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TRANSACTIONS OF THE SOCIETY.

X.—*Report on the Recent Foraminifera of the Malay Archipelago,
collected by Mr. A. Durrand, F.R.M.S.—Part VI.*

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(Read 18th October, 1899.)

PLATE VII.

Family TEXTULARIDÆ.

Sub-Family Textularinæ.

Textularia DeFrance.

Textularia inconspicua Brady, plate VII. fig. 1.

T. inconspicua Brady, 1884, Chall. Rept., p. 357, pl. xlii. fig. 6.

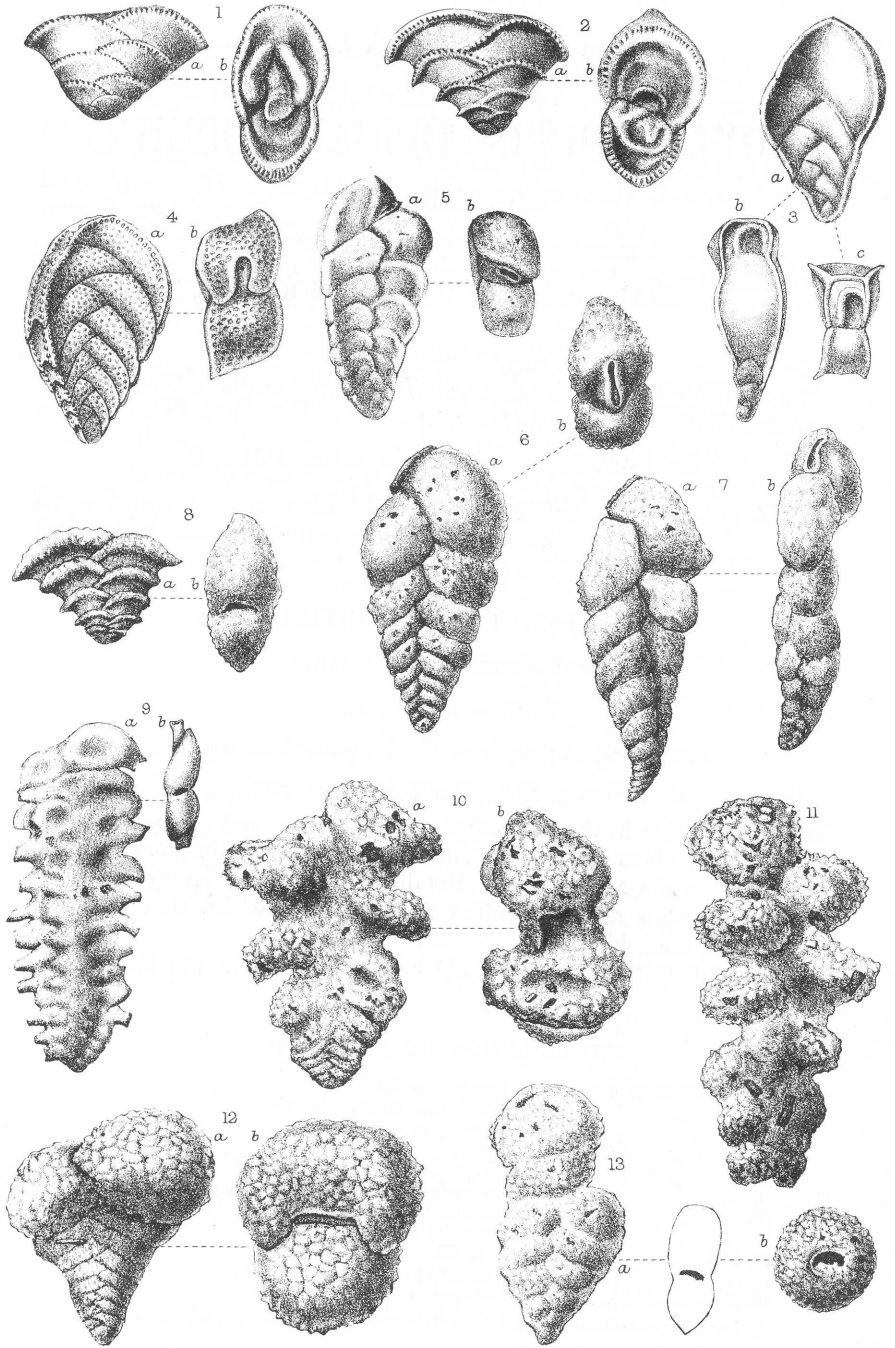
THIS is a feeble hyaline isomorph of *T. conica*, and occurs in two forms, one of them having the sutures limbate. Brady notes its resemblance to a small trochoid Rotalian; the Malay specimens are associated with a minute hyaline *Discorbina*, to which they bear a considerable resemblance.

