASSIZ, 1863, op. cit.)

The genus *Pleurechinus* was established without diagnosis by L. AGASSIZ, in July, 1841 (l. c.), for *Cidaris bothryoides* N. G. LESKE. The type specimen of this species is, according to J. LAMBERT, derived from a Cretaceous (?) deposit in Germany, and kept now in the Dresden Museum. In December of the same year, in the Preface of the 'Anatomie du genre *Echinus*' page 8, AGASSIZ defined the genus and selected *Cidaris bothryoides* LESKE as the type species. His generic diagnosis, however, does not agree with the features of LESKE's *bothryoides*; his '*Cidaris bothryoides* LESKE' is really a specimen collected by M. STOKES, and perhaps a recent form probably of *Microcyphus*; but his type specimen is lost and hence the type species is unrecognizable at present, as already stated by LAMBERT²⁾ and CLARK. In 1846, however, L. AGASSIZ and DESOR threw away the generic name and transferred their *bothryoides* in *Temnopleurus*. The type specimen of *Temnopleurus bothryoides* is a fine bare test in MICHELIN's collection (L'école des Mines in Paris: labelled "Coll. MICHELIN, Iles Galapagos."³⁾), to which their diagnosis of this species applies. Contrary to their expression that

1) J. LAMBERT and P. THIÉRY described "Type: *D. agassizi* LAMBERT et THIÉRY, vivant des mers du Japon. Cette espèce est l'ancien *Pleurechinus bothryoides* AL. AGASSIZ, 1881, Rep. Challenger, 3, p. 108, pl. xa, f. 1-2 (non L. AGASSIZ-Juillet 1841, Mon. Ech., Mon. Scut., p. 7), parfaitement figuré par DÖDERLEIN, 1903 Jena. Denkschr., tab. 61, f. 1-2." The Challenger specimens are now stored in the British Museum; AL. AGASSIZ' *Pleurechinus bothryoides* is a composite species and distinguished by MORTENSEN and CLARK through their examination as follows:—

1. *Temnotrema sculptum* AL. AGASSIZ, 1863. = *Pleurechinus variegatus* Th. MORTENSEN. Kobe, Japan. 8-50 fathoms. May 17, 1875.
2. *Temnotrema decorum* DÖDERLEIN, 1914. = *Pleurechinus bothryoides* (L. AGASSIZ). Station 186. Sept. 8, 1874. Lat. 10° 35' S., Long. 142° 18' E. 8 fathoms. Coral sand.

The Japanese specimens are referred to *T. sculptum*, however; DÖDERLEIN's figures (l. c., 1-1b) are really a *T. decorum*.

2) LAMBERT states that it may be *M. zigzag* from Japan.

3) MORTENSEN, 1904, Dansk. Vidensk. Selsk. Skr., ser. 7, vol. 1, (1), p. 83.

their *Temnopleurus bothryoides* is identical with LESKE's *Cidaris bothryoides*, it is now quite evident that their diagnosis does not apply either to the fossil species figured by KLEIN and described by LESKE or to the species in STOKE's collection. This specimen (in Paris) was erroneously taken by AL. AGASSIZ (l. c.) and by later writers as the type specimen of *Pleurechinus bothryoides*. LAMBERT¹⁾, in 1907, gave a new name *Opechinus michelini* to the Paris specimen based on the description of AGASSIZ²⁾, but the specimen according to MORTENSEN cannot be referred to the genus *Opechinus*; the last author examined the type specimen and found that its description by AL. AGASSIZ is incorrect. MORTENSEN unfortunately used the generic name *Pleurechinus* for it, although the name must be rejected from the story cited above. Neither *Pleurechinus* nor *Opechinus* being applicable to the Paris specimen, its generic name must be put into a renewed consideration. Judging from its description and figure, it seems to be congeneric with a small sea-urchin from Japan, described in 1863 by AL. AGASSIZ under the name *Temnotrema sculptum*, as stated by CLARK and DÖDERLEIN. Later the specimen was believed to be a young *Temnopleurus hardwickii*, and *Temnotrema* was hence placed in the synonymy of the *Temnopleurus*. In 1911, LAMBERT and P. THIÉRY proposed a new generic name *Dicoptella* for the species, under the old rule of 'once synonym, ever synonym'; this action, however, is not tenable and *Temnotrema* stands now valid.

