

A NEW EUROPEAN CRINOID.

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The careful and painstaking work of the late Dr. Oswald Seeliger upon the embryogeny of *Antedon* carried on at Trieste gave results which were, in many important particulars, different from those attained by Prof. Jules Barrois at Villafranca and by Mr. H. Bury at Naples.

Seeliger finds the diameter of the eggs to be 0.25 mm., while Bury gives it as 0.30 mm. It will be remembered that Wyville Thomson found the eggs of *Antedon bifida* to measure 0.50 mm. in diameter. Seeliger noticed that the segmentation from the third cleavage furrow onward was unequal, resulting in the formation of a blastosphere with markedly larger cells at the vegetative than at the animal pole, but Bury and Barrois found the cells of the blastosphere to be similar throughout. Gastrulation occurred, according to Seeliger, scarcely seven hours after the appearance of the first cleavage furrow; but Barrois and Bury first noticed it from twenty to twenty-four hours after fertilization. Seeliger reports that the blastopore is closed at the latest thirty-six hours after the first cleavage, but Bury records that this change takes place about forty hours after. Bury, who was the first to find underbasals in *Antedon* (though their occurrence in the larvæ had been shown to be probable many years before by Wachsmuth and Springer), gives the usual number as three; Seeliger, on the other hand, reports it as four or five.

Now from an embryological point of view these differences are fundamental, and are far greater than would reasonably be expected within the limits of a single species. All three workers referred their specimens to *Antedon rosacea*, which, as understood by them, ranged from Norway southward to and throughout the Mediterranean; but they all suspected that this specific determination was unsatisfactory, though none of them attempted to investigate the question. The *Challenger* report upon the comatulids had just been published, and this was naturally taken as their systematic basis.

In the preparation of a monograph upon the recent crinoids I have been enabled, thanks to the kindness of very many fellow-workers,

to examine some hundreds of *Antedons* representing all the localities inhabited by the genus, and I find that there are four perfectly distinct and readily recognizable species, two inhabiting the Atlantic coasts of Europe and two the southern shores east of the Straits of Gibraltar. For the two first the names *Alecto petasus* Düben and Koren, 1846, and *Asterias bifida* Pennant, 1777, are available, while one of the two last should bear the title of (*Comatula*) *mediterranea* Lamarek, 1816. The fourth species, which so long ago as 1792 Olivi found to be abundant in the Adriatic Sea, has never been recognized by systematists, but has always been considered the same as the preceding, which, in turn, has usually been confused with the *bifida* of Pennant and often, in addition, with the *petasus* of Düben and Koren.

These four species, far from being so closely related that only an extremist can distinguish them, may be at once recognized at sight by anyone who will take the trouble to make himself familiar with their characters; the two Mediterranean forms have very long and slender arms, and long slender cirri with numerous segments, while the Atlantic species have much shorter and stouter arms and cirri, the latter with fewer segments. *Antedon petasus* differs from *A. bifida* chiefly and most obviously in the very much greater number of its cirri, while the two Mediterranean forms are most readily differentiated by the proportionate length of the cirri and by the numbers of their component segments.

A review of the facts presented by the study of comatulid ontogeny shows that *Antedon bifida*, and especially *A. petasus*, represent a phylogenetically more advanced condition than the comparatively primitive Mediterranean forms, and that of these latter the Adriatic species is less developed than the one found from Italy westward. Now the Adriatic form usually has four or five underbasals, and the one occurring at Naples, Toulon, and Villafranca three. No underbasals have ever been found in *Antedon bifida*, but this is not at all remarkable, nor does it reflect upon the powers of observation of the able naturalists who have studied it; for if the comparatively slight specialization of *Antedon mediterranea* over the Adriatic species is sufficient to result in the reduction of the number of underbasals from four or five to three, we may readily infer that the much greater degree of specialization of *A. bifida* over *A. mediterranea* would result in the elimination of underbasals entirely from the ontogeny of the former. I can see no reason whatever for doubting the accuracy of the work of Wyville Thomson, Perrier, and the two Carpenters, who, none of them, found underbasals in *Antedon bifida*, and I should be greatly surprised if anyone in the future should find them in that species or in *A. petasus*, except, perhaps, in sporadic instances.

The anal plate is the only interradiation which has been observed in the two Mediterranean species of the genus *Antedon*: but Wyville Thomson observed "in one or two cases * * * about the time of the first appearance of the anal plate a series of five minute rounded plates developed interradially between the lower edges of the anal plates and the upper edge of the basals." The appearance of five interradiations in *Antedon bifida* is exceedingly interesting, for it shows an approach to the conditions found in the highly specialized family Comasteridæ, in which they are always, so far as known, highly developed in the young,^a and to the conditions found in the equally specialized family Pentametrocrinidæ, in which they were described in the young of one of the species of *Pentametrocrinus* ("*Thaumatocrinus*").