It occurs sparingly at a few Stations in both areas, but the speci-

EXPLANATION OF PLATE VII.

- Fig. 1.—*Textularia inconspicua* Brady. × 90.
" 2. " var. *jugosa* Brady. × 90.
" 3. " *quadrilatera* Schwager. × 90.
" 4. " *rhomboidalis* sp. n. × 90.
" 5. " *concava* Karrer sp. × 60.
" 6, 7. " var. *heterostoma* Fornasini. Fig. 6 × 90, fig. 7 × 60.
" 8. " *sagittula* var. *jugosa* T. R. Jones. × 90.
" 9. " var. *fistulosa* Brady. × 90.
" 10, 11. " var. × 60.
" 12. " var. *Candeina* d'Orbigny. × 45.
" 13.—*Bigenerina nodosaria* d'Orbigny. × 60.

a, Transverse section of the biserial portion of the test: b, oral aspect.



F.W. Millett del. ad. nat.

West, Newman lith.

FORAMINIFERA OF MALAY ARCHIPELAGO.



mens are sufficiently numerous to mark perfectly the transition from the normal to the limbate form.

Brady gives three 'Challenger' Stations, all in the Pacific, namely, off East Moncœur Island, Bass Straits; Nares Harbour, Admiralty Islands; and the *Hyalonema*-ground south of Japan.

Textularia inconspicua var. *jugosa* Brady, plate VII. fig. 2.

T. jugosa Brady, 1884, Chall. Rept., p. 358, pl. xlii. fig. 7.
T. jugosa (Brady) Egger, 1893, Abhandl. k. Bayer. Akad. Wiss., Cl. II. vol. xviii. p. 273, pl. vi. figs. 19-21.

"D'Orbigny has figured a specimen to all appearance belonging to this species (Foiam. Canaries, pl. i. figs. 19-21) under the name of *Textularia sagittula*, and it is difficult to account for the apparent confusion of two forms so entirely distinct":—So wrote Brady (Chall. Rep., p. 358). In his 'Foraminifera of the Crag,' 1895, p. 145, Prof. T. Rupert Jones has no difficulty in associating as varieties of *T. sagittula* both d'Orbigny's and Brady's forms, and adds to them the heavy arenaceous limbate variety of *T. sagittula* found in the Crag and other deposits.

It is not stated by d'Orbigny nor by Brady if the shell-substance of their species is hyaline or arenaceous; the latter, however, remarks that the raised bands of *T. jugosa* are of clear shell-substance. From Raine Island ('Challenger' Station 185) I have some fine specimens of the last named form, and they are all distinctly hyaline, the limbations, moreover, being clearer than the other portions of the test. In Brady's figures, both of *T. inconspicua* and *T. jugosa*, there is shown a delicate striation of the margin of the oral face of the segments; this is conspicuous in all the specimens I have had an opportunity of examining; and in the large fossil specimens from Lucugnano figured by Costa* under the name of *T. sagittula* this feature is well shown.

Seeing that the relationship of *T. inconspicua* with *T. jugosa* is well indicated by the Malay specimens, and that the arenaceous form is also found in the same seas, it would appear convenient to treat the hyaline form as *T. inconspicua* var. *jugosa* Brady, and the arenaceous form as *T. sagittula* var. *jugosa* T. Rupert Jones. In the absence of a knowledge of the shell-substance of the limbate varieties of *T. sagittula* figured by Costa and by d'Orbigny, it is not clear to which of these varieties they should be assigned.

It is doubtful if the power possessed by certain forms of strengthening the secreted shell by the agglutination of extraneous particles of matter has any zoological value; that it has none as far as genera are concerned, is shown by such obsolete names as *Plecanium* and *Ataxo-phragmium*; but it appears to be of use in dealing with the characters

* Costa, Atti Accad. Pontaniana, vol. vii. fas. 2, 1856, p. 287, pl. xxiii. fig. 11.

of species and varieties, consequently it would not be wise to ignore it entirely.

