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TEXTILINA nov. gen., *TEXTULARIA* DEFRANCE AND *SPIROPLECTAMMINA* CUSHMAN, (*FORAMINIFERA*)

BY

AKSEL NØRVANG

København 1966

Kommissionær: Ejnar Munksgaard

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Synopsis

The new genus *Textilina* is defined to accomodate species with perforated test wall and presence of an adventitious chamber. As a request for change of the type species for the genus *Textularia* might have undesirable consequences, the number of species in this genus is drastically reduced. A neotype is selected for the type species, *Textularia sagittula*, and as this species is characterized by an imperforate wall and a planospiral initial end the diagnosis of *Textularia* is accordingly emended. The genus *Spiroplectammina* has a purely arenitic wall in which respect it differs from both *Textilina* and *Textularia*, which have calcarenitic walls.

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During the course of work on samples from West Africa, collected by the Atlantide and Galathea Expeditions, it was found that the genus *Textularia* might be divided into two different genera. As it has been necessary to use a great deal of material from the Mediterranean and other areas, it was finally decided to prepare a special report on the subject. The result of the examination has shown that the species, conventionally referred to the genus *Textularia*, vary so widely that the author can only confirm Hofker's assumption that some of them may rather be related to *Dorothia* and *Karreriella* of the family Valvulinidae than to the type species *Textularia sagittula*. The difficulty in examining specimens however, was that the perforation of the wall is very difficult to observe, even in very thin sections, and the figures given by Hofker are not very convincing. Consequently, the main problem was to develop a technique which establishes with certainty the presence, or—what is perhaps more important—the absence of perforations in all cases. The procedure, fortunately, appeared to be fairly simple, and at the same time revealed details of the wall texture which are considered of value in discussing problems on the amount of secreted substance in the agglutinated, calcareous walls.

The nomenclatural problem is primarily caused by the fact that Defrance did not mention the presence of a spiral initial end in his diagnosis. Consequently, later authors referred a multitude of species with no planospire to the genus *Textularia*. When agglutinated, biserial forms with a large and easily recognisable, planospiral initial end were discovered, these species were referred to the genus *Spiroplecta* Ehrenberg, 1844 = *Spiroplectammina* Cushman, 1927. As nearly all the species, by common usage, referred to the genus *Textularia* have no planospire, some specialists have preferred to incorporate *T. sagittula* in *Spiroplectammina*, evidently being unaware of the fact that the genus *Textularia* is monotypic and that *T. sagittula* must therefore be the type species.

T. sagittula is a very distinctive species, and since the publication of excellent figures by Brady (1884) identification seems to have caused little trouble; the attempt made by Silvestri (1903) to distinguish between *T. sagittula* with no planospire and *Spiroplecta wrightii*, is of course, excepted. Silvestri's view has been thoroughly discussed by Lacroix (1929) and Höglund (1947), and the present author has himself never found perfect specimens, referable to *T. sagittula*, without a planospiral initial end.

Among the synonyms Brady lists "polymorpha sagittulae", described by Soldani (1779–1792), and the figures published by Soldani appear to be sufficiently accurate to exclude any other possibility than that of *T. sagittula*. It may consequently be inferred, and most authors seem tacitly to have done so, that the very name indicates that Defrance had Soldani's form in mind, and that it was his intention to present it with a Linnean name. Unfortunately, Defrance did not directly refer to Soldani's publication, and his subsequent description and figures may thus fit a variety of Mediterranean forms. Only examination of the holotype could definitely solve the problem. For this reason the author visited the University Museum in Caen, France, where the curator, Dr. Rioult could testify that the whole museum, including the Defrance Collection, was totally destroyed during the 1944 invasion. As d'Orbigny recorded the species in 1826, there was, however, a possibility that he had received the material from Defrance, and if the material had still been present in the d'Orbigny Collection in the Museum d'Histoire Naturelle in Paris, a lectotype could have been selected. Unfortunately, examination of the d'Orbigny Collection revealed that no such specimens exist. Thus, in the present situation it will be necessary to select a neotype, because without fixation of the species, *T. sagittula*, there will always be doubt as to which of the two groups shall in future carry the generic name, *Textularia*. If one accepts the view that Defrance actually did have Soldani's form in mind when he defined the genus *Textularia*, only two of the present known species can be incorporated in this genus, and a new genus must be defined for the majority of the species. On the other hand, the total loss of Defrance's material means that the opposite view can never be disproved, and were a neotype to be chosen from another of the Mediterranean forms, the common usage of the name *Textularia* could be continued. However, in this case the name *T. sagittula* would suppress another, equally well-established name, and a new name would have to be introduced for the well-known and easily recognisable form recorded earlier under this name. For this reason, it has been considered less confusing to assume that Defrance actually did have Soldani's form in mind, and in this case to stabilise the species and its name by choosing a neotype and finally, to define a new genus to accommodate the rest of the species.

Method

The thin sections have been prepared by grinding specimens embedded in araldite. In some cases the araldite has been colored by eosine, and the perforations can normally be observed without further treatment of the section. However, in practice, it is almost impossible to place the specimen with the degree of accuracy necessary for sectioning perpendicular to the wall, and in very thin sections only parts of the perforations are observed. In thicker sections the high index of refraction of the calcite hampers the observation of detail, and in these cases it has been necessary to remove the calcite. Acids destroy, or at least partly destroy the tectine, and

the rest is destroyed by the effervescence. The dissolution of the calcite takes place by placing the thin sections in a bath of ammonium nitrate (100 g/l) and leaving them overnight. The next day—or the day after if the section is very thick—the calcite is completely and very gently removed. The residue of the wall, however, is extremely delicate, and normally the strain of undergoing baths of alcohol and xylene for final embedding in canada balsam more or less completely destroys the details. For this reason it is recommended, after removing the ammonium nitrate into a bath of distilled water, to add only a drop of glycerine and a cover-glass. For more permanent storage glycerine gelatine has been used with reasonable success.

