

VI.

THE COMATULAE

of the „Willem Barents” Expeditions, 1880—84.

BY

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The Comatulæ of the „Willem Barents” Expeditions, 1880 and 1881.

With Pl. I.

I am greatly obliged to the members of the Commission of the Royal Zoological Society of Amsterdam, which was appointed to report upon the results of the dredgings by the »Willem Barents«, for placing the collection of Comatulæ in my hands; and I am more particularly indebted to Dr. C. KERBERT, the Secretary of the Commission, both for the information which he has afforded me respecting it, and for the efforts which he has made to ensure my having the opportunity of examining all the individuals obtained. This has been a matter of some importance to me, as I have found to be especially the case in differentiating *Antedon quadrata* from young and immature individuals of *Antedon Eschrichti*.

These two species were the only ones obtained in 1880. The former (*A. quadrata*) was never met with in 1881; but the dredging near Vardö in this year (Station 6) brought up two small individuals of *A. dentata* (*A. Sarsii*, auct.) together with a single specimen of a new and very remarkable form which I propose to call *Antedon Barentsi*.

The collection unfortunately contains no Stalked Crinoids; but the southernmost dredging of the »Willem Barents« was nearly five degrees further north than the highest station at which *Bathycrinus Carpenteri* was obtained by the Norwegian North Atlantic Expedition of 1875; and the bathymetrical range of the type, 1050—1495 fathoms, is at least 850 fathoms below the deepest haul of the »Willem Barents«. Under these circumstances, therefore, its occurrence in the collection now under consideration was scarcely to be expected, especially as it was never met with by the »Vega«.

The collection contains a fine series of the well known Arctic species *Antedon Eschrichti*, which has recently been well described by SLADEN ¹⁾ from specimens in the collection made by

¹⁾ DUNCAN and SLADEN. A Memoir on the Echinodermata of the Arctic Sea to the West of Greenland. London. 1881. pp. 73—75. Pl. VI, fig. 1—4. In HOFFMANN's report on the Echinoderms obtained by the „Willem Barents“ in 1878—79 (Niederl. Arch. für Zool. Suppl. Band I. p. 1). DUNCAN and SLADEN are erroneously quoted as calling this species by the old generic name *Alecto* of Leach. This has not been applied to a Comatula for at least twenty years, since the revival of de Freminville's name *Antedon* by Mr. NORMAN (Ann. and Mag. Nat. Hist. Series 3. Vol. XV. p. 98); and it is not likely therefore that my countrymen would have been guilty of the anachronism which is attributed to them by HOFFMANN. I believe that I am correct in saying that *Alecto* has also fallen into disuse as a generic name among the Polyzoa.

the British Arctic expedition of 1875—76. These were exclusively obtained from the sea to the West of Greenland, ranging as far north as lat. 81°. 41' N; while those now under consideration were dredged in the neighbourhood of Nova Zembla, between the parallels of 74° and 77°. Many specimens were obtained by the »Vega« off the Siberian coast, and also by the »Porcupine« (1869) and the »Triton« (1882) in the »Cold Area« between the Shetlands and the Faeroes; and lastly by the »Challenger« off Halifax, this being, so far as I know, the southernmost limit of the type.

The specimen described as *Antedon Eschrichti*, var. *Magellanica*, by Prof. F. J. BELL¹⁾ appears to me to be as distinct from the Arctic type as is *Antedon quadrata* (*A. celtica* of VON MARENZELLER and of SLADEN). I do not separate them on account of the slight differences which BELL describes between the pinnules of the Northern and Southern forms respectively; but because of the shape of the arm-joints in his var. *Magellanica*, to which he makes no allusion whatever. This is a far more constant character than the appearance of the lower pinnules, which varies greatly in *Ant. Eschrichti*; and it produces a very decided effect upon the general facies of the plume which is formed by the outer parts of the arms in the two types.

The cirri of *Ant. Magellanica* are somewhat smaller than those of an equal sized *Ant. Eschrichti*; and the short triangular outline of the joints in the outer and middle parts of the arms, which is so very characteristic of this species (Pl. I, fig. 9), is totally wanting in *Ant. magellanica*.

