

Cyathidium vlieksi, a new holopodid crinoid from the Upper Maastrichtian (Late Cretaceous) of southern Limburg, The Netherlands

John W.M. Jagt

Maasbreesestraat 55, 5921 EJ Venlo, The Netherlands

Received 17 February 1986; accepted in revised form 25 May 1986

Abstract

On the basis of fairly well preserved specimens of a holopodid crinoid of the genus *Cyathidium*, a new species of this genus is described: *Cyathidium vlieksi* sp. nov.

As yet, fossils of this crinoid were found only in the Upper Maastrichtian of the province of Limburg. They occur in the Kunrade facies of the Maastricht Formation as well as in the type-area of the Maastrichtian stage (Maastricht, The Netherlands).

Introduction

During the construction of motorway E39 (Geleen–Aachen) (1971–1975) a fossiliferous section of the so-called Kunrade Limestone (Maastricht Formation) was exposed in the neighbourhood of Benzenrade, municipality of Voerendaal, SW of Heerlen. Especially the middle part of this section yielded a rich and well preserved macrofauna consisting of sponges, bivalves, brachiopods, regular and irregular echinoids, asteroids and crinoids. Among the latter Bourgueticrinidae, Comatulida, Isocrinida and a new species of the genus *Cyathidium* were recognised.

Judging from the occurrence of *Belemnitella* ex gr. *junior* Nowak, 1913 (Voigt 1979; author's observations) this section dates from the lower part of the Upper Maastrichtian, *Belemnitella junior* Partial-range-zone of Van der Tuuk & Bor (1980) and Van der Tuuk in Robaszynski *et al.* (1985).

According to W.M. Felder (1977, 1980), Albers *et al.* (1978) and Albers & W.M. Felder (1979) the Benzenrade section is to be correlated with the

lower part of the Maastricht Formation as exposed at the ENCI-quarry near Maastricht, stratotype of the Maastrichtian stage as presently defined. However, unpublished data furnished by Ing. P.J. Felder (Natural History Museum Maastricht) suggest that the Benzenrade-Imstenrade exposure may turn out to be the lateral time equivalent of the uppermost part of the Gulpen Formation (Lanaye Member) in the western part of southern Limburg and adjacent Belgian territory.

Systematic palaeontology

Class Crinoidea Miller, 1821

Subclass Articulata Von Zittel, 1879

Order Cyrtocrinida Sieverts-Doreck in Moore, Lalicker & Fischer, 1952

Suborder Holopodina Arendt, 1974

Family Holopodidae Von Zittel, 1879

Genus *Cyathidium* Steenstrup in Michaelis & Scherk, 1847

Type species *C. holopus* Steenstrup in Michaelis &

Scherk, 1847 n.p. *Cyathidium vlieksi* sp. nov.
 pars 1961 *Cyathidium holopus* Steenstrup, 1847 –
 Rasmussen, p. 242 (specimens from the Maastricht
 area (Maastricht, Geulhem) only)
 1965 *Cyathidium holopus* – Rasmussen, p. 37,
 Table 1

Locus typicus. Temporary roadcut-exposure (ex-
 posure 62B-293; file number Geological Survey
 Heerlen) (see Albers *et al.* 1978, p. 41) between
 Benzenrade and Imstenrade, municipality of
 Voerendaal, SW of Heerlen, southern Limburg,
 The Netherlands. *Stratum typicum* – Kunrade
 Limestone, Maastricht Formation (Felder 1977,
 1980). Lower part of the Upper Maastrichtian, bio-
 zone of *Belemnitella junior* Nowak, 1913. *Derivatio
 nominis* – The species is named after Mr H.J.
 Vlieks (Molsberg-Simpelveld, The Netherlands),
 who collected the type specimens.

Diagnosis. A species of *Cyathidium* with a rela-
 tively large and thick-walled theca which is nor-
 mally conical with a fairly narrow base. In low,
 more or less shield-shaped specimens the base is
 enlarged. The surface of the theca only shows fine
 growth lines (in some cases becoming rather promi-
 nent), otherwise it is smooth as are the axillary
 primibrachials. The interradial processes separa-
 ting the articula are rather small and not really
 protruding. The first axillary primibrachials are
 relatively stout and low and very tumid aborally.

