Biologiske Meddelelser
udgivet af
Det Kongelige Danske Videnskabernes Selskab
Bind **23**, nr. 15

Biol. Medd. Dan. Vid. Selsk. **23**, no. 15 (1966)

EARLY CAMBRIAN DISTACODONTID CONODONTS FROM BORNHOLM

BY

VALDEMAR POULSEN

København 1966
Kommissionær: Munksgaard

DET KONGELIGE DANSKE VIDENSKABERNES SELSKAB udgiver følgende publikationsrækker:

THE ROYAL DANISH ACADEMY OF SCIENCES AND LETTERS *issues the following series of publications:*

	Bibliographical Abbreviation
Oversigt over Selskabets Virksomhed (8°) *(Annual in Danish)*	Overs. Dan. Vid. Selsk.
Historisk-filosofiske Meddelelser (8°)	Hist. Filos. Medd. Dan. Vid. Selsk.
Historisk-filosofiske Skrifter (4°) *(History, Philology, Philosophy, Archeology, Art History)*	Hist. Filos. Skr. Dan. Vid. Selsk.
Matematisk-fysiske Meddelelser (8°)	Mat. Fys. Medd. Dan. Vid. Selsk.
Matematisk-fysiske Skrifter (4°) *(Mathematics, Physics, Chemistry, Astronomy, Geology)*	Mat. Fys. Skr. Dan. Vid. Selsk.
Biologiske Meddelelser (8°)	Biol. Medd. Dan. Vid. Selsk.
Biologiske Skrifter (4°) *(Botany, Zoology, General Biology)*	Biol. Skr. Dan. Vid. Selsk.

Selskabets sekretariat og postadresse: Dantes Plads 5, København V.

The address of the secretariate of the Academy is:

Det Kongelige Danske Videnskabernes Selskab,
Dantes Plads 5, København V, Denmark.

Selskabets kommissionær: MUNKSGAARD's Forlag, Prags Boulevard 47, København S.

The publications are sold by the agent of the Academy:

MUNKSGAARD, *Publishers,*
47 Prags Boulevard, København S, Denmark.

Biologiske Meddelelser
udgivet af
Det Kongelige Danske Videnskabernes Selskab
Bind **23,** nr. 15

Biol. Medd. Dan. Vid. Selsk. **23**, no. 15 (1966)

EARLY CAMBRIAN DISTACODONTID CONODONTS FROM BORNHOLM

BY

VALDEMAR POULSEN

København 1966
Kommissionær: Munksgaard

Synopsis

Two early Cambrian distacodontid conodonts are described from the island of Bornholm. *Hertzina? danica* n. sp. is an unusually large species from the late Lower Cambrian. The species is at the present time hesitantly included in *Hertzina* MÜLLER, 1959 which is not considered to be a synonym of *Coelocerodontus* ETHINGTON, 1959. *Hertzina? bisulcata* MÜLLER, 1959 is recorded from the Middle Cambrian *Triplagnostus lundgreni – Goniagnostus nathorsti* Zone and the *Jincella brachymetopa* Zone.

PRINTED IN DENMARK
BIANCO LUNOS BOGTRYKKERI A/S

Introduction

The Middle Cambrian sequence on the island of Bornholm includes an interesting deposit of unconsolidated clay. The clay only contains a few Middle Cambrian fossils, whereas Lower Cambrian non-trilobite fossils are common and easily obtained by elutriation of the clay. Among these are about fifty specimens of a large distacodontid conodont which is described in the present paper.

A previously known species is represented by a few specimens from the Andrarum Limestone (*Jincella brachymetopa* Zone) and the subjacent anthraconite (*Triplagnostus gibbus* – *Goniagnostus nathorsti* Zone).

Longitudinal section of the new species was kindly made by H. J. Hansen M. Sc. who also made the photographs. Drawings were made by the present writer.

The material is in the collections of the Mineralogical and Geological Museum of the University of Copenhagen.

Descriptions

Order **Conodontophorida** Eichenberg, 1930

Family Distacodontidae Bassler, 1925

Genus ***Hertzina*** Müller, 1959

Type species: *Hertzina americana* Müller, 1959

The type species is of Franconian age belonging to the *Elvinia* Zone in the Eureka District, Nevada. Two additional species have been recorded from the Middle and Upper Cambrian of Sweden and Northern Germany (erratics).

