

ON SOME RECENT JAPANESE BRACHIOPODA, WITH A DESCRIPTION
OF A SPECIES BELIEVED TO BE NEW.

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The collection of Brachiopoda described in the following pages was made by Mr. Frederick Stearns of Detroit, Michigan, when travelling in Japan during the years 1889-90. The specimens were dredged in depths not exceeding thirty fathoms, at localities along the eastern coast southward from Tokyo to Kii Channel and in the Inland Sea as far south as Jojo-sima.

The specimens are in the collections of the Academy of Natural Sciences of Philadelphia and of Mr. Stearns.

Genus **TEREBRATULA** Auct.

Terebratula (*Davidsoni* var?) *Stearnsii*, Dall and Pilsbry, Plate IV, figs. 1-3.

Shell large, waxen white or yellowish, smooth except for lines of growth, somewhat wedge-shaped, laterally compressed behind, wider in front, valves moderately inflated, larger or neural valve subtriangular in outline, deep, the sides flattened, straight, diverging, the front margin evenly rounded; viewed laterally the profile of the line (the hæmal valve being downward) between the two valves rises slightly to a weak flexure in front of the hinge plate and then descends forming a long curve, rising to a more marked flexure almost an angle, where the sides meet the front margin; between the two anterior angles the anterior margin of the neural valve is moderately convex downward while the hæmal valve, subangulate at the corners, is correspondingly excavated between them; the middle portion of the neural valve is slightly flattened as in *Eudesia Raphaelis*, the beak is prominent, high and inflated, the foramen large, circular and (in the specimen) much worn, the lower part projects curving downward to a point, but does not touch the hæmal valve when the shell is closed; deltidial area narrow, with no mesial groove, bordered by a sharp angle and concavely excavated. The hæmal or smaller valve is less flattened and shallower than the other, the apex is entirely concealed under the curved beak of the opposite valve; internally the cardinal process is rounded, the hinge short and rather weak, unsupported by any buttresses; there is no mesial septum in either valve; the partial sinuses are barely distinguishable, there seems to have been five in the neural and four in

hæmal valve, narrow, slender, extending straight forward and beginning to dichotomize only near the front margin. The loop resembles somewhat that of *T. depressa* Lam., and is especially notable for the breadth of the lamina and the keeled mesial ridge of the anterior transverse portion; this part is usually more rounded-over in *Terebratula*.

Long. of neural valve 48·5; max. lat. of the same 33·0; max. diameter of shell 28·0 mm.

Habitat, eastern coast of Japan, Province of Kii.

This shell recalls some varieties of *T. depressa* Lamareck from the Greensand of Britain. As the specimen is unique, it was not thought best to separate the valves to study the loop but sufficient could be seen from the natural opening to determine that the species belongs rather to the *T. vitrea* type than to that of *T. sphenoides*. From both and from any other species known, it differs in the prominence and narrowness of the mesial bend or fold in the transverse anterior part of the loop.

There is no species known from Japan or the Pacific which could be identified with this one unless it be the *Terebratula Davidsoni* A. Adams, which is treated by Dr. Davidson in his last publication (Trans. Linn. Soc., Zoology, 2nd Ser. part 1, p. 9, Pl. 1, figs. 14-16, 1886) under the head of *Liothyris vitrea* var? *Davidsoni* but which can hardly be regarded as varietally connected with *T. vitrea*.

T. Davidsoni is only known from two small specimens dredged in 55 fathoms at Satanomosaki, Japan, by A. Adams. Dr. Davidson says "I am not certain that this small species is really a variety of *T. vitrea*, * * * they much resemble the typical var. *minor*. One of the specimens bore some resemblance to young examples of *Liothyris uva* from the Gulf of Tehuantepec; but differs from it, according to A. Adams, in its more solid structure and globose form and in the foramen being smaller and entire" (op. cit. p. 10). From the figures and observations which have been published, it would seem highly probable that *T. Davidsoni* is an adult shell measuring about 18·0 mm. in length while the young of *T. Stearnsii*, as indicated by the lines of growth, is a more circular shell in outline and less evenly globose. The specimen figured shows no indication of compression or distortion and the wedge-like outline of the adult seems normal. If this conclusion is correct and this peculiarity be constant, the species will be well characterized by it. We are of the opinion that the species is distinct from *T. Davidsoni*, but leave the

question open until more material shall be available. We have dedicated the new species to Mr. Stearns from whom it was received. With regard to its relations to *T. uva*, it may be observed that specimens of *T. uva* in the National Museum from Guayaquil, have an entire foramen, as figured by Dr. Davidson, as does the original type specimen, so that the implication of A. Adams is not sustained by the facts. But *T. uva* is readily distinguished from any other species by the fact that it is finely obsoletely radiated all over, with rather sparse radii, situated much as in *T. subquadrata* Jeffreys, but less sharp and wider. To a casual inspection the shell appears smooth, but a careful examination reveals the sculpture. *T. Stearnsii* is destitute of such radii. The relative size of the foramen in *Terebratula*, of course, is a character of no importance. Its margins are always eroded and its size depends entirely on the amount of friction to which it has been subjected during life. Specimens of *L. vitrea* from still, deep water, which were attached only to very small branches of decorticated Gorgonians, have an extremely minute foramen; while specimens from more agitated waters, attached to rock or coral surfaces, have quite a large pedicle and foramen.