In the arm-joints of the latter the length bears a large proportion to the width, eventually exceeding it, while the joints become markedly quadrate in form; so that the later pinnules are widely separated.

¹⁾ Note on a Crinoid from the straits of Magellan. Proc. Zool. Soc. Lond. 1882 p. 650.

Description of the specimens.

1. *Antedon Eschrichti*, MÜLL. sp.

Pl. I. Figs. 7—10.

Specific formula ¹⁾ — A. $10 \frac{c}{c}$

Special marks. Very numerous long cirri of 40—60 joints. Arm-bases more or less tubercular; the following joints of triangular outline and wider than long, especially in the outer parts of the arms. The first three outer pinnules (on 2nd, 4th, and 6th brachials) tolerably equal, long, and flagellate. The following ones shorter, but soon increasing again; their two basal joints becoming enlarged and flattened, but more or less widely separated by ligament.

A. Cruise of 1881. August 18th. Station 17.

Lat. 75° 49' N., long. 58° 41' E. 68 fathoms. Fine grey mud with stones. Bottom temperature —1°.8 C.

Only a single individual was obtained here; but it is one of the largest I have ever seen, its spread reaching fifty centimetres (Pl. I, fig. 7).

The hemispherical centrodorsal is thickly covered with cirri the longest of which, consisting of 50 joints, reach 60 mm. There are a few short basal joints, and the next twenty are longer than wide, but in gradually diminishing proportion. The later joints and especially the penultimate, project slightly beyond the bases of their successors; but they can scarcely be said to have distinct spines. The first radials are invisible, and but little can be seen of the second. The axillaries are diamond-shaped, the width being about equal to the length, more than half of which is on the distal side of the line joining the lateral angles.

The arm-bases are strongly tubercular, alternately on opposite sides, owing to the elevation of the apposed edges of successive joints. There are more than 300 joints in an arm, the largest number I have ever counted in any Comatula. They are smoother from about the twelfth onwards and distinctly wider than long (Pl. I, figs. 7, 9); while they are triangular throughout till quite near the arm-ends, where they become quadrate, but never longer than wide.

The lower pinnules vary somewhat in size, but are all long and flagellate. The first one, borne by the second brachial, reaches about 30 mm. The next two on the outer side of the arm (on 4th and 6th brachials) reach from 35 to 40 mm., the second one being rather the longer; while the fourth pinnule falls to 30—35 mm.

The first four pairs of pinnules have wide lower joints, somewhat longer along the ventral than along the dorsal edge, which is slightly sharpened and not in contact with those of adjacent joints. For the first 15 or 20 joints these pinnules taper rather rapidly, afterwards remaining tolerably slender and uniform till near their ends; and the joints retain indications of the sharpened dorsal edge, which is produced in the later ones into a bluntly angular process, so as to give the end of the pinnule a somewhat serrate appearance.

¹⁾ For an explanation of the signs used in these formulae, see F. J. BELL. Proc. Zool. Soc., 1882, pp. 530—535; and P. H. CARPENTER, *ibid.* pp. 731—747.

After the third pinnule the length diminishes considerably, the sixth barely reaching 20 mm. The basal joints become longer as well as broad, so as to support the large genital glands, and the later ones are markedly longer than wide. The pinnules also taper more slowly and again increase in length, those on the middle of the arm reaching 30 mm., after which they diminish again. The dorsal surface of these middle and outer pinnules is nearly smooth.

After the tenth or twelfth pinnule (about the 25th brachial) the two basal joints become much wider than the rest. They are somewhat compressed laterally, and assume a trapezoidal form with their broader ends in contact (Pl. I, fig. 8). This becomes more marked as the pinnules decrease in stoutness, while the two joints gradually come to be less and less closely approximated. Thus about the middle of the arm their apposed faces are only in contact by their ventral edges, the large ligamentous bundles filling up the intervening space on the dorsal side.

The disc of this specimen is not visible, owing to the arms being closed over it.

B. Station 18. August 25. 1881. Lat. 77° 5' 2" N., long. 63° 53' E. 65 fathoms. Fine mud with many stones. Bottom temperature — 1° C.