Texture of the Test Wall

Among previous studies of this subject the present author is of the opinion that the views expressed by Wood (1948), give, by and large, a very clear picture of the general opinion. His introductory statement of the presence of four main types of wall structure of which "only the Porcellanea and the Fusulinidae can be claimed to be natural groups" seems to favour the view that there is an intergradation of the agglutinated and the hyaline types. The restricted scope of the present publication does not allow any definite conclusions, but a few observations seem to indicate that the problem needs further examination.

Wood very logically starts his conclusions by stating that a binding medium must be present, even if the cement may be difficult to observe in some of the agglutinating forms. He consequently assumes that the calcitic grains may form this binding medium and are, accordingly, secreted by the protoplasm. After studying a number of species, Wood arrives at the conclusion that there is complete intergradation from forms with a test of detrital grains and scant amounts of secreted calcite to types in which "agglutination appears to have been superseded by direct secretion of calcite granules". The examination of a number of thin sections seems completely to confirm Wood's conclusions, but after dissolution of the calcitic grains the picture is quite different. After such treatment not only the quartz grains remain but also a fine, spongy net-work of tectine which still presents perfect imprints of even the smallest grain of calcite. This indicates rather that the binding medium in the tests is tectine, and not the fine grained calcite presumed by Wood. This however does not disprove the fact that calcite grains may be secreted by the organism. It is true that some species have tests constructed by few, comparatively large detrital grains in a matrix of generally smaller calcitic granules. Nevertheless, in the species here described, the size distribution of the quartz grains appears to be almost similar to that of the calcitic grains. Thus, the major part of the coarser grains are calcitic and only few are siliceous, but after dissolution of the calcite it is possible to observe a large number of tiny quartz grains, evenly distributed throughout the whole test. One cannot exclude the possibility that all the mineral grains may be of detrital origin, and a gradual evolution

from agglutinated forms to species with a secreted granular test can thus not be considered a proven fact.

It now appears obvious that there is a certain doubt regarding the existence of a "calcareous cement". Most authors seem to have used this descriptive term—as well as "siliceous cement"—fairly loosely, without recording any facts. (The present author has the suspicion that with several authors the term "siliceous cement" means only that the test is insoluble—or at least, only soluble after a long period—in dilute acids). For these reasons an attempt has been made to avoid these terms in the present study, and in their place to introduce the more neutral terms arenitic, calcarenitic and calcitic (or aragonitic) which by and large, cover the well-known descriptions arenaceous/agglutinated, arenaceous "with much calcareous cement" and calcareous (aragonitic)/secreted, respectively.

Regarding the perforations of the calcarenitic tests, Wood states that there "can be little doubt that these tubuli and multiple apertures are physiologically equivalent to the pores of the perforate types". The present author is inclined to agree that they are similar in function, but doubts whether they are homologues. In contrast to the perforations of the secreted, calcareous test, the tubuli of the calcarenitic tests are winding, and seem to bifurcate in the exterior parts.

Genus *Textilina* nov. gen.

Synonyms: *Textularia* Defrance, 1824 (part); *Plecanium* Reuss, 1861 (part); *Valvotextularia* Hofker, 1951 (part).

Type species: *Textilina stricta* (Cushman) = *Textularia stricta* Cushman, 1911.

Diagnosis:

Test free, polythalamous; chambers biserially arranged; initial part in most species with an adventitious chamber in the microspheric form, and in some species, also in the megalospheric form; wall calcarenitic, perforate; aperture interior-marginal; with no distinct lips.

Differential Diagnosis:

This genus differs from both *Spiroplectammina* and *Textularia* in having an adventitious chamber instead of an initial planospire, and in the distinct perforation of the chamber wall.

Remarks:

The perforations of the test were already observed by Möbius (1880) on material which he referred to *Textularia agglutinans*. Möbius gave some excellent illustrations of the texture of the wall which are surprisingly accurate, when the optical and other technical aids of his time are taken into account. However, apart from a few random remarks in the text-books this important discovery remained more or less in obscurity

until it was confirmed by Lacroix (1931) in several other species. A few years later Hofker (1933) observed the very coarse perforations in the wall of *T. stricta*.

The adventitious chamber was discovered by Lacroix (1933) in *Bigenerina nodosaria*, but unfortunately, this author did not revise his previous work (1932) on several Mediterranean species which he had referred to the genus *Textularia*. This omission confused Höglund (1947), who observed an adventitious chamber in the microspheric form from Scandinavia which was previously referred to *T. agglutinans* by Göes (1894). As Lacroix, after examining the very similar form from the Mediterranean, had interpreted the initial end as a planospire, Höglund was unable to judge the importance of his discovery and merely defined the Scandinavian form as a new species, *T. bocki*.

Hofker (1951, 1956), who realized that the forms with adventitious chambers and perforated walls were different from *T. sagittula*, suggested that these might rather be related to certain species of the *Valvulinidae* with a similar wall texture. He consequently defined the genus *Valvotextularia* to cover these species, but unfortunately chose *Siphotextularia catenata* as the type species. For this reason—irrespective of whether *Textilina* and *Siphotextularia* are considered congeneric or not—the name *Valvotextularia* will, according to the Rules of Nomenclature, forever remain a junior synonym of *Siphotextularia*, unless it can be proved that *S. catenata* belongs to another genus than the type species *S. wairoana*.

