

# Ordovician Echinoderms from the Trondheim Region, Norway

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Echinoderms recently collected from the Hølonnda area in the Trondheim Region are described. The remains are those of a cystoid (*Cheirocrinus* sp.), a plate possibly belonging to a crinoid, and a pelmatozoan stem. The material bears some similarities to forms from the Upper Arenig-Lower Llanvirn.

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Among fossils collected by R. B. Neuman and D. L. Bruton from Trotland farm in the Hølonnda district (Neuman & Bruton 1974), there are some remains of echinoderms, which form a small part of the fauna. On the whole, echinoderms are uncommon in the Trondheim area, but they have been found in a few places. When present, the pelmatozoan ossicles are numerous. Cystoids such as *Echinosphaerites* sp. have been known from the Trondheim area since Kjerulf's time. Kiær (1932) mentions the presence of *Echinosphaerites* in the Kalstad Limestone in Meldalen where they were common in some layers. Apart from these recordings, no other information concerning echinoderms has been gathered. The present cystoid find in the Trondheim Region has for long been expected, since *Cheirocrinus* is a natural element of the faunas in several facies types. Finds of this fossil, together with a crinoid fragment and numerous other shelly fossils, indicate that these deposits cannot be of great depths. Judging from the fragmentary state of the material, the deposits may not even be from below wave base.

*Cheirocrinus* has a wide geographical distribution, being known from most areas in the world where Ordovician sediments occur. Recently the genus was collected from Arenig series of Spitsbergen.

## Systematic description

*Class Rhombifera* (Paul 1971 emend.)

*Family CHEIROCRINIDAE*

### *Cheirocrinus* sp.

Figs. 1, 4A

*Material.* – Three loose thecal plates (PMO 91564, 91566, 91567) were all thought to belong to the same species.

*Characteristics.* – A species of *Cheirocrinus* with small plates, longest axis seldom exceeding 10 mm. Rhombs disjunct, axial ridges narrow and somewhat wrinkled. No secondary ridges.

*Description.* – None of the plates are complete; two of them (PMO 91564, 91566) appear to have been basals or to have bordered the periproct. One plate (PMO 91566, Figs. 1A, B, 4A) has two axial ridges visible, but as it is not complete, it may have had a third ridge. If this was so, then two of the three axes might have bordered the aboral margin of the plate. In PMO 91567 (Fig. 1C, D), four axial ridges were observed. No porerhombs were seen on this plate, which belongs to the lateral or infra-lateral circlet. In PMO 91566, a disjunct porerhomb, which is most probably a demirhomb, can be seen (plate incomplete).

Measurements taken at right angles to the poreslits showed that there were five slits per mm, which become broader and more concentrated towards the centre of the plate (Fig. 1A). The axial ridges are narrow, particularly in PMO 91567, and somewhat wrinkled and pointed at the plate centre (Fig. 1B). The wrinkled structure bears similarities to that known from *Cheirocrinus holmi* Regnéll (Regnéll 1945:70); the axial ridges, however, do not widen towards the plate sutures of that species, in contrast to PMO 91567 (Fig. 1C, D). The projection in the plate centre rises quickly in PMO 91566 (Fig. 1B), whereas in PMO 91567 (Fig. 1D) the whole plate is strongly evaluated. The