Textularia jugosa was observed at only one 'Challenger' Station, off Raine Island, Torres Strait, but Brady quotes other localities where it has been found. The solitary 'Gazelle' Station is West Australia. In the Malay Archipelago it is more rare than the non-limbate form.

Textularia quadrilatera Schwager, plate VII. fig. 3.

T. quadrilatera Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. p. 253, pl. vii. fig. 10. *T. quadrilatera* (Schwager) Brady, 1884, Chall. Rept., p. 358, pl. xlii. figs. 8-12.

The group of *Textulariæ* with abnormal apertures and other features indicating an affinity with the *Bolivinae* is well represented in Mr. Durrand's collection, and affords opportunities of comparison which should prove of value to Rhizopodists. Prof. T. Rupert Jones in his 'Catalogue of the Fossil Foraminifera in the collection of the British Museum, 1882,' assigns the *Textularia obsoleta* of Eley to the genus *Bolivina*, and it is very doubtful if this species can be distinguished from *T. quadrilatera*.

In the Malay Archipelago this distinctly hyaline form is very rare, and has been observed only at Station 30.

It is recorded from several 'Challenger' Stations, both in the Atlantic and in the Pacific. As a fossil it occurs in the Pliocene of Kar Nicobar, and in the tertiary beds of St. Erth, Cornwall. To the kindness of Prof. Yokoyama I am indebted for some fine specimens from the tertiary of Hane, Prov. Tosa, in the Island of Sitkoku, Japan.

Textularia rhomboidalis sp. n., plate VII. fig. 4.

Test cuneiform, quadrilateral; the peripheral oblique to the lateral faces, making the transverse section of the test rhomboidal; sides slightly concave, margins rounded and lobulate, sutures curved and deeply excavated. Aperture an arched slit. Shell-substance hyaline and coarsely perforate. Length, 0.34 mm.

The rhomboidal section and hyaline test will serve to distinguish this from any other species of *Textularia*. A superficial resemblance to *Verneulina spinulosa* may have caused it to be overlooked hitherto, as it is widely dispersed. It occurs at several of the Malay Stations in both areas. I have specimens from Raine Island ('Challenger' Station 185) and other localities in Torres Strait, and have examined fine examples from the Ægean Sea collected by C. H. Nevill, Esq.

Textularia concava Karrer sp., plate VII. fig. 5.

Plecanium concavum Karrer, 1868, Sitzungsber. k. Akad. Wiss. Wien, vol. lviii. Abth. I. p. 129, pl. i. fig. 3. *Textularia concava* (Karrer sp.) Brady, 1884, Chall. Rept., p. 360, pl. xlii. figs. 13, 14, and pl. xliii. fig. 11. *Textularia* (?) *concava* (Reuss) Egger, 1893,

Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 271, pl. vi. figs. 3, 4.

The typical form is represented only by a few examples from Station 6. The shell substance is composed of very small grains of sand, and the surface is smooth and of a light buff colour. There is a slight tendency to limbation of the sutures, or to a slight overlapping of the chambers.

It is reported from several 'Challenger' Stations in the Atlantic and in the South Pacific. Egger's rather doubtful examples are from West Africa, Mauritius, and between New Amsterdam and Australia.

Textularia concava var. *heterostoma* Fornasini, pl. VII. figs. 6, 7.

Sagrina affinis Fornasini, 1883, Boll. Soc. Geol. Ital., vol. ii. p. 189, pl. ii. fig. 10. *Sagrina affinis* Fornasini, 1888, Boll. Soc. Geol. Ital., vol. vii. p. 45, pl. iii. fig. 1. *Textularia heterostoma* Fornasini, 1896, Mem. R. Accad. Sci. Istit. di Bologna, ser. 5, vol. vi. p. 4, pl. figs. 6, 12, 13.

This is one of the many interesting forms of *Textularia* from the Italian tertiaries described by Signor Fornasini. It differs from the type in the peripheral margin, which is less square, and also in the position of the aperture. In *T. concava* the aperture is a slit with a raised border situated at the inner margin of the terminal chamber and parallel to the suture. In *T. heterostomella* the aperture is similar in character, but varies in its position. In the Italian specimens it is usually remote from the suture and placed obliquely to it at various angles. In the Malay form it usually reaches to the suture and is perpendicular to it. In the Malay Archipelago this is one of the most abundant and widely distributed of the *Textulariæ*. It is more coarsely arenaceous than *T. concava*; and in one form (fig. 7) there is a considerable contortion of the test and a general resemblance to *T. crispata*.

