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TWO NEW CRINOID GENERA.

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A critical study of the arm structure and the brachial homologies in the recent representatives of the family Pentacrinitidae has made it evident that we are at present confusing, under the name of *Isocrinus* (= *Pentacrinus* of P. H. Carpenter) three quite distinct types, one of which occupies, in certain ways, an intermediate position between the others and *Metacrinus*. In *Metacrinus* we have a condition similar to that found in the Pentametrocrinidae, costals being absent altogether (see these Proceedings, *antea*, p. 134), the only difference being that in *Metacrinus* the arms branch, sometimes as many as five or six times, while in the Pentametrocrinidae the arms are undivided. In *Isocrinus asteria*, *I. blakei*, and *I. decorus*, costals are present, but the arm distal to the first axillary is strictly comparable to the entire arm in *Metacrinus*; that is, in these three species, no matter how many times the arms divide, they are strictly homologous with the arms in a *ten-armed* comatulid (excepting, of course, *Decametrocrinus* and *Uintacrinus*), and are not at all homologous morphologically (though strictly analogous physiologically) to the arms of a multibrachiate comatulid. In *Isocrinus alternicirrus*, *I. parrae*, *I. sibogae* and *I. wyville-thomsoni* the arms are morphologically and physiologically homologous with the arms of multibrachiate comatulids, being composed of costals, distichals, palmars, and one or two post-palmar series before the undivided free arms are reached.

The fact that the arm division in each case results in an isotomous dichotomy appears to have led students to consider it as strictly similar; but while in *Isocrinus alternicirrus*, *I. parrae*, *I.*

sibogae and *I. wyville-thomsoni* arm reduplication is effected by the interpolation of various division series which in reality are mere repetitions of the first two joints of the free undivided arm, as in multibrachiate comatulids, in *Metacrinus* the arm reduplication results from a splitting of the arm at more or less uncertain intervals.* The former I call *interpolated division*, the latter *extraneous division*. In *Isocrinus asteria*, *I. blakei*, and *I. decorus*, we find a combination of these two modes of arm division; the first arm division (and the first only) is an *interpolated division*, those following are *extraneous divisions*. In *Metacrinus* and these two divisions of *Isocrinus*, the first post-radial joints bearing pinnules are in all cases homologous, regardless of the number of joints intervening between them and the radials; this is shown by the articulation between them and the succeeding joint being a muscular articulation in which the transverse ridge separating the dorsal ligament fossa from the interarticular ligament fossa is strongly oblique; that is, an *oblique muscular articulation*, as opposed to a muscular articulation where the transverse ridge is at right angles to the dorso-ventral axis of the joint face, or a *straight muscular articulation*. The first *oblique muscular articulation* occupies morphologically the same position in the arms of all comatulids, and in all the recent Pentacrinitidae, and is followed exclusively by articulations of the same type, interspersed with occasional syzygies; proximal to the first *oblique muscular articulation*, only *straight muscular articulations* and *synathrics* or *bifascial articulations* (which may in any or all cases be replaced by *syzygies*) occur. The first *oblique muscular articulation* in *Metacrinus* and the two divisions of *Isocrinus* is always found on the distal end of the joints bearing the first pinnule.

The *Isocrinus asteria* group is, in arm structure, intermediate between the *I. parvæ* group in which only *interpolated* division is found, and *Metacrinus*, which has only *extraneous* division, as it has one *interpolated* series, followed by one or more *extraneous*

* In both sections of *Isocrinus*, as in the multibrachiate comatulids, the young are ten-armed, the multibrachiate condition arising, as explained by Minckert, through a process of autotomy by which the original arms break off at the articulation between the first and second brachials of the undivided arm, or the third and fourth post-radial joints. Now in *Metacrinus* the first two post-radial joints correspond to these first two post-costal joints in young *Isocrinus*; therefore, it is reasonable to suppose that the very young of *Metacrinus*, having but five articulations when autotomy is possible instead of ten as in *Isocrinus*, will be found to possess but five arms.

series. It therefore appears that, if *Metacrinus* be deemed worthy of generic rank, which no one has questioned, the two divisions of the genus now known as *Isocrinus* are equally entitled to generic rank, as they are as different from each other as the *I. asteria* group is from *Metacrinus*.

