Online ISSN 2435-0931 Print ISSN 0385-0900

Bulletin of the Mizunami Fossil Museum, no. 46, 11–15, 2 figs.

Manuscript accepted on August 7, 2019; online published on March 13, 2020
http://zoobank.org/urn:lsid:zoobank.org:pub:A500A328-DFBC-470E-BAF7-96AEAD2946DD

A Palaeozoic crinoid from Marker Wadden, a man-made island in north-central Netherlands

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Abstract

Reworked fragments of Mississippian (Early Carboniferous) crinoid columns are a feature of both fluvial systems and glacial deposits in the Netherlands. A pluricolumnal from an unusual situation, the beach of a man-made island in the Marker Wadden archipelago (province of Flevoland, north-central Netherlands), is well preserved for a reworked, much travelled fossil. Distinctive features include: circular section; slightly eccentric, rounded pentagonal lumen; radial symplectial articulation extending from circumference of columnal to lumen edge; pluricolumnal heteromorphic, N212; and latera unsculptured. With a broad axial canal, this specimen is undoubtedly of Palaeozoic and most likely Mississippian age (Lower Carboniferous), and represents either a cladid or monobathrid. The pluricolumnal is from the mesistele; the eccentric axial canal suggests it was close to a recumbent dististele.

Key words: Flevoland, beachcombing, artificial archipelago, Mississippian, preservation

Introduction

Living crinoids may be robust, but, like other echinoderms, start to disarticulate soon after death (Blyth Cain, 1968; Hess et al., 1999). The occurrence of one or more articulated ossicles may be sufficient to be both recognisable and to provide information on their *post-mortem* history. For example, one such pattern of occurrence is provided by parallel accumulations of long crinoid pluricolumnals indicating the palaeocurrent trends (Donovan, 2012 and references therein). Prior to final burial and diagenesis, crinoid pluricolumnals may remain articulated because they may still be alive after the crown is lost (Donovan and Pawson, 1998; Oji and Amemiya, 1998).

Herein, we report a short, but robust pluricolumnal. The main interest of this specimen is its occurrence in an unlikely environment perhaps 300 million years or so after its demise. The specimen comes from an artificial archipelago in a freshwater setting that is being built up from the accumulated silt and underlying sandy sediments of a lake (Markermeer). A Late Palaeozoic crinoid in this setting is an unexpected find; its preservation is good enough to indicate that transport was not excessively corrasive (= corrosion + abrasion).

Terminology of the crinoid endoskeleton follows Moore et al. (1968, 1978), Webster (1974) and Ubaghs (1978). Our philosophy of open nomenclature follows Bengtson (1988). The specimen is registered in the collections of the Natuurhistorisch Museum Maastricht, the Netherlands (prefix NHMM).

Locality

The Marker Wadden is an artificial archipelago in the Markermeer lake in the province of Flevoland, north-central Netherlands. It was initiated as recently as 2016 as a freshwater lake restoration project. The islands provide a non-tidal, artificial wetland habitat for wildlife; dredged underwater canals act as reservoirs in which silt deposition takes place in order to increase water quality and for the silt to be used in future expansions of the project. One of the islands is accessible by ferry to tourists, including fossil collectors.

The islands have been constructed from silt accumulated in the Markermeer and from underlying sandy sediments that were dredged from a depth of over 20 m below the original bottom of the lake in the direct vicinity of the project (Staatscourant, 2016; Natuurmonumenten, pers. comm. to BWL, 2019). Data on the geology and stratigraphy for the source area of the sands are available online (www.dinoloket.nl, borehole B20B0013 of the Geological Survey of the Netherlands) and in a few papers (for instance, Huizer, 2016; Troelstra et al., 2016; Vos and de Vries, 2016). Four, predominantly sandy and fossiliferous units were suction dredged, namely the Kreftenheye, Drente, Urk and Eem formations. The Kreftenheye and Urk formations consist of Pleistocene fluvial strata laid down by the precursors of the present-day rivers Maas (Meuse) and Rhine. These contain both reworked material from the hinterland as well as *in situ* fossils of Pleistocene fauna and flora (Bosch et al., 2003b; Busschers and Weerts, 2003). The Drente Formation consists of a variety of sedimentary rocks associated with former ice sheet cover during the Saalian glacial interval; this explains why it predominantly yields erratic fossils from northerly sites (Baltic, Scandinavia; see Bakker et al., 2003). Finally, the Eem Formation is a marine unit of Eemian interglacial age; it contains an *in situ* warm-temperate molluscan fauna (Bosch et al., 2003a). At the Marker Wadden, this fauna is only rarely found and generally is poorly preserved (B.W. Langeveld, research in progress).

The specimen was collected from along the edge of the main island of the Marker Wadden (co-ordinates 52.584314/5.363391), from coarse-grained sandy sediments, rich in larger, poorly rounded rocks. It is now in the collection of the Natuurhistorisch Museum Maastricht, the Netherlands (NHMM) under registration number NHMM 2019 001 (Figs. 1, 2).