Holotype. The best preserved specimen is selected
 as holotype. Its dimensions (in mm.) are: greatest
 height 27.5, greatest outer width 17.9, greatest in-
 ner width 11.6 and width of the articula for IBrr 7.7.
 The growth lines on the surface of this theca are
 distinct, so is the crenulation of the articular ridge.
 One of the rays was slightly damaged during life
 causing a thickening of the theca's outer edge.

Material examined. The material was obtained
 from the following collections: 1 theca (holotype,
 Natural History Museum Maastricht, no. NHMM
 198617, leg. H.J. Vlieks); 17 thecae (paratypes,
 coll. H.J. Vlieks); 3 thecae (paratypes, coll. H. van
 Loo); 1 theca (paratype, coll. J. Hollands); 1 theca
 (paratype, coll. L. Blezer). Two axillary pri-
 mibrachials (paratypes, Natural History Museum
 Maastricht, nos. NHMM 198618-198619; leg. H.J.

Vlieks); 4 primibrachials (paratypes, coll. H.J.
 Vlieks).

In the collections of the Institut royal des Sci-
 ences naturelles de Belgique at Brussels there is a
 single axillary primibrachial (paratype, no. 257,
 Bosquet) from Maastricht (St. Pietersberg). The
 accompanying label only states 'Système Maes-
 trichtien, Mt. St. Pierre'. The preservation of this
 ossicle suggests that it originates from the upper
 part of the Maastricht Formation (Nekum or Meer-
 ssen Member).

At present the theca from the Upper Maastrich-
 tian of Geulhem (Dutch Limburg) mentioned by
 Voigt (1959, p. 138) and Rasmussen (1961, p. 242,
 246; 1965, p. 37) is untraceable. In spite of an
 intensive search the specimen could as yet not be
 located in the collections of the Geological Survey
 at Heerlen. Prof. Dr. E. Voigt has informed me
 (letter of July 1985) that it is not present in the
 collections of the Geologisch-Paläontologisches
 Institut of Hamburg University.

Description

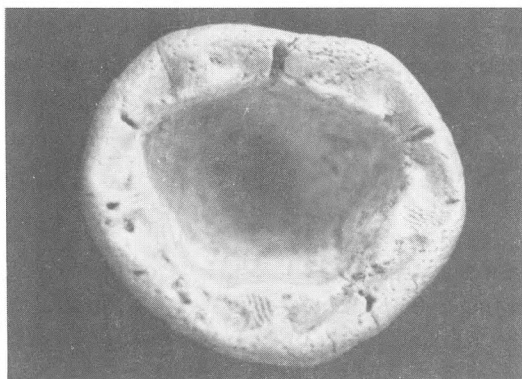
The terminology used is that suggested by Moore *et al.* (1978). The theca consists of fused radials only and is attached to the substrate by a fairly narrow base. Relatively small, more or less shield-shaped specimens have an enlarged base. The theca has a round to slightly subpentagonal outline and it is conical with an upward-increasing diameter. As is the case in all other species of *Cyathidium*, the growth of the individual animals is strongly dependent on the available room offered by the substrate. The upper edge of the theca shows the wide, trapezoid articula for the primibrachials (IBrr) separated by small, non-protruding processes that are inwardly directed and whose width is about one fifth of the width of the articulum. On the upper edge these interradial processes form a small triangular knob which separates the primibrachials. In slightly worn specimens these processes are crenulated on the sides against the IBrr. The fulcral ridge is completely straight with a very fine crenulation perpendicular to the axis. This crenulation is only visible in better preserved specimens.



