Serpulidae from the Senonian and Danian Deposits of Denmark.

By K. Brünnich Nielsen.

With three plates (I–III) and two figures in the text.

CONTENTS

The Material.

The material for these investigations mainly originates with collections of my own from the different localities throughout several years. The Serpulides from Faxe are mainly collected in 1910, when the Hydrocorals were worked on[1]).

Besides my own collections I have received for investigation several Serpulides from Mr. Rosenkrantz and Dr. Ødum, to whom I return my hearty thanks.

Material of comparison from foreign localities I have had from Meudon near Paris, from Trimingham in England and from Rügen and Gross Bülten in Northern Germany, and for this I am greatly indebted to Mr. Harald Faber, who has spared no pains in helping me, and to Dr. Voigt, Dessau, who in several ways has stood by me.

I have gone over the collection of the Mineralogical Museum of the University of Copenhagen in which much of great interest was found,

[1]) K. Brünnich Nielsen, 1919: En Hydrocoralfauna fra Faxe. Avec résumé en français: Une faune d'hydrocoraux de Faxe, et Remarques sur la condition géologique du Danien. Medd. Dansk geol. Foren. Bd. 5. Nr. 16. — D. G. U. 4. Række, Bd. 1, Nr. 10.

among other things some specimens presented by V. HAGENOW, and have gone over the recent material of Serpulides belonging to the Zoological Museum of Copenhagen. For that I take the opportunity of thanking Professor BÖGGILD and Professor AD. S. JENSEN, also Dr. TH. MORTENSEN and Mr. J. P. J. RAVN.

The material is on the whole excellently preserved. On forms from the White Chalk all ornaments are preserved, and even small fragile teeth may be recognized. Also the Serpulides of the Danian are well preserved and allow cleaning for adhesive matter; only specimens from certain parts of the lime-quarry at Faxe in East-Sealand are so thickly covered with calcite crystals that the ornaments have become indistinct.

Most of our Serpulides belong to the epi-fauna; only a few of them live in the mud-bottom, where they either move about freely, like the forms of the genus of *Ditrupa*, or form long, free tubes, which are irregularly contorted, or form elongated tubes, so that the animal may constantly be able to keep in the surface of the mud.

The material exclusively consists of calcareous tubes; there are no remains of the more perishable parts (uncini and setae), and opercula have never, in spite of persistent searching, been found in our Cretaceous.

Fossil Serpulides.

In the prevailing text-books of palaeontology only a very poor treatment is given the Serpulides. In ZITTEL's 'Grundzüge der Paläontologie' 1920 these animals are dismissed very shortly, and a few genera are mentioned: *Serpula* L., *Plocostegus* PHILL., *Protula* RISSO, *Neomicrobis* ROVERETO, *Filograna* BERKELEY, *Vermilia* LAMK., besides *Ditrupa* BERKELEY, *Spirorbis* DAUD., *Pyrgopolon* MONTF.

Turning to the special works, the first of some importance is: SOWERBY: Mineral Conchology of Great Britain, London 1812—1846.

In the first volume from 1812 the following genera are mentioned: *Serpula* L., *Vermicularia* LAMK. (with the synonym of *Vermiculum* MONTF.). In volume VI from 1829 p. 197 a survey with explanations of the then known genera is given:

(P. 197:) SERPULA, *Linn.*

»GEN. CHAR. Shell tubular, variously curved, fixed by a considerable portion of one side; operculum corneous or shelly, pedunculated,

attached to the anterior extremity of an articulated, acephaleous animal whose feathered branchiæ surround its mouth.

The difficulty there always must be in distinguishing the four genera of Annelides that have shelly tubes, when we only have the means of examining the tubes deprived of their animals, has induced me to relinquish the attempt; neither does it appear to be of much importance, since the animals are very similar, and their habits the same.

The following are the four genera alluded to, which are distinguished by the characters attached. They may form subgenera.

Spirorbis. Shell curved into a discoid volute, attached by its lower flattened surface.

Animal furnished with six-pinnated branchiæ and a peltate operculum.

Obs. The shells are mostly minute, often produced beyond the convoluted part, and then irregularly curved.

Serpula. Shell irregularly contorted, fixed by a part of its side; aperture simple.

(P. 198:) Animal furnished with two fan-shaped branchiæ, and a funnel or club-shaped corneous operculum.

Obs. The tubes often assume the same form as the preceding genus; they are generally larger, often very large in comparison.

Vermilia. Shell variously curved, attached by its side; one or more teeth occur upon the edge of the aperture.

Animal furnished with two fan-shaped branchiæ, and a shelly, simple, operculum.

Obs. One or more carinæ upon the tube being produced, form the teeth upon the margin of the aperture: these carinæ do not always extend to the aperture, and are sometimes wanting in a few individuals of the same species as those which have them (see S. ampullacea, tab. 597). The operculum is sometimes conical, sometimes has a tricuspidate apex, and sometimes flat . . . . .

Galeolaria. Shell variously curved, attached by its side; a spatulate process upon the edge of the aperture terminates a double keel along the back. Operculum shelly concave; in its disk are inserted a number of lanceolate moveable pieces.

Obs. This is the most distinct genus; but should it occur among fossils, it would be difficult to discover, unless the operculum should happen to be preserved . . . . . .

Many Serpulæ form septa in their tubes, as the animals proceed from the smaller extremities towards the larger, in consequence of their increased thickness."

After this account SOWERBY gives up all generic division of the Serpulites and calls all these animals '*Serpula*'.

Of the species mentioned by him the following are pointed out here, because they may be of importance to the study of the species which are already found with us or which may be found.

(P. 199:) SERPULA ampullacea.

Tab. DXCVII. — figs. 1. 2. 3. 4. and 5.

SPEC. CHAR. Thick, irregular, antiquated, with a globose enlargement near the entire aperture; more or less carinated upon the back; surface of attachment expanded, thickened . . . . . .

A large thick species, varying in form according to the surface to which it is fixed, often choosing a thin cylindrical substance, when it becomes discoid, with a perforation in the centre . . . . . It has sometimes a carina extending its whole length . . . . . ., sometimes only for a part of it . . . . . ., and at other times scarcely to be discovered . . . . . The surface is often marked with small undulating lines, that give it in parts a granulated appearance . . . . . .; other specimens are smooth . . . . . All these varieties, when full grown, are considerably thickened before the aperture is finished; so that the extremity appears to be inflated, but the inside remains cylindrical . . . . . .

(P. 200:) SERPULA (VERMILIA?) macropus.

Tab. DXCVII. — fig. 6.

SPEC. CHAR. Tube thick, slightly curved, rapidly increasing, triquetrous; aperture small, round, elevated by the thick mass that fixes the tube; front sulcated . . . . . .

SERPULA (SPIRORBIS?) granulata.

Tab. DXCVII. — figs. 7 and 8.

SPEC. CHAR. Discoid, thick; surface granulated.

A pretty Serpula, composed of little more than one whorl, ornamented by rows of very prominent granules; it is about two lines in diameter.

Attached to a Terebratula in Chalk. . . . . .

(P. 201:) SERPULA Plexus.

Tab. DXCVIII. — fig. 1.

SPEC. CHAR. Cylindrical, smooth, very much curved, entangled into dense masses; diameter about half a line, diminishing very slowly from the aperture.

A common species that occurs in compact masses in Chalk.

(P. 203:) SERPULA tetragona.

Tab. DXCIX. — figs. 1 and 2.

SPEC. CHAR. Tube very long and narrow; free for a great part of its length; externally four-sided, with prominent angles; aperture round . . .

Serpula quadrangularis of Lamarck is probably a distinct species, perhaps even a Vermetus.

SERPULA rustica.

Tab. DXCIX. — fig. 3.

SPEC. CHAR. Tube externally four-angled, angles obtuse; as the tube increases, the angles are variously bent and interrupted, at length becoming irregular convexities arranged about a cylindrical tube.

(P. 204:) SERPULA articulata.

Tab. DXCIX. — fig. 4.

SPEC. CHAR. Externally square, furnished with rings, composed of four oval tubercles each, placed at remote irregular distances; angles rounded; aperture round.

SERPULA vertebralis.

Tab. DXCIX. — fig. 5.

SPEC. CHAR. Tube externally square, its angles set with longitudinal, blunt tubercles disposed in rings placed at short regular distances.

Somewhat smaller than the last, its tubercles are more regularly arranged and more numerous, four in each ring.

(P. 227:) SERPULA runcinata.

Tab. DCVIII. — fig. 6.

SPEC. CHAR. Repent, subtriangular, with three distinct serrated or lacerated keels upon its back; aperture round.

(P. 228:)

SERPULA obtusa.

Tab. DCVIII. — fig. 8.

SPEC. CHAR. Repent, smooth, obtusely quadrangular, with an obtuse thick keel along the flat back; edge of the aperture produced as a short cylinder beyond a bilobed thick margin; base expanded.

SERPULA fluctuata.

Tab. DCVIII. — fig. 5.

SPEC. CHAR. Repent, smooth, circular, with five regularly waved low keels.

[Vol. VII:]
(P. 51:)

SERPULA trilineata.

Tab. DCXXXIV. — fig. 6.

SPEC. CHAR. Linear, attached throughout, tortuose, minute; attached surface broad; on the back are three slightly elevated keels.
SYN. Vermilia trilineata, *Morris, Catal.* 67.

SERPULA heptagona.

Tab. DCXXXIV. — fig. 7.

SPEC. CHAR. Cylindrical, with seven keels; free except near the apex, where it is conical, with 3 to 5 keels curved and attached; lines of growth strong; keels often expanded into variously undulating wings. Operculum funnel-shaped, its disc radiated.

(P. 53:)

SERPULA Ilium.

Tab. DCXXXV. — fig. 3.

SPEC. CHAR. Filiform, slender, smooth, curled up into irregular masses; shell rather thick; aperture round, its diameter $^1/_3$rd of a line.
SYN. Serpula Ilium, *Goldfuss*, 234, t. 69. f. 10.

(P. 54:)

SERPULA plana.

Tab. DCXXXV. — fig. 4.

SPEC. CHAR. Attached, involute, discoid, smooth; base broad; aperture slightly expanded, nearly circular.
SYN. Serpula plana, *Woodward, Geol. Norfolk*, t. 5. f. 9. *Morris, Catal.* 66.

SERPULA pusilla.

Tab. DCXXXV. — fig. 5.

SPEC. CHAR. Attached in part, involute, subdiscoid; the free portion erect, cylindrical; base expanded; surface obscurely granulated; aperture slightly contracted.

SERPULA Turbinella.

Tab. DCXXXV. — fig. 6.

SPEC. CHAR. Wound into the form of an elongated cone attached by its apex; surface nearly smooth; whorls flattened, aperture contracted."

In 1840 v. HAGENOW published a monography on cretaceous fossils from Rügen, and in this the Serpulides are discussed. He does not try to divide them generically, but calls all of them '*Serpula*'. His principles of division are: spirally enrolled, cylindrical, 4-sided and 7-sided tubes. As his treatise is of considerable interest to the treatment of our own cretaceous forms all his species are gone over here.

1) Spirally enrolled tubes:

Serpula granulata Sow.: It is easily known as a form of *Spirorbis* with longitudinal striae dissolving into rows of close-set granules. I have seen specimens from Rügen and am therefore sure to be able to recognize them in our own White Chalk.

Serpula aspera v. Hag. is also a *Spirorbis*-form. There is no figure of it, but the Mineralogical Museum of Copenhagen is in possession of a specimen from Rügen, presented by v. HAGENOW, from which it will be easy to recognize.—It has two visible whorls, and has but a small surface of attachment, is transversally wrinkled, but is also in possession of numerous very fine longitudinal striae, so that it becomes more scabrous than wrinkled.

Serpula trochiformis v. Hag. There is a figure of it, and it is recognizable; I am in possession of specimens from Rügen.

Serpula conica v. Hag. There is also a figure of this species, and it is very characteristic; I possess specimens from Rügen.

Serpula umbilicata v. Hag.: The fine tube is irregularly finely striated and furrowed in longitudinal direction; shows faint rings of growth. It is discoidally convoluted and completely attached by its 4—5 whorls. As the tube increases in strength, a rather deep umbilicus is being formed, in which only the two last whorls are visible. Surface of attachment forms an expanded seam. There is no figure of it, and I have not seen anything that might resemble this form.