The genus *Temnotrema* is sufficiently distinguished from *Temnopleurus* by its usually non-crenulate tubercles, (though crenulated in some large specimens of *sculptum*), the uniform size of the spines and the uniform aspect of both sides of the test as to tuberculation. Since the genus was recently so fully revised by

1) LAMBERT, 1907, in E. PACHUNDAKI, Revu. intern. d'Egypte, vol. 4, p. 17; LAMBERT and THIÉRY, 1911, Ess. nomencl. rias. Ech., 3, p. 232. "L'un de nous a créé pour le prétendu *Temnopleurus bothryoides* Agassiz, 1846, der Galapagos, réellement différent du *Cidaris bothryoides* LESKE. Cette espèce qu'il ne faut confondre avec notre *Dicoptella agassizi*."

2) AL. AGASSIZ, 1873, in the Mem. Mus. Comp. Zool., vol. 3, p. 465 described that "there are four deep disconnected pits of about equal size along the sutures of the plates above the ambitus." The type specimen is, however, according to MORTENSEN, an uncommonly large, (40 mm. in diameter, 31 mm. high), beautiful, naked test having only two large, deep disconnected pits along each horizontal interambulacral suture and one in each ambulacral horizontal suture.

MORTENSEN and by CLARK, here the repetition is avoided.

The species not belonging to the genus are as follows:

Recent Species.

1. *T. sculptum* AL. AGASSIZ, 1863, op. cit. p. 358. (l. c.)
2. *T. rubrum* (L. DÖDERLEIN) H. L. CLARK, 1919, op. cit., p. 319. (see below).
3. *T. scillae* (A. G. MAZZETTI) CLARK, 1912, op. cit., p. 318.
Pl. scillae (MAZZETTI) TH. MORTENSEN, 1904, op. cit., p. 87, pl. 1, f. 9, 10, 17 and 18. (Red Sea: in Acad. Sci. Modena.)
4. *T. döderleini* (MORTENSEN) CLARK, 1912, op. cit., p. 319.
Pl. döderleini MORTENSEN, 1904, op. cit., p. 77, pl. 1, f. 12, 13, pl. 2, f. 1, 7 and 8 (off Tung Kaben, in Siam Gulf: 6 fathoms sandy: MORTENSEN Coll.: Copenhagen Mus.)
5. *T. siamense* (MORTENSEN) CLARK, 1912, op. cit., p. 318.
Pl. siamensis MORTENSEN, 1904, op. cit., p. 79, pl. 1, f. 2, 7, 11, 20, pl. 2, f. 2, 9, 14, 15 and 22. (Koh. Mesan, in Siam Gulf: 3-15 fathoms: MORTENSEN Coll.: Copenhagen Mus.)
6. *T. maculatum* (MORTENSEN) H. L. CLARK, 1912, op. cit., p. 318,
Pl. maculatus MORTENSEN, 1904, op. cit., p. 89, pl. 1, f. 4, 14. (Siboga Stations: 43, 99, 164, 258 and 315: Amsterdam Mus.)
7. *T. hawaiiense* (AL. AGASSIZ et CLARK), CLARK, 1912, op. cit., p. 319, pl. 99, f. 1-3. (Albatross Station: 3823, 3847, 3871, 3872, 3876 etc. in Hawaiian Islands: 13-222 fathoms. Mus. Comp. Zool.)
8. *T. decorum* DÖDERLEIN, 1914, Fauna südwest-Austral.: Ech., p. 459.
Pl. bothryoides L. AGASSIZ and DESOR, 1846, op. cit., p. 360. - L. DÖDERLEIN, 1903, op. cit., pl. 61, f. 1-lb.
9. *T. pallescens* CLARK, 1925, A Cat. Rec. Sea-urchins Brit. Mus., p. 90, pl. 7, f. 5, 6. (Billiton: Brit. Mus.)

Fossil Species.

1. *P. javanum* (K. MARTIN) comb. nov.
Pl. javanus MARTIN, 1880, Tertiärsch. aus Java, App. p. 2, f. 1-lb. (Koen. Kelier, Jogjakarta, Java: Miocene: Lyden Mus.)
2. *T. bigoti* (J. LAMBERT et P. THIÉRY) comb. nov.
Dicoptella bigoti J. LAMBERT and P. THIÉRY, 1911, op. cit., p. 232, pl. 7, f. 1-3. (Gourbesville, Mache; Miocene: LAMBERT Coll.: In Facult. Sci. Caen.)