Another fine specimen was obtained here, nearly as large as that just described, its disc being 25 mm. across.

The axillaries are not so much diamond-shaped as triangular, with a backward projection in the middle of the base. This forms the proximal angle which is a good deal blunter than in the preceding specimen, its limbs being more horizontal; so that a still larger proportion of the length of the plate lies in front of the line joining its lateral angles, and more of the second radial is visible. In like manner the second brachials project backwards less strongly into the first, and the arm-bases as a whole are less tubercular.

The pinnules are as already described. The first three are tolerably equal, that on the second brachial being rather the shorter; and there is then a sudden diminution in length, followed by a gradual increase.

C. Station 21. September 7. 1881. Lat. 76° 51' N., long. 44° 20' E. 145 fathoms. Mud. Bottom temperature — 1°.1 C.

Ten specimens were obtained here, none of them, however, so large or so perfect as the two just noticed; and also one example of the parasite *Myzostoma gigas*, LUTKEN, M. S. ¹⁾

Some of the axillaries are distinctly triangular; while others are as decidedly diamond-shaped. In fact there is more or less variation in form between the five axillaries of each individual. A similar indefiniteness prevails in the relative proportions of the lower pinnules; for both the third and the fourth may be much smaller than the second, and more nearly equal than they are in the two large specimens; while the basal joints of these lower pinnules have their distal ends considerably raised above the proximal ends of the following joints. The tubercular character of the arm-bases is less apparent; and in the pinnules of the joints immediately following the greater width of the two lowest joints is less evident, though it is distinct enough farther out on the arms. These differences are doubtless merely of an ontogenetic nature, and due to the immature condition of the specimens; for they are more evident in the smaller individuals obtained in 1880.

D. Cruise of 1880. Station 21. July 30. 1880. Lat. 74° 41' 4" N., long. 50° 23' E. 84 fathoms. Bottom temperature 0°.6 C.

¹⁾ My friend Prof. L. VON GRAFF has been kind enough to identify this specimen for me.

The nine specimens obtained here are somewhat less mature than those dredged in 1881, and the arm bases are less tubercular with relatively longer joints. Portions of the first radials are visible at the angles of the calyx, and also the whole of the trapezoidal second radials. These are much raised in the centre, and deeply incised to receive the strong backward process from the middle of the base of the axillary.

The third pinnule is generally nearly equal to the second, though sometimes considerably shorter; but it is a good deal longer than the fourth. Many individuals show a well marked serration along the medio-dorsal line of the lower portions of the basal pinnules. On the other hand, the peculiar lateral compression and extra width of the lower pinnule-joints is less well marked in the pinnules at the end of the first third of the arm, though it is distinct enough farther out.

Two individuals of *Myzostoma gigas*, LÜTKEN, M. S., were obtained with these specimens.

2. *Antedon quadrata*, P. H. CARPENTER, sp.

Pl. I. Fig. 6.

Specific formula, $A. 10 \frac{c}{bc}$

Special marks. The lower arm-joints (after the twelfth) as long or somewhat longer than wide, and slightly quadrate in outline, though sometimes triangular. Those in the middle of the arm are distinctly quadrate, the length bearing a large proportion to the breadth; and the later ones are somewhat elongated. But none of the joints are shaped like an isosceles triangle, and much shorter than wide.

The third pair of pinnules (on 6th and 7th br.) are little more than half as long as the second pair; and the basal joints of the lower pinnules have their dorsal edges more or less produced into sharp flattened processes.

This widely distributed Arctic species has hitherto been known under the name of *Antedon celtica*. This name was applied to it by VON MARENZELLER ¹⁾ in the first instance, and subsequently by DUNCAN and SLADEN ²⁾, in the belief, since found to be erroneous, of its identity with the type previously described by BARRETT under that name. An account of the circumstances which have led me to give it a new specific title, will be found in my report on the Crinoids dredged by H. M. SS. »Porcupine« and »Triton« in the years 1869 and 1882 respectively ³⁾.