Serpula caudata v. Hag. is also a *Spirorbis*-form. The tube is smooth with a faint furrow on the dorsal side. It begins with a few irregular whorls before it forms its spirally enrolled two or three whorls which rise pointedly screw-formed. There is no figure of it, and it does not seem to be found with us.

Serpula pygmaea v. Hag. is a *Spirorbis*-form of the size of a grain of sand. Somewhat more than one whorl. Transversal folds sparingly. Though there is no figure of it, the description is so plain that I think I have found this form in our Senonian and Danian deposits.

Serpula bardensis v. Hag. Though v. HAGENOW has a figure of it, it has not been possible to find the said species in the material that till now has been provided from our Cretaceous.

2) Cylindrical tubes:

Serpula granulosa v. Hag. is of the same thickness as *S. gordialis v. Schloth.*, smooth and with close-set, granulated rings.

Serpula implicata v. Hag. is identical with *S. gordialis* and *S. ilium Sow.*—Our museum possesses a specimen from Rügen, presented by v. HAGENOW.

Serpula maeandra v. Hag. is formed of fine wound tubes which are fixed to a support. This species may perhaps be the incipient stage of *S. gordialis v. Schloth.*

Serpula ampullacea Sow. is a coarse form with thick walls with intervals leaving thick rings as marks from former margins of the aperture. According to REUSS it may be spirally enrolled.

3) 4-sided tubes:

Serpula canteriata v. Hag. The figure plainly shows that it is a species of *Ditrupa*. Our museum possesses a specimen from Rügen, presented by v. HAGENOW.

4) 5-sided tubes:

Serpula subtorquata v. Münster has according to a drawing in a work by REUSS a sharply cut 5-radiated cross-section. v. HAGENOW has no figure of it.

Serpula undulata v. Hag. (= *S. fluctuata Sow.*) is adherent in its first stage, later on it becomes free. It has on the dorsal side three undulated longitudinal crests; when it becomes free, it gets five. It is a common form which, with few modifications, goes through several stages of the Cretaceous. Our museum possesses a specimen from Rügen, presented by v. HAGENOW.

Serpula costata v. Hag. is one inch long, fixed. Its sides are finely longitudinally furrowed, its dorsal side has a sharp keel and is covered with close-set, sharp, transverse ribs that show on the surface of attachment like fine teeth.—There is no figure of it, nor is it refound.

5) 7-sides tubes:

Serpula heptagona Sow. starts like a 3-keeled *Serpula* fixed to *Belemnites* and other foreign objects; later on it gets two additional keels, and where it becomes free two more. v. HAGENOW has no figure of it.

The result of this review is then that we among v. HAGENOW's seventeen forms only refind eight of them in our White Chalk.

v. HAGENOW sent to our museum originals of some Serpulides from Rügen. Here I repeat their names: *S. aspera, S. canteriata, S. conica, S. granulata, S. heptagona, S. implicata, S. subtorquata, S. trochiformis, S. undulata.*

In REUSS: Versteinerungen der böhmischen Kreideformation from 1845—46 all forms are divided as with v. HAGENOW, according to the cross-section of the tube, into 3-sided, 4-sided, 5-sided, 6-sided and cylindrical forms. In this collection of species not much is consistent with the Danish forms besides *S. gordialis,* of which is found an excellent figure.

In QUEENSTEDT: Handbuch der Petrefactenkunde (1885) are mentioned a great number of Serpulides, especially from the different Jurassic deposits, but no attempt has been made to divide them into genera. None of the species figured there seem to appear in our Senonian and Danian deposits beyond the well-known *S. gordialis;* it is however of interest to see how near the Jurassic forms are to the Cretaceous ones.

O. A. L. MÖRCH has in his treatise: Revisio serpulidarum (Naturh. Tidssk. 3. R. I 3) from 1863 a list of all known Serpulides and has also the names of several fossil forms. Among those of interest may be mentioned:

Spirorbis conica v. Hag.

— *trochiformis v. Hag.*

Ditrypa canteriata v. Hag.

— *liberaeformis M. U. H.*[1]) from the locality of Terkelskov in Sealand. Besides he has a few remarks concerning the generic relationship.

Hydroides is one of the forms that is nearly always known by the shell having an almost square section, is very much oblong and is all over of an even thickness. *Spirulaea* BRONN, is regularly spiral-formed like a crosier.

Thus MÖRCH has tried also to get the fossil Serpulides to fit into the classification of the recent ones.

[1]) *M. U. H.* = Museum Universitatis Hauniensis.

The Structure of the Tubes of Serpulides.

The Serpulides form a well-defined family within the order of the *Polychaetae*.

As the only thing that has been found fossil in the sediments is the calcareous tube in which the animal is staying all through life, a closer description of the structure of the more perishable parts—operculum, setae and uncini—which systematically play such a big part in recent Zoology, is omitted. Yet, it is known already from long ago that there is a possibility for finding remains of the calcareous opercula. Already SOWERBY knew the operculum of *S. heptagona Sow.* from English cretaceous deposits. Also quite recently finds of this kind have been made, W. SCHMITT[1]) having found the operculum of *Serpula heptagona Sow.* in tertiary sediments.

It is however not to be expected in this way to be able to arrive at a valuation of the classification of the Serpulides as I, in spite of methods of investigation that should answer the purpose, if the opercula were found, have not once succeeded in finding any operculum of Serpulides. Possibly most fossil Serpulides have had chitinous opercula.

The tube, a feature common to the whole family, is formed of two calcarous layers of which the innermost, which directly encircles the animal, has a circular circumference, and is smooth on the inside. In tubes, more or less elongated, this inner layer may be closed in different ways as either dissepiments are formed, or the tube is thickened in such a way that it becomes closed. By this is obtained that the foremost, occupied part of the tube may be separated from the hindmost, uninhabited part.

The external layer, which may be of different strength, gives the external form of the tube, being provided with decorations of different kinds.

1) The external layer may as a close cylindrical tube enclose the internal tube, and has either quite a smooth surface or a surface with longitudinal striae.

If these tubes are fastened to a foreign object, they generally form elongated whorls of an even thickness in their whole length and are only fastened by a small part of their surface. If the tubes

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[1]) WILHELM SCHMITT: Über Opercula von Serpula etc. Zeitschrift für Geschiebeforschung Bd. III. Berlin. 1927, S. 138.

are free, they form coiled masses in which each separate part of the tube may easily be divided from the others. If these coils are being crushed, they disperse into small, slightly curved bits.

2) The external layer may expand and merge into the corresponding layer of the former whorls of the animal, so that some knotty contorted lumps are formed, but the separate whorls cannot be distinguished, and they do not disperse, when the lumps are being crushed.
3) The external layer may also merge into the external layers of the neighbouring, parallel-growing individuals, so that net-like masses consisting of a colony of homogeneous individuals are formed.
4) If the animal is spirally enrolled, the external layers of the separate whorls often form a smooth cover all round the animal, so that the demarcation between the separate whorls are only with difficulty discernible. Sometimes the external layer expands like a mantle over several of the older whorls so that only a few of them may be distinguished from the outside.
5) The external layer may expand to the sides so as to cover the foreign object to which the shell has been fixed, and in such a way that the transition from the support to the surface of the tube becomes smooth. The external layer may in this case become many times broader than the inner-tube.

The Ornamentation.

The external ornamentation may be of different kinds. Across the tube may be found inspissations with regular intervals; these mark pauses in the growth, as the thickened edge of the aperture remains, when the animal continues its growth. These margins of the aperture may not only be inspissations of the external layer, but they may form funnel-shaped expansions in the bottom of which the new tube grows out. Besides these old rings also other less pronounced lines of growth may be found as transversal striae across the tube.

Another form for transversal ornamentation consists of irregular transversal folds of confluent, delicately curved lines, which sometimes can only be seen under a magnifier. On forms making bent, completely attached tubes, these transversal lines are often

continued on the rim made of the external layer, and may cause the forming of tooth-like irregularities in the edge of the rim, or may cause the edge to be rippled.

The most prominent ornaments are the longitudinal ones. On the dorsal side of the tube is very often formed a crest which, at the aperture of the tube, projects like a tooth. This crest may be smooth, or dentated, or regularly rippled.

Besides this crest (keel) there may be others generally symetrically arranged in proportion to the dorsal crest, so that there may be 3—5—7 crests, in strength equal to the dorsal crest, or, and this is often the case, weaker than that.

There may also be two dorsal crests, so that the middle of the back becomes free, and the cross-section of the tube becomes square.

The crests may be delicately projecting like low lamellae, and when crossed by the transversal ornamentation, there will very often be rows of tubercles, so that the whole tube may have quite an uneven tubercled, or spined appearance.

Sometimes the crests are not sharp, but form rounded folds along the sides of the tube, and with furrows between.

As said before the crests (the keels) may be evenly distributed all over the surface of the tube, but may also be limited to a few places, especially to the centre-line of the back.

If an elongated, adherent form raises itself from the support, and grows out freely, the external layer will cover the internal layer, also on the ventral surface of the tube, and it will here form an ornamentation much like that on the dorsal surface, but along the centre-line it will generally be visible where the two side-parts of the external layer meet.

External Shape.

The external shape of the tubes is very varying:

1. As mentioned before very long, adherent tubes are often formed, more or less regularly contorted, and of an even thickness all over. The oldest part is often destroyed.
2. The smooth, free tube may form contortions in which the separate whorls may easily be distinguished.
3. The tubes may be gathered in great masses of individuals, the

tubes of which are partly cemented to each other, and form big, reticular masses of nearly parallel tubes.

4. Irregularly enrolled coils may be formed, into which the external layers of the whorls are cemented to each other, so that the surface of the whole tube is smooth, and shows but indistinctly the separate whorls.
5. The tube may be regularly spirally enrolled. The whorls may either be on the outside of each other so as to form a flat disk, with a big or small surface of attachment, or the whorls may be on the top of each other so that the tube becomes conversely conical or cylindrical. The whorls may either extend to the axis of the cone, or they may be placed in such a way so as to form a funnel-shaped hollow, or a narrow canal in the axis. It may be attached to the support, either by a small, almost dot-like area of adhesion, or by a broad, lower one.
6. The tube may be slightly waved, or quite straight, with a strong increase in thickness; adherent in almost its whole extention.
7. The tube may be free in its whole extention, open at both ends, generally slightly curved, and with a narrow aperture.

Classification.

The thought of classifying the Serpulidae systematically, according to the construction of the tube, has repeatedly been put forth (f. i. SOWERBY), but it has quickly been dropped again, sometimes because the tube of the caught animal has not even been known, the animal having fallen out of it.

The authors that have occupied themselves with the classification of these animals are in the first place three Scandinavians: MÖRCH[1]), MALMGREEN[2]) and LEVINSEN[3]), and of late the American naturalist CATHARINA BUSK[4]).

The principles of classification of these authors are far from being based on the shell. They mainly use the look of the operculum as well as the aspect of setae and uncini. All these things

1) O. MØRCH: Revisio serpulidarum. Naturhist. Tidsskrift 3 R. I. 3. 183.
2) A. I. MALMGREEN: Annulata polychaeta. Helsingfors. 1867.
3) G. M. LEVINSEN: Nordiske Annulata. Vid. Medd. naturhist. Forening. 1882—1883. Kbhvn.
4) C. BUSK: Tubicolous Annelides from the Pacific Ocean. Harriman. Alaska Expedit. Washington. 1910.

are completely lacking in the fossil finds, and it is therefore of some importance that we, in LEVINSEN's book, after a table in which the above mentioned principles of classification are used entirely, also find another table, by which it is possible to determine the genus from the aspect of the shell. Looking closer into this table, it is easy to see that several things may be conveyed to the fossil shells, and for that reason it follows here in its entirety.

1. Tube free, not attached to foreign objects, elongate, narrow, pointedly curved, is very much like *Dentalium*, but has a narrow aperture. *Ditrupa* BERK.