Temnotrema rubrum (L. DÖDERLEIN, 1885) H. L. CLARK, 1912.

(Pl. I, figs. 1-21)

Temnotrema ruber (DÖDERLEIN) CLARK, 1912, Mem. Mus. Comp. Zool., Harvard, 34, (4), p. 319. (asynonym, nominal.)

Pleurechinus ruber LÖDERLEIN, 1885, Archiv. für Naturg., 51 (1), p. 92 (20), (Kadsiyama at Tokyo Bay, in 20 fathoms: DÖDERLEIN Coll.: in Strassburg Mus.): DÖDERLEIN, 1903, Jena. Denkschr., vol. 8, p. 706, pl. 91, f. 3-3b. (Type figured). MORTENSEN, 1904, Dansk. Vidensk. Selsk. Skr., ser. 7, vol. 1, (1), p. 84, pl. 6, f. 28, pl. 7, f. 6. (Pedicellariae of the type figured). TOKUNAGA, Sh., 1906, Illust. Cat. Jap. Ech., pl. 8, f. 8-10. (Reproduced from DÖDERLEIN's figures). Reg. No. 58340 in the Institute of Geology and Palaeontology, Tôhoku Imperial University, Sendai.

Fossil-Localities:—North side of Kagetu-en, Turdumi-ku, Kanagawa-ken.

Horizon:—Namamugi fossil zone (Pleistocene). Coll. by F. UEDA.

A single specimen at hand is about 16 mm, in diameter and 12 mm. in height. It has 14 interambulacral and 16 ambulacral plates in each column; though lacking spines, oculo-genital ring and buccal membrane, it is fairly well preserved and still retains partly its natural colouration. The description of the specimen is as follows:

Test rather high (0.75 of diameter), beautifully rounded above, slightly curved inwardly at peristome, gill-slits indistinct. Peristome 6.5 mm. in diameter, being about 0.4 of that test. Apical system wanting, vascant area about 4 mm. in diameter. Ambulacra about two-thirds as broad as interambulacra at ambitus; ambulacral pores rather large, disposed in nearly straight series and close to edge of area; poriferous zone very narrow, without tubercles, about one-fourth to one-fifth as broad as interporiferous zone. 16 ambulacral plates in each column, lower and somewhat more numerous than interambulacral plates (14 in each column); one primary tubercle, on each compound plate, forming a distinct series close to poriferous zone, almost equal in size to interambulacral primary tubercles; secondary tubercles rather large, few, forming a distinct longitudinal series on inside of primary tubercles almost throughout each column; pits very small, shallow, slit-like, slightly rounded at inner ends. Interambulacra with primary tubercles in distinct longitudinal series and slightly diminishing in size towards apex and peristome; tubercles not crenulated; interambulacral plates of midzone with a primary tubercle at centre, two distinct secondaries on either side, and 4-6 secondaries in a regular row on upper half; miliary tubercles rather scarce; pits in interambulacral areas also narrow and shallow, not reaching to base of primary tubercles, leaving a rather large part of horizontal suture not depressed.

Temnotrema rubrum is restricted in its present distribution to central Japan ("Kadsiyama"¹⁾ and Ubara, Tiba-ken²⁾), and is

1) "Kadsiyama" = Katsiyama 加知山 in Tiba-ken?

2) Ubara 鵜原; the Station 51 of Fusa-maru of the Tiba Fisheries Experi-

known only from small depths.

BELL¹⁾ said "a pretty strong conviction that the progress of research will result in showing that *Pleurechinus variabilis* and *P. ruber* of DÖDERLEIN are synonyms of this variable species (*P. bothryoides*)." Later, however, DÖDERLEIN maintained specific distinction of his species from the others and MORTENSEN also, after he had examined the type specimens of all these species, recognized *Pl. ruber* as a distinct species. The two species *rubrum* (Pl. I, figs. 4-10) and *sculptum* (the genotype: Pl. I, figs. 11-18) are evidently related closely, both agreeing with each other in having much smaller pits than those in the other species of *Temnotrema*). The two, however, are distinct. The pores in larger and ambulacral plates lower in *rubrum* than in *sculptum*; they are further different more or less in tuberculation and decidedly in colouration.