Textilina stricta (Cushman)

Pl. 1, fig. 1; pl. 2, figs. 1 & 2.

Textularia stricta Cushman, 1911, p. 11, fig. 13.
Textularia vertebralis new species – Cushman, 1913, p. 663, pl. 78, fig. 1.
Textularia stricta Cushman-Cushman, 1921, p. 107, pl. 21, fig. 1.
Textularia vertebralis Cushman-Cushman, 1921, p. 110, pl. 22, fig. 3; pl. 24, fig. 1.
Textularia stricta Cushman-Hofker, 1933, p. 78, pl. 1, figs., 1, 2, Text-figs. 3, 4.
Valvotextularia stricta Cushman-Hofker, 1951, p. 33, fig. 11.

Remarks:

This species was originally described by Cushman from off Japan and the Philippines; Hofker found it in the Banda Sea and south of Borneo. We have in the Copenhagen collection excellent specimens from the Banda Sea (identified by Hofker), and from the Great Australian Bight (collected by the Galathea-Expedition).

As the exterior characters of this very large species are excellently described by Cushman, little can be added. However, as no mention is made of the adventitious chamber and the perforations it is probable that Cushman had not actually examined any sections. The adventitious chamber must have been observed by Chapman, however, who referred the species to the genus *Spiroplecta*. Hofker (1933) stated that the microspheric form has a planospiral initial end which he did not find in the megalospheric form. It is quite possible that the adventitious chamber may easily be observed

in the thin-walled, microspheric, initial end, but in the thicker megalospheric form its presence can only be proved with certainty in thin sections. Even as late as 1951 Hofker does not seem to have discovered the adventitious chamber in *T. stricta*, although he very distinctly describes a similar chamber in *T. miletti*. The presence of perforations in the genus, discovered by Möbius (1880) and later confirmed by Lacroix (1931), was further confirmed by Hofker's discovery (1933) of the very coarse pores of this species. Hofker's description (1956) of the specimens in material from the Siboga Expedition does not add much to his previous one. He does, however, consider *T. stricta* and *T. vertebralis* conspecific, which the material from the Great Australian Bight seems to confirm.

Textilina agglutinans (d'Orbigny)

Pl. 1, figs. 2, 3 & 4; pl. 2, figs. 3, 4, 5 & 13.

Textularia agglutinans d'Orbigny, 1839, p. 144, pl. 1, figs. 17, 18, 32, 34.
Textularia candeina d'Orbigny, 1839, p. 143, pl. 1, figs. 25–27.
Textularia agglutinans d'Orbigny-Brady, 1884, p. 363, pl. 43, figs. 1–3.
Textularia agglutinans d'Orbigny-Cushman, 1922, p. 7, pl. 1, figs. 4, 5.
Textularia candeina d'Orbigny-Cushman, 1922, p. 8, pl. 1, figs. 1–3.
Textularia agglutinans d'Orbigny-Lacroix, 1931, p. 7, figs. 1–2.
Textularia agglutinans d'Orbigny-Lacroix, 1932, p. 16, figs. 13, 14.
Textularia candeina d'Orbigny-Lacroix, 1932, p. 17, figs. 15–17.
Textularia agglutinans d'Orbigny-Hofker, 1932, p. 91, fig. 16.
Valvotextularia candeina (d'Orbigny)-Hofker, 1956, p. 34, pl. 2, figs. 13–25.
Textularia agglutinans d'Orbigny-Hofker, 1960, p. 237, fig. 18.
Textularia gramen d'Orbigny-Hofker 1960, p. 237, fig. 16.

Remarks:

Both *T. agglutinans* and *T. candeina* were originally described from beach sand from Cuba. According to the type figures *T. candeina* has a rapidly widening shape, while *T. agglutinans* has a more lingulate shape. It seems evident that the type of *T. candeina* was a microspheric individual, and consequently, it is reasonable to assume that *T. agglutinans* is the corresponding megalospheric form. Some material from the Virgin Islands is included in the present collection, referred by Hofker to *Valvotextularia candeina*. The specimens are probably megalospheric but are, nevertheless, forms that more or less rapidly flare. However, this does not exclude the possibility that the type figure of *T. agglutinans* may represent an extreme form. Comparison with the similar Mediterranean form does, to some extent, make this assumption reasonable.

Some excellent material from the Mediterranean in the present collection admirably illustrates the forms which Hofker and Lacroix referred to *T. agglutinans* and *T. candeina*. Lacroix evidently had difficulty in keeping the forms apart, as he mentions that one of them may only be a variety of the other. The present author fully agrees with Lacroix, as intermediate specimens occur to such an extent that it seems most

reasonable to assume that the whole material represents only one species with a rather wide range of variation.

While *T. stricta* has an adventitious chamber both in the megalospheric and the microspheric form, this is only present in the microspheric form of *T. agglutinans*. The chamber was discovered by Höglund in material from Kattegat and the Gullmar Fjord, and as Lacroix had suggested that the Mediterranean form had a planospiral initial end, Höglund concluded that the Scandinavian form was a different species. However, as the two forms have an identical initial end, they would appear to be conspecific.

Textilina conica (d'Orbigny)

Pl. 1, figs. 5, 6 & 7; pl. 2, fig. 8.