1. Tube not free, but in varying extension, sometimes by its full length, sometimes only by one end (the apex) attached to foreign objects, or clustered together.
   2. Tubes in great masses and many layers attached to each other so as to form reticular, latticed masses (tubes filiform, bent). *Filograna* OKEN.
   2. Separate tubes, more or less close at the side of each other, or on the top of each other; they do not form reticular latticed masses.
      3. Tubes forming regular whorls, as a rule in their whole length, more seldom only with the apex, in such a way that the whorls either touch each other (by which snail-like tubes are formed), or the whorls are free; in the latter case either spirally ascending, or lying in the same plane (generally very small forms). *Spirorbis* DAUD.
      3. Tube most often irregular and more or less bent, more seldom stretched out, but never (except by twisting round other tubes) wound in regular whorls (generally big forms).
         4. Opaque tubes with thick walls (apex tapering into three strong teeth). *Placostegus* PHIL.
         4. Calcarous tube, walls not specially thick.
            5. Cross-section of tube triangular. The tube has on the dorsal surface a single keel, in front tapering into a more or less distinct tooth.
               6. Tube smooth with faint transversal striae. Tooth strongly developped. Big form. *Pomatocerus* PHIL.
               6. Tube with distinct transversal striae. Tooth not much developped. Small form. *Chitinopoma* LEVINSEN.

5. Section of tube round or irregularly angular; either no keel or several sharp keels.
   7. Tube reddish, most often (or always) with a row of sharp, most frequently toothed keels (aperture often widened and tube often with offsets). *Serpula* PHIL.
   7. Tube white, without sharp keels.
      8. Tube without ringed offsets.
         9. Tube more or less bent, adherent by its whole length, or by the greatest part of it. *Hydroides* GUNN.
         9. Tube partly stretched out, in a great extent free. *Hyalopomatus* MARZ.
      8. Tube with ringed offsets (often stretched and partly free). *Apomatus* PHIL. and *Protula* RISSO.

Although this table renders many holds for a division of genera of the fossil forms, there are still so many difficulties in using the recent description of genera, as each genus must have additions and corrections to make the fossil forms fit within the particular frames, that it seems to me more appropriate to set up a row of new genera, where the shape of the shell should exclusively be of importance. The system is of course quite unnatural, risking to get species that have nothing to do with each other into the same genus; but as it seems impossible to find deciding momenta for a more natural division, the deciding parts not being found, a row of exclusively fossil genera after the following scheme is set up.

1. Tube free, bent, evenly increasing in thickness, with an entire mouth evenly rounded from the external side towards the aperture. *Ditrupula.*
2. Tubes gathered in colonies, elongate, twisted, gathered in bunches forming a meshy web. *Filogranula.*
3. Tube labyrinthically coiled, evenly thick in its whole length. The separate whorls free, not cemented together. *Glomerula.*
4. Tube irregularly contorted, often coiled. Tube evenly thick in its whole length. The separate whorls of the coil are cemented together, so that the surface of the coil does not always show the suture between the separate whorls. The coil is as a rule attached to foreign objets. *Cementula.*

5. Tube elongate, more or less wound, curved from side to side, adherent by nearly the whole of its length; of an even thickness all over. *Proterula.*
6. Tube comparatively short, more or less wound from side to side, cemented by most of its length to some foreign object. The thickness strongly increasing from the apex towards the aperture. *Serpentula.*
7. Tube wound in spirally enrolled whorls, either lying in the same plane, or forming spirally enrolled, inversely conical, or cylindrical bodies. *Spirorbula.*

The names are as far as possible in accordance with the names of the corresponding recent genera (*Protula, Serpula, Spirorbis, Ditrupa, Filograna*). As terminal syllable is, as far as possible, added the syllable *ula* (of the name of '*Serpula*').

In this way quite a new basis for classification of the fossil Serpulidae is being made, without having made any attempt to move the setting of the recent genera.

The Species.

For practical reasons I shall divide the description of the separate species in three parts: 1) The Serpulidae from the White Chalk, 2) The Serpulidae from the main facies of the Danian Bryozoan Limestone and lime-sand, 3) the Serpulidae from the Danian Coral Limestone.

The few species common to all groups will only be described in one of the groups: the first one in which they appear. The Serpulidae from the Coral Limestone are kept as a special group, partly because they are connected with the corals and hydrocorals as an epifauna, partly because there, in the structure of them, is a common feature that seems to be of some importance, also with regard to the understanding of the biology of the Coral Limestone.

Serpulides from Senonian deposits in Denmark.

In the Danish White Chalk the following species are found:

Ditrupula canteriata v. Hag. sp. *Ditrupula Hagenowii n. sp.*
— *cicatricata n. sp.* — *Triminghamiensis n. sp.*

Glomerula gordialis v. Schloth. sp.
Cementula sphaerica n. sp.
Serpentula ampullacea Sow. sp.
— *cincta Goldf. sp.*
— *fluctuata Sow. sp.*
— *idmonoides n. sp.*
— *tetragona Sow. sp.*
— *tuberculifera n. sp.*
Spirorbula aspera v. Hag. sp.
— *conica v. Hag. sp.*
— *cylindrica n. sp.*
— *granulata Sow. sp.*
— *pygmaea v. Hag. sp.*
— *tortilis n. sp.*
— *trochiformis v. Hag. sp.*

Ditrupula canteriata v. Hag. sp.

Pl. I. Figs. 1—2.

Serpula canteriata v. Hag. 1840. v. HAGENOW: Monographie der Rügenchen Kreideversteinerungen. Neues Jahrbuch für Mineralogie, p. 668, pl. IX, Fig. 18 a-c.

Tube recognizable by its rounded four-sided cross-section, its regular bent form, tapering end, and its constricted aperture. v. HAGENOW's figure distinctly shows the typical form of *Ditrupa*. The sides may sometimes be provided with fine, transversal wrinkles.

Fragments of the tube may be mistaken for the remains of another four-sided species, starting as a fixed *Serpula*, but later on growing out freely, viz. *Serpula tetragona Sow.*—This adherent form is also known from the Danish White Chalk, especially from the Jutland localities.

Localities: Stevns. Møen. Aalborg, Randrup, East of Fjerritslev, Nørre Uttrup and other places.
It is also known from Rügen.

Ditrupula cicatricata n. sp.

Pl. I. Figs. 3—4.

Tubes slightly curved, increasing strongly in thickness. Typical *Ditrupa*-aperture and *Ditrupa*-growth. Outer surface smooth, only broken by irregular, scar-like, longitudinal cavities that may be found in greater or smaller numbers. The cavities may be wanting on smaller individuals, so that the tube is almost smooth.

Localities: Stevns. Møen. Aalborg.
It is also found at Tullstorp (Scania).

Ditrupula Hagenowii n. sp.

Pl. I. Figs. 5—6.

Tube slightly curved, strongly built, faintly wound round its axis, becomes thicker towards the front part, where the constricted aperture is found. Along the sides are up to seven longitudinal keels, more or less broad.

I have a specimen of *Ditrupula Hagenowi* from Rügen which was defined as *Serpula heptagona Sow.*, but from the description, this species is to have seven keels in the free part of the tube, and these keels should be sharp and may be winged.

Localities: Stevns. Møen.
As mentioned before, it is also known from Rügen.

Ditrupula Triminghamiensis n. sp.

Pl. I. Figs. 7—8.

From the upper grey chalk at Trimingham I have some fragments of a *Ditrupula*-species, easily recognizable by the regular curve, the tapering form and the constricted aperture. It is very much like *D. canteriata v. Hag.*, but it has five longitudinal keels divided by low furrows. Surface smooth. It has formerly been known, but has been incorporated with *D. canteriata v. Hag.*, as a five-sided variety. As four-sided forms are not found at Trimingham, and four-sided forms are practically exclusively found in Danish cretaceous deposits, and as no transition forms are found between them, it is most reasonable to keep them apart, especially as they seem to be of some Zonal importance. Found in Denmark, but rare.

Localities: Stevns. Møen.
Plentiful at Trimingham (upper grey chalk).

Glomerula gordialis v. Schloth. sp.

Pl. I. Figs. 9—11.

Serpulites gordialis v. Schloth. 1820. v. SCHLOTHEIM: Die Petrefactenkunde auf ihrem jetzigen Standpunkte, p. 96.

Serpula implicata v. Hag. 1840. v. HAGENOW: Monogr. Rügen. Kreideverst. p. 668, pl. IX, Fig. 17.

— *ilium Sow.* 1846. SOWERBY: Min. Conchology Vol. VII, p. 56, pl. 635, Fig. 3.

Easily recognizable by the long, cylindrical tubes, that are twisted together into bigger or smaller coils without any cementing between the separate whorls, and with no indication of regularity in direction and form of the whorls. The coils are generally free, but sometimes you find coils that, in a certain length, are cemented to foreign objects, whereafter the tube becomes free, and forms free coils. Sometimes the tube continues its growth with long, straight pieces followed by new coils.

The thickness of the tube is so to speak the same in the whole of its length, but is rather varying in the separate specimens; the thickest tubes are found in the White Chalk, and in certain parts of the Younger Danian (Herfølge in Sealand), the thinnest ones in the rest of the Danian (f. i. Rejstrup in Funen). If a considerable material is at hand, we shall soon see that the thickest ones and the thinnest ones are connected to each other by smooth transitions, so that there is no reason to set up more species in spite of the difference in thickness of the extreme forms.

Localities: Lower Senonian: Bavnodde Greensand (Isle of Bornholm).
Upper Senonian (White Chalk): Stevns. Møen. Nørre Uttrup, Mariager, Aalborg, Søndbjerg, Tinbæk and other Jutland localities.
Older Danian: Stevns, Kagstrup. Jutland localities.
Younger Danian: Saltholm, the port of Copenhagen, Frederiksholm, Herfølge (Limestone detritus and Bryozoan Limestone), Faxe (Coral Limestone and Bryozoan Limestone). Rejstrup. Bredstrup (near Grenaa) and other Jutland localities.

Is moreover known from Scania: Tullstorp (White Chalk) and Ignaberga (Upper Senonian), from Rügen (White Chalk) and from Chatham (the *Cor-testudinarium* zone).

Cementula sphaerica n. sp.

Pl. I. Fig. 12.

Tube strongly curved, wound, and the separate whorls cemented together by their outer layers, so that they are difficult to distinguish from the outside, all the furrows between them being smoothed down.

The specimens from the White Chalk are easily distinguished from the corresponding Danian specimens by their small dimensions and their almost spherical form of the coils.

Localities: Nørre Uttrup.
Is also known from Tullstorp (Scania).

Serpentula ampullacea Sow. sp.

Pl. I. Figs. 13—16.

Serpula ampullacea Sow. 1829. SOWERBY: Min. Conchology, Vol. VI, p. 199, pl. 597, Figs. 1—5.
— — — 1840. v. HAGENOW: Mon. Rügen. Kreideverst. p. 668.
— *laevicollis Br. N.* 1926. ØDUM: Studier over Daniet i Jylland og paa Fyn. D. G. U. II. Række Nr. 45, p. 164.
— *proboscis Br. N.* 1926. ØDUM: Studier over Daniet i Jylland og paa Fyn. D. G. U. II. Række Nr. 45, p. 166, pl. II, Fig. 2.

The species has a thick, irregular tube of considerable dimensions. With certain intervals are found roundish (sometimes ball-like) inspissations round the tube. This is often the case at the aperture. The shell often starts as a narrow tube, quickly increasing in thickness, slightly bent, but it may also begin with a spiral whorl like a *Spirorbis*. In time the tube becomes free and has then rather a cylindrical form. The surface is generally quite smooth, but may also have finer or coarser wrinkles across the tube. Consequently it is a very varying form, sometimes causing some difficulty at the determination; but characteristic are the big dimensions, the thick tube, and the ringed inspissations. It is therefore only reasonable to assume that *S. proboscis* of Mr. ØDUM is the free end of a *S. ampullacea*.

Localities: White Chalk: Stevns.
Older Danian: Stevns. Common in Jutland localities.
Younger Danian: Saltholm. Herfølge, Faxe. Common in Jutland localities.

Is moreover known from Oppmanna (Scania), Rügen, Norwich, and other places.

Serpentula cincta Goldf. sp.

Pl. I. Figs. 17—19.

Serpula cincta Goldf. 1831. GOLDFUSS: Petrefacta Germaniae, S. 237.