Two very characteristic specimens were obtained by the »Willem Barents« in 1880, within a few miles of the position where VON MARENZELLER's example was dredged. Station 21. July 30. 1880. Lat. 7° 41' 4" N., long. 50° 23' E. 84 fathoms. Bottom temperature 0°.6 C.

¹⁾ „Die Coelenteraten, Echinodermen, und Würmer der K. K. Oesterreichisch-Ungarischen Nordpol-Expedition.“ Denkschr. d. Wien. Akad., Bd. XXXV. p. 25 (of separate copy).

²⁾ Op. cit. p. 75, Pl. VI. Figs. 5, 6.

³⁾ „On the Crinoidea of the North Atlantic between Gibraltar and the Faeroe islands“. Proc. Roy. Soc. Edinburgh, Session 1883-84. Vol. XII. pp. 375-377.

The larger one measures 5 mm. across the radials, and 16 mm. across the disc; but the arms are unfortunately very much mutilated.

The mature cirri do not differ essentially from those of an equal sized *Antedon Eschrichti* from the same locality; they consist of from thirty to forty smooth joints, most of which are longer than broad, though never very prominently so. The first radials are just visible in the form of short, band-like plates, as in the young *Ant. Eschrichti*; and the axillaries are broader than long, with the middle of the base projecting backwards into the second radial.¹⁾ But this is scarcely marked enough to give the plate a really rhombic outline.

The first brachials are flatter and less deeply incised than those of *Ant. Eschrichti*, and the arm-bases are quite smooth. The thirteenth and following brachials are not triangular as in that species, but distinctly quadrate; though here and there one may be seen with the short fourth side reduced to a minimum. Farther out on the arms this distinction is still maintained, and the contrast between their terminal joints and the relatively short, wider, and more triangular joints of *Ant. Eschrichti* (Pl. I, figs. 7—9) is very marked.

The lower pinnules are much broken, and it is therefore difficult to estimate their relative sizes. Their basal joints, though broad, are relatively less so than in *Ant. Eschrichti*, and have very prominent dorsal processes.

The serrate appearance of the pinnule-ends which is characteristic of that type, is but slightly marked in *Ant. quadrata*. A pinnule on the third brachial of this specimen, measuring 14 mm., consists of 35 joints; while that borne by the sixth brachial is only 8 mm. long with about 15 joints; the third pair of pinnules being considerably shorter than their predecessors.

The following pinnules closely resemble those of *Ant. Eschrichti*, but the lower joints are relatively longer and less stout, and do not overlap so much, so that the dorsal edge of the pinnule is smoother. The peculiar flattening of the two lower joints in the middle and outer pinnules which is so marked in *Ant. Eschrichti* (Pl. I, fig. 8) is much less apparent in *Ant. quadrata*; though the general plume of the arms in this specimen and in two of the individuals dredged by H. M. S. »Alert« in Discovery Bay (Lat. 81° 41' N.) and in Franklin Pierce Bay (Lat. 79° 25' N.) is just as feathery in appearance as in *Ant. Eschrichti*.

The smaller specimen is marked Station 22; though it has the same date and locality as those for Station 21. It measures 4 mm. across the radials, and I have compared it with a still immature individual of *Ant. Eschrichti*, in which this measurement is 8 mm. Of these two the *Ant. quadrata* has fewer and more slender cirri. The longest one remaining reaches 14 mm., and consists of 25 joints the lowest of which, after the first three, are longer than their successors. The bases of a few much stouter and longer ones still remain (Pl. I, fig. 6).

The distal edges of the first radials are just visible above the edge of the centrodorsal; and the second are less trapezoidal than in the older individual, while the backward process of the rhombic axillary occupies more of the width of the plate. The quadrate form of the arm-joints is fairly well marked, and strikes the eye at once when the specimen is compared with a young *Ant. Eschrichti*. The basal joints of the lower pinnules are not specially broad, though the dorsal processes are exceedingly distinct; but the modification of the two first joints in the later pinnules is scarcely as definite as in larger individuals.

¹⁾ This and other descriptions of the shape of the radials and lower brachials apply to the joints as seen "full" from the dorsal side. In the position which they occupy when the animal is represented as a whole, they are always more or less foreshortened.

3. *Antedon dentata*, SAY, sp.