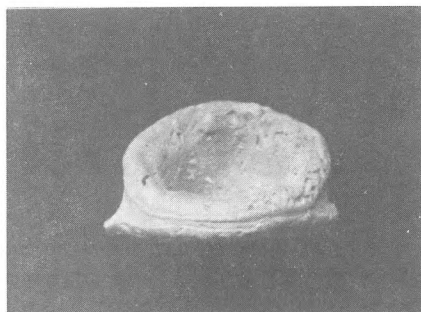
1



2



3

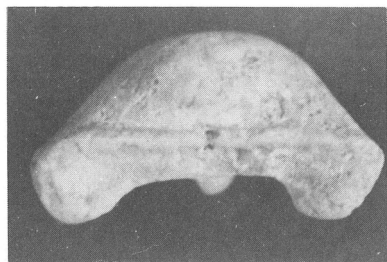


4

Figs 1–4. *Cyathidium vlieksi* sp. nov. Thecae. Kunrade Limestone (Maastricht Formation). Exposure 62B–293, Benzenrade (municipality of Voerendaal), southern Limburg, The Netherlands. 1. NHMM 198617 (holotype); lateral view, \times ca. 3. 2. NHMM 198617 (holotype); ventral view with radial cavity and articular for IBrr, \times 4.3. Paratype (coll. H.J. Vlieks); ventral view. The articular for the IBrr are worn, \times 3. 4. Paratype (coll. H.J. Vlieks); lateral view of a relatively small, shield-shaped specimen, \times 1.7.

At the centre of this fulcral ridge the aboral ligament pit is visible, so is the axial canal on the adoral side of it. There are no distinct aboral or interarticular ligament fossae. However, on the holotype, a wide, triangular field bordered by some coarse granules is visible on the upper edge of the

theca. The adoral muscular fossae are large, sloping inwards and clearly separated from the radial cavity by a raised adoral edge. The processes that separate the articular do not continue as ridges into the radial cavity. The radial cavity is fairly large and subpentagonal in outline. It gradually becomes



5a



5b



6

Figs 5–6. *Cyathidium vlieksi* sp. nov. Axillary primibrachials. Kunrade Limestone (Maastricht Formation). Exposure 62B-293, Benzenrade (municipality of Voerendaal), southern Limburg, The Netherlands. 5a. NHMM 198618 (paratype); proximal articulum, $\times 3.9$. 5b. as 5a; adoral side with the artacula for the IIBrr, the triangular process and the curved lines on the interradiol facets, $\times 5.9$. 6. NHMM 198619 (paratype); adoral side with the triangular process and the artacula for the IIBrr, $\times 6.2$.

narrower below the artacula, depending on the external form of the theca. The axial canal passes below the artacula and continues as an extremely thin midradial furrow. The wall of the theca is fairly thick and it has often overgrown or incorporated corals and other foreign objects. The surface of the theca shows growth lines which may become rather prominent near the upper edge. Nearly all specimens are encrusted by bryozoan colonies. On some

of them there are additional incrustations by bivalves.

In each radius there is a single, undivided axillary primibrachial. This ossicle is wide, low, stout and trapezoid. The aboral surface is strongly tumid and smooth. The proximal articulum corresponds to that of the theca's upper edge. The concave adoral side shows the pair of tapering artacula for the secundibrachials (IIBrr). The articular facets for the IIBrr show the same form as those of the IBrr with a ligament pit and an axial canal. However, these are not situated in the centre of the fulcral ridge but approach the point where the two artacula meet on the upper edge of the IBrr. On the adoral side of very stout, triangular process close to the proximal articular ridge is conspicuous. From this process there is, in six of the seven IBrr available, a distinct ridge that reaches the upper edge of the IBrr where the two artacula for the IIBrr meet under an obtuse angle. The interradiol facets are covered with curved lines. A distinct median furrow which branches off to the two artacula for the IIBrr is never present on the adoral side of the IBrr.

IIBrr, pinnulars and orals have as yet not been recognised at the type locality of *C. vlieksi*.

Dimensions

The paratypes in H.J. Vlieks's collection were measured. The greatest height of the thecae varies from 3.1 to 34 mm, the greatest outer diameter from 14.5 to 20.5 mm, the greatest inner diameter from 9.5 to 14 mm and the greatest width of the artacula for the IBrr from 5 to 9 mm.

The greatest breadth, height and thickness of the axillary primibrachials varies from 6.7 to 11.9, 3.6 to 4.9 and 3.1 to 5.6 mm respectively. The greatest width of the artacula for the IIBrr varies from 3.5 to 6 mm.