The form is like that of an elongate *Serpula* which in its cemented part has three faint keels, with certain intervals supplied with tubercles, and sometimes slightly waved. With rather regular intervals are found old margins of the aperture as rings round the tube, with projecting tubercles in the edges of the tube. Later on the tube grows out freely and becomes five-sided. The margins of the aperture then stand out very strongly and may become spined at the five points of the angles.

Localities: Stevns. Aalborg, Nørre Uttrup, Rær.
Is also found at Gr. Bülten (Hannover).

Serpentula fluctuata Sow. sp.

Pl. I. Fig. 20.

Serpula fluctuata Sow. 1829. SOWERBY: Min. Conchol., Vol. VI, p. 228, pl. 608, Fig. 5.
— *undulata v. Hag.* 1840. v. HAGENOW: Mon. Rügen. Kreideverst., p. 668.

Tube adherent to a certain extent, whereupon it rises freely. When it has reached full growth, the tube is five-sided with three keels, one along the middle of the back, one on each side. These keels are sharp, low, and the upper free margin is remarkably regularly flexuous. When the tube becomes free, it gets five keels.

Localities: Stevns. Møen. Nørre Uttrup.
Is also found in Upper Chalk at Norwich.

Serpentula idmonoides n. sp.

Pl. I. Fig. 21.

Two fragments have been found of a *Serpula* so peculiar, that I cannot refrain from mentioning it. The fragments are cemented to the under side of *Bryozoa* colonies. The tube has a triangular cross-section, and a keel formed by tubercles. Along the sides of the tube are seen transversally placed, small crests, slightly granulous. The total look of it is quite the same as of a *Bryozoa* colony of the Idmoneid-structure. Thus we have a *Serpula* form that tries to imitate the support to which it is fastened.

Locality: Nørre Uttrup.

Serpentula tetragona Sow. sp.

Serpula tetragona Sow. 1829. SOWERBY: Min. Conch., p. 203, pl. 599, Figs. 1—2.

Tube very long and narrow, free by a great part of its length, section four-sided with somewhat projecting edges. Aperture round, but the mouth is not constricted; the four edges of the tube may project slightly over margin.

Jutland localities.

Serpentula tuberculifera n. sp.

Pl. I. Figs. 22—23.

I have only found fragments of the tube of which one or two are cemented to a *Bryozoa* colony. Tube 5—7-sided with 5—7 projecting keels formed by well divided tubercles. The keels are not flexuous, and the tubercles are not so close to each other as on *Spirorbula granulata Sow.*

Localities: Møen. Aalborg, Nørre Uttrup.

Spirorbula aspera v. Hag. sp.

Pl. I. Figs. 24—25.

Serpula aspera v. Hag. 1840. v. HAGENOW: Mon. Rügen. Kreideverst. p. 666.

Tube of the ordinary *Spirorbis*-form with a big or small surface of attachment; spiral either dextral or sinistral. On the external surface is only seen the last whorl covering the former ones. Marks of 3—4 whorls are seen on the attached side. Surface of the tube apparently smooth, but under a magnifier may sometimes be seen rather close transversal striae, and very faint longitudinal ones.

v. HAGENOW has no figure of the species, but the Mineralogical Museum of Copenhagen is in possession of a specimen from Rügen, presented by v. HAGENOW, so that the definition of the Danish forms is sure enough.

Localities: Stevns. Møen.
Is also found at Rügen and at Trimingham (upper grey chalk).

Spirorbula conica v. Hag. sp.

Pl. I. Figs. 26—28.

Serpula conica v. Hag. 1840. v. HAGENOW: Mon. Rügen. Kreideverst. p. 666, pl. IX, Fig. 15.

Tube spirally enrolled, forming a regular cone with the point downwards, and the mouth at the upturned basis of the cone. The separate whorls have joined so intimately that it is difficult to distinguish them on the surface of the shell. The tube has a rather sharp edge, and that is the reason why the basis of the cone is always sharp-edged.

Localities: Stevns. Møen. Aalborg, Randrup and other Jutland localities.

Is also known from Rügen.

When VOIGHT refers it to the Danian deposits, it must be due to a mistake; perhaps he mistakes it for the nearly-related *S. ascendens Br. N.*

Spirorbula cylindrica n. sp.

Pl. I. Figs. 29—30.

Tube forms, with its regular, connated whorls, an upright, hollow cylinder. Section of tube four-sided. The aperture may be placed on a short, freely projecting tube with an almost circular section.

Localities: Møen. Aalborg.

Is also known from Rügen and Trimingham.

Spirorbula granulata Sow. sp.

Pl. I. Figs. 31—32.

Serpula granulata Sow. 1829. SOWERBY: Min. Conchology, Vol. VI, p. 200, pl. 597, Fig. 7—8.

— — — 1840. v. HAGENOW: Mon. Rügen. Kreideverst., p. 666.

Tube like that of a *Spirorbis*, either dextral or sinistral. Section circular, and the whole surface covered with longitudinal rows of close, rounded tubercles. Up to eighteen of such rows may be counted at the aperture of the tube. The aperture is circular; lower part of tube generally not free.

Surface of attachment quite small.

Locality: Møen.

Is also known from English White Chalk and from Rügen.

Spirorbula pygmaea v. Hag. sp.

Pl. I. Figs. 33—34.

Serpula pymaea v. Hag. 1840. v. HAGENOW: Mon. Rügen. Kreideverst., p. 667.

v. HAGENOW has no figure of the species, but the description is such that it is possible to recognize the tube.

By size it is like a grain of sand, forms 1—2 closely cemented whorls. Aperture not projecting. Surface smooth.

Localities: Senonian: Stevns. Nørre Uttrup.
Younger Danian: Herfølge (Bryozoan Limestone); Faxe (Coral limestone).
Also known from Rügen.

Spirorbula tortilis n. sp.

Pl. II. Fig. 1.

Tube forms an upright, screw-formedly wound, slightly bent cylinder inclosing no cavity. The whorls, 6—8 in numbers, are not so completely cemented that they may not be discerned. The tube increases in thickness towards the aperture. This is often trumpet-shaped, circular. Surface smooth.

Closely related to this form is a *Spirorbula* that is found in great masses at Ignaberga in Scania. Still, this form has bigger dimensions and but few (2—3) whorls, but has the screw-formed growth as well as the widened aperture.

Localities: Møen. Nørre Uttrup.

Spirorbula trochiformis v. Hag. sp.

Pl. II. Figs. 2—3.

Serpula trochiformis v. Hag. 1840. v. HAGENOW: Mon. Rügen. Kreideverst., p. 666, pl. IX, Fig. 14.

The form is easily recognizable by help of v. HAGENOW's figure and a specimen from Rügen in the Mineralogical Museum of Copenhagen, presented by v. HAGENOW.

Tube either dextral or sinistral; it is only fixed by a small part of the first whorl. It is spirally enrolled in such a way that the cemented, yet visible whorls form a more or less flattened bowl. Section circular, but slightly angular, so that the separate whorls may easily be distinguished.

Localities: Stevns. Møen.
Is also known from Rügen.

Serpulides from the Main Facies of the Danian.

Besides the three species in common with the White Chalk, viz.

Glomerula gordialis v. Schloth. sp. *Spirorbula pygmaea v. Hag. sp.*
Serpentula ampullacea Sow. sp.

the following forms are found in the main facies of the Danian:

Ditrupula faxensis n. sp.
— *Schlotheimi Rkz. sp.*
— *subtorquata Münster sp.*
— *tubaeformis n. sp.*
Cementula applanata n. sp.
Serpentula incrassata n. sp.
— *dentata n. sp.*
— *dorsolineata n. sp.*
— *erecta n. sp.*
— *indistincta n. sp.*
— *ter-undulata n. sp.*
— *undulifera n. sp.*

Spirorbula ampla n. sp.
— *ascendens n. sp.*
— *consolida Ødum. sp.*
— *corrugata n. sp.*
— *distincta n. sp.*
— *dorsata n. sp.*
— *Hisingeri Lundgr. sp.*
— *multilineata n. sp.*
— *parietalis n. sp.*
— *Rosenkrantzi n. sp.*
— *serrata n. sp.*
— *sulcata n. sp.*
— *tenuilineata n. sp.*

Ditrupula faxensis n. sp.

Pl. II. Figs. 4—5.

A small, thick-walled, slightly bent form. Exterior provided with numerous, more or less projecting lines of growth, and a few longitudinal folds, often spirally enrolled round the tube. Aperture like that of an ordinary *Ditrupa*. Resembles *D. cicatricata Br. N.* from the White Chalk, but is much smaller. The furrows most often cover rather long stretches of the tube, while those of *D. cicatricata* are shorter. It is comparatively rarely found, and it only appears in the characteristic coast-deposits found at the locality XI in the Bryozoan Limestone at Faxe, in which *Cyathidium Holopus* was also found.

Locality: Younger Danian: Faxe (Bry. XI).

Ditrupula Schlotheimi Rkz. sp.

Serpula liberaeformis M. U. H. Amtl. Bericht der 24. Versammlung Naturforscher und Aerzte, Kiel 1847, p. 118.

Ditrupa liberaeformis M. U. H. 1863. Mørch: Revisio critica serpulidarum. Naturhist. Tidskr. p. 467.

Ditrupa Schlotheimi Rkz.	1920. ROSENKRANTZ: Craniakalken fra Københavns Sydhavn. D. G. U., II. R., Nr. 36, p. 25.
— — —	1926. ØDUM: Daniet, p. 167, pl. II, Figs. 8—9.

Concerning further particulars of the history of the species refer to the treatise by ROSENKRANTZ.

The species has been known from old times as indicator fossil for certain kinds of limestone of Danian age, and has in 1847 been shown to the 24th Congress of Naturalists by the name of '*Serpula liberaeformis M. U. H.*'.

The species is easily recognizable by its smooth exterior, which is but rarely crossed by lines of growth and faint longitudinal furrows. The bend is not strongly pronounced, seldom so strongly as in the figure in ROSENKRANTZ's book.

Localities: Younger Danian: Lime-sand-facies: Saltholm. The port of Copenhagen, Herfølge (Limestone detritus). Aarslev, Lime, Mygind, Mønsted and other Jutland localities.

Ditrupula subtorquata Münster.

Serpula subtorquata Münster.	1820. v. SCHLOTHEIM: Die Petrefactenkunde auf ihrem jetzigen Standpunkte.
Ditrupa interjuncta Ødum.	1923. JESSEN & ØDUM: Senon og Danium ved Voxlev. D. G. U., 2. R., 39, p. 28, pl. II, Fig. 8.
— — —	1926. ØDUM: Daniet, p. 167.

The species is known by its slightly tapering form and its *Ditrupa*-aperture. Section five-sided, but the five edges are, with certain interspaces, displaced in proportion to each other, as if the tube were twisted round its own axis and the growth continued. At the Mineralogical Museum of Copenhagen is found a specimen of *Ditrupula subtorquata Münster* determined by and presented to the collection by v. HAGENOW. It is exactly in conformity to the Danish forms.

Localities: Older Danian: Kagstrup. Voxlev (upper parts of 'the dead stratum') and other Jutland localities.

Ditrupula tubaeformis n. sp.

Pl. II. Fig. 6.

Ditrupa tubaeformis Br. N. 1926. ØDUM: Daniet, p. 167.

Besides the Jutland specimens only one specimen from Rejstrup in Funen is at hand. It is a big, thick, slightly bent tube with ordinary *Ditrupa*-constriction round the aperture. Tube trumpet-shaped, strongly tapering. Lower end broken. Surface smooth.

Localities: Younger Danian: Rejstrup and Jutland localities.

Cementula applanata n. sp.

Pl. II. Fig. 7.

Serpula aplanata Br. N. 1926. ØDUM: Daniet, p. 165.

The cylindrical, elongated, flexuous, and twisted tubes form plate-shaped or rather irregular expansions. The tubes are strongly cemented, so that it is not always possible to distinguish the boundary planes between the separate tubes. The species is always attached to some foreign object on the sea-bottom. The aperture of the tube is slightly flange-shaped and has a faintly projecting tooth on the dorsal side, what may be seen from the somewhat projecting older margins of the aperture.