Genus **TEREBRATULINA** Orbigny.

Terebratulina Crossei Davidson.

Terebratulina Crossei Davidson, Journ. de Conchyl. XXX, p. 106, pl. VII, fig. 1, 1882; Trans. Linn. Soc. 2, Zool. IV, p. 33, pl. III, figs. 4-6, 1886.

Two specimens of this fine species were included in the series sent by Mr. Stearns. They were attached to a large fragment of a silicious sponge. Habitat, "Inland sea," south of Province Kii.

Genus **TEREBRATELLA** Orbigny.

Owing to the peculiar development through which the loop passes before reaching the adult condition it is quite certain that *Eudesia* (or *Waldheimia* of most authors) belongs in the subfamily containing *Terebratella* and *Megerlia* rather than that to which *Terebratula* proper and *Terebratulina*, may be referred.

Terebratella Gouldii Dall. Plate IV, figs. 4-5.

Magasella Gouldii Dall, P. Z. S. 1871, p. 307, pl. XXXI, fig. 11a-c. Davidson, op. cit., p. 96, pl. XVII, figs. 20-22, 1887. (*Magasella Stage*.)

Shell waxen white, more or less stained with extraneous dark brown or black matter, large, thin; evenly radiately sculptured with uniform equal delicate costæ separated by very distinct but not very deep interspaces of about equal width; the costæ begin to

dichotomize about the middle of the shell and maintain a remarkably uniform size over the whole surface but do not crenulate the adult margin; there are about 13 costæ to a centimeter of width; valves wider behind the middle, hæmal valve with a very faint concave medial flexure or concavity (possibly due to an injury in youth) marked on the anterior margin by an obscure wave at each side and, on the neural or larger valve, by an analogous eminence or reverse flexure; the anterior margin otherwise is rather evenly rounded; hæmal valve flattish, in the type specimen with some indentations near the beak which show that its growth was cramped when young by projections of the stone to which it was attached or some other agency; beak of the hæmal valve not prominent; cardinal process obscure, concave medially; cardinal margin extensive nearly straight; neural valve more convex, beak not very prominent, considerably eroded; lateral areas flattened, foramen incomplete, the grooves marking off the pseudo-deltidia on each side very oblique obscure and close to the edge of the hiatus; interior with the pallial sinuses large, one on each side and arborescent but obscure on account of the condition of the specimen; neural valve with a short obscure thickened septal line mesially; hæmal valve with a well-elevated, subtriangular, rather short septum to which the lower portion of the loop is attached on each side by a slender process; loop very slender throughout, the transverse processes situated very near the crura which are rather strong; the anterior part of the loop reaching within a centimeter of the anterior margin before recurving, the recurved portion very narrow and delicate; the hinge is laterally well extended but feeble. Max. lat. 42.0; long. of neural valve 37.0; diameter of shell 20.0 mm.

Habitat, eastern coast of Japan, between Yeddo and Oshima.

It is now well understood, through the researches of Mr. Herman Friele and subsequently of Dr. Davidson and others, that the stages of development having their permanent representatives in the genera *Magasella*, *Terebratella* and *Waldheimia* are successively exhibited in the development of the last mentioned, while *Terebratella* stops short with the second stage. Consequently, when a small species of *Magasella* is discovered, it may be taken for granted that a large species of one of the three above mentioned genera exists in the vicinity, and it is impossible to say which, unless the series is traced. Usually the large adult form has been found first, and, when two names have been applied to the stages, that of the *Magasella*, or

smallest stage, is generally the one which falls into synonymy. Many of the latter were named and properly discriminated before the connection between them was understood, though the remarkable parallel between them was pointed out in detail in these Proceedings in 1873. One such case was that of two *Magasella* described by Mr. Dall and the late Dr. Davidson, respectively, in the paper on Japanese brachiopods published by the latter in 1871. Mr. Dall has since been able, by the examination of a graded series, to trace the adult of *Magasella Adamsi* Davidson to *Eudesia Grayi* Davidson. The *M. Adamsi* differed from the *M. Gouldii* Dall in its coarser radii, in having its mesial flexure in the opposite direction and by its less transverse form. The long sought for adult of *M. Adamsi* is at last supplied by the present species, which in spite of the difference in size, differs from the adult *Eudesia Grayi* in much the same way. The character of the sculpture and the direction of the flexure being quite the same, as well as the transverse form, there can be no reasonable doubt that the two are thus genetically connected. The direction of the flexure, which at best is very feeble in the normal adult *E. Grayi*, may change in growth or become asymmetrical, so that the slight concavity is in the smaller valve, but this is not the case in the *Magasella* stage, and in fact is only evident in the variety *transversa* Davidson.