The Italian specimens are from the pliocene of Ponticello di Savena, near Bologna.

Textularia sagittula Defrance.

"Polymorphum *sagittula*," Soldani, 1791, Testaceographiæ, vol. i. pt. 2, p. 120, pl. cxxxiii. fig. T. *Textularia sagittula* Defrance, 1824, Dict. Sci. Nat., vol. xxxii. p. 177; Atlas, Conch., pl. xiii. fig. 5. *T. sagittula* (Defrance) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 332, pl. xiii. figs. 15-17. *T. sagittula* (Defr.) Malagoli, 1887, Boll. Soc. Geol. Ital., vol. vi. p. 520, pl. xiii. fig. 1. *T. sagittula* (Defr.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 219, pl. xlii. fig. 1. *T. sagittula* (Defr.) Fornasini, 1888, Boll. Soc. Geol. Ital., vol. vii. p. 46, pl. iii. figs. 2-4, *T. sagittula* (Defr.) Chapman, 1892, Journ. R. Micr. Soc., p. 328, pl. vi. fig. 16. *T. sagittula* (Defr.) Egger, 1893, Abhandl. k. bayer.

Akad. Wiss., Cl. II. vol. xviii. p. 271, pl. vi. figs. 8–10. *T. sagittula* (Defr.) Grzybowski, 1894, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej. Krakowie, vol. xxix. p. 187, pl. i. fig. 4. *T. sagittula* (Defr.) Jones, 1895, Palæont. Soc., p. 142, pl. v. figs. 15, 16, 18. *T. sagittula* (Defr.) Burrows and Holland, 1897, Proc. Geol. Assoc., vol. xv. p. 31, pl. ii. fig. 10.

There is nothing in the Malay specimens of this well known and ubiquitous species to call for remark. It is found at several Stations, and shows the usual variations of form and structure.

Textularia sagittula var. *jugosa* T. R. Jones, plate VII. fig. 8.

T. sagittula (Defr.) Fornasini, 1887, Boll. Soc. Geol. Ital., (vol. vi. p. 374, pl. ix. figs. 1, 2. *T. sagittula* (Defr.) var. *jugosa* (Brady) T. R. Jones, 1895, Palæont. Soc., p. 145, pl. v. fig. 19. *T. rugosa* (Reuss) var. *marginata* Silvestri, 1896, Mem. Pontif. Accad. Nuovi Lincei, vol. xii. p. 77, pl. ii. fig. 4.

This is the arenaceous form of *T. jugosa* before referred to. It has been found only at Station 13, and the specimens are neither numerous nor well developed. The only perfect example (the one figured) is short and triangular, but there are fragments which possess the characters of the forms figured by Fornasini and Prof. T. R. Jones.

It is a question if this arenaceous variety has previously been found recent; yet strangely enough, Prof. T. R. Jones, writing of the Crag specimen, remarks, "this is the first record of the variety in a fossil condition."* Fornasini's and Silvestri's examples are from the pliocene of Italy.

Textularia sagittula var. *fistulosa* Brady, plate VII. fig. 9.

T. sagittula var. *fistulosa* Brady, 1884, Chall. Rept., p. 362, pl. lxii. figs. 19–22. *T. fistulosa* (Brady) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 271, pl. vi. figs. 15, 16.

This variety is very rare, and has been observed only at Station 2.

Brady considers the fistulose condition to be the result of redundant growth, and states that it is principally met with in specimens from tropical or sub-tropical latitudes. The only 'Gazelle' Station is Mauritius.

Textularia sagittula var., plate VII. figs. 10–12.

This is another form of the *sagittula* group. Essentially the initial portion of the test is much flattened with a more or less acute margin, and is formed of a great number of short broad segments. So far the characters of the test are constant, but the later chambers have a tendency to expand and become inflated in various manners. Sometimes each individual segment expands without regard to its

* Palæont. Soc., 1895, p. 146.

neighbours, as shown in figs. 10, 11; at other times they combine to form a symmetrical inflation of the test, as in fig. 12. In the Malay specimens these variations are very numerous, and afford materials for bringing together figures by various authors, the affinities of which have hitherto been very doubtful.