Localities: Older Danian: Stevns, Kagstrup. Bulbjerg and other Jutland localities.
Younger Danian: Lille Skjensved, Thorslunde, Faxe (Bryozoan Limestone). Rejstrup. Jutland localities.

Serpentula incrassata n. sp.

Pl. II. Fig. 8 a, b and c.

Serpula incrassata Br. N. 1926. ØDUM: Daniet, p. 166.

Ordinary, coarse *Serpula*-form; cross-section five-sided, having two smooth lateral surfaces and a two-parted dorsal surface. Along the back are three crests, two along the edges, and one in the middle. The crests (keels) are not evenly flexuous as in *S. undulata v. Hag.*, but are very irregular, and are provided with spines pointing in different directions. The spines are often placed in such a way that they alternately point to the right and to the left. Freely projecting

tube-parts with constantly only three keels may be found. The mouth has three pointed spines at the end of the three dorsal crests.

Localities: Younger Danian: Frederiksholm, Faxe (Bryozoan Limestone). Rejstrup. Jutland localities.
Is also found at Limhamn (Scania).

Serpentula dentata n. sp.

Pl. II. Fig. 9.

Serpula dentata Br. N. 1926. ØDUM: Daniet, p. 167.

The tube begins as a *Serpula* with a three-sided tube provided with a dorsal crest, but it soon projects freely, also as a three-sided tube. Sides of tube rather smooth, but the three sharp edges have close-set small teeth. The aperture is not widened. The three edges of the sides form three pretty big teeth round the aperture.

Localities: Younger Danian: Frederiksholm. Bredstrup and other Jutland localities.

Serpentula dorsolineata n. sp.

Pl. II. Figs. 10—11.

Serpula quinquedentata Br. N. 1926. ØDUM: Daniet, p. 166.

Tube of an ordinary *Serpentula*-form with an almost four-sided cross-section. The side-parts are rather smooth, but on the flat back are five well-separated keels formed of numerous close-set tubercles. A few lines of growth are seen. Aperture slightly funnel-shaped, sometimes quite smooth, but sometimes with the five keels slightly projecting above the margin like short teeth.

It somewhat resembles the German cretaceous form, *Serpula quinquecristata Münster;* but as the figures of that species are not very distinct, and as I have had no material of comparison, I have not ventured to incorporate them with each other.

Localities: Older Danian: Stevns. Valsted Gaard and other Jutland localities.
Younger Danian: Lille Skjensved, Thorslunde, Herføgle (Bryozoan Limestone), Faxe (Bryozoan Limestone). Rejstrup. Jutland localities.
Also found at Limhamn (Scania).

Serpentula erecta n. sp.

Pl. II. Figs. 12—13.

Serpula erecta Br. N. 1926. ØDUM: Daniet, p. 167.

The species is thick-shelled, section triangular with rounded edges. To begin with the tube is attached to a support, may here form whorls, but when it becomes free, it stretches itself into a straight line. The cross-section of the free tube is triangular with evenly rounded edges. The aperture is round, showing three projecting teeth.—It is closely related to *S. dentata Br. N.* and *S. undulifera Br. N.*

Localities: Younger Danian: Saltholm. Herfølge (Bryozoan Limestone), Faxe (Bryozoan Limestone). Rejstrup. Aggersborggaard and other Jutland localities. (According to Dr. ØDUM it should also be found in older Danian in Jutland localities).

Serpentula indistincta n. sp.

Fig. 1 in the text.

Straight, adherent, but faintly flexuous tube; cross-section triangular. The side-parts are indistinctly marked off from the dorsal part. It has a dorsal crest (keel) but slightly developped with faint, rounded jags. Aperture not known, but the lines of growth show that there has been a pointed spine above the aperture.

Locality: Older Danian: Stevns.

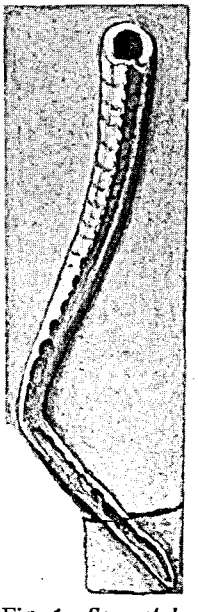

Fig. 1. *Serpentula indistincta n. sp.* Older Danian. Stevns Klint. ×4,5.

Serpentula ter-undulata n. sp.

Pl. II. Fig. 14.

Serpula terundulata Br. N. 1926. ØDUM: Daniet, p. 166.

The species is somewhat like *S. fluctuata Sow.* from the White Chalk, and it has the three waved crests in common with that species. It is of the usual Serpula-shape, generally attached by its whole length, increasing rather rapidly in

breadth during its growth. Lateral parts almost vertical, attaching themselves to the support with expansions that are irregularly ruffled along the rim, and the surface of which is often transversely furrowed. Sometimes the side-parts are smooth, sometimes they show distinct lines of growth across the tube. The somewhat flat dorsal side carries the projecting crests that are rather high and undulated, but not regular as those of *S. fluctuata*, but often, especially in older parts of the tube, formed by rows of stump spines.

Localities: Older Danian: Stevns.
Younger Danian: Saltholm. Lille Skjensved, Herfølge (Bryozoan Limestone), Faxe (Bryozoan Limestone). Jutland localities.

Serpentula undulifera n. sp.

Pl. II. Figs. 15 a and b.

Serpula undulifera Br. N. 1926. ØDUM: Daniet, p. 167.

The tube of this species, which, like many of the others, is only found in a fragmentary state, is formed like that of *S. dentata Br. N.*, and *S. erecta Br. N.*, but the three side-planes are not smooth; they are ornamented with numerous sharp, close-set transversal wrinkles. The three edges may be toothed, but may also be smooth. Only one specimen from the Bryozoan Limestone at Herfølge shows that these triangular fragments of the tube originally have started as creeping *Serpula*-forms.

The free ends are those most commonly found. The aperture shows three projecting teeth.

The three species, *S. dentata*, *S. erecta*, and *S. undulifera* seem to be limited to Danian strata, especially to the younger Danian.

Localities: Younger Danian: The port of Copenhagen, Herfølge (Bryozoan Limestone), Faxe (Bryozoan Limestone). Thisted and other Jutland localities.

Spirorbula ampla n. sp.

Pl. II. Fig. 16.

Ordinary *Spirorbis*-form with large surface of attachment. Tube rather wide, shell comparatively thin. Exterior surface covered with very close-set, fine, transversal wrinkles which are slightly undulated

and running from edge to edge. The youngest part of the tube is freely projecting. Aperture circular, whorls covering each other in considerable extension, so that only the last whorl is visible. Umbilicus quite small, not deep.

Locality: Younger Danian: Faxe.

Spirorbula ascendens n. sp.

Pl. II. Figs. 17—19.

Serpula ascendens Br. N. 1926. ØDUM: Daniet, p. 165.

The species reminds, by many things, of the Senonian *S. conica v. Hag.*, but it lacks the regular cone-form of this species. It has also a good deal in common with the Senonian *S. tortilis Br. N.*, but lacks the funnel-shaped aperture of the latter. The tube is formed by a comparatively regular convolution of a smooth, cylindrical tube, the external layers of the whorls being cemented to each other. The whorls are all of the same size causing a cylindrical form into which the separate whorls are faintly discernible through the cementing external layer. The lower end has been attached to some foreign body on the sea bottom. In the upper part the tube may be freely protruding from the cylinder with its extreme end. Aperture of tube not widened and has no teeth. At times the whorls do not close completely, so that the axis of the cylinder may hold a capillary canal. The species is very plentiful, where it is found.

Localities: Younger Danian: Saltholm, Frederiksholm, Herfølge (Limestone detritus and Bryozoan Limestone), Faxe (Bryozoan and Coral Limestone). Rejstrup. Davbjerg, Søndbjerg, Uglev and other Jutland localities.
Is also found at Limhamn (Scania).

According to Dr. ØDUM it is also found in older Danian in several Jutland localities.

Spirorbula consolida Ødum sp.

Serpula consolida Ødum. 1926. Daniet, p. 165; pl. II, Fig. 3.

Tube regularly rolled, conical, with an apical angle of about 90°. Umbilicus large and open, cross-section of tube more or less circular.

Tube somewhat flattened on the upper surface; this part ornamented with faint longitudinal stria. Edge towards umbilicus rounded, outer edge sharply carinate. Outside the latter is seen another flattened part, in its turn bordered by a less marked keel. The part between this one and the irregular, indistinct suture is slightly longitudinally striated. Lines of growth all over the shell. Varices at intervals.

Localities: Older Danian: Nye Kløv (N.E. of Thisted, Jutland).
Younger Danian: Kaase II (N.N.E. of Thisted), Frøslevvang II (Isle of Mors).

Spirorbula corrugata n. sp.

Pl. II. Figs. 20—21.

Spirally enrolled. Whorls partly covering each other, so that in umbilicus only the edges of the last whorls are visible. Surface of attachment but small; tube generally attached to a *Bryozoa*-branch. Underside of tube smooth, or provided with lines of growth. On the surface along the dorsal side of the tube is found a rather deep furrow flanked by strongly pronounced edges, and in the middle provided with a longitudinal strong keel dividing the deep furrow in two parallel furrows. The keels are often provided with close-set, minute spines. Besides are found close-set, flexuous transverse lists which may only be seen under a magnifier. There do not seem to be freely projecting parts of the youngest whorls. Aperture evenly rounded.

Localities: Older Danian: Stevns, Kagstrup.

Spirorbula distincta n. sp.

Pl. II. Figs. 22—24.

Serpula distincta Br. N. 1926. ØDUM: Daniet, p. 166.

The tube is formed like that of an ordinary *Spirorbis* with a large surface of attachment. Whorls partly free, so that marks of several (or all) whorls are seen in umbilicus. Last whorl may protrude freely loosening itself from the compact whorls. The sculpture is characteristic, having 4—5 longitudinal, easily perceptible lists and having with regular spaces minute spines in transversal rows; the surface is thus divided into squares with spines in all points of the

angles. Aperture slightly funnel-shaped with 4—5 protruding spines along the edge.

Localities: Older Danian: Jutland localities.
Younger Danian: Faxe (Bryozoan Limestone).

Spirorbula dorsata n. sp.

Pl. II. Figs. 25—26.

The tube is very thick-walled and clumsily shaped like a conical or short cylindrical spiral. Section of tube not quite circular, having a flat, thickened list along the dorsal side. This list may protrude above the aperture like a broadly rounded tooth. Sometimes a fine transversal wrinkling of the lateral parts of the tube is seen here and there. The species is in many respects formed like a *S. ascendens Br. N.*, but the cross-section, the heavy tube, and the aperture easily show the difference. The separate whorls do not generally close completely, producing in this way a central, canal-formed cavity in the axis. By this the species differs from the English *S. turbinella Sow.*, to which it bears a strong resemblance. The species only occurs in a few places, especially where the layers suggest the nearness of the sea-shore. More especially at Saltholm and in the Bry X and XI[1]) at Faxe.

The shore deposits at Saltholmen have lately been discovered, and the layers in Bry X at Faxe are also known as shore-conglomerates, the material being rolled, and sorted by size. For that reason we seem in this *Serpula*-form to have a criterion, that the discordance shown at Saltholm is simultaneous with the discordance at Faxe. The juncture for the change of level which has caused this discordance is, what is well known: Younger Danian-time; and at Faxe we have probably had a cliff, while the shore at Saltholm was low, slightly sloping.

Localities: Younger Danian: Saltholm. Frederiksholm, Lille Skjensved, Faxe.
Is also found at Limhamn.

Spirorbula Hisingeri Lundgr. sp.

Pl. III. Figs. 1—4.

Serpula Lituus Schloth. 1837—40. HISINGER: Lethaea suecica, p. 20; pl. 4, Fig. 8.

[1]) Bry X and Bry XI are two localities in the Bryozoan Limestone. See the map-sketch fig. 1 on p. 602 in BR. NIELSEN: Brachiopoderne i Faxe. Medd. Dansk geol. Foren. Bd. 3, Nr. 17 (1911).

Serpula Hisingeri Lundgr. 1891. LUNDGREEN: Studier öfver fossilförande lösa block. Geol. Fören. Stockholm. Förhandl. Bd. 13, p. 118.