Description

Pluricolumnal holomeric, circular in section, about 14.9 mm long; columnal diameter about 20.2 mm across nodals (Figs. 1, 2). Lumen slightly eccentric, rounded pentagonal, angles strongly rounded, sides gently infolded; lumen diameter about 12.5 mm. Articulation radial symplectial, extending from circumference of columnal to lumen edge; crenulae slender, numerous, closely-packed, unbranched. No areola or perilumen. Internal details of axial canal obscured by medium-grained bioclastic limestone.

Pluricolumnal composed of about 22 columnals; uniformly heteromorphic, N212. Nodals highest and widest *et seq*. Nodals and priminternodals have convex latera; secundinternodals with planar latera. Latera unsculptured.

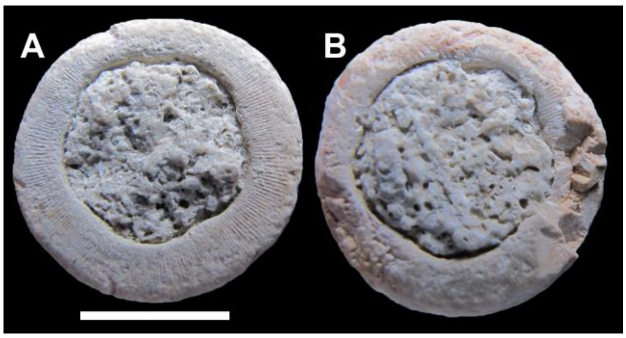

Fig. 1. Crinoid sp. indet., NHMM 2019 001. Views of articular facets at either end of the pluricolumnal. Note fine crenulae (A) and eccentric lumen. Specimen uncoated. Scale bar represents 10 mm.

Discussion

Origins and transport: Reworked Palaeozoic fossils are well known from the Netherlands (for instance, see Schuijf and Boelens, 1949; Van der Lijn, 1986; Rhebergen et al., 2001; Akkerman, 2012). Donovan et al. (2016, p. 344 and references therein) noted that they were "… transported both by Pleistocene precursors of the rivers Maas and Rhine in the south of the country, by Pleistocene glaciers in the north-central and east parts, and the Eridanos River [Wong et al., 2007] in the north and east". Based on the strata that were used for the construction of the Marker Wadden, specimen NHMM 2019 001 was thus most likely derived by glacial or fluvial action from the north or east.

Correlation: The broad axial canal is a feature of many Palaeozoic, but not post-Palaeozoic crinoids (Donovan, 2016). The large diameter of this pluricolumnal is most suggestive of Carboniferous or Permian crinoids; pluricolumnals from these intervals include some with a diameter of over 50 mm (Donovan, 2013). From northern Europe the most likely age for this pluricolumnal is Mississippian (Early Carboniferous), the so-called 'Age of Crinoids' (Kammer and Ausich, 2006). Although rocks of this age do not crop out in the Netherlands, there are exposures of Mississippian rocks in nearby countries to the north-east (Burger, 2012). In the bedload of rivers in the southern and central parts of the Netherlands, crinoids have long been known; most of these are Early Carboniferous, Late Jurassic or latest Cretaceous in age (see, for example, Van der Lijn, 1986; Donovan et al., 2016).

Fig. 2. Crinoid sp. indet., NHMM 2019 001. Lateral view of regularly heteromorphic pluricolumnal, N212. Specimen uncoated. Scale bar represents 10 mm.

Identity: By the Late Palaeozoic, crinoid pluricolumnals showed a limited morphological range compared with, for example, the Late Ordovician (Donovan, 1985); exceptions are few and well known. The specimen discussed herein is not an exception. Its size shows that it was not a disparid, which were relatively rare by this time. Rather, it most likely represents the dicyclic subclass Cladida Moore and Laudon, 1943, or the subclass Camerata Wachsmuth and Springer, 1885, more probably the (commoner) monocyclic order Monobathrida Moore and Laudon, 1943 than the (rarer) dicyclic order Diplobathrida Moore and Laudon, 1943.

Functional morphology: Most likely, this specimen represents part of the mesistele. In the proxistele the pattern of insertion of the columnals is developed; in the dististele the column is adapted for attachment. Only in the mesistele, which is also likely to be the longest (= elevating) part of the column, is such stability of structure attained. However, and conversely, the eccentric axial canal is prominent (Fig. 1) and may indicate that this was either recumbent or in the transition zone from an upright mesistele to a recumbent dististele.

Even the highest (nodal) columnals are low and the crenulae of the articulation are fine (Figs. 1, 2). Flexibility between any two sequential columnals would have been slight through 360º, but the sum of all columnals would have permitted considerable tractability.

The broad axial canal is quite unlike the thread-like canals of post-Palaeozoic crinoids. The canal of NHMM 2019 001 presumably included those tissues found in the axial canal of an extant crinoid, filled by perihaemal fluid (Donovan, 2016, p. 178).

Acknowledgements

The specimen was collected by Mrs Trudy Langeveld, who kindly made it available for study and donated it to the Natuurhistorisch Museum Maastricht. Special thanks to Mr David N. Lewis (formerly the Natural History Museum, London) for his supportive review.

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