Lindström (1964, p. 139) regards *Hertzina* as a synonym of *Coelocerodontus* Ethington, 1959, but the present writer is of the

opinion that *Hertzina* is a distinct genus which differs from *Coelocerodontus* in possessing only two costae, as the anterior side is gently rounded.

The type species of *Coelocerodontus* – *C. trigonius* – has a regular triangular cross section and the three edges of the cusp are keeled. *Coelocerodontus tetragonius* has a quadrate cross section and the cusp accordingly has four keeled edges. *Hertzina* has a rounded, semicircular anterior side which is not in any way delimited from the lateral sides, and only the two posterior side edges are keeled.

Hertzina? danica n. sp

Pl. 1, figs. 1–8. Text-figs. 1–2.

Derivation of name. – Latin *danicus* = Danish.

Holotype (here selected). – Imperfectly preserved cusp (MMH no. 9970), pl. 1, figs. 1–2; text-figs. 1–2.

Other material. – About fifty cusps, most of which are represented by phosphoritic internal moulds of the basal cavity. The cusps are of a beige to greyish-white colour and appear to be somewhat abraded; they consist of calcium phosphate.

Horizon. – Presumably Lower Cambrian, *Strenuella linnarssoni* Zone.

A discussion on the origin and age of the material is appropriate, as *Hertzina? danica* n. sp. at the present time seems to be the oldest known conodont.

The Middle Cambrian clay – the Kalby Clay – containing the conodonts belongs to the *Tomagnostus fissus* – *Ptychagnostus atavus* Zone of the *Paradoxides paradoxissimus* Stage (V. Poulsen, 1963). As a number of reworked Lower Cambrian faunal elements is found in the clay, no definite statement with regard to the age of the conodonts can be given. However, the conodonts appear to be reworked and have a beige to greyish-white colour very much like the associated specimens of *Stenothecopsis* and hyolithellid tubes. These tubes are commonly represented by lustrous black, fine-grained phosphoritic internal moulds, and most of the conodonts are only preserved as internal moulds of an identical type.

Phosphatic material like that described above is unknown

from the slightly older Exsulans Limestone (*Triplagnostus gibbus* Zone), and the present writer is of the opinion that *Stenothecopsis*, the hyolithellid tubes, and the conodonts most likely originated from the Lower Cambrian *Strenuella linnarssoni* Zone. Beds from this zone are no longer present in the sequence on Bornholm, but it has been suggested (C. POULSEN, 1942 and V. POULSEN, 1963) that thin, unconsolidated beds of this age were deposited and later reworked into the Middle Cambrian beds.

Fig. 1. *Hertzina? danica* n.sp. ×25. Imperfectly preserved cusp (holotype, MMH no. 9970); oblique posterior, lateral, and oblique anterior view. Kalbygård at Læså, Bornholm.

Locality. – Kalbygård at Læså, Bornholm.

Diagnosis. – Cusp large and simple, symmetrical, gently curved. Lateral walls thin. Basal cavity extending to the tip of the cusp. Basal portion simple, not flared. Posterior side distinctly concave throughout, edges forming well-defined costae outlined by wide, aborally well-impressed furrows on lateral sides.

Description. – The slender, undenticulated cusp is large, symmetrical, gently but evenly curved towards the posterior side. The angle between the anterior and posterior side at the tip is about 4–6°. Basal portion is simple and no tendency to flare is observed; the base itself is not preserved in any of the specimens and possibly no proper base was developed. The lateral walls are thin and surround a basal cavity which extends all the way to the tip of the cusp.

The anterior side is rounded, almost semicircular in cross section, and smoothly continues into the lateral sides which cannot be delimited anteriorly. The lateral sides are rounded anteriorly and concave posteriorly due to the presence of a wide furrow running from base to the tip of the cusp. The posterior

side is strongly or at least distinctly concave throughout, and the edges form well-defined costae which are outlined by the furrows on the lateral sides. The costae attain their maximum width at the base where the lateral side furrows are deepest; the furrows are shallowing up in direction of the tip, and the costae accordingly become narrower. The tip itself is simple due to the gradual reduction of costae and furrows.

Cross sections are perfectly symmetrical at all levels; the anterior side together with the lateral sides roughly form from half to three-fourths of a circle which is cut off by the concave, keeled posterior side.

Longitudinal section shows that the walls are of uniform thickness throughout. The material has clearly been affected by diagenetic changes and the eventual laminated structures are destroyed.

Dimensions. – The length of the cusps vary from about 0.7 mm to about 8.0 mm (estimated from large fragments).

