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**On *Oanducystis* (col.) Stukalina (Crinoidea) from the Craighead
Limestone Formation, Girvan district, Ayrshire**

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Abstract: Only two nominal species of crinoid, the diplobathrid camerates *Diabolocrinus craigheadensis* Ramsbottom and *Diabolocrinus globularis* (Nicholson & Etheridge), have been described from the Ordovician (Chatfieldian; Sandbian) Craighead Limestone Formation, Craighead quarry, near Girvan, Ayrshire. In contrast, columnal morphotaxa are represented by over 20 taxa including those in open nomenclature. Two thecae from Craighead quarry and referred to *Diabolocrinus* sp. or spp. preserve features of the stem facet that are similar to specimens referred to *Oanducystis* (col.) spp. from the same locality. These columnal morphotaxa are synonymised with *Diabolocrinus* and left in open nomenclature. However, *Diabolocrinus* is limited to Laurentia, whereas the remaining morphospecies of *Oanducystis* (col.) Stukalina are limited to Kazakhstan and Estonia.

The Ordovician palaeontology of the Craighead Limestone Formation (Williams & Floyd 2000, fig. 2), exposed at Craighead Quarry, near Girvan, Strathclyde (Ayrshire), is replete with diverse shelly taxa including brachiopods (Williams 1962), trilobites (Tripp 1980) and ostracods (Williams & Floyd 2000). The crinoid fauna was monographed by Ramsbottom (1961) and the columnals by Donovan (1986-1995) (Table 1 herein). The only other stalked echinoderm from this formation is the rhombiferan *Pleurocystites mitratus* Regnéll & Paul, 1981. It is relevant to the present study that the two species described by Ramsbottom, namely *Diabolocrinus craigheadensis* Ramsbottom, 1961, and *Diabolocrinus globularis* (Nicholson & Etheridge 1880), were listed as “Stem unknown” by Donovan (1986, table 3). Although this pelmatozoan fauna appears depauperate, this is undoubtedly an artefact of preservation; columnal morphotaxa are diverse (Table 1).

It was recognised that one or more of the columnal morphotaxa was likely derived from the *Diabolocrinus* spp. from the same quarry, but without evidence of the stem associated with the thecae, no comparison was possible. Recently, specimens of

Diabolocrinus sp. or spp., despite being incompletely preserved, were found to retain evidence of the facet at the base of the cup. These are highly indicative and permit synonymization between thecae of *Diabolocrinus* and columnal morphotaxa.

Terminology of the crinoid endoskeleton follows Moore *et al.* (1978) and Ubaghs (1978a). The specimens illustrated herein are registered in the collections of the Hunterian, University of Glasgow, Glasgow, UK (prefix GLAHM), and the Natural History Museum, London, UK (prefix BMNH).

Systematic palaeontology

Class **Crinoidea** J.S. Miller, 1821

Subclass **Camerata** Wachsmuth & Springer, 1885

Order **Diplobathrida** Moore & Laudon, 1943

Superfamily **Rhodocrinitoidea** Roemer *in* Bronn & Roemer, 1855 *sensu* Kolata, 1982

Family **Rhodocrinitidae** Roemer *in* Bronn & Roemer, 1855 *sensu* Kolata, 1982

Genus *Diabolocrinus* Wachsmuth & Springer, 1897

Type species. *Rhodocrinus vesperalis* White, 1880, p. 252, pl. 1, figs 11, 12, a senior synonym of *Diabolocrinus perplexus* Wachsmuth & Springer, 1897 (see Brower & Veinus 1974, p. 71 *et seq.*).

Diagnosis. See Ubaghs (1978b, pp. T425-T426). Regarding the stem, it is stated that “Column round or subpentagonal, with large quinquelobate canal.”

Remarks. Webster & Webster (2014, pp. 931-934) listed eight nominal species of *Diabolocrinus* and three taxa in open nomenclature.

Range. Ordovician, Sandbian – Katian (Champlainian); Oklahoma, Tennessee and Virginia, USA: Ordovician, Sandbian (Chatfieldian), south-west Scotland, UK (Webster & Webster 2014).

Diabolocrinus sp. or spp.

(Fig. 1)

Material. Two specimens, GLAHM 152683a, b (part and counterpart) and GLAHM 152684; all natural moulds.

Locality and horizon. Craighead Inlier, Craighead quarry [NGR NS 234 014 and surrounding area]; Ardwell Group, Craighead Limestone Formation; Chatfieldian ('Caradoc'), Sandbian. For locality maps, see Williams & Floyd, 2000, figs 1, 3). The labels of both specimens state "cliff top Craighead Quarry ... shaly limestones on cliff top ..."

Description of stem facet. (Based on GLAHM 152683a and 152684.) Articular facet pentagonal, angles rounded, sides straight to gently infolded. Marginal, radial symplectial articulation with short, peg-like crenulae. Areola broad (GLAHM 152683a) or absent (GLAHM 152684). Lumen (GLAHM 152684) pentagonal, broad and central with rounded angles.