The single IBrr kept at Brussels has the following dimensions: length 7, height 3.8, thickness 3.6 and width of the artacula for the IIBrr 2.8 mm.

Comparison with other species of *Cyathidium*

Up to now three fossil and one Recent species have been described in literature.

Cyathidium depressum Sieverts 1931 (Sieverts 1931; Rasmussen 1961) from the Late Cenomanian of Nordrhein Westfalen (FRG) and the Early Turonian of Czechoslovakia differ from *C. vlieksi* in the small, low, shield-shaped thecae with distinct interradiial processes and a granulation of their surfaces. The axillary IBrr of *C. depressum* are comparable in outline to those of *C. holopus*; aborally they are practically flat and granulated. The triangular process on the adoral side of the IBrr is situated near the upper edge of these ossicles.

C. senessei (Valette in Lambert & Valette 1934) (Rasmussen 1961) from the Santonian of Bugarach (Aude, France) resembles *C. vlieksi* especially in the subpentagonal outline of the radial cavity, the thickness of the theca wall and in particular in the outline of the IBrr. The triangular process on the adoral side resembles that of *C. vlieksi*, so does the tumidity of this ossicle.

C. holopus Steenstrup in Michaelis & Scherk 1847 (Nielsen 1913; Rasmussen 1953, 1961, 1979) of which I was able to study specimens from the Middle Danian of Fakse quarry (Sjælland, Denmark) thanks to Dr. W.K. Christensen's kind assistance, is closely related to *C. vlieksi*. The latter species differs by the fact that the articula for the IBrr are clearly separated from the radial cavity and that the interradiial processes have a different structure. Moreover, the IBrr of *C. vlieksi* are distinctly more tumid, lower and the position of the articula for the IIBrr are more inwardly directed. Finally the position of the aboral triangular process is closer to the proximal articular edge and is larger in *C. vlieksi* than in *C. holopus*.

The Recent species *C. foresti* Cherbonnier & Guille 1972 (*C. meteorensis* Fechter 1973 is probably a junior synonym, cf. Rasmussen 1978, p. T 839), is to all appearances a descendant from the Early Tertiary *C. holopus*. The theca and IBrr are very much alike in both species. *C. vlieksi* differs from *C. foresti* in the characteristics of the IBrr (outline, tumidity) and of the theca.

Palaeobiology

Unfortunately none of the type specimens of *C. vlieksi* was found *in situ*. It is therefore very difficult to state if they grew like specimens of *C. holopus* more or less upside down in cavities and under overhanging rocks protected against sedimentation (Nielsen 1913; Rasmussen 1961, 1973, 1978).

The Kunrade Limestone at the type locality of *C. vlieksi* shows an alternation of hard and soft chalk layers with a relatively high terrigenous content. Judging from the macrofauna (bryozoans, brachiopods) these sediments were deposited in a shallow marine environment. They are strongly bioturbated (*Gyrolithes kunradensis* and *Thalassinoides*-burrows). Consequently two possible habitats may be considered for *C. vlieksi*.

Firstly, the individual animals may have been growing in some of these burrows, provided that there be enough room and a suitable substrate. Secondly, they may have attached themselves to slight depressions in or debris on the hard chalk layers (hardgrounds) similar to solitary corals. A comparable habitat was described for *C. depressum* (Sieverts 1931: 175) and *C. foresti* (Cherbonnier & Guille 1972; see also Fechter 1973: 163).

The theca mentioned by Voigt (1959) and Rasmussen (1961, also 1965) may come from the inside wall of a burrow in a hardground in the upper part of the Meerssen Member (Maastricht Formation). Therefore it seems likely that the above mentioned habitats of *C. vlieksi* are not mutually exclusive. Finally it should be admitted that the reconstruction of the palaeobiology of the new species is also hampered by the fact that all specimens, the holotype excluded, show traces of wear that have resulted from transport by wave action.

Stratigraphical and geographical distribution

C. vlieksi is up to now only known from the Upper Maastrichtian of the Dutch province of Limburg. It is to be expected that this species will also be recorded from equivalent strata in the Belgian provinces of Limburg and Liège (Eben Emael area).