Affinities. – Species of a simple form like *Hertzina* will of necessity have a majority of features in common, and distinction of new genera of this type requires a large material and a better knowledge of early Cambrian conodont faunas. The present writer is of the opinion that the *Hertzina* group may eventually be divided further, but at the present stage tentative assignments to *Hertzina* are preferable.

Hertzina? danica n. sp. differs from the type species – *H. americana* – in having a slender basal portion, in being perfectly symmetrical, and in the posterior side being evenly concave throughout.

The new species resembles *Hertzina elongata* MÜLLER, 1959 in many respects, but *H. elongata* has a flat or even convex posterior side, and is also distinctly asymmetrical.

Hertzina? bisulcata MÜLLER, 1959 has a general shape similar to that of *Hertzina? danica* n. sp., but MÜLLER's species has a gently convex posterior side, the costae are less pronounced, and the longitudinal furrows on the lateral sides are generally more shallow and more distant from the posterior edges.

Hertzina? danica n. sp. appears to be more primitive than the other species of *Hertzina*, and particularly the perfect symmetri shown by the cusps is of interest.

Remarks. – The known natural assemblages of conodonts are from the late Palaeozoic, and it is an open question if the Cambrian discrete conodonts were combined into an "apparatus". MÜLLER (1956, p. 1327) suggested a statistical approach to solve the question, but so far no positive answers have been obtained. On the other hand the knowledge of Cambrian conodonts is still very limited.

If the Cambrian conodont-bearing animals did have the conodonts grouped together in an "apparatus", it is only reason-

Fig. 2. *Hertzina? danica* n. sp. ×25. Cross sections of two phosphatic internal moulds and one shelly specimen with mould in place (holotype, MMH no. 9970). The sections are from the middle portion of the cusps and show the range of variation.

able to expect a very simple structure strongly different from the Carboniferous (Mississippian – Pennsylvanian) natural assemblages.

LINDSTRÖM (1964) stated that the structure of the assemblages suggested that the conodonts might have been supporting a frilled, lophophore-like organ which had a function as a filter. By assuming current directions, which would pass the conodont-supported frills in the most favourable way, the circulation pattern of the water was reconstructed.

The present writer is of the opinion that an eventual lophophore-like organ in the Cambrian forms might have been supported by only a few conodonts and possibly even of the same type. During the later development the compound blade-like, bar-like, and plate-like conodonts evolved, the distacodontids disappeared, and at the same time a decrease in size is evident. These trends leading to the highly complex assemblages most likely resulted in an increased capacity of the "apparatus".

In the known natural assemblages the conodonts are arranged with their cusps and denticles more or less at right angles to the sagittal axis of the animal. If the early Cambrian distacodontid conodonts are placed in a similar position, it becomes evident that the "apparatus" might be up to about 20 mm in width, whereas the known natural assemblages are 2–3 mm wide and

about 9 mm long. The present writer believes that the Cambrian distacodontids more likely had an orientation roughly parallel to the sagittal axis of the animal, with the tips in anterior direction and the flat or concave posterior sides facing the sagittal axis.

Hertzina? bisulcata MÜLLER, 1959

Pl. 1, fig. 9. Text-fig. 3

1959 *Hertzina? bisulcata* n. sp. MÜLLER: Kambrische Conodonten, p. 456, pl. 13, figs. 22–24, 27. (Description and figs. of four cusps)

Fig. 3. *Hertzina? bisulcata* MÜLLER, 1959. ×25. Lateral view of slightly flattened cusp (MMH no. 9977). Southeast of Kalbygård at Læså, Bornholm.

Material. – One almost complete and three somewhat fragmentary cusps. The material is frail, and most of the damage was probably done during the etching and later handling of the residue. They do not possess internal moulds of phosphatic material like in *Hertzina? danica* n. sp.

Horizon. – Middle Cambrian, Andrarum Limestone (*Jincella brachymetopa* Zone) and subjacent anthraconite (*Triplagnostus lundgreni – Goniagnostus nathorsti* Zone). The cusps were obtained by etching with acetic acid of only one hand-sized sample of the limestone and the anthraconite. Thus the species may possibly be common at this level.

Locality. – Southeast of Kalbygård at Læså, Bornholm.

Description. – The cusp is long and slender, gently curved towards the posterior side, and slightly asymmetrical, as the tip portion is slightly twisted. The basal cavity, which extends all the

way to the tip, is surrounded by extremely thin walls. The base is not preserved in any of the specimens.

