IX. *Tapering Ends of Crinoid Stems from Roscobie.* By
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THREE specimens in the collection of Mr James Wright, junior, numbered 902 *a*, *b*, *c*, from the Hurlet Limestone of Roscobie, differ from any distal ends of crinoid stems that I have previously noted. Their peculiarity consists, not merely in an extremely rapid tapering, but in the continuation of the stem thereafter in the form of one or more columnals of normal appearance, but very much smaller size.

In specimen *a*, there are three large columnals with a diameter of 8 mm. The height of the middle one is 5·1 mm., and the height of the distal one is 6·3 mm. This distal one tapers rapidly in its lower third, and is succeeded by three very low ossicles, continuing the same rapid tapering. Whereas the upper ossicles are barrel-shaped, and the sutures between them therefore depressed, the sutures between these low ossicles are flush with the surface, so that all the tapering ossicles appear to form part of a larger one. These are followed by a single small ossicle of normal appearance, but having a diameter of only 2·1 mm.

Specimen *b* (Text-figure) comprises four larger ossicles with a

Specimen *b*; $\times 2$ diam.

diameter of 6·6 mm. The middle ones each have a height of 2·8 mm., and the last one has a height of 4·9 mm. This tapers rapidly, and is succeeded by four small ossicles with a diameter of 2·8 mm.

Specimen *c* consists of an apparently single large ossicle, with a diameter of 5·6 mm., having a height of 8·2 mm., rapidly tapering, and succeeded by a single small ossicle with a diameter of 2·6 mm.

These specimens probably all belong to the same species. The

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larger ossicles are all more or less barrel-shaped, and are covered with an ornament of pustules. In specimen *a* these pustules are irregularly scattered over the surface, but in specimen *b* they are arranged in rings round the ossicle. This appears to have been the case also in specimen *c*, but that is somewhat worn. The tapering ossicles in specimen *a* are also marked by pustules. The small low ossicles in specimen *b*, which are somewhat moniliform, also bear pustules forming a milled edge. The lumen of the larger ossicles in all three specimens appears to have been large. It can be measured in specimen *b*, where it has a diameter of 2.6 mm. The lumen of the small ossicles at the end of the specimen is quite minute. The joint-face of the larger columnals, so far as it can be observed, was covered with radiating striæ, and the exposed joint-face of the last small ossicle of specimen *b* is similarly covered with striæ, radiating from the minute lumen to the circumference. Some of them bifurcate as they radiate, while in other cases the ridges between them bifurcate.

It is probable that these specimens belong to one of the *Dicyclia Inadunata*, but it is not possible to say which. Many of the cup-plates and brachials of species found at Invertiel and Roscobie have a similar granular or pustulate ornament. It is probable that the species was one of those which had the habit of breaking away from its original attachment. In other such cases, the distal end of the stem frequently appears to have become partly resorbed and rounded off. In *Woodocrinus*, the whole stem tapers gradually, as though the crinoid had broken away in rather early youth, and each additional columnal had remained permanently with the same diameter as when first formed. In the specimens before us, however, we seem to see not merely the breaking away of the stem and a partial resorption of the distal columnal, but some sort of attempt at renewed growth from the distal end, resulting in the production of a diminutive stem. There is, however, room for much speculation, and it will probably be wiser to wait till further specimens can shed more light on these curious appearances.

Some words may be added here, on the supposed undue preponderance of stem-fragments in the Carboniferous Limestone at Invertiel and elsewhere. Careful examination of the constituents of the rock frequently shows that this preponderance is not so disproportionate as it appears at first sight. In almost any crinoid, the stem bulks far more largely than the crown. In a disintegrated crinoid, the brachials and smaller plates of the calyx are easily lost sight of in the confused mass of larger plates and columnals, though careful search with a lens or by washing will often detect them. But apart from all this, any disproportion that really exists may often be explained by the fact

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that a large number of these crinoids, though doubtless fixed in their earlier stages, seem to have assumed a partially free mode of life. This was probably the case with the crinoid to which the stem-fragments before us belonged. In this and other species the animal broke away from its primitive attachment, and anchored itself either by cirri or by coiling the end of its stem round some marine object. Often the process may have been repeated, as seems to be the case in some of the Pentacrinidæ now living, and so, as the crinoid moved "to fresh woods and pastures new," it left behind it successive ends of its stem. These portions remained to build up the crinoid limestone, and to puzzle with their abundance the inquisitive Primates of the Holocene Era.

Postscript.—February 1912. Three months after the above was written, Mr Edwin Kirk published his interesting and very full study of this subject, entitled, "The Structure and Relationships of certain Eleutherozoic Pelmatozoa" (*Proc. U.S. National Mus.*, vol. xli. pp. 1-137, pts. i.-xi.).