Among the species now assigned to *Temnotrema* three groups are distinguishable. The first group comprises those forms characterized by smaller pits, which are shorter than the distance between the two of them on the same horizontal interambulacral suture and not bordered by a membrane, and by the possession of ten buccal plates and tentacles in the buccal membrane [viz. *sculptum* = *Pleurechinus variegatus* MORTENSEN) (Pl. I, figs. 17-18) and *rubrum*]. The second group comprises those with larger pits, which are longer than the distance between the two of them on the same horizontal interambulacral suture and bordered by a membrane, and further with ten buccal plates (viz. *decorum*, *scillae*, *siamense*, *maculatum*, *hawaiiense* and *pallescens*). The third group comprises, on the other hand, only one particular form characterized by having only five buccal plates and tube-feet in the buccal membrane and lacking anal plates, (*döderleini*). These three groups seem to be not worthy of generic separation, but here I rather prefer to leave them all in the genus *Temnotrema*.

Finally, I wish to record here my thanks to Prof. H. YABE, for his kind guidance during the preparation of this note and also to Mr. F. UEDA, for his kind offer of the material.

mental Station. Institute of Geology and Palaeontology, Tôhoku Imperial University, Reg. No. 58319.

1) F. J. BELL, 1894, Proc. Zool. Soc. London, p. 410.

2) MORTENSEN, 1904, op. cit., p. 84, pl. 1, f. 5, 6, 8 and 19. (Formosan Channel, in 35 fathoms: SUENSON Coll.: Copenhagen Mus.)

神奈川縣鶴見の更新層に *Temnotrema rubrum* の産出 (摘要)

西 山 省 三

先年植田房雄學士が神奈川縣鶴見區鶴見町花月園北側(同氏の生麥化石帶)より1個の海膽を採集せられたが、是れは *Pleurechinus ruber* DÖDERLEIN に同定すべきものと思はれる。本種の模式標本は東京灣 20 尋(カヂヤマ(加知山?)附近)の處から現生種として採集され、専門家ですら僅かの人々が此の標本を見た様で、特に化石としては最初の報告である。

尙ほ *Pleurechinus* 屬には種々の困難な問題があるが、AL. AGASSIZ, 1872 年以來の *Pleurechinus* の種は大部分 *Temnotrema* に編入すべきものであり、*rubrum* は同屬の模式種 *sculptum* に近縁を有した異種のものと思はれる。*rubrum* の分布は模式標本並に教室所藏標本(東北帝國大學地質學古生物學教室登記番號 5831 の千葉縣水産試験所々屬房丸採集地點 51 千葉縣夷隅郡鵜^{ウバ}原灣)より知られる所では殆んど中央日本太平洋岸に限られる様であり、垂直分布も約 5 米—39 米である。

Temnotrema 屬は尙ほ三群に細分出来るが、今假に 1 屬と見做すことにし、今後の研究に俟つ。

Explanation of Plate

- Figs. 1- 9. *Temnotrema rubrum* (DÖDERLEIN, 1885) CLARK, 1912.
 1- 3. Fossil from Turumi, (Reg. No. 58340, in Institute of Geology and Palaeontology, Tôhoku Imperial University) X 1.7
 4- 6. Recent, (Reg. No. 58319, in Institute of Geology and Palaeontology, Tôhoku Imperial University: Husa-Marû Station 51). X. 1.7
 7- 9. *Pleurechinus ruber* DÖDERLEIN, (Type, in Strassburg Museum: Katsiyama, Japan). Natural size, after DÖDERLEIN.
- Figs. 10-16. *Temnotrema sculptum* AL. AGASSIZ, 1863.
 10-11. Type, (in Museum of Comparative Zoology, Cambridge: Kagosima Bay, Japan; Coll. STIMPSON). Natural size, after CLARK.
 12-14. Recent, (Reg. No. 58318, in Institute of Geology and Palaeontology, Tôhoku Imperial University; Husa-Marû Station 24). X 1.7
 15-16. *Pleurechinus variegatus* MORTENSEN, (Type, in the Copenhagen Museum: Formosa-Channel in 35 fathoms; Coll. SUENSON). Natural size, after MORTENSEN.
- Figs. 17-19. *Temnotrema decorum* DÖDERLEIN, 1914.
 17-19. *Pleurechinus bothryoides* (L. AGASSIZ et DESOR) AL. AGASSIZ, 1872, (in Strassburg Museum: Thursday Island; Coll. SEMON). Natural size, after DÖDERLEIN.