Of the figures in which the inflation of individual chambers occurs, the following may be mentioned:—*T. globigera* Schwager, 1866, Novara-Exped., Geol. Theil, vol. ii. pl. vii. fig. 100; *T. sagittula* var. *Soldanii* Fornasini, 1883, Boll. Soc. Geol. Ital., vol. ii. pl. ii. fig. 2; *T. Soldanii* Fornasini, 1887, Boll. Soc. Geol. Ital., vol. vi. pl. ix. figs. 3, 4; *T. conica* Chapman, 1892, Journ. R. Micr. Soc., pl. vi. fig. 20; *T. agglutinans* forma *jugosa* Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. pl. vii. figs. 297–299; and *T. lucenta* Brady, 1884, Chall. Rept., p. 364. The inflation in the last-mentioned form is not represented in Brady's figures, but I have specimens from 'Challenger' Station 24 (off Culebra Island) in which it is well shown. This variety is represented by figs. 10, 11, plate VII.

The figured specimens of the other form in which the later segments combine to form a club-shaped test are:—*T. Candaina* d'Orbigny, 1839, Foram. Cuba, pl. i. figs. 25–27; *Plecanium acuminatum* Seguenza, 1880, Atti R. Accad. Lincei, ser. 3, vol. vi. pl. x. fig. 5; *T. fungiformis* Fornasini, 1887, Boll. Soc. Geol. Ital., vol. vi. pl. x. fig. 1, and 1896, Mem. R. Accad. Sci. Ist. Bologna, ser. 5, vol. vi. pl. 1–5; and *T. cordiformis* Terquem, 1883, Cinq. Mém. Foram. Oolithique, pl. xiv. fig. 5. The Malay form of this variety is represented by fig. 12, pl. VII.

The most numerous and regular, and therefore probably the most typical, form of this variety of *T. sagittula* closely resembles *T. aciculata* d'Orbigny in the shape and arrangement of the chambers forming the later portion of the test, but the margins are obtuse instead of being acute as in that species. This particular form is found at a considerable number of the Malay Stations; the inflated varieties are more rare and more local.

Textularia agglutinans d'Orbigny.

T. agglutinans d'Orbigny, 1839, Foram. Cuba, p. 144, pl. i. figs. 17, 18, 32. *T. agglutinans* (d'Orb.) Woodward and Thomas, 1885, Thirteenth Ann. Rept. Geol. Nat. Hist. Survey of Minnesota for 1884, p. 167, pl. iii. figs. 6, 7. *T. agglutinans* (d'Orb.) Vine, 1885, Proc. Yorkshire Geol. Polytech. Soc., n.s., vol. ix. p. 28, pl. ii. fig. 17. *T. agglutinans* (d'Orb.) Sherborn and Chapman, 1886, Journ. R. Micr. Soc., ser. 2, vol. vi. p. 742, pl. xiv. fig. 6. *T. agglutinans* (d'Orb.) Brady, Parker, and Jones, 1888, Trans. Zool. Soc., vol. xii. p. 219, pl. xli. figs. 17, 23, and pl. lii. figs. 2, 3. *T. agglutinans* (d'Orb.) Chapman, 1892, Journ. R. Micr. Soc., p. 329, pl. vi. fig. 21. *T. agglutinans* (d'Orb.) Woodward and Thomas, 1893, Final. Rept.

Geol. Nat. Hist. Survey of Minnesota, p. 30, pl. C, figs. 7, 8. *T. agglutinans* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 267, pl. vi. figs. 1, 2. *T. agglutinans* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 35, pl. vii. figs. 300-303. *T. agglutinans* (d'Orb.) T. R. Jones, 1895, Palæont. Soc., p. 147.

There is little to be said about this well-known species; the Malay specimens are not large, and are widely diffused throughout both areas.

Textularia gramen d'Orbigny.