The anterior side is rounded, semicircular in cross section, smoothly continues into the lateral sides which are not well-delimited from the anterior and posterior sides. The lateral sides are distinguished by a wide and shallow longitudinal furrow running from the base to the tip of the cusp. The posterior side is gently convex to flat, the edges are gently rounded, and thus no real costae are developed.

Cross section is oval with constrictions corresponding to the longitudinal furrows on lateral sides.

Dimensions. – The almost complete cusp is about 2 mm long.

Remarks. – *Hertzina? bisulcata* is undoubtedly closely related to *Hertzina? danica* n. sp., but differs in having a wider basal portion, the posterior side is generally convex, the cusp is asymmetrical, and the cross sections are distinctly different. The wider basal portion in MÜLLER's species problably indicates the progressive development of the flared base which distinguishes the majority of the Upper Cambrian conodonts.

Geological Institute of the
University of Copenhagen.

References

Ethington, R. L. 1959: Conodonts of the Ordovician Galena Formation. – Journ. Paleontology, vol. 33. Tulsa.

Lindström, M. 1964: Conodonts. – Elsevier Publishing Company. Amsterdam.

Müller, K. J. 1956: Taxonomy, nomenclature, orientation, and stratigraphic evaluation of conodonts. – Journ. Paleontology, vol. 30. Tulsa.

— 1959: Kambrische Conodonten. – Z. Deutsch. Geol. Ges., Bd. 111. Hannover.

Poulsen, C. 1942: Nogle hidtil ukendte Fossiler fra Bornholms Exsulanskalk. (Summary in English). – Medd. Dansk Geol. Forening, vol. 10, no. 2. Copenhagen.

Poulsen, V. 1963: The lower Middle Cambrian Kalby-ler (Kalby Clay) on the island of Bornholm. – Biol. Medd. Dan. Vid. Selsk., vol. 23, no. 14. Copenhagen.

Indleveret til Selskabet den 27. december 1965.
Færdig fra trykkeriet den 20. april 1966.

PLATE

Explanation to plate I

Fig. 1–8. *Hertzina? danica* n. sp. 4

1–2: Incomplete cusp (MMH no. 9970); oblique posterior and oblique lateral view. Holotype. Kalby Clay; Kalbygård, Læså. ×35.

3: Worn cusp (MMH no. 9971); lateral view. Kalby Clay; Kalbygård, Læså. ×35.

4: Incomplete cusp (MMH no. 9972); oblique posterior view. Kalby Clay; Kalbygård, Læså. ×35.

5: Incomplete cusp (MMH no. 9973); oblique lateral view. Kalby Clay; Kalbygård, Læså. ×35.

6: Phosphatic internal mould of basal cavity (MMH no. 9974); lateral view. Kalby Clay, Kalbygård, Læså. ×30.

7: Incomplete phosphatic mould of basal cavity (MMH no. 9975); lateral view. Kalby Clay; Kalbygård, Læså. ×30.

8: Incomplete phosphatic mould of basal cavity (MMH no. 9976); oblique lateral view. Kalby Clay; Kalbygård, Læså. ×30.

Fig. 9. *Hertzina? bisulcata* MÜLLER, 1959 8

Almost complete, slightly flattened cusp (MMH no. 9977); oblique lateral view. Andrarum Limestone; southeast of Kalbygård, Læså. ×30.


1
2
3
4
5
6
7
8
9

Det Kongelige Danske Videnskabernes Selskab

Biologiske Meddelelser

(Biol. Medd. Dan. Vid. Selsk.)

Bind 22 (kr. 65,00)

kr. ø.

1. JENSEN, P. BOYSEN: Untersuchungen über Determination und Differenzierung. 2. Über die Wachstumsvorgänge in der Spitze der Wurzelhaare von *Phleum*. With an English Summary. 1954 3,50
2. BÖVING, ADAM G.: Mature Larvae of the Beetle-Family Anobiidae. 1954 35,00
3. GAMOW, G.: Possible Mathematical Relation between Deoxyribonucleic Acid and Proteins. 1954 2,00
4. BØRGESEN, F.: Some Marine Algae from Mauritius. Additions to the Parts Previously Published. VI. 1954 8,00
5. JENSEN, P. BOYSEN: Untersuchungen über Determination und Differenzierung. 3. Über die Wirkungsweise des determinierenden Faktors, der bei der Bildung der Wurzelhaare von *Lepidium*, *Sinapis* und *Phleum* tätig ist. With an English Summary. 1955 4,50
6. SALOMONSEN, FINN: The Evolutionary Significance of Bird-Migration. 1955 6,00
7. MUNCH-PETERSEN, AGNETE, KALCKAR, HERMAN M., and SMITH, EVELYN E. B.: Uridyl Transferases, their Occurrence and Physiological Role. 1955 3,00
8. GAMOW, G.: On Information Transfer from Nucleic Acids to Proteins. 1955 1,00
9. HEVESY, G.: Conservation of Skeletal Calcium Atoms through Life. 1955 2,00