Specific formula — A 10 $\frac{bc}{ab}$

Antedon Sarsii, Auct.

Cruise of 1881. Station 6. June 24, 1881. Close to Vardö. Lat. 70° 40' N., long. 31° 10' E. 132 fathoms. Hard ground, covered with a thin layer of mud.

Two calyces were dredged here, both with portions of the arms attached, one of them being small and the other fairly mature. So far as I am aware, no examples of this widely distributed species have been recorded from any locality east of the North Cape, with the exception of those obtained by the dredging of the ill-fated »Tegetthof« off the south-east portion of Franz-Joseph Land. The latter were regarded by VON MARENZELLER ¹⁾ as differing from the typical Norwegian specimens in having long cirri consisting of over thirty joints. The two dredged by the »Willem Barents« occupy an intermediate position between the two forms; for they have rather over 20 cirrus-joints with forward projecting spines which are much more marked than in the individuals from southern Norway. The latter, however, are generally less robust than the northern forms, which rather resemble those dredged by the »Porcupine« and »Triton« in the Atlantic and in the Faeroe channel, and also the American variety from New Jersey, to which SAY's name was originally applied. ²⁾

4. *Antedon Barentsi*, sp. nov.

Pl. I. Figs. 1—5.

Specific formula — A 10 $\frac{bc}{b}$

Cruise of 1881. Station 5. June 24, 1881. Close to Vardö. Lat. 70° 40' N., long. 31° 10' E. 132 Fathoms. Hard ground, covered with a thin layer of mud.

Description of an individual. Centrodorsal hemispherical, and thickly covered with cirri, except at the dorsal pole. These do not reach 20 mm. in length, and consist of 20 to 25 or 30 joints of which the fourth and the eight or ten following ones are longer than wide, and overlap slightly on the dorsal side. The later joints are somewhat sharpened and carinate; but there is very little trace of an opposing spine on the penultimate one.

The first radials are totally concealed; the second short, even at the sides, and only just visible in the middle line of the ray, as they are deeply incised to receive the strong backward projections of the rhombic axillaries, which are about as long as wide. The first brachials have long outer sides and short inner ones, which are well separated above the axillaries. The second brachials are irregularly quadrate, projecting backwards into the first, but not so much so as to conceal them in the median line of the arm. The third brachials are roughly oblong, and the next six quadrate, with pinnules on the shorter sides, the longer being marked by backward projections.

There are syzygies in the third and eighth brachials, and then at intervals of three or four joints throughout the rest of the arm. The lower and middle brachials are triangular and about as wide as long. But farther out the length exceeds the width, and the quadrate form is gradually assumed.

¹⁾ Op. cit. p. p. 25, 26.

²⁾ See VERRILL, Amer. Journ. Sci., vol. XXIII. p. 222; and also Proc. R. S. Edinburgh. 1883—84. p. 363.

The distal edges of the joints are somewhat raised so that the dorsal surface of the arm is rather uneven.

The first pair of pinnules (on 2rd and 3rd br.) consist of some 30 joints, and reach nearly 15 mm. in length. The dorsal edges of the wide lower joints are cut away at the ends so as to be somewhat pointed, while those of the following joints are sharpened; and traces of this sharpening appear on the more elongated later joints, so that the end of the pinnule has a slightly serrate appearance. The second pair are much shorter than the first, only reaching 8 mm., and consisting of about 20 joints. The basal ones are larger than those of the preceding pinnules, and also much sharpened dorsally, being sometimes slightly bifid; while the third pair are still shorter, though composed of larger basal joints. The next following pinnules consist of longish joints, the lowest of which are very stout and the later ones slender. In the outer parts of the arms the pinnules are very slender and delicate; they consist of 15 joints, the two lowest of which are flattened and expanded and the remainder elongated.

The genital glands are fusiform but not very long, only occupying about half the length of the pinnules which contain them (Pl. I, fig. 5). The six or eight joints which support them have their outer sides (i. e. those away from the middle line of the arm) produced upwards, and the perisome enclosing the glands is thickly covered with very irregularly arranged limestone plates.

