

FOUR NEW SPECIES OF THE CRINOID GENUS RHIZOCRINUS.

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In his report upon the stalked crinoids collected by the *Challenger*, Dr. P. H. Carpenter admitted only two recent species of the genus *Rhizocrinus*, *R. lofotensis*, and *R. rawsoni*. The former is credited with a geographical range extending from the Lofoten Islands and Nantucket (Mass.) southward to Uruguay, and with a bathymetric range of from 80 to 1,900 fathoms; the latter is said to inhabit the Atlantic coasts of southern Europe and northern Africa, and to occur among the outlying groups of islands and throughout the West Indies at depths of from 73 to 1,277 fathoms. The first record of *lofotensis* is, of course, the original description of Sars, in 1864, when the genus was founded; the first record of *rawsoni* (under the name *lofotensis*) is that published in 1870 by Fischer,^a who had obtained specimens off Setuval, Portugal, this antedating by two years Sir Wyville Thomson's record of the *Porcupine* specimens, cited as the first by Carpenter.

In 1883 Professor Perrier had described a supposedly new crinoid which had been dredged by the *Travailleur* off Morocco under the name of *Democrinus parfaiti*. This new genus was strongly criticised by Carpenter, who placed the type-species under the synonymy of *Rhizocrinus rawsoni*, as understood by him. Two years later (a year after the publication of the *Challenger* report) Perrier described, under the name of *Ilyocrinus recuperatus*, a very remarkable species, in all essentials a *Bathycrinus*, but having separate basals. This was also subjected to severe criticism by Carpenter. In the next year Korotneff reported the discovery of a large species of "*Rhizocrinus*" in the Straits of Sunda, where it was easily obtainable before the eruption of Krakatoa.^b

Aside from a few additional records by Rathbun, K  hler, Chun, Grieg, and Agassiz (the last proving to be a *Bathycrinus*), nothing

^a Actes de la Soc. linn. de Bordeaux, XXVII, p. 351.

^b Bull. de l'acad. roy. de Belgique [3], XII, p. 558.

additional was learned in regard to this genus until 1907, when Professor Döderlein published his report on the stalked crinoids of the *Siboga* expedition. In this he includes two new species, one obtained by the German steamer *Valdivia* off east Africa, the other by the *Siboga* in the East Indies. The latter, *R. weberi*, is possibly the species recorded by Korotneff in 1886.

Doctor Carpenter considered both *Rhizocrinus lofotensis* and *R. rawsoni* extremely variable in all their characters, and so broad are the diagnoses he gives that there appear to be no hard and fast lines of division between them. This, taken in connection with the enormous geographic and bathymetric ranges of the two forms as understood by him, led me to believe that each of Carpenter's species was in reality a composite of several. This opinion was confirmed by an examination of several hundred specimens from the West Indies and Gulf of Mexico in the United States National Museum and in the Museum of Comparative Zoology at Cambridge.

Rhizocrinus lofotensis does not occur on the American side of the Atlantic, its place being taken, from Cape Cod to Florida, by *R. verrilli*, which differs in being somewhat larger, generally stouter, with a less expanded basal cone and much shorter columnars.

RHIZOCRINUS CONIFER, new species.

Basals separated by distinct sutures; calyx very long, conical, expanding evenly from the top of the stem, the diameter at the distal end of the radials about three times that at the distal (lower) end of the basals; length of the calyx six times the distal diameter of the basals and over twice the distal diameter of the radials; a more or less marked constriction at the level of the base or the middle of the radials. The length of the calyx from the top of the stem to the end of the radials is 11 mm.

Stem moderately stout, probably about 150 mm. long; in the type 80 mm. long to the end of the thirtieth columnar; first columnar very short and discoidal, second about four times as broad as long, third not quite twice as broad as long, fourth about one-third longer than broad, fifth about twice as long as broad, after the seventh or eighth becoming three times as long as broad; second to fourteenth or fifteenth slightly barrel shaped, then becoming more cylindrical, with very slightly swollen ends. The longest columnars are about 3 mm. long by 1 mm. in diameter.

The first brachials are trapezoidal, longer than their proximal width.

Type-specimen.—Cat. No. 22679, U.S.N.M.; from *Albatross* station No. 2756; off Ceará, Brazil; lat. 3° 22' 00" S., long. 37° 49' 00" W.; 417 fathoms; bottom temperature, 40.5° F.

RHIZOCRINUS BREVIS, new species.