— *Hisingeri Lundgr.* 1920. ROSENKRANTZ: Craniakalken fra Kjøbenhavns Sydhavn. D. G. U., II. Række, Nr. 36, p. 24.

— — 1926. ØDUM: Daniet, p. 165.

The shape is like a flat button, the evenly thick tube being wound up in one plane, like a flat coil of rope on a deck; the separate whorls are cemented to each other so that it, when seen from above, is not possible to count the whorls. On the upper side of the button is found a rather deep, flat umbilicus. On the under side several of the whorls are open, showing 4—5 whorls altogether. From the edge of this button may spring a free piece varying in length in the separate specimens. This free part is cylindrical and with a smooth surface. Aperture circular.

Localities: Younger Danian: The port of Copenhagen (Knippelsbro, Sydhavnen). Bredstrup Klint (near Grenaa), and other Jutland localities.

Otherwise it is most frequently found in erratic blocks from Scania.

Spirorbula multilineata n. sp.

Pl. II. Figs. 27—29.

Serpula multilineata Br. N. 1896. ØDUM: Daniet, p. 166.

Rather small form with a generally broad surface of attachment. Whorls do not quite overlap, thus showing several whorls in umbilicus, which is rather wide. Along the tube are about ten longitudinal, faintly protruding striae evenly distributed round the tube. The striae are sometimes rather smooth, but may also be covered with more or less projecting spines in longitudinal as well as in transversal rows, and giving a spiny appearance to the whole of the tube. The distance between the spines are greater than the length of the spines. Between the smoothly striated specimens and the strongly spined ones are found all possible transitions. Aperture funnel-like widened; numerous protruding, small spines are often seen along the edge.

Localities: Older Danian: Kagstrup. Valsted Gaard and other Jutland localities.
Younger Danian: Lille Skjensved, Faxe (Bryozoan-Limestone and Coral-Limestone). Rejstrup. Jutland localities.
Is also found at Limhamn.

Spirorbula parietalis n. sp.

Pl. II. Figs. 30—31.

The tube has the form of an ordinary *Spirorbis*. Whorls overlapping each other so that in umbilicus only the edge of the last whorl is visible. Surface of attachment generally broad. Lateral parts of tube smooth, at most showing a few lines of growth as transversal lists. On the dorsal side of tube are seen 5 well-developped, slightly projecting crests that may be slightly flexuous, and are but rarely provided with spines. Aperture faintly funnel-shaped, lists somewhat projecting at the margin of the aperture.

Localities: Younger Danian: Faxe (Bryozoan Limestone and Coral Limestone). Rejstrup.
Is also found at Limhamn.

Spirorbula Rosenkrantzi n. sp.

Pl. III. Fig. 8.

The tube has the form of an ordinary *Spirorbis* with a broad surface of attachment and almost smooth tube. Under a magnifier are seen a few very faint longitudinal stria with close-set transversal striae (not wrinkles). Umbilicus is deep, only showing the last whorl. Aperture circular, may be slightly funnel-shaped.

Localities: Older Danian: Stevns, Kagstrup.
Younger Danian: Rejstrup.

Spirorbula serrata n. sp.

Pl. II. Fig. 32.

An ordinary spirally enrolled tube only raising a little above its generally narrow basis (fixed upon small *Bryozoa* branches). Externally it is covered with longitudinal lists, the upper end of which are serrated. The lists are partly big, protruding ones (ca. 5), partly smaller ones lying in the furrows between the bigger ones. At the aperture the entire number of lists amounts to about twelve.

The under side of the tube, nearest the surface of attachment, is more or less smooth. Umbilicus rather deep, showing but few whorls. Aperture circular. The species somewhat reminds of *S. corrugata Br. N.*, but the ornamentation of the latter is far less conspicuous.

Localities: Younger Danian: Thorslunde, Lille Skjensved, Herføgle (Bryozoan Limestone).

Spirorbula sulcata n. sp.

Pl. III. Figs. 6—7.

Serpula sulcata Br. N. 1926. ØDUM: Daniet, p. 165.

The whorled tube forms a regular, low spiral that has only a very small surface of attachment. The surface of the tube is smooth, but along the dorsal side is a longitudinal, deep furrow, flanked by tall, sharp crests. The tube has not generally any projecting part; but the extreme part of the tube may protrude freely. Aperture circular; but on account of the dorsal furrow and the sharp crests of the latter, there are two crooked teeth above the margin of the aperture.

It is one of the most common species, and is characteristic of the younger Danian.

Localities: Younger Danian: Saltholm, Frederiksholm, Thorslunde, Herføgle (Limestone detritus and Bryozoan Limestone), Faxe (Bryozoan Limestone and Coral-Limestone). Rejstrup. Tinbæk and other Jutland localities.

Is also found at Limhamn.

(According to Dr. ØDUM it is also found in older Danian at Vigsø I, North of Thisted, Jutland).

Spirorbula tenuilineata n. sp.

Pl. III. Fig. 10.

The tube is like an ordinary *Spirorbula* with a generally broad, but sometimes quite narrow, surface of attachment. Whorls do not quite cover each other, so that the edges of several whorls may be visible in umbilicus. The surface of the tube is, on the upturned side, covered with numerous longitudinal, very close-set, faintly projecting lists, which are only visible under a magnifier. The

lists may be faintly rugged. Sometimes are found, especially in the younger parts of the tube, waved transversal lists. The edge of the aperture is circular without spines. Free parts of the younger portion of the tube do not seem to be formed.

Localities: Older Danian: Stevns, Kagstrup.
Younger Danian: Saltholm. Frederiksholm, Thorslunde, Faxe (Bryozoan Limestone).

Serpulides from the Danian Coral Limestone.

In addition to those mentioned before:

Glomerula gordialis v. Schloth. sp.
Spirorbula ampla n. sp.
— *ascendens n. sp.*
— *multilineata n. sp.*
Spirorbula parietalis n. sp.
— *pygmaea v. Hag. sp.*
— *sulcata n. sp.*

are known as species peculiar to the Coral Limestone:

Filogranula faxensis n. sp.
Cementula contorta n. sp.
Proterula costata n. sp.
— *faxensis n. sp.*
— *transversa n. sp.*
Serpentula alata n. sp.
— *annulata n. sp.*
— *filiformis n. sp.*
Serpentula juliformis n. sp.
— *quadrata n. sp.*
— *siphonata n. sp.*
— *tripartita n. sp.*
Spirorbula cingulata n. sp.
— *expansa n. sp.*
— *jodiformis n. sp.*

Filogranula faxensis n. sp.

Fig. 2 in the text.

In the Mineralogical Museum of Copenhagen is found one specimen of this species. It is probably very rare. The piece at hand is as big as a fist, and it consists of interwoven masses of tubes with interjacent meshes, what is peculiar to *Filograna*. These meshes are rather elongate, while they in *Serp-*

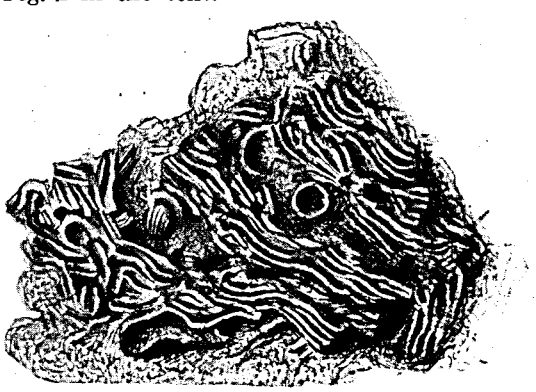

Fig. 2. *Filogranula faxensis n. sp.* Danian. Coral Limestone, Faxe. $^3/_8$ Nat size.

ula plexus Sow., as well as in species from cretaceous deposits at Ciply and from French Turonian, are rather short. I therefore venture to give it a specific name.

Locality: Faxe (Coral Limestone).

Cementula contorta n. sp.

Pl. III. Fig. 5.

Serpula contorta Br. N. 1926. ØDUM: Daniet, p. 165.

Medium sized, smooth tubes cemented into clusters of irregular form. No lines of growth are visible. Aperture unknown. Perhaps the species does not differ from *C. applanata Br. N.*; it may be the irregular support (corals) that causes the somewhat irregular form of the clusters.

Localities: Older Danian: Jutland localities.
Younger Danian: Faxe (Coral Limestone). Jutland localities.

Proterula costata n. sp.

Pl. III. Fig. 11—12.

Short or long, thin-walled tubes, generally fixed to some support; thickness alike all over; the tubes are also found as free pieces. Surface provided with straggling, faint, longitudinal ribs. Entire, funnel-shaped aperture. There are frequent expansions on the tubes corresponding to pauses in the growth. The attached part of the tube is fixed to the support by a short base formed of the external layer.

Localities: Younger Danian: Faxe (Coral-Limestone).

Proterula faxensis n. sp.

Pl. III. Fig. 9.

Completely smooth tube of medium thickness, most often fixed to foreign objects, but frequently quite free. Tubes elongate, thin-walled, only very little twisted, and with numerous expansions corresponding to pauses in the growth. Aperture slightly funnel- shaped, circular, without teeth. They are fastened by a short expansion to the external layer.

Locality: Younger Danian: Faxe (Coral-Limestone).

Proterula transversa n. sp.

Pl. III. Fig. 13.

Wide, rather thin-walled tubes fixed to corals by the whole of their length. Aperture large. Margin of the aperture unknown. Tube ornamented with numerous transversal, irregularly wrinkled folds.

Locality: Younger Danian: Faxe (Coral Limestone).

Serpentula alata n. sp.

Pl. III. Figs. 18—19.

The species is *Serpula*-shaped. Cross-section triangular on account of a projecting keel protruding above the aperture like a short tooth. On the sides, which for the rest are smooth, the old margins of the aperture are seen projecting like small, short wings. The aperture is, on account of the projecting side-wings and the prominent tooth, provided with two deep curves on each side. The surface of attachment is somewhat expanding to the sides forming an even, slanting transition from the support to the back of the tube.

Locality: Younger Danian: Faxe (Coral Limestone).

Serpentula annulata n. sp.

Pl. III. Figs. 14—17.

Tube like an ordinary *Serpula*, short and broad. It is spread flat over the object to which the tube is fixed. Side-parts somewhat articulated, and broad. The middle part of the back is by numerous, close-set, small transversal furrows strongly articulated, so that the look of the shell resembles that of different marine chaetopods (f. i. a *Nereis*). Aperture faintly projecting, circular, surrounded by a thickened chalk-ring. In young individuals the middle part may be smooth, so that they look quite different from the old ones; it is therefore possible to find individuals where the older part of the tube is smooth, and the younger part articulated.

Locality: Younger Danian: Faxe (Coral Limestone).

Serpentula filiformis n. sp.

Pl. III. Fig. 21.

Long, slightly bent, filiformed, pretty thick-walled tubes without side-expansions. The margin of the aperture smooth. The species may perhaps be a *Protula*.

Locality: Younger Danian: Faxe (Coral Limestone).

Serpentula juliformis n. sp.

Pl. III. Fig. 30.

Tube like an ordinary adherent *Serpula*. Section square. The back but slightly vaulted with a faintly projecting dorsal-list. The lateral parts with the strongly developped surfaces of attachment are provided with numerous, close-set transversal lists, making the tube look like a millepede (*Julus*).

Locality: Younger Danian: Faxe (Coral Limestone).

Serpentula quadrata n. sp.

Pl. III. Fig. 22.

The tube is like an ordinary *Serpentula* with a square section. The back is quite flat with a longitudinal list in the middle. The margins towards the side planes form slightly raised, longitudinal, and almost smooth lists. Numerous faint lines of growth.

Locality: Younger Danian: Faxe (Coral Limestone).

Serpentula siphonata n. sp.

Pl. III. Fig. 20.

Tube like an ordinary *Serpentula*, often strongly flexuous, forming twines or short spirals. On account of exceedingly broad, smooth side parts and surface of attachment the whole shell becomes completely flat-expanded. Middle part smooth, with distinct furrows set off from the side parts. The aperture, which is circular, protrudes freely, placed as it is on a smooth cylindrical tube.