I have recently shown that *Antedon* is primarily an Indian Ocean genus, an intrusion into the Atlantic area, like *Leptometra*. The area inhabited by it is marked by a series of species each phylogenetically more developed than its predecessor, and the least specialized more advanced than the species of *Mastigometra*, its modern representative in the Indian Ocean.

The hitherto undescribed *Antedon* from the Adriatic Sea may be appropriately known as:

ANTEDON ADRIATICA, new species.

Centrodorsal flattened hemispherical, about 4 mm. in diameter at the base, the bare dorsal pole flat, about 1.5 mm. in diameter; cirrus sockets arranged approximately in three closely crowded alternating rows, the uppermost of which includes about four sockets in each radial area.

Cirri XXV–XL (usually XXX–XXXV) 22–30 (usually 24–28), 20 mm. to 27 mm. long, slender, and of uniform thickness throughout their length; first segment very short, the second about half again as broad as long, the third about as long as broad, the fourth half again as long as the width of its expanded ends; fifth and following about twice as long as the width of the distal ends, and remaining of practically the same proportions to the end of the cirrus, though the distal segments may be a trifle shorter than those nearer the base; penultimate segment nearly or quite twice as long as broad, and bearing a prominent slender and sharp opposing spine which is subterminal in position, directed slightly forward or nearly erect, and equal to about one-half the distal diameter of the penultimate segment in height. Terminal claw slender, evenly tapering, and moderately and uniformly curved, about equal to the penultimate segment

^aThey have been described in the young of *Comatilia*, and they are equally well developed in the pentacrinoids of *Comactinia meridionalis*.

in length. The fourth and following segments are moderately constricted centrally, so that the ends are prominent; this character slowly diminishes in the distal half of the cirri. The cirri are nearly round in basal section, but gradually become slightly compressed laterally and are moderately compressed in the distal portion; this lateral compression is very gradual, and is not attended with an increase in the lateral diameter of the cirrus as in *Antedon bifida*. In a lateral view the dorsal profile of the segments is seen to be slightly more concave than the ventral, especially distally, making the proximal and distal dorsal ends of the segments somewhat prominent.

Disk resembling that of *Antedon mediterranea*, usually naked, but sometimes with a more or less abundance of calcareous spicules in the inner part of the interpalmar areas; sacculi abundant along the ambulacra, but small and irregularly arranged in one, two, or three rows, becoming more definitely arranged in a single row along the brachial ambulacra.

Radials even with, or extending very slightly beyond, the edge of the centrodorsal, rising in the interradial angles of the calyx into a low triangle; I Br₁ oblong or slightly trapezoidal, two and a half to three times as broad as long, the lateral edges slightly produced and swollen; a shallow groove usually borders this swollen edge interiorly, which may be reduced to a small round pit just proximal to the median horizontal diameter of the ossicle. I Br₂ (axillary) roughly a right-angled triangle, the apex rather sharp; lateral edges, which are about half the length of those of the I Br₁, somewhat swollen and produced.

Ten slender arms 100 mm. to 110 mm. long; first brachial wedge-shaped, twice as long exteriorly as interiorly, about half again as broad as the exterior length, interiorly just in contact basally; the exterior margin is swollen and slightly produced; second brachial irregularly quadrate, larger than the first, though of about the same length exteriorly; synarthrial tubercles sometimes slightly prominent, but usually not marked; third and fourth brachials (syzygial pair) slightly longer interiorly than exteriorly, about half again as broad as long in the median line; fifth brachial slightly wedge-shaped, about twice as broad as long in the median line, the following becoming more obliquely wedge-shaped, and after the second syzygy triangular, about as long as broad, soon becoming somewhat less oblique and wedge-shaped again and very slowly increasing in length, being very long terminally. Syzygies occur between the third and fourth brachials, again between the ninth and tenth and fourteenth and fifteenth, and distally at intervals of three oblique muscular articulations.

P₁ 11 mm. to 13 mm. long with seventeen or eighteen segments, the first about as long as broad, the remainder about twice as long as broad, becoming somewhat longer distally; the pinnule is much

stouter than those succeeding, and tapers very gradually to the tip; it is not so slender distally as in *A. bifida*; the third and following segments have the distal outer edge produced and finely spinous, this increasing gradually in intensity and becoming prominent in the outer half of the pinnule. P_2 7 mm. to 8 mm. long with twelve segments, the first about twice as broad as long, the second squarish, the remainder about twice as long as broad, becoming terminally about three times as long as broad; the third and following develop projecting and spinous distal outer edges which are quite prominent; P_3 and following pinnules similar to P_2 ; the distal pinnules are 10 mm. to 12 mm. long, exceedingly slender, with twenty segments, the first longer than broad, the remainder greatly elongated with swollen articulations.

Type-specimen.—Cat. No. 24313, U.S.N.M., from Trieste.

Ninety-six additional specimens from Trieste were examined.

Cotypes are in the Copenhagen Museum, Copenhagen, Denmark; the Zoological Museum at Berlin, Germany, and in the Museum of Comparative Zoology at Cambridge, Massachusetts.