Textularia conica d'Orbigny, 1939, p. 143, pl. 1, figs. 19, 20.
Textularia conica d'Orbigny-Cushman, 1922, p. 22, pl. 5, figs. 5–7.
Textularia communis d'Orbigny-Hofker, 1960, p. 237, fig. 28 B.

Remarks:

This form is easily distinguished from the former species by its conical shape and the truncated apertural end which causes the flattened apertural face to meet the sides of the test in a distinct angle. The form occurs commonly in the samples from the Bay of Naples, and it is evidently this species to which Hofker (1960) applies the name *T. communis*. However, this name is not only a nomen nudum but also a nomen oblitum. Actually, material from Banyuls and other places meets d'Orbigny's diagnosis of the West Indian form very well, and since, according to other authors, it seems to be a species of wide distribution the present author has little hesitation in referring the Mediterranean form to *T. conica*. In the present collection are specimens from Kattegat and the Gullmar Fjord, which undoubtedly belong to the form Höglund (1947) described as *T. truncata*. This form does not differ in any characters from the Mediterranean form from Banyuls and Naples. Thus, the Mediterranean form has no adventitious chamber in the microspheric form, the absence of which was already pointed out by Höglund in *T. truncata*.

The wall structure of this species is very similar to that of *T. candeina*, but while the wall of both species is distinctly perforated, the apertural end and the septa of *T. conica* are practically imperforate. As mentioned in the discussion of the preceding species, recognition of the presence or absence of an adventitious chamber and the degree of perforation of the wall and septa as characters of generic value, would—at least in this particular case—lead to the unhappy result, a genus for every species. In this respect, the author has refrained from trying to define any new genera pending further examination of these interesting characters in other species.

Genus *Textularia* Defrance, 1824

Synonym: *Plecanium* Reuss, 1861, (part).
Type species: *Textularia sagittula* Defrance, 1824, (monotypic).

Emended Diagnosis:

Test free, polythalamous; chambers of the initial end planospirally arranged both in the megalospheric and the microspheric generations, later chambers biserial, wall calcarenitic, imperforate; aperture interior-marginal, with no distinct lips.

Differential Diagnosis:

This genus differs from *Textilina* in having an initial planospire and no adventitious chamber, and in the lack of perforations. The wall of *Textularia* is calcarenitic, but it is at present unknown whether the difference between the calcarenitic and the purely arenitic wall is of generic importance. If later examinations should reveal an intergradation *Spiroplectammina* will probably be a junior synonym of *Textularia*.

Remarks:

The name of the type species seems to indicate that Defrance had in mind the form, previously described by Soldani (1791) from the Mediterranean, under the name "polymorpha sagittulae", and that Defrance wanted only to present a proper binomial name for this form. At least, d'Orbigny (1826) must have thought so, because he gave credit to Soldani for the species and Defrance only for the genus.

Soldani expressly mentions the beach of Rimini as being one of the localities, and furthermore states that the specimens are similar to those he previously pictured (1780) from the Pliocene of Italy. While the first illustration is lacking in detail and the fossil form consequently difficult to place, this is not the case with his beautiful figures of the Mediterranean form. The compressed test with the deepened and slightly curved sutures and the thickened median part leaves hardly any doubt that his material belonged to the species which ever since has been named *Textularia sagittula*. Until the year 1884 the records of this species are uncertain, but in the Challenger Report Brady published excellent illustrations of a form unquestionably identical to that of Soldani under the name *T. sagittula*. The present conception of this species is probably based entirely on Brady's figures. In the interval between Soldani and Brady very few records exist as the form may have been confused with other species, and unfortunately, this may even be the case with Defrance's record. In fact, the description and figures by Defrance are so deficient that they may fit a variety of forms. Under these circumstances it has been considered necessary to define a neotype, as mentioned in the introduction.

According to the new, emended definition the genus *Textularia* exclusively comprises species with a planospiral initial end and imperforate walls. This means a drastic reduction of the number of species within the genus. At the present time

only two species are known, viz., besides the recent species *T. sagittula*, known at least from the Pliocene, the closely related *T. carinata* from the Oligocene and the Miocene.

Textularia sagittula Defrance

Pl. 1, figs. 9–23; pl. 2, fig. 12.

"sagittulae" Soldani, 1780, p. 120, pl. 14m, figs. 74 Sand F.
"polymorpha sagittulae" Soldani, 1779–1792, p. 120, pl. 133, figs. O, P, Q, R, S, T, and V.
Textularia sagittula Defrance, 1824, p. 177, pl. 13m, fig. 3.
Textularia sagittula Sold.-d'Orbigny, 1826, p. 263, No. 20.
Textularia sagittula Defrance-Brady, 1884, p. 301, pl. 42, figs. 17, 18.
Textularia sagittula Defrance-Cushman, 1922, p. 6.
Textularia sagittula Defrance-Lacroix, 1929, p. 1, text-figs. 1–12.
Spiroplectammina sagittula (Defrance)-Hofker, 1930, p. 365, pl. 12, figs. 1–3; text-figs. 2, 4, and 3.
Textularia sagittula Defrance-Lacroix, 1931, p. 13, fig. 8.
Textularia sagittula Defrance-Lacroix, 1932, p. 10.
Spiroplectammina sagittula (Defrance)-Hofker, 1932, p. 95.
Textularia sagittula (Defrance)-Lacroix, 1933, p. 1, figs. 1–9.
Textularia sagittula Defrance-Höglund, 1947, p. 167, pl. 12, figs. 3, 4, text-figs. 143–146.
Spiroplectammina sagittula (Defrance)-Hofker, 1960, p. 237, fig. 17.