Locality: Younger Danian: Faxe (Coral Limestone).

Serpentula tripartita n. sp.

Pl. III. Figs. 25—26.

A peculiar, strongly twisted, often twine-formed *Serpula* species with a more or less sharp, slightly flexuous dorsal crest, that may protrude above the aperture like a tooth. Side parts sharply set off from the crista bearing middle part. The surface of attachment is expanded, so that the whole of the shell looks as if it were flat spread over the object, to which it is fixed. The side parts are smooth, or provided with faint, longitudinal, slightly raised lists. Aperture circular with a protruding tooth. The youngest part of the tube may sometimes spring forth freely like a triangular tube. On this

free part may be formed funnel-shaped widenings of the aperture with three pointed teeth.

Locality: Younger Danian: Faxe (Coral Limestone).

Spirorbula cingulata n. sp.

Pl. III. Figs. 23—24.

Serpula cingulata Br. N. 1926. ØDUM: Daniet, p. 166.

The species is shaped like an ordinary *Spirorbis*, but has very long, free terminal parts. Tube smooth, and aperture funnel-shaped and smooth-margined. The numerous, funnel-shaped expansions from former margins of the aperture appear as rings round the tube with either short or long interspaces. The species is pretty common.

Localities: Younger Danian: Faxe (Bryozoan Limestone and Coral Limestone). Aggersborggaard.

Is also found at Limhamn.

Spirorbula expansa n. sp.

Pl. III. Figs. 28—29.

The tube is shaped like an ordinary *Spirorbis*. Lateral parts flat-spread over the object to which the animal is attached, so that the transition from the surface of attachment to the dorsal side of the tube becomes quite even. Flat, faintly projecting, longitudinal lists are spread all over free part of tube. Whorls partly overlap, so that only the last whorl is visible in umbilicus. Terminal part of tube is often free. Aperture circular, not funnel-shaped. The ornaments are often distributed in such a way so as to form a faintly vaulted back, below which one or two rather sharp keels are seen. The flat back may have transversal wrinkles.

Locality: Younger Danian: Faxe (Coral Limestone).

Spirorbula jodiformis n. sp.

Pl. III. Fig. 27.

The tube is formed like an ordinary *Spirorbis* with few whorls and a straight-running, attached part, giving the tube the look of the letter j. Umbilicus only shows the last whorl. Surface of tube shows few faint longitudinal lists.

Locality: Younger Danian: Faxe (Coral Limestone).

Some Comments on the Serpulides of the Coral-Limestone.

When this little group has been kept apart, it is partly because it includes so many species that are not refound in the rest of the Danian (although there is a fairly large number common to the Coral Limestone and the rest of the Danian), but also because a great many of these forms have a peculiar stamp that must be due to the surroundings into which these animals have lived; meaning not only that they have been attached to corals and hydrocorals, but also that outward circumstances must have stamped these forms.

This turns our thoughts on an old discussion from the beginning of the century between A. HENNIG and Mr. J. P. J. RAVN. HENNIG, on observing the parallel bendings of *Cyathidium Holopus* when found together in great numbers, had come to the conclusion that this bending was due to the animal's trying to direct its arms towards a constant current filled with nutritious matter.

This theory was strongly contradicted by Mr. RAVN who, on investigating the pieces kept in the Museums of Copenhagen, could not acknowledge that the bending of *Cyathidium* could give any proof of the presence of a constant current. Later on it has been pointed out that the bending of *Cyathidium* partly aims at making a passage for the animal between the close-set coral branches, and partly tries to turn the animal, so that it turns down its arms; this also grants that Mr. RAVN is right.

Looking into our corallophile Serpulides the idea forces itself upon my mind whether there, after all, may not be a possibility of proving that there were constant currents in the sea in which the Coral Limestone was formed. It is not possible however by that way to say anything about the directions and other conditions of these currents.

Regarding a great deal of the corallophile Serpulide-fauna, we get the impression that great efforts must have been at work to place these worm-tubes so that they offered the smallest resistance possible to the movement of the water. The *Serpula*-species have large, broad surfaces of attachment, and as the transition from the surface of the corals to that of the *Serpula*'s is quite smooth, they are often difficult to discern.

It is just the same with the *Spirorbula*-species; they have large surfaces of attachment, and on the outside of the last whorls is

formed a border of attachment, likewise making a smooth transition from the support to the surface of the tube.

Animals in the territory of the currents will in the same manner try to adjust themselves in such a way that they are not affected too much by the current. Also the minute surfaces of the mud-masses which fill up the cavities between the coral branches give a hint of this tendency.

Thus we have HENNIG's theory of the currents revived on a new basis.

These currents may perhaps have been of importance to the building up of the Coral shoal so that it may be possible from the positions of these shoals to draw some conclusions concerning the direction of the currents.

Explanation of Plate I.

Figs. 1—2. *Ditrupula canteriata v. Hag. sp.* Stevns Klint. White Chalk. 1. Lateral view ×1.5. 2. Aperture ×3.

— 3—4. *Ditrupula cicatricata n. sp.* Stevns Klint. White Chalk. 3. Lateral view ×1.5. 4. Aperture ×1.5.

— 5—6. *Ditrupula Hagenowii n. sp.* Stevns Klint. White Chalk. 5. Lateral view ×1.5. 6. Aperture ×1.5.

— 7—8. *Ditrupula Triminghamiensis n. sp.* Trimingham. Grey Chalk. 7. Lateral view ×3. 8. Cross section ×3.

— 9. *Glomerula gordialis v. Schloth. sp.* Stevns Klint. White Chalk. ×1.5.

— 10—11. *Glomerula gordialis v. Schloth. sp.* Rejstrup. Bryozoan Limestone, Younger Danian. ×4.5.

— 12. *Cementula sphærica n. sp.* Nørre Uttrup. White Chalk. ×4.5.

— 13—14. *Serpentula ampullacea Sow. sp.* Stevns Klint. 13. White Chalk ×3. 14. Bryozoan Limestone ×3.

— 15—16. *Serpentula ampullacea Sow. sp.* Herfølge. Bryozoan Limestone. 15. ×2.25. 16. ×2.25.

— 17—19. *Serpentula cincta Goldf. sp.* Rær. White Chalk. 17. Cross section ×4.5. 18. Free part ×4.5. 19. Attached part ×4.5.

— 20. *Serpentula fluctuata Sow. sp.* Møen. White Chalk. × 4.5.

— 21. *Serpentula idmonoides n. sp.* Nørre Uttrup. White Chalk. ×7.5.

— 22—23. *Serpentula tuberculifera n. sp.* Nørre Uttrup. White Chalk. 22. Lateral view ×6. 23. Cross section ×6.

— 24—25. *Spirorbula aspera v. Hag. sp.* Trimingham. White Chalk. 24. Upper surface ×6. 25. Under surface ×6.

— 26—28. *Spirorbula conica v. Hag. sp.* Stevns Klint. White Chalk. 26 and 27. Lateral view ×2.25. 28. Aperture. ×2.25.

— 29—30. *Spirorbula cylindrica n. sp.* Trimingham. White Chalk. 29. Lateral view ×3. 30. Dorsal view ×3.

— 31—32. *Spirorbula granulata Sow. sp.* Rügen. White Chalk. 31. Upper surface ×4.5. 32. Under surface ×4.5.

— 33—34. *Spirorbula pygmaea v. Hag. sp.* Faxe. Coral Limestone. ×7.5.

All the figured specimens belong to the Mineralogical and Geological Museum of the University, Copenhagen.

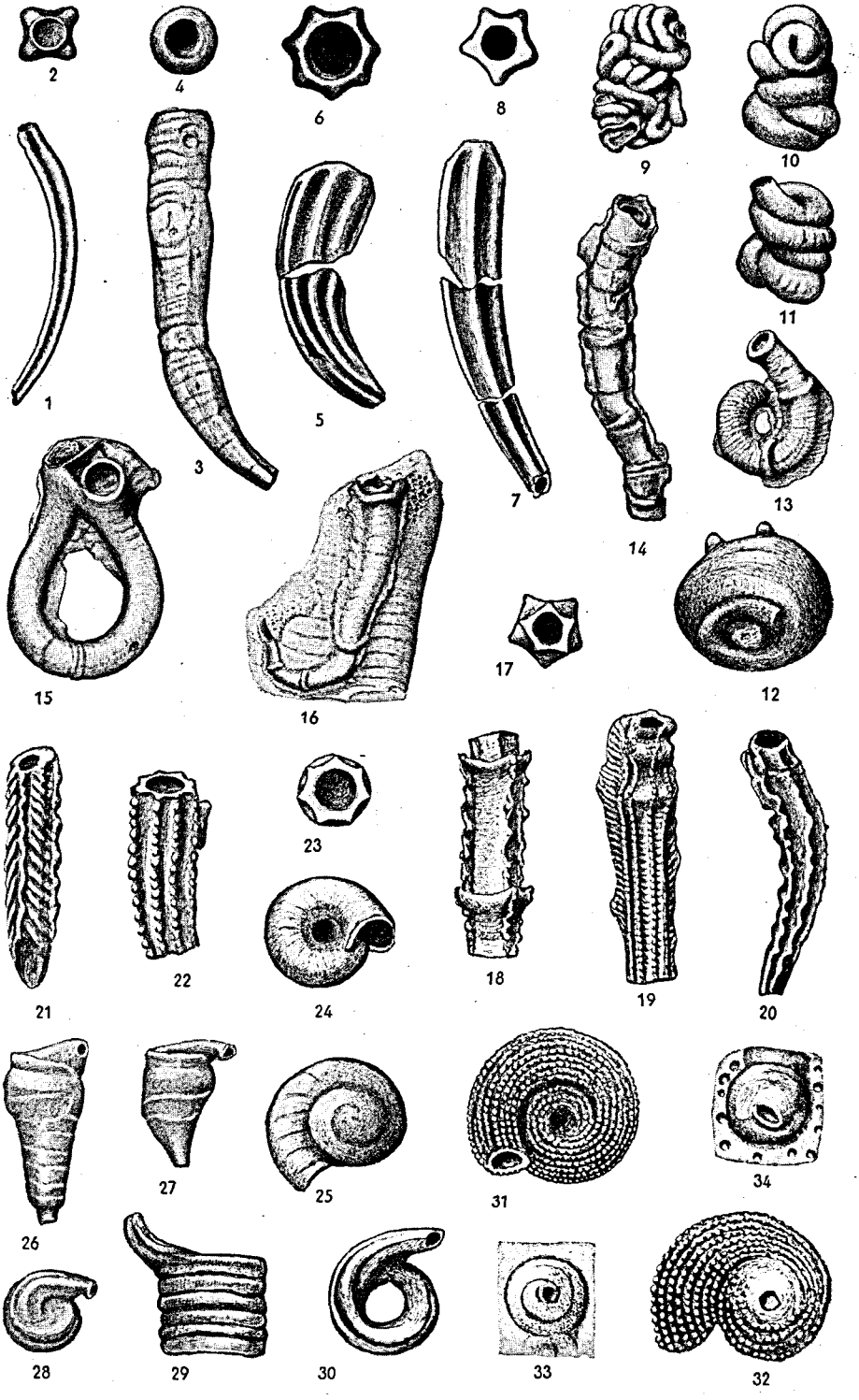
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PLATE II.

Explanation of Plate II.