1888. *Rhizocrinus rawsoni* P. H. CARPENTER, *Challenger* Reports, XXVI, Zoology, p. 267, fig. 19; p. 262 (part); p. 263 (SS. *Investigator*, 15 miles N. by E. of Panama; 300 fathoms).

The two specimens figured by Carpenter, which were dredged by Capt. E. Cole, of the cable ship *Investigator*, off Colon (not Panama), appear to be well worthy of specific recognition. They are not merely an extreme variety of *rawsonii* as supposed by Carpenter, but represent a definite type, presenting valid characters.

The calyx may be described as very short, conical, the width at the distal ends of the radials twice that at the distal (lower) end of the basals, one-fifth greater than the length; the radials are slightly longer than to half again as long as broad; the basals are separated by sutures.

The stem is not figured; but it is probably much like that of *R. robustus*.

The two figured specimens (of which the one represented by figure 19A may be considered the type) are in the zoological department of the British Museum; two others are in the geological department of the same institution.

RHIZOCRINUS SABÆ, new species.

Calyx four times as long as the diameter of the proximal part of the column, and about three times as long as the diameter across the radials; the basal cup is somewhat swollen, so that the greatest diameter of the calyx is between the topmost columnar and the radials, usually nearer the latter, instead of across the radials as usual; this diameter is one-fifth greater than that across the radials, and is 1.8 times the diameter of the upper part of the stem; basals separated by distinct sutures. The calyx measures 4.5 mm. in length from the top of the stem to the distal end of the radials.

Stem very stout, as in *R. rawsonii*, the longest columnars being 2.6 mm. long by 1.7 mm. broad, with a rather prominent constriction.

The arms resemble those of *R. rawsonii*, and are 19 mm. long from the radials.

Type-specimen.—Cat. No. 22700, U.S.N.M., from off Saba, 200 fathoms, taken by Capt. E. Cole, of the cable steamer *Investigator*.

RHIZOCRINUS ROBUSTUS, new species.

Calyx conical, moderately long, expanding evenly from the distal portion of the basals to the radials; summit of stem proportionately small, causing the calyx to appear disproportionately large; calyx three-fifths to nine-tenths again as long as the diameter at the radials and about five times as long as the proximal diameter of the stem.

There is sometimes a slight constriction about the basals or radials, but more commonly none. The basals are separated by distinct sutures.

Stem in large specimens 190 mm. to 280 mm. in length, comparatively slender, with 74 to 106 joints, the longest of which are 1.6 to twice as long as broad, about 3 mm. long. The columnars are all approximately cylindrical, those in the proximal third showing a very slight tendency toward a barrel-like shape, the remainder to a slight central constriction, but neither is as marked as in the related species; the lowest 30 mm. or 40 mm. of the stem has the articulations more or less swollen and produced, this soon giving place to numerous fine radicular cirri and stout irregular branching roots.

Type-specimen.—Cat. No. 22680, U.S.N.M., from *Albatross* station No. 2401; Gulf of Mexico, off Pensacola, Fla.; lat. $28^{\circ} 38' 30''$ N., long. $85^{\circ} 52' 30''$ W.; 142 fathoms; green mud and broken shell.

R. rawsonii may be at once distinguished from any of the above species by its almost cylindrical calyx, which is twice as long as broad at the radials, the latter dimension being usually less than half again as great as the diameter of the proximal part of the stem.

The calyx of *R. parfaiti* (which is a perfectly valid species) is more inclined to conical in its shape; the diameter across the radials is twice that across the distal end of the basals, while the length is one and one-half times the breadth at the radials.^a

The species of *Rhizocrinus* may be conveniently grouped as follows:

- (1) Basals anchylosed, without sutures: *R. lofotensis*, *R. verrilli*.
- (2) Basals always separated by distinct sutures.

(a) Stem comparatively slender, the longer columnars being at least twice as long as broad; calyx distinctly conical: *R. conifer*, *R. brevis*, *R. robustus*, *R. chuni*.

(b) Stem very stout, the longer columnars but little longer than broad; calyx approaching the cylindrical: *R. rawsoni*, *R. parfaiti*, *R. weberi*, *R. saba*.

Döderlein has found that the species of *Bathycrinus* are, like the species of *Rhizocrinus*, divisible into two groups, one with the basals anchylosed into a solid basal cup or ring, the other with the basals separated by suture. This was, however, known long ago, for Perrier's *Ilyocrinus recuperatus* is a species belonging to the latter group, and was the first species of it to be described. A very good figure of it was published by Perrier in his *Explorations sous-marines*, page 273, figure 193 (1886).

^aThe data are taken from the figure published by Professor Perrier in his *Explorations sous-marines* (1886).