Neotype:

A slightly twisted, megalospheric specimen. Mediterranean, Baie de Villefranche; 70 m. Coll: Le Calvez, St. 8 (see Y. Le Calvez 1958, pp. 163, 164).

Description of Neotype:

Length 0.92 mm, breadth 0.40 mm; thickness: 0.20 mm. Composed of four chambers, with the initial chamber forming the planospiral initial end, followed by 19 paired chambers; sutures indistinct in the initial end, slightly depressed in the mature part of the specimen; median thickening very distinct in the initial part, less so in the mature part; size of initial chamber approx. 40 μ.

Remarks:

T. sagittula is perhaps one of the best described foraminifera in the world. Moreover, the material from the Bay of Villefranche corresponds closely in general size, number of chambers and size of the initial chambers to the measurements given by Lacroix. Höglund has probably rendered the most exact description of the species, and his description—although based on material from Skagerak and the Gullmar Fjord—fits the Mediterranean material so well that the present author sees no reason to prepare another description which, point by point, would be a repetition. The specimens in the present collection from the Gullmar Fjord are only slightly smaller, a bit coarser grained, and the median thickening a little more pronounced than in the Mediterranean specimens. The specimens from Banyuls are in all respects similar to those from Villefranche, but in the Bay of Naples specimens the median thickening

is more pronounced. Lacroix stated that both the microspheric and megalospheric specimens had a planospiral initial part, Hofker, however, maintaining that Lacroix had only observed the A_1 and A_2 generations, published a drawing of a microspheric specimen from the Bay of Naples with no planospire and an initial chamber with a diameter of only 14 μ. Lacroix drew attention to the fact that measurements of the initial chambers would necessarily have a very considerable margin of error, and suggested that Hofker had drawn an incomplete, microspheric specimen with slight erosion of the initial end. After studying Scandinavian specimens, Höglund could only confirm the views expressed by Lacroix, but supposed that the forms described by both Lacroix and Hofker were not conspecific. He then drew attention to Hofker's thin section showing "Mundlippen" i. e., an extra-marginal aperture which differs from the inferior-marginal aperture of *T. sagittula*. The examination of specimens from the Bay of Naples shows a definite interior-marginal aperture, but it must be admitted that the specimens are very difficult to place correctly for sectioning in balsam, and oblique sections show phenomena which bear some resemblance to Hofker's figure. As a result of these examinations the present author considers that the collected evidence overwhelmingly confirms the view expressed by Lacroix and Höglund. The very great number of specimens now known seems to indicate that the single specimen pictured by Hofker is either slightly eroded or abnormal. Likewise, it appears reasonable that the forms with no planospiral initial end, described by Silvestri, are specimens with broken initial parts, and that *Spiroplecta wrightii* Silvestri is a synonym of *T. sagittula*. There is material in the present collection both from Rimini and Porto Corsini in the Adriatic. The specimens, though not very well preserved, are obviously closely related to the Atlantic and Western Mediterranean form, but they differ from these in the more pronounced obliquity of the sutures (in which respect they are intermediate between *T. sagittula* and *T. carinata*). As a matter of interest, the Adriatic form is strikingly similar to the specimens from the Pliocene of Rome and Castel Arquato. It would consequently be of great interest if such specimens were some day caught in the living state.

Textularia carinata d'Orbigny

Pl. 1, fig. 8; pl. 2, fig. 10.

Textularia carinata d'Orbigny, 1826, p. 263, (nomen nudum).
Textularia carinata d'Orbigny-d'Orbigny, 1846, p. 247, pl. 14, figs. 32–34 (type figure).
Textularia carinata d'Orbigny-Brady, 1884, p. 360, pl. 42, figs. 15, 16.
Textularia carinata d'Orbigny-Egger, 1893, (1895), p. 270, pl. 6, figs. 39–41.

Remarks:

Excellent specimens from Nussdorf are found in the present collection, and these are presumed to belong to the form described by d'Orbigny (1846). They correspond very well to his description but not to his figure. However, present in the d'Orbigny Collection in Paris are specimens from the Adriatic labelled *T. carinata*

which are very similar to the specimens from Nussdorf. There is, unfortunately, no material of the Indo-Pacific form in the present collection (separated under the name, *Textularia pseudocarinata* by Cushman (1921)). It has therefore, been impossible to discuss the difference between the fossil and the Indo-Pacific form. Nevertheless, it may be opportune to mention that the few diagnostic features given by Cushman in no way suffice to separate the two forms. Moreover, the type locality of *T. carinata* is the Adriatic, and if the fossil and the recent forms are not found to be conspecific it might be advisable to rename the fossil one. *T. carinata* is normally easy to distinguish from *T. sagittula* by the thin and sharp carina, usually provided with long, spinal projections. On specimens with a less developed or poorly preserved carina, the presence of a fairly sharply defined apertural face may provide a means of distinguishing these two species. Thin sections of the test of *T. carinata* reveal that the content of siliceous grains is considerably larger than in *T. sagittula* and that these grains are generally of greater size, but the diagnostic value of this feature is at present unknown.

Genus *Spiroplectammina* Cushman, 1927

Synonym: *Spiroplecta* Ehrenberg, 1844 (part).
Type species: *Spiroplectammina biformis* (Parker & Jones) = *Textularia agglutinans* Var. *biformis* Parker & Jones, 1865.