All specimens studied, one theca and one IBr excepted, originate from the Kunrade Limestone which is said to be correlatable with the lower part of the Maastricht Formation at the ENCI-quarry (Felder 1977, 1980). However, recent research by Felder *et al.* (1985) points to the fact that current lithostratigraphic correlations will have to be revised.

From as yet unpublished data it appears that the Kunrade Limestone-section near Benzenrade should be looked upon as the lateral time equivalent of the upper part of the Gulpen Formation (Lanaye Member). Biostratigraphically this does not present any difficulties since the largest part of the Gulpen Formation and almost the entire Maastricht Formation fall within the biozone of *Belemnitella junior* Nowak 1913.

The two specimens from the Maastricht area (St. Pietersberg and Geulhem) originate from the Maastricht facies of the Maastricht Formation. Unfortunately the IBr kept at Brussels is not well documented. Its state of preservation suggests it comes from one of the many fossil grit layers in the upper part of this formation (Nekum and Meerssen Members).

Rasmussen (1965), who based his record of *C. holopus* on the single theca from the Curfs quarry at Geulhem (municipality of Valkenburg aan de Geul, The Netherlands), expressed some doubt as to whether the fossil originated from the Upper Maastrichtian or from the overlying Geulhem Member (Houthem Formation) of Danian age. Prof. Dr. E. Voigt informed me (letter of December 1985) that this theca has not been found *in situ*; it was collected from chalk blocks on the quarry floor. Its exact stratigraphic position is therefore unknown. It seems likely that it came from the Meerssen Member, as I have not yet seen any remains of *Cyathidium* from the Geulhem Limestone Member.

Acknowledgements

I am indebted to the following persons who helped during the preparation of this paper: Mr. H.J. Vlieds (Molsberg-Simpelveld) lent me the type

specimens and examined the specimens in the private collections of Messrs H. van Loo and J. Hollands (both Simpelveld) and L. Blezer (Ubaghsberg) on my request. Prof. Dr. E. Voigt (Hamburg University) informed me about the Geulhem theca; Mr J.J. Glerum kindly assisted in the search for this specimen in the collections of the Geological Survey (Heerlen). Dr A.V. Dhondt (Brussels) allowed me to study a primibrachial of the new species kept at the Institute there. Dr W.K. Christensen (Copenhagen Museum) kindly lent me specimens of *C. holopus* from its type locality for comparison. Ing. P.J. Felder (Maastricht) encouraged me all along and read parts of an earlier draft of this paper. The bibliographical assistance of Mrs C. Willems-Dreezen (Heerlen) and Ms K. Brenøe is gratefully acknowledged. My special thanks to Dr M. Jäger (Konstanz), who critically read the manuscript and who suggested improvements. Finally I like to thank Mr J. Bellen (Venlo) for preparing the photographs.

References

- Albers, H.J., W.M. Felder, P.J. Felder, O.S. Kuyl, H.W.J. van Amerom, P.W. Bosch & J.P.M.Th. Meessen 1978 Lithology and stratigraphy of the Upper Cretaceous of eastern South Limburg and neighbouring Belgium and Germany – Paläontologische Gesellschaft-Palaeontological Association, Joint annual meeting, excursion A: 1–49
- Albers, H.J. & W.M. Felder 1979 Litho-, Biostratigraphie und Palökologie der Oberkreide und des Alttertiärs (Präobersanton-Dan/Paläozän) von Aachen-Südlimburg (Niederlande, Deutschland, Belgien). In: Wiedmann, J. (ed.): Aspekte der Kreide Europas IUGS Series A, no. 6: 47–84
- Cherbonnier, G. & A. Guille 1972 Sur une espèce actuelle de Crinoïde crétacique de la famille Holopodidae: *Cyathidium foresti* nov. sp. – Acad. Sci. Paris, Comptes Rendus, série D, 274: 2193–2196
- Fechter, H. 1973 *Cyathidium meteorensis* spec. nov., ein neuer Crinoïde (*sic*) aus der Familie Holopodidae – Helgoländer wiss. Meeresunters., 25: 162–169
- Felder, P.J., M.J.M. Bless, R. Demyttenaere, M. Duser, J.P.M.Th. Meessen & F. Robaszynski 1985 Upper Cretaceous to early Tertiary deposits (Santonian-Paleocene) in northeastern Belgium and South Limburg (The Netherlands) with reference to the Campanian-Maastrichtian – Prof. Paper Belg. Geol. Dienst, 1985/1, no. 214: 1–151
- Felder, W.M. 1977 De stratigrafische plaats van de 'Kunrader Kalksteen' in het Boven-Krijt van Zuid-Limburg – Grondboor en Hamer, 31, 6:163–172