Colour, in spirit, a light brick red, with darker patches on the cirri. Sacculi very abundant and more deeply coloured.

Spread probably about 90 mm.

Remarks. This curious species is most nearly allied to *Antedon hystrix* and *A. proluxa*; but it is very well defined from both of them. The cirrus-joints are fewer in number and less elongated, while the third pinnule is shorter and not longer than the second, as is the case in these two species. Both of them have smooth arms, with the outer joints distinctly quadrate or even elongated; while the arm-joints of *Ant. Barentsi* have raised edges and are relatively short, only becoming quadrate near the ends. In the relations of the two outer radials and of the two lower brachials *Ant. Barentsi* resembles *Ant. proluxa* rather than *Ant. hystrix*, in which the axillaries and the second brachials almost entirely conceal the preceding joints in the middle line of the arm.

The most striking peculiarity about *Ant. Barentsi* is the extensive development of anambulacral plates in the perisome of the genital pinnules. In this respect it differs from all the Comatulæ of the arctic and temperate regions, and resembles those of the Caribbean sea and Oceania.

The plates are not very well defined, however, and are usually disposed quite irregularly (Pl. I, figs. 2—5). The limestone network extends up into the edges of the food-groove; but it does not form regular side plates or covering plates as in the tropical species; though there are gaps in it for the reception of the sacculi, just as in these forms. In some cases besides the regular row of sacculi at the bases of the tentacles, there are a few additional ones which lie among the anambulacral plates (Pl. I, fig. 5). Where these plates are absent, as at the ends of the ovarian pinnules and in the later pinnules of the arm, the limestone network is still largely developed at the sides of the ambulacra, though without any regular arrangement into plates.

¹) Proc. Roy. Soc. Edinburgh. 1883—84. pp. 365—368.

The Comatulæ of the „Willem Barents” Expeditions, 1882 and 1884.

The only Crinoid obtained by the »Willem Barents« during the Expedition of 1882 was a specimen of *Antedon Eschrichti* of medium size, and perfectly normal in its characters.

This species was also the only one obtained in 1884, examples of it occurring at two stations.

N°. 4. July 6th, 1884. Lat. 76° 59' N., long. 18° 21' E. 70 fathoms. Clay. Bottom temperature — 0°.3 C.

- a.* A large and fully grown specimen with decidedly tubercular arm-bases; but the flattening of the basal joints of the pinnules on the outer parts of the arms is less apparent than is sometimes the case.
- b.* A somewhat smaller and less mature individual with smoother arm-bases; but there is a more marked flattening of the basal joints of the outer pinnules.
- c.* A smaller and much younger specimen with smooth arm-bases. In its general facies it presents a certain resemblance to some forms of *Antedon quadrata*; but its true nature is revealed by the comparative shortness of the later arm-joints, which are much wider than long.

N°. 10. September 17th, 1884. Lat. 75° 30' N., long. 33° 40' 7" E. 90 fathoms. Clay and stones. Bottom temperature — 0°.6 C.

Three nearly mature individuals with slightly tubercular arm-bases, and the lower joints of the later pinnules perceptibly flattened. Another specimen rather younger.

None of these Comatulæ obtained in 1884 are in such a good state of preservation as some of those which were dredged in previous years.

Explanation of Pl. I

Fig. 1—5. Antedon Barentsi, Sp. N.

Fig. 1. The only specimen obtained. $\times 1\frac{1}{2}$.

Fig. 2—4. Three genital pinnules dried, to show the perisomic plates protecting their enlarged lower portions. $\times 10$.

Fig. 5. Another genital pinnule, viewed as a transparent object. $\times 10$.

Fig. 6. Antedon quadrata, P. H. CARPENTER, Sp. The smaller specimen. $\times 2$.

Fig. 7—10. Antedon Eschrichti, MÜLLER, Sp.

Fig. 7. Calyx and arm bases of the largest specimen obtained. Natural size.

Fig. 8. Portion of the third quarter of an arm, from the side. $\times 2$.

Fig. 9. Portion of the second quarter of an arm; dorsal view. $\times 2$.

Fig. 10. Portion of one of the brachial ambulacra. $\times 2$.