Emended Diagnosis:

Test free, polythalamous, chambers of the initial end planospirally arranged both in the megalospheric and the microspheric generations, later chambers biserial; wall arenaceous, imperforate, aperture interior-marginal with no distinct lips.

Differential Diagnosis:

This genus differs from *Textilina* by the presence of an initial planospire. It differs from both *Textilina* and *Textularia* in the non-calcareous wall.

Remarks:

There is, unfortunately, no authentic material in the present collection of *Bolivinopsis capitata* Yakowlev, 1891, and it is, consequently, impossible to decide whether *Spiroplectammina* is a junior synonym of *Bolivinopsis*. In the event that the wall of *B. capitata* is calcarenitic, *Bolivinopsis* will be a junior synonym of *Textularia* Defrance, 1824; if not, *Bolivinopsis* will have priority over *Spiroplectammina* Cushman, 1927.

According to the new definition of the genus it is found that the species *Textularia elegans* Lacroix, 1932, should be classified with the genus *Spiroplectammina*. As the species shows a somewhat reduced initial end it may be anticipated that species with no planospiral initial end may be observed in the future. If, however, the wall should

consist of siliceous grains only, the author feels that this character will be of subgeneric value only, as the form—or group of forms—will be linked to *S. biformis* by the intermediate form *S. elegans*.

Spiroplectammina biformis (Parker & Jones)

Pl. 1, fig. 24; pl. 2, fig. 9.

Textularia agglutinans d'Orb., Var. *biformis*, Parker & Jones, 1865, p. 370, pl. 15, figs. 23–24.
Textularia biformis Parker & Jones-Brady, 1878, p. 436, pl. 20, fig. 8.
Spiroplecta biformis Parker and Jones-Brady, 1884, p. 376, pl. 45, figs. 25–27.
Spiroplecta biformis Parker & Jones-Göes, 1894, p. 38, pl. 7, figs. 308–312.
Spiroplectammina biformis (Parker & Jones)-Lacroix, 1932, p. 5, fig. 1.
Spiroplectammina biformis (Parker and Jones)-Höglund, 1947, p. 163, pl. 12, fig. 1; text-figs. 140, 141.
Spiroplectammina biformis (Parker and Jones)-Cushman, 1948, p. 30, pl. 3, figs. 7, 8.

Remarks:

Excellent material of this species from Kattegat is found in the present collection and—like Höglund—the author sees no reason to doubt that the form from temperate waters is identical to the species originally described by Parker & Jones. The test wall consists of siliceous grains of very different sizes generally arranged in a single layer and firmly cemented by brownish tectine. Thus the species has a wall texture very similar to most other arenaceous species and, accordingly, the wall appears to be imperforate.

Spiroplectammina elegans (Lacroix)

Pl. 1, fig. 24; pl. 2, fig. 11.

Textularia elegans Lacroix, 1931, p. 15, fig. 11, (nomen nudum).
Textularia elegans Lacroix, 1932, p. 8, figs. 4–6, (type figure).
Textularia tenuissima Earland-Höglund, 1947, p. 176, pl. 13, fig. 1; text-figs. 154, 155, 161.

Remarks:

According to the emended diagnosis of the genera *Spiroplectammina* and *Textularia* this species is referred to *Spiroplectammina* because of the agglutinated wall which is built up exclusively of siliceous grains, and the presence of a planospiral, initial part, although this planospire seems to be reduced and imperfectly developed in most specimens. Höglund states that the species has been found not only in the Gullmar Fjord and Skagerak but in all stations in Kattegat, and consequently, there is no reason to doubt the present material not being identical to his. Unfortunately, the author has not yet been able to find any specimens in the present material from the Mediterranean, but the Scandinavian form fits the definition by Lacroix exactly, even in several small details, e. g., the somewhat irregular arrangement of the planospiral chambers, so distinctly illustrated by Lacroix.

The specific name was abandoned as a homonym of *Plecanium elegans* Hantken, 1868, but after transfer of the species to another genus it will be available again. As there are no specimens of the species *Textularia parvula* Cushman, 1922, in the Copenhagen collection, it is impossible to determine whether this species and *S. elegans* are conspecific.

Acknowledgments

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Zoologisk Museum, Copenhagen