- Felder, W.M. 1980 Krijt. In: Kuyl, O.S. (ed.): Toelichtingen bij de geologische kaart van Nederland 1:50.000. Blad Heerlen (62 W oostelijke helft, 62 O westelijke helft): 31–53
- Lambert, J. & A. Valette 1934 Etudes sur quelques Echinodermes crétacés de Bugarach (Aude) – Bull. Soc. géol. France, série 5, 4: 43–60
- Moore, R.C., G. Ubaghs, H. Wienberg Rasmussen, A. Breimer & N. Gary Lane 1978 Glossary of crinoid morphological terms. In: Moore, R.C. & C. Teichert (eds.): Treatise on Invertebrate Paleontology, part T, Echinodermata 2, 1: T 229–T242
- Nielsen, K. Brünnich 1913 Crinoiderne i Danmarks Kridtaflejringer – Danm. Geol. Unders., 2, 26: 1–120
- Rasmussen, H. Wienberg 1953 Cretaceous Crinoidea. Preliminary report on the species found in Denmark – Meddr dansk geol. Foren., 12: 415–419
- Rasmussen, H. Wienberg 1961 A monograph on the Cretaceous Crinoidea – Biol. Skr. Dan. Vid. Selsk., 12, 1: 1–428
- Rasmussen, H. Wienberg 1965 The Danian affinities of the Tuffeau de Ciply in Belgium and the 'Post-Maastrichtien' in the Netherlands – Meded. Geol. Sticht., n.s., 17: 33–38
- Rasmussen, H. Wienberg 1973 En lysky hulefauna fra Fakse som vidnesbyrd om koralkalkens dannelse i lyszonen – Dansk geol. Foren., Arsskrift for 1972: 87–91
- Rasmussen, H. Wienberg 1978 Articulata. In: Moore, R.C. & C. Teichert (eds.): Treatise on Invertebrate Paleontology, part T, Echinodermata 2, 3: T 813–T 928
- Rasmussen, H. Wienberg 1979 Crinoids, asteroids and ophiuroids in relation to the boundary. In: Birkelund, T. & R.G. Bromley (eds.): Cretaceous-Tertiary Boundary Events Symposium. I. The Maastrichtian and Danian of Denmark: 65–71
- Robaszynski, F., M.J.M. Bless, P.J. Felder, J.C. Foucher, O. Legoux, H. Manivit, J.P.M.Th. Meessen & L.A. van der Tuuk 1985 The Campanian-Maastrichtian boundary in the chalky facies close to the type-Maastrichtian area – Bull. Centres Rech. Explor.-Prod. Elf-Aquitaine, 9, 1: 1–113
- Sieverts, H. 1931 *Cyathidium depressum* n. sp. aus dem Oberen Cenoman Rheinland-Westfalens – Jb. preuss. geol. Landesanst., 52: 159–176
- Van der Tuuk, L.A. & T.J. Bor 1980 Zonering van het Boven Krijt in Limburg met behulp van Belemnitidae – Grondboor en Hamer, 34, 4: 121–132
- Voigt, E. 1959 Die ökologische Bedeutung der Hartgründe ('Hardgrounds') in der oberen Kreide – Paläont. Z., 33, 3: 129–147
- Voigt, E. 1979 Bryozoen der Kunrader Schichten in Süd-Limburg (Oberkreide, Ob. Maastrichtium). I. Cheilostomata – Grondboor en Hamer, 33, 2: 33–88