Remarks. There are two broadly similar columnal morphogenera from the Craighead Limestone Formation and which are of relevance to our discussion. “[*Lanxocolumnus* (col.) Donovan, 1995] is differentiated from the morphologically similar *Oanducystis* (col.) Stukalina [*in* Stukalina & Hints, 1979] by the orientation of the lumen, the angles of which are opposed to (*Lanxocolumnus*) or coincident with (*Oanducystis*) those of the columnal” (Donovan, 1995, p. 138). In GLAHM 152683a the lumen is not identifiable (Fig. 1B); in GLAHM 153684 the angles of the lumen and articular facet are coincident (Fig. 1A). So, herein, we suggest that *Oanducystis* (col.) spp. from the Craighead Limestone Formation are better ‘lumped’ into *Diabolocrinus* spp. until better preserved thecae becomes available for study. For comparison with the specimens discussed herein, we include copies of Ramsbottom’s (1961) images of *Diabolocrinus* spp. in basal view, from Craighead quarry (Fig. 2), and the morphospecies of *Oanducystis* (col.) from the same site (Fig. 3).

To reiterate, we consider the morphospecies of *Oanducystis* (col.) – *Oanducystis* (col.) *crispangulatus* Donovan, 1995, *Oanducystis* (col.) spp. A and B, and *Oanducystis?* (col.) sp. C (Table 1) – from the Craighead Limestone Formation to be more correctly identified as *Diabolocrinus* sp. or spp. This is not to imply that other species of *Oanducystis* (col.) are also *Diabolocrinus*, but it is at least possible. Webster & Webster (2014, p. 2527) recognised only two other nominal members of this morphogenus. *Oanducystis levis* Stukalina, 1985, is from the Ordovician (Sandbian) of Kazakhstan. The type morphospecies, *Oanducystis excisus* Stukalina *in* Stukalina and Hints, 1979, is from the Ordovician (Darriwilian) of Estonia. It is relevant to note that this is older than the earliest *Diabolocrinus* (see above), a genus limited to Laurentia, including much of the coeval succession in Scotland (Ingham, 1978).

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Table 1. Crinoids of the Craighead Limestone Formation, Craighead Quarry, near Girvan, Strathclyde, after Ramsbottom (1961) and Donovan (1984, 1986-1995). Morphospecies marked thus (‡) are synonymised with *Diabolocrinus* herein.

Order Dipolobathrida (n = 2)

Diabolocrinus craigheadensis Ramsbottom, 1961

Diabolocrinus globularis (Nicholson & Etheridge, 1880)

Columnal morphotaxa (n = 24)

Bystrowicrinus (col.) *scoticus* Donovan, 1995

Cyclocyclicus (col.) *turricolumnus* Donovan, 1989

Fascicrinus (col.) *stukalinae* Donovan, 1986

Fascicrinus (col.) *turgocolumnus* Donovan, 1986

Lanxocolumnus (col.) *quinquelateralis* Donovan, 1995

Lanxocolumnus (col.) spp. A, B, C, D, E, F *in* Donovan, 1995

Latocolumnus (col.) *girvanensis* Donovan, 1995

Malovicrinus (col.) sp. cf. *M. implicatus* Stukalina *in* Stukalina & Tuyutyay, 1970

Oanducystis (col.) *crispangulatus* Donovan, 1995 ‡

Oanducystis (col.) spp. A *in* Donovan, 1995 ‡

Oanducystis (col.) spp. B *in* Donovan, 1995 ‡

Oanducystis (col.) spp. C? *in* Donovan, 1995 ‡

Pentagonocyclicus (col.) *harperi* Donovan, 1995

Pentagonocyclicus (col.) *magniligamentum* Donovan, 1995

Pentagonocyclicus (col.) *turriculatus* Donovan, 1995

Pentagonoellipticus (col.) *ellipticus* Donovan, 1989

pentagonocyclic columnal *in* Donovan, 1995

pentameric columnal sp. *indet. in* Donovan 1986

pentameric radicular runner sp. *indet. in* Donovan 1986

FIGURE CAPTIONS

Fig. 1. *Diabolocrinus* sp. or spp., Craighead Limestone Formation, Craighead Quarry, Strathclyde. Natural moulds of the bases of thecae. (A) GLHM 152684. (B) GLAHM 152683a. Scale bars represent 10 mm. Specimens whitened with ammonium chloride.

Fig. 2. Bases of thecae of *Diabolocrinus* spp., Craighead Limestone Formation, Craighead Quarry, Strathclyde (after Ramsbottom, 1961, pl. 8, figs 7, 10, 13, respectively). (A) *Diabolocrinus craigheadensis* Ramsbottom, 1961, BMNH E46906, paratype. (B, C) *Diabolocrinus globularis* (Nicholson & Etheridge, 1880), possibly syntypes (Ramsbottom, 1961, p. 28). (B) BMNH E46892. (C) BMNH E46895. All scale bars represent 10 mm.

Fig. 3. Articular facets and epifacets of *Oanducystis* (col.) spp., Craighead Limestone Formation, Craighead Quarry, Strathclyde (after Donovan, 1995, pl. 16, figs 1, 8; pl. 17, figs, 2, 5). (A) *Oanducystis* (col.) *crispangulatus* Donovan, 1995, BMNH EE3006, holotype. (B) *Oanducystis* (col.) sp. A, BMNH EE3008. (C) *Oanducystis* (col.) sp. B, BMNH EE3001. (D) *Oanducystis?* (col.) sp. C, BMNH EE3011. All scanning electron micrographs of specimens treated with hydrofluoric acid (Sevastopulo & Keegan, 1980) and coated with 60 % gold-palladium; all have become fractured due to the fluoridization process. All scale bars represent 1 mm.