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PLATES

Plate I

Fig. 1. *Textilina stricta*, Great Australian Bight, 37°11′ S 138°42′ E, 370 m, Galathea Expedition St. 558. 30 ×.
Fig. 2. *Textilina agglutinans*, Bay of Villefranche, 70 m; Y. Le. Calvez St. 8. 30 ×.
Fig. 3. *Textilina agglutinans*, Bay of Naples, Walther Bank, 180 m, Hilterman No. 25 (12934). 30 ×.
Fig. 4. *Textilina agglutinans*, Banyuls, 42°28′ N 3°11′ E, 50, Nørvang St. 5. 30 ×.
Fig. 5. *Textilina conica*, Bay of Villefranche, 70 m, Y. Le Calvez. St. 8. 30 ×.
Fig. 6. *Textilina conica*, Bay of Naples, Biondo Palomba, 110 m, Hiltermann No. 23 (12932). 30 ×.
Fig. 7. *Textilina conica*, Banyuls, 42°32′ N 3°20′ E, 100 m, Nørvang St. 10. 30 ×.
Fig. 8. *Textularia carinata*, Austria, Badener Tegel, Sooss, Miocene. 30 ×.
Fig. 9. *Textularia sagittula* (after Soldani).
Fig. 10. *Textularia sagittula* (after Defrance).
Fig. 11. *Textularia sagittula*, Bay of Villefranche, 70 m, Y. Le Calvez, St. 8; a) incidental light, b) transmitted light. 30 ×.
Fig. 12. *Textularia sagittula*, Neotype, Bay of Villefranche, 70 m, Y. Le Calvez, St. 8; a & c) incidental light, b) transmitted light. 30 ×.
Fig. 13. *Textularia sagittula*, Bay of Villefranche, 70 m, Y. Le Calvez, St. 8; a) incidental light, b) transmitted light. 30 ×.
Fig. 14. *Textularia sagittula*, microspheric specimen, Bay of Villefranche, Y. Le Calvez, St. 8; a) incidental light, b) transmitted light. 30 ×.
Fig. 15 & 16. *Textularia sagittula*, Bay of Villefranche, 70 m, Y. Le Calvez, St. 8. 30 ×.
Fig. 17. *Textularia sagittula*, Bay of Naples, Biondo Palomba, 110 m, Hiltermann No. 23 (12932). 30 ×.
Fig. 18. *Textularia sagittula*, Gullmar Fjord, Sweden, 30 ×.
Fig. 19. *Textularia sagittula*, Atlantic Ocean near Rockall, "Pourquoi – Pas?", St. 9. 30 ×.
Fig. 20 & 21. *Textularia sagittula*, microspheric specimens, Bay of Villefranche, 70 m, Y. Le Calvez, St. 8. 30 ×.
Fig. 22. *Textularia sagittula*, microspheric specimen, transmitted light, Atlantic Ocean near Rockall, "Pourquoi – Pas?". St. 9. 30 ×.
Fig. 23. *Textularia sagittula*, transmitted light, Atlantic Ocean near Rockall, "Pourquoi – Pas?". St. 9. 30 ×.
Fig. 24. *Spiroplectammina biformis*, Kattegat, SE of Hirsholmene. 30 ×.
Fig. 25. *Spiroplectammina elegans*, Kattegat, SE of Hirsholmene. 30 ×.

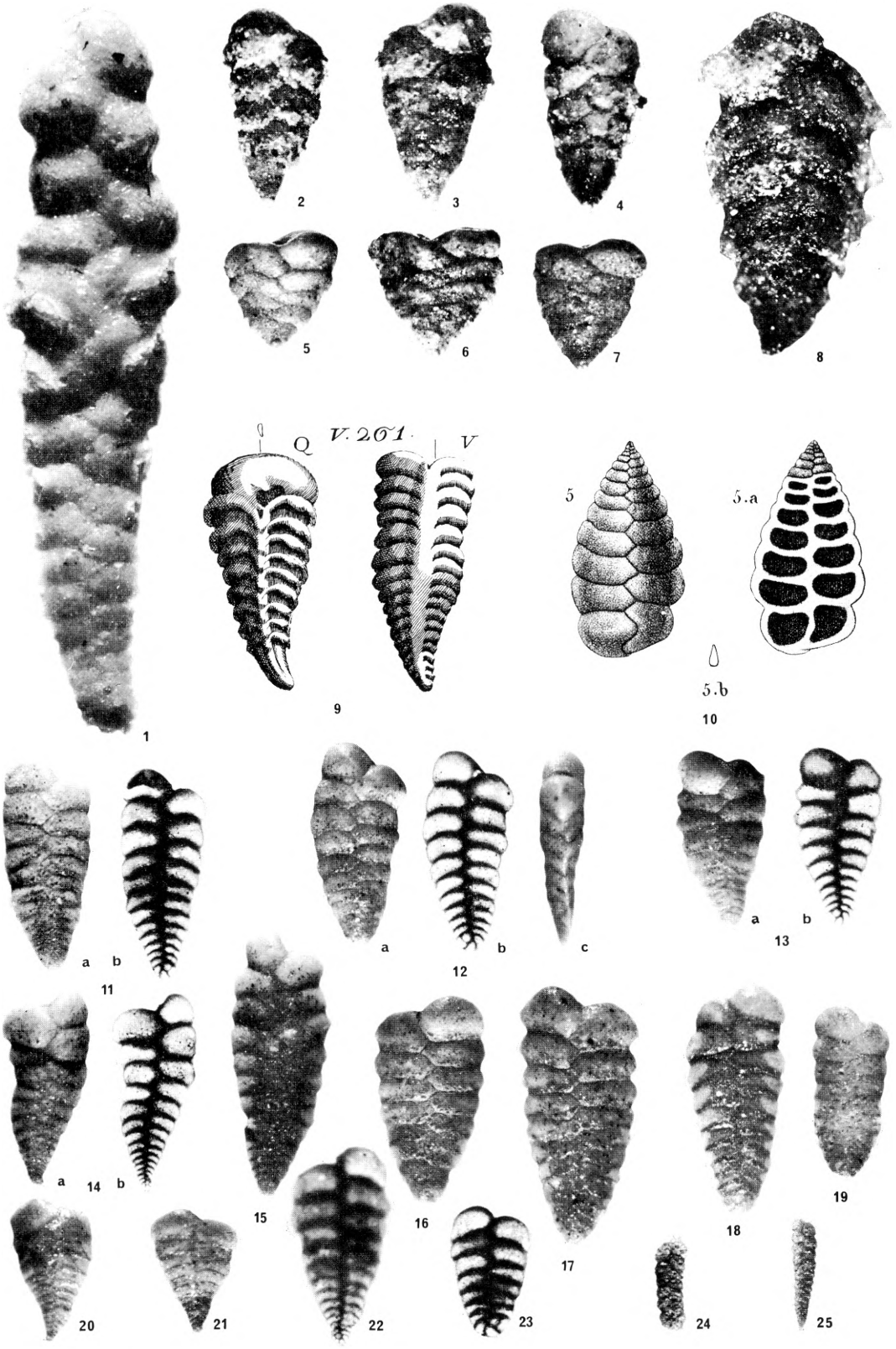

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Plate II

Fig. 1. *Textilina stricta*, Kei Islands, 5°40′ S 132°21′ E, 263 m, Th. Mortensen, St. 48; section of initial part of megalospheric specimen, ordinary and polarized light; p= initial chamber; a = adventitious chamber; 1 = first biserial chamber; 2 = second biserial chamber. 50 ×.