T. gramen d'Orbigny, 1846, For. Foss. Vienne, p. 248, pl. xv. figs. 4-6. *T. gramen* (d'Orb.) Balkwill and Wright, 1885, Trans. R. Irish Acad., vol. xxviii. (Sci.) p. 332, pl. xiii. figs. 13, 14. *T. gramen* (d'Orb.) Terrigi, 1889, Mem. R. Accad. Lincei, ser. 4, vol. vi. p. 103, pl. v. fig. 1. *T. gramen* (d'Orb.) Haeusler, 1890, Abhandl. schweizer. Pal. Gesellschaft, vol. xvii. p. 71, pl. xi. figs. 26, 27, 37. *T. gramen* (d'Orb.) Fornasini, 1891, Foram. Plioc. del Ponticello di Savona, pl. ii. fig. 6. *T. gramen* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 272, pl. vi. figs. 24-26.

The specimens are numerous and widely dispersed, but few of them are characteristic; in the majority the earlier formed portion of the test resembles *sagittula*, the later portion *agglutinans*.

Textularia conica d'Orbigny.

T. conica d'Orbigny, 1839, Foram. Cuba, p. 143, pl. i. figs. 19, 20. *T. conica* (d'Orb.) Haeusler, 1890, Abhandl. schweizer. Pal. Gesellschaft, vol. xvii. p. 72, pl. xi. figs. 40-42; 45, 46. *T. conica* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 273, pl. vi. figs. 34-36. *T. calix* Grzybowski, 1895, Rozprawy Wydz. Mat.-Przyr. Akad. Umiej. Krakowie, vol. xxix. p. 287, pl. ix. fig. 17. *T. conica* (d'Orb.) T. R. Jones, 1895, Palæont. Soc., p. 152, pl. vii. fig. 24.

This species is well represented, the examples being numerous and widely distributed. The exterior of the test is arenaceous, and is rougher than is usual in this form. It is most abundant in Area 1.

Textularia trochus d'Orbigny.

T. trochus d'Orbigny, 1840, Mém. Soc. Géol. Fr., vol. iv. p. 45, pl. iv. figs. 25, 26. *T. trochus* (d'Orb.) Haeusler, 1890, Abhandl. schweizer. Pal. Gesell., vol. xvii. p. 72, pl. xi. figs. 43, 44. *T. trochus* (d'Orb.) Burrows, Sherborn, and Bailey, 1890, Journ. R. Micr. Soc., p. 553, pl. viii. fig. 14. *T. trochus* (d'Orb.) Egger, 1893, Abhandl. k. bayer. Akad. Wiss., Cl. II. vol. xviii. p. 273, pl. vi. figs. 37, 38. *T. trochus* (d'Orb.) T. R. Jones, 1895, Palæont. Soc., p. 150.

The specimens are numerous and fine, and all, without exception, have the limbate sutures common in the recent, but rarely found in the fossil examples. It is restricted to Stations 2 and 22.

Bigenerina d'Orbigny.

Bigenerina nodosaria d'Orbigny, plate VII. fig. 13.

B. nodosaria d'Orbigny, 1826, Ann. Sci. Nat., vol. vii. p. 261, pl. xi. figs. 9-12; Modèle No. 57. *B. nodosaria* (d'Orb.) Fornasini, 1887, Atti Soc. Nat. Modena (Rendic.) ser. 3, vol. iii. p. 108, pl. i. figs. 3, 4. *B. nodosaria* (d'Orb.) Haeusler, 1890, Abhandl. schweizer. Pal. Gesell., vol. xvii. p. 73, pl. xii. figs. 1-4. *B. nodosaria* (d'Orb.) Goës, 1894, K. Svenska Vet.-Akad. Handl., vol. xxv. p. 27, pl. vii. figs. 313-323; and *Clavulina textularioidea* p. 42, pl. viii. figs. 387-399. *B. agglutinans* (d'Orb.) Egger, 1895, Jahresber. XVI. naturhist. Ver. Passau, p. (8) pl. i. fig. 1. *Clavulina textularioidea* (Goës) Goës, 1896, Bull. Mus. Comp. Zool. Harvard Coll., vol. xxix. p. 37, pl. iv. figs. 26-38. *B. nodosaria* (d'Orb.) A. Silvestri, 1896, Mem. Pont. Accad. Nuovi Lincei, vol. xii. p. 81, pl. ii. figs. 5, 6.

The specimen figured possesses the characters of the species in an extreme degree; it is smoothly arenaceous, and in this form is very rare, having been noticed only at Station 10. Very common is the rough form equivalent to the *B. agglutinans* of D'Orbigny, which occurs at several Stations in both areas.

Clavulina textularioidea Goës seems to be nothing more than an aberrant form of this species.