The species of the *Isocrinus asteria* group are congeneric with the fossil *Isocrinus pendulus* of von Meyer, which is the type of *Isocrinus* of L. Agassiz, and several other genera have been founded on other species of the same group. No generic name has so far been given to any species of the *I. parvæ* group, and I propose to differentiate them from the *I. asteria* group under the name *Endoxocrinus*.

The peculiar species described by Dr. P. H. Carpenter as *Pentacrinus naresianus* differs in some important characters both from *Endoxocrinus* and from the remaining species of *Isocrinus* and appears to be worthy of rank as a separate genus.

Endoxocrinus gen. nov.

Genotype.—*Eucrinus parvæ* Guérin, 1835 (= *Pentacrinus mülleri* Örsted, 1856).

A genus of Pentacrinitidæ in which the first two post-radial joints are united by syzygy, and the isotomous division series are all of two joints united by syzygy (*interpolated*); the first *oblique muscular articulation* is between the second and third brachials beyond the last axillary; infra-basals always (?) absent, and interior ends of basals more or less resorbed, the primary axial canals forking and entering the basals through two apertures;* basals large and broad, forming, when viewed dorsally, a rounded-pentagonal figure.

Geographic Distribution.—Caribbean Sea and Gulf of Mexico; Atlantic coasts of southern Europe and northern Africa (with the outlying islands); East Indies; not known as a fossil.

Depth.—84–1095 fathoms.

The following species are included in this genus:

E. alternicirrus (P. H. Carpenter).

E. parvæ (Guérin).†

* Reichensperger (Bull. Mus. Comp. Zool. Vol. XLVI, No. 10, p. 173, December, 1905) figures the condition of the axial canals in *Endoxocrinus parvæ*, misidentified as *Isocrinus* ("Pentacrinus") *decorus*. The course of the canals in the latter species is quite different.

† This species, which inhabits the shallowest water of any of the genus, is extraordinarily variable, while the others appear to be pretty constant in their characters; this accords with the rule that a species of a genus which occupies a habitat on the borders of the habitat of the genus as a whole, either geographically or bathymetrically, is more variable than are the other species of the same genus; thus *Rhizocrinus lofotensis* and the corresponding species on the American coast are very commonly

E. sibogae (Döderlein).

E. wyville-thomsoni (Wyville-Thomson).

Hyalocrinus gen. nov.

Genotype.—*Pentacrinus naresianus* P. H. Carpenter, 1882.

A genus of Pentacrinitidae in which the first two post-radial and first two post-costal joints are united by synarthry; a single *interpolated* series is present; no further division; the first *oblique muscular articulation* is between the second and third brachials beyond the only axillary; infra-basals?; basals as in *Endoocrinus*, and not narrow, forming a rounded stellate figure, as in *Isocrinus*.

Geographic distribution.—Kermadec Islands, Fiji, Celebes, and Philippines.

Depth.—500-1350 fathoms.

The only known species is:

H. naresianus (P. H. Carpenter).

The species remaining in *Isocrinus* as here restricted are (in addition to numerous fossil species):

I. (Cenocrinus) asteria (Linnæus).

I. (Isocrinus) blakei (P. H. Carpenter).

I. (Isocrinus) decorus (Wyville-Thomson).

six-rayed, while the numerous species of the same genus within the normal tropical area are invariably five-rayed, and the most variable species of *Metacrinus*, *M. rotundus*, is also the most northerly of the genus; it is the same with species; the examples taken farthest from the center of distribution, or at the limits of distribution, are the most variable; *Tropiometra carinata*, constant in its characters from East Africa to Oceania, is extremely variable in Brazil; *Antedon bifida* is more variable about the British coasts than in the Mediterranean, and *Heliometra eschrichtii* varies most along the southern limit of its range.