Bind 23

(uafsluttet/in preparation)

1. RASMUSSEN, ERIK: Faunistic and Biological Notes on Marine Invertebrates III. The Reproduction and Larval Development of some Polychaetes from the Isefjord, with some Faunistic Notes. 1956 11,00
2. PETERSEN, JOHS. BOYE, and HANSEN, J. BENTH: On the Scales of some Synura Species. 1956 7,00
3. BRØNDSTED, H. V.: Experiments on the Time-Graded Regeneration Field in Planarians. With a Discussion of its Morphogenetic Significance. 1956 7,00
4. BØRGESEN, F.: Some Marine Algae from Mauritius. Final Part. Edited by TYGE CHRISTENSEN. 1957 5,00
5. JENSEN, P. BOYSEN: Untersuchungen über Determination und Differenzierung. 4. Über den Aufbau des Zellwandgerüstes der Pflanzen und die Determination desselben. With an English Summary. 1957 6,00

		kr. ø.
6.	LARSEN, KAI: Cytological and Experimental Studies on the Genus *Erodium* with Special References to the Collective Species *E. Cicutarium* (L.) L'Her. 1958	4,00
7.	PETERSEN, JOHS. BOYE, and HANSEN, J. BENTH: On the Scales of some Synura Species. II. 1958	3,50
8.	JENSEN, P. BOYSEN: Untersuchungen über Determination und Differenzierung. 5. Über die Wirkungsweise des Wuchsstoffes in dem Epikotyl von *Phaseolus* (Die Brückentheorie der Wuchsstoffwirkung). With an English Summary. 1958	7,00
9.	GOLOMB, S. W., WELCH, L. R., and DELBRÜCK, M.: Construction and Properties of Comma-Free Codes. 1958	5,00
10.	JENSEN, P. BOYSEN: Untersuchungen über Determination und Differenzierung. 6. Über den Aufbau des Zellwandmusters des Blattes von *Helodea densa*. With an English Summary. 1959	5,00
11.	NIELSEN, ERIK TETENS: On the Habits of the Migratory Butterfly *Ascia monuste* L. 1961	12,00
12.	POULSEN, VALDEMAR: Notes on *Hyolithellus* Billings, 1871, Class *Pogonophora* Johannson, 1937. 1963	2,50
13.	POULSEN, VALDEMAR: *Ctenopyge (Ctenopyge) pecten tenuis n. subsp.* from the Upper Cambrian of Bornholm. 1963	2,00
14.	POULSEN, VALDEMAR: The Lower Cambrian Kalby-Ler (Kalby Clay) on the Island of Bornholm. 1963	3,00
15.	POULSEN, VALDEMAR: Early Cambrian Distacodontid Conodonts from Bornholm. 1966	4,00

On direct application to the agent of the Academy, MUNKSGAARD, Publishers, 47 Prags Boulevard, København S., a subscription may be taken out for the series of *Biologiske Meddelelser*. This subscription automatically includes the *Biologiske Skrifter* in 4to as well, since the *Meddelelser* and the *Skrifter* differ only in size, not in subject matter. Papers with large formulae, tables, plates etc., will as a rule be published in the *Skrifter*, in 4to.

For subscribers or others who wish to receive only those publications which deal with a single group of subjects, a special arrangement may be made with the agent of the Academy to obtain the published papers included under one or more of the following heads: *Botany, Zoology, General Biology.*

In order to simplify library cataloguing and reference work, these publications will appear without any special designation as to subject. On the cover of each, however, there will appear a list of the most recent papers dealing with the same subject.

The last published numbers of *Biologiske Meddelelser* within the group of **General Biology** are the following:

Vol. **23**, nos. 9, 12–15.

Printed in Denmark.
Bianco Lunos Bogtrykkeri A/S