Fig. 2. *Textilina stricta*, Kei Islands, 5°38′ S 132°26′ E, 196 m, Th. Mortensen, St. 7; section of wall showing coarse perforation. 150 ×.

Fig. 3. *Textilina agglutinans*, Banyuls, 42°28′ N 3°11′ E, 50 m, Nørvang St. 5; decalcified section of wall showing perforation. 150 ×.

Fig. 4. *Textilina agglutinans*, Bay of Naples, Walther Bank, 180 m, Hiltermann No. 25 (12934); decalcified section showing perforation. 150 ×.

Fig. 5. *Textilina agglutinans*, Banyuls, 42°28′ N 3°11′ E, 50 m, Nørvang St. 5; Ordinary light and polarized light. Perforation hardly visible before decalcification (comp. figs. 3 & 4). 150 ×.

Fig. 6. *Textularia sagittula*, Bay of Villefranche, 70 m, Y. Le Calvez St. 8; Ordinary and polarized light. 200 ×.

Fig. 7. *Textularia carinata*, Badener Tegel, Sooss, Austria, Miocene; Ordinary and polarized light. 150 ×.

Fig. 8. *Textilina conica*, Banyuls, 42°28′ N 3°11′ E, 50 m, Nørvang St. 5; decalcified section showing perforation of chamber walls and imperforate septa. 150 ×.

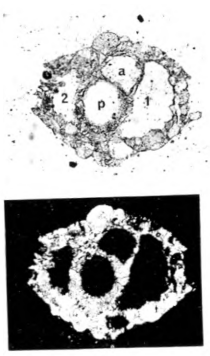
Fig. 9. *Spiroplectammina biformis*, Kattegat, SE of Hirsholmene; thin section; Ordinary and polarized light. 70 ×.

Fig. 10. *Textularia carinata*, Badener Tegel, Sooss, Austria, Miocene. Decalcified section, showing initial planospire of megalospheric specimen. 120 ×.

Fig. 11. *Spiroplectammina elegans*, Kattegat, SE of Hirsholmene; initial planospire; transmitted light. 300 ×.

Fig. 12. *Textularia sagittula*, Bay of Villefranche, 70 m, Y. Le Calvez St. 8; a) decalcified section, ordinary light, showing initial, megalospheric planospire and lack of perforation; b) same section, polarized light, note the insignificant amounts of siliceous grains and the great variation in size. 95 ×.

Fig. 13. *Textilina agglutinans*, Banyuls, 42°32′ N 3°20′ E, 100 m, Nørvang St. 10; decalcified section of microspheric specimen; the adventitious chamber is seen near the initial chamber slightly above the level of the first pair of chambers. 210 ×.



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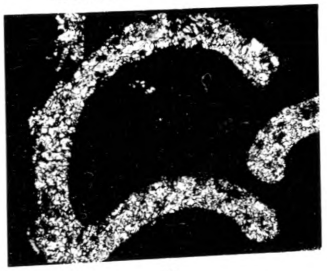

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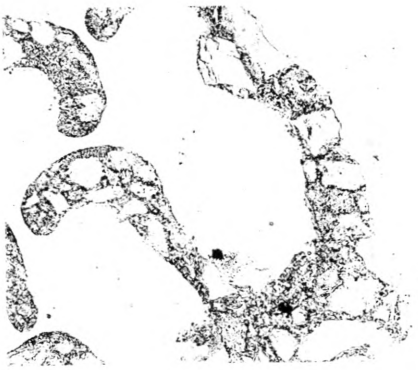

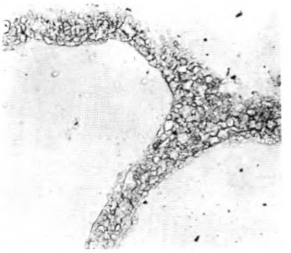

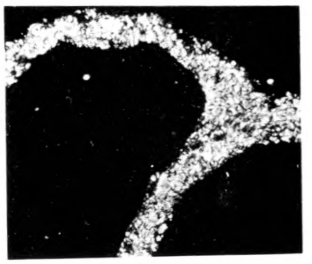

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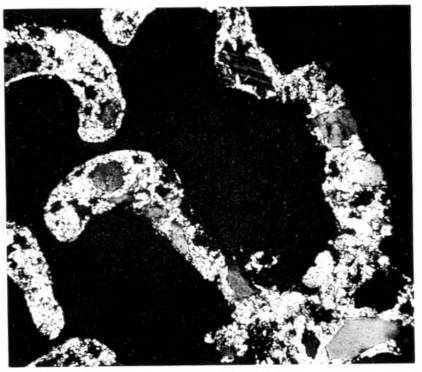

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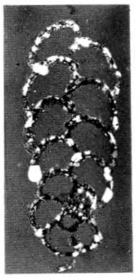

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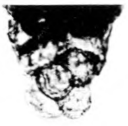

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