The transverse processes of the present specimen are represented only by small remnants attached to the loop near the crura and to the short septum. Still the size of the specimen is so large that this deficiency is probably to be attributed to accident or injury, rather than an indication that *T. Gouldii* progresses to the *Eudesia* stage and is, in its final adult form, a *Eudesia*.

The transverse form of the shell favors the opinion that it does not develop beyond the *Terebratella* stage, the dimensions of the specimen also point toward its being adult, since no instance is known of a subordinate stage of any brachiopod reaching more than one quarter this size before the transformation of the loop becomes complete.

This fine and remarkable species is distinctively characterized by its fine and uniform sculpture. It most resembles *T. cruenta*, of New Zealand, which is bright red, a much coarser and heavier shell, with a complete foramen and much more prominent beak. They cannot be confounded by any one who carefully inspects them. The nearest Japanese resemblance is offered by *Eudesia Grayi*

which is even coarser than *T. cruenta* so that there seems no reason, even in the absence of the loop, why they should not readily be distinguished.

The following stages are now known in Pacific brachiopods, an asterisk indicating the adult stage:—

MAGASELLA.	TEREBRATELLA.	EUDESIA.
<i>M. Alentica</i> Dall,	= <i>T. frontalis</i> Midd.*	
<i>M. Adamsi</i> Dav.,	= <i>T.</i>	= <i>E. Grayi</i> Dav.*
<i>M. lewis</i> Dall,	= <i>T. pulvinata</i> Gld.,	= <i>E. venosa</i> Sol.*
<i>M. Gouldii</i> Dall,	= <i>T. Gouldii</i> Dall.*	
<i>M.</i>	= <i>T. Coreanica</i> Reeve,*	
<i>M. radiata</i> Dall,	= ? <i>T. transversa</i> Sby.*	
<i>M. Patagonica</i> Gld.	= <i>T. dorsata</i> Gmel.*	
<i>M.</i>	= (<i>Megerlia</i>) <i>Jeffreysi</i> Dall	= (<i>Laqueus</i>) <i>Californicus</i> * Koch.

Subgenus **LAQUEUS** Dall.

Terebratella (Laqueus) Blanfordi Dunker.

Terebratula Blanfordi Dkr., Ind. Moll. Mar. Jap., p. 251, pl. XIV, figs. 4-6, 1882.

Terebratella Blanfordi Davidson, op. cit., p. 83, pl. XV, figs. 9-12, 1887.

Two specimens of this fine species are included in the lot sent. They show that this species instead of being a typical *Terebratella* is a *Laqueus* and the one of all the species of this North Pacific group which shows the peculiarly complicated loop in its finest development and strength. These also show that, in life, the pallial sinuses are red in color, broad and branched, somewhat as in *Eudesia venosa*, a fact which has not hitherto been noticed. The specimens are from the eastern coast.

Laqueus rubellus G. B. Sowerby.

Terebratula rubella Sowb., Proc. Zool. Soc. Lond. 1846, p. 94.

Laqueus rubellus Davidson, op. cit., p. 113, pl. XIX, figs. 1-5.

Numerous specimens of this beautiful species were collected along the coast at and near Joja Shima. Some of them are quite as brilliantly striped as the figures in Sowerby's Thesaurus, which Davidson seems to think exaggerated.

Genus **EUDESIA** King.

Waltheimia King, Perm. Foss., p. 81, 1850; not of Brullé, Hist. Nat. Ins. Hymenopt. IV, p. 665, Nov., 1846; (Hymenoptera.)

Eudesia King, Perm. Foss., p. 144, 1850; Dall, Index Names of Brach. Bull. U. S. Nat. Mus. VIII, p. 28, 1877.

Eudesia Raphaelis Dall.

Waldheimia Raphaelis Dall, Am. Journ. Conch. VI, p. 3, pl. VII, figs. a-d, 1870.
Davidson, op. cit., p. 58, pl. XI, figs. 11-13, 1887.

Japanese coast near Yeddo, Pumpelly. Sagami Bay, 100-200 fathoms, Döderlein.

A single specimen somewhat smaller and more wedge-shaped than the original type, and with stronger folds, was included in the lot sent.

This shows the deep brown color to be a constant character and confirms the opinion of the writers and the late Dr. Davidson as to the validity of this species, which had been referred to *E. septigera* by Dr. Jeffreys.