Figs. 1. *Spirorbula tortilis n. sp.* Nørre Uttrup. White Chalk. ×4.5
— 2—3. *Spirorbula trochiformis v. Hag. sp.* Stevns Klint. White Chalk. 2. Upper surface ×4.5. 3. Under surface 4.5.
— 4—5. *Ditrupula faxensis n. sp.* Faxe. Coral Limestone. 4. Lateral view 4.5. 5. Aperture ×4.5.
— 6. *Ditrupula tubaeformis n. sp.* Rejstrup. Bryozoan Limestone. ×3.
— 7. *Cementula applanata n. sp.* Rejstrup. Bryozoan Limestone. ×3.
— 8.a.b.c. *Serpentula incrassata n. sp.* Rejstrup. Bryozoan Limestone. a. Dorsal view ×3. b. Surface of attachment ×3. c. Cross Section ×3.
— 9. *Serpentula dentata n. sp.* Bredstrup. Coccolith Chalk. ×2.25.
— 10—11. *Serpentula dorsolineata n. sp.* Faxe. Coral Limestone. 10. Lateral view ×4.5. 11. Dorsal view ×4.5.
— 12—13. *Serpentula erecta n. sp.* Faxe. Bryozoan Limestone. 12. Surface of attachment ×4.5. 13. Free part ×4.5.
— 14. *Serpentula terundulata n. sp.* Herfølge. Bryozoan Limestone. ×4.5.
— 15.a.b. *Serpentula undulifera n. sp.* Bredstrup. Coccolith Chalk. Y. Danian. a. Lateral view ×4.5. b. Aperture ×4.5.
— 16. *Spirorbula ampla n. sp.* Faxe. Coral Limestone. ×2.25.
— 17—19. *Spirorbula ascendens n. sp.* Rejstrup. Bryozoan Limestone. 17. Aperture. 18 and 19. Lateral views ×3.
— 20—21. *Spirorbula corrugata n. sp.* Stevns Klint. Bryozoan Limestone. 20. Upper surface ×4.5. 21. Under surface ×4.5.
— 22—24. *Spirorbula distincta n. sp.* Rejstrup. Bryozoan Limestone. 22. Aperture ×4.5. 23. Upper surface ×4.5. 24. Under surface ×4.5.
— 25—26. *Spirorbula dorsata n. sp.* Lille Skjensved. Bryozoan Limestone. 25. Lateral view ×3. 26. Upper surface ×3.
— 27—28. *Spirorbula multilineata n. sp.* Faxe. Bryozoan Limestone. 27. Lateral view ×4.5. 28. Upper surface ×4.5.
— 29. *Spirorbula multilineata n. sp.* Rejstrup. Bryozoan Limestone. Under surface ×3.
— 30—31. *Spirorbula parietalis n. sp.* Faxe. Bryozoan Limestone. 30. Dorsal view ×4.5. 31. Lateral view × 4.5.
— 32. *Spirorbula serrata n. sp.* Herfølge. Bryozoan Limestone. ×4.5.

All the figured specimens belong to the Mineralogical and Geological Museum of the University, Copenhagen.

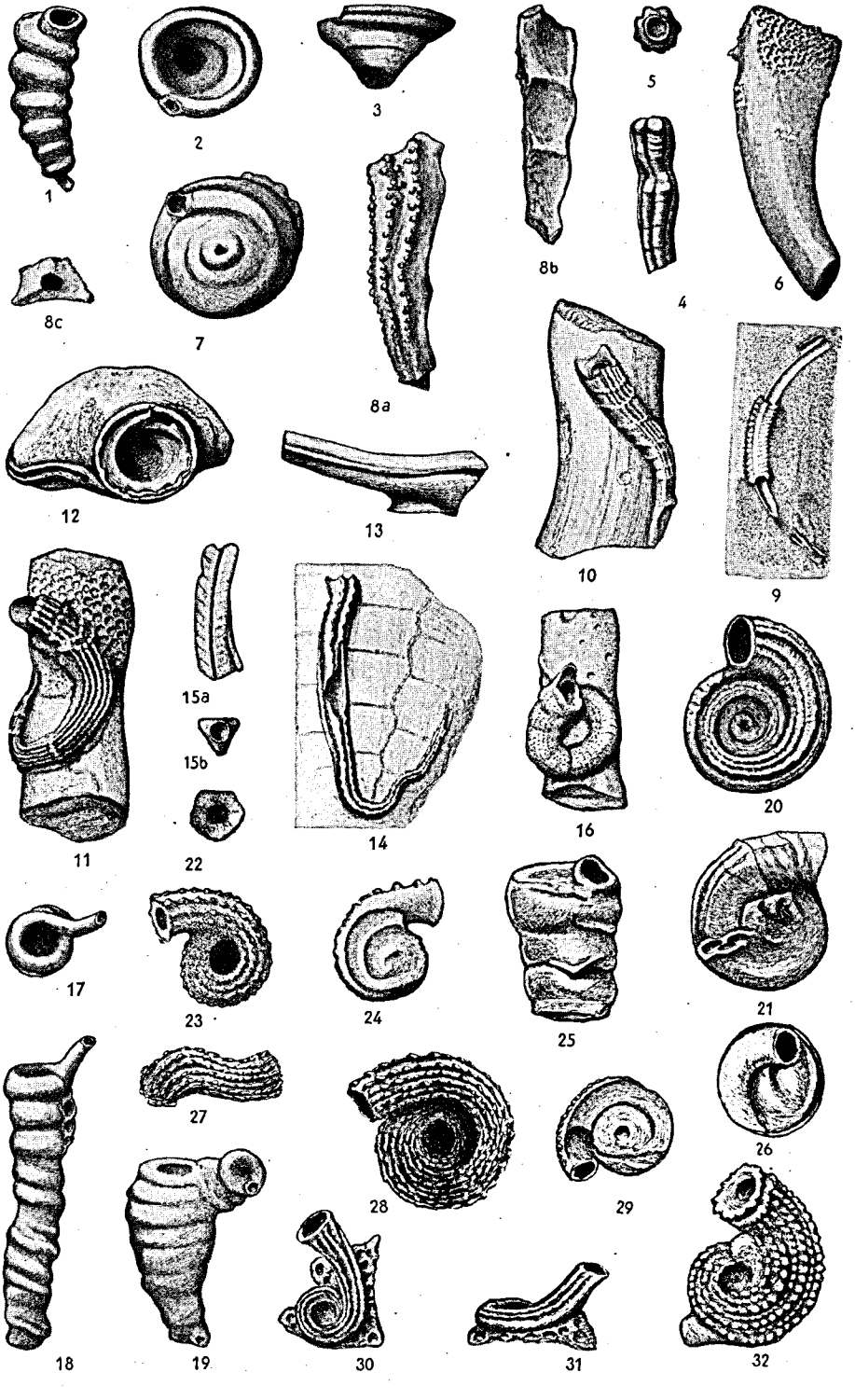
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PLATE III.

Explanation of Plate III.

Figs. 1—4. *Spirorbula Hisingeri Lundgr. sp.* Boulder of paleocene origin. Holms brickwork, Ystad (Scania). 1. Under surface ×3. 2. Upper surface ×3. 3. Under surface ×4.5. 4. Upper surface ×4.5.

— 5. *Cementula contorta n. sp.* Faxe. Coral Limestone. ×4.5.

— 6—7. *Spirorbula sulcata n. sp.* Rejstrup. Bryozoan Limestone. 6. Under surface ×3. 7. Upper surface ×3.

— 8. *Spirorbula Rosenkrantzi n. sp.* Kagstrup. Bryozoan Limestone. ×4.5.

— 9. *Proterula faxensis n. sp.* Faxe. Coral Limestone. ×3.

— 10. *Spirorbula tenuilineata n. sp.* Faxe. Bryozoan Limestone. ×3.

— 11—12. *Proterula costata n. sp.* Faxe. Coral Limestone. 11. Dorsal view ×3. 12. Lateral view ×4.5.

— 13. *Proterula transversa n. sp.* Faxe. Coral Limestone. ×4.5.

— 14—17. *Serpentula annulata n. sp.* Faxe. Coral Limestone. 14. Dorsal view ×2.25. 15. Dorsal view ×3. 16. Dorsal view ×3. 17. Dorsal view of a young specimen ×3.

— 18—19. *Serpentula alata n. sp.* Faxe. Coral Limestone. ×4.5.

— 20. *Serpentula siphonata n. sp.* Faxe. Coral Limestone. ×4.5.

— 21. *Serpentula filiformis n. sp.* Faxe. Coral Limestone. ×4.5.

— 22. *Serpentula quadrata n. sp.* Faxe. Coral Limestone. ×4.5.

— 23—24. *Spirorbula cingulata n. sp.* Faxe. Coral Limestone. 23. Dorsal view ×4.5. 24. Lateral view ×4.5.

— 25—26. *Serpentula tripartita n. sp.* Faxe. Coral Limestone. 25. Dorsal view ×4.5. 26. Dorsal view with the aperture ×4.5.

— 27. *Spirorbula jodiformis n. sp.* Faxe. Coral Limestone. ×4.5.

— 28—29. *Spirorbula expansa n. sp.* Faxe. Coral Limestone. Dorsal view ×4.5.

— 30. *Serpentula juliformis n. sp.* Faxe. Coral Limestone. ×4.55.

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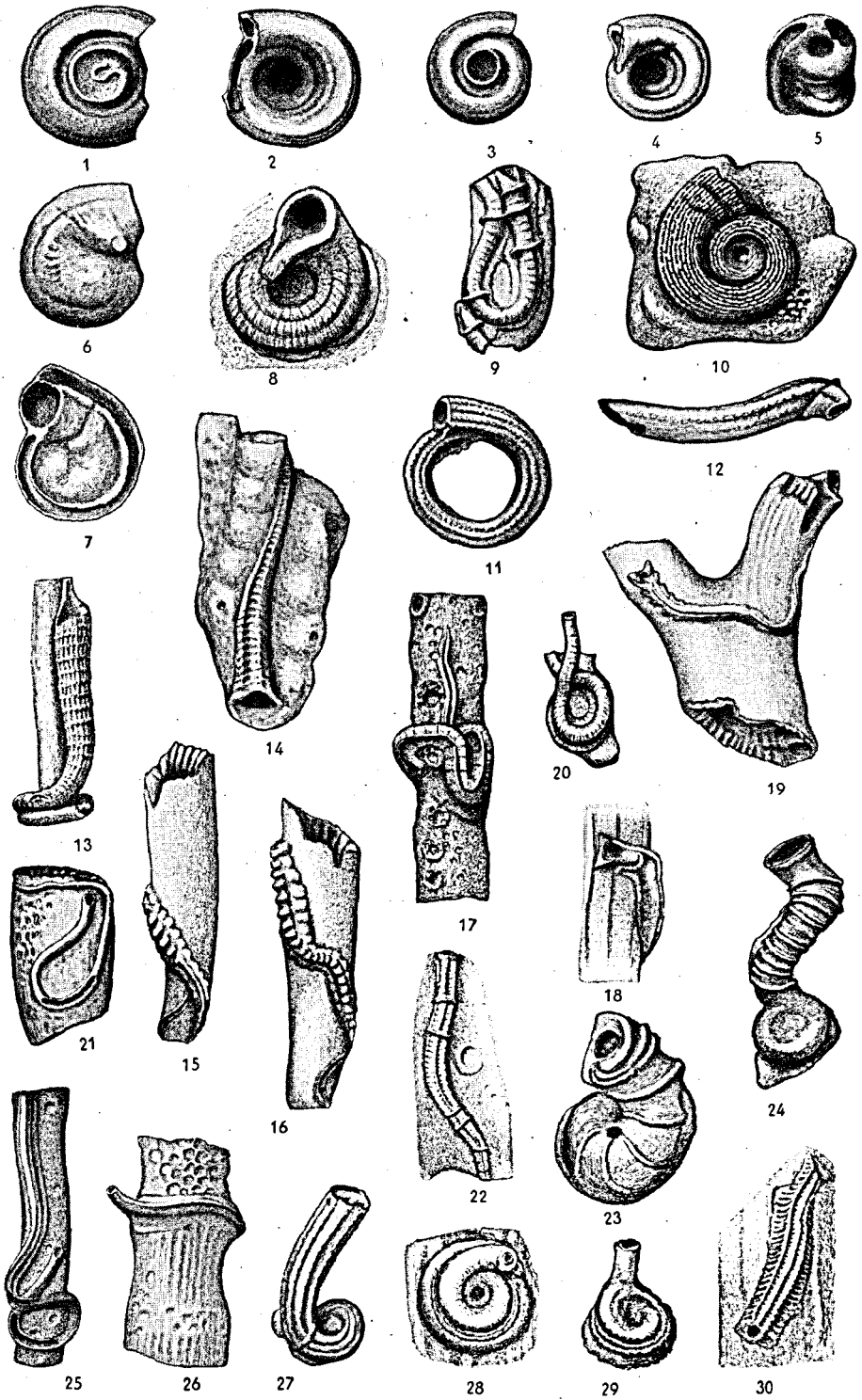
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