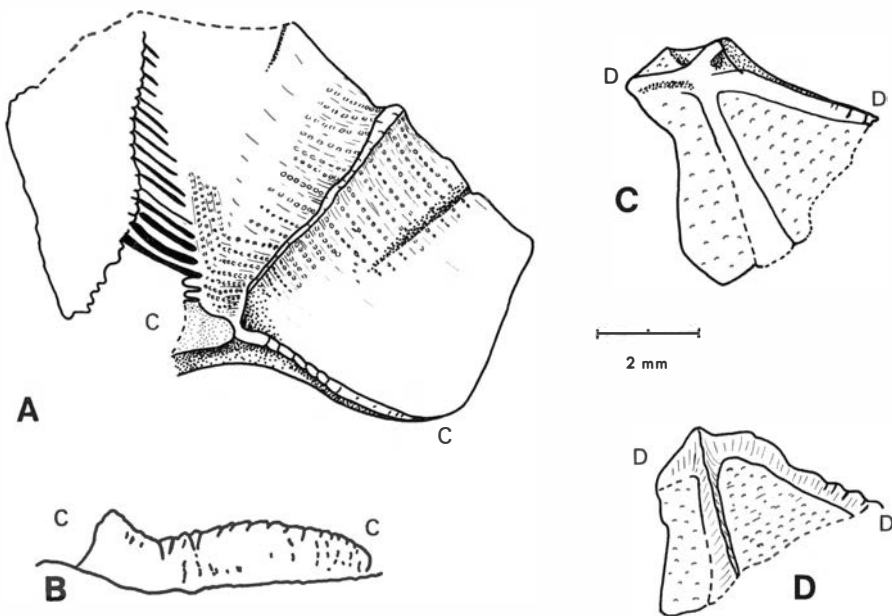


Fig. 1. *Cheirocrinus* sp.

A and B: casts of plates of PMO 91566. A: plate seen from above. B: sideview along line c-c in Fig. A. Note the wrinkled structure and pointed plate centre. C and D: Casts of plate of PMO 91567. A: plate seen from above, B: plate in lateral view along line d-d.

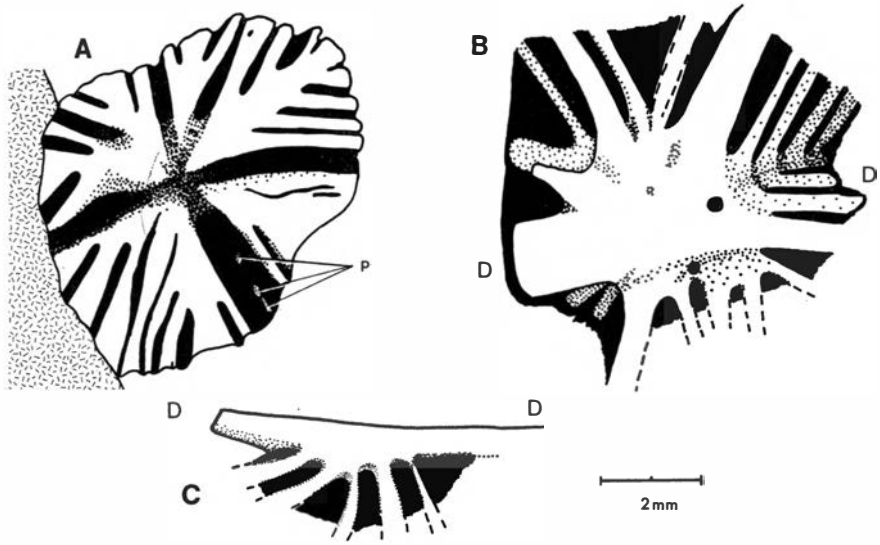


Fig. 2. Crinoid plate (?)

A: Cast of plate interior, PMO 91569. B: Cast of plate exterior, PMO 91568. C: longitudinal section along line D-D on Fig. B. p: small projections on plate interior, probably pores.

plates are generally small and the longest axis seldom exceeds 10 mm. The entire surface, where not provided with porerhombs, is slightly granular; granules can be observed in several species of *Cheirocrinus*, but are best developed in *C. granulatus* (Jaekel).

The plates described here show similarities to *C. anatformis* (Hall) from the Trentonian Rocks of the U.S.A. in that they are roughly time-equal to the Hølonnda material. They are similar as far as the delicate ridges, and size and granulations of the plates are concerned, but differ in that the Norwegian species has additional ridges. There are also differences in the number of pore-slits per mm; where *C. anatformis* has 1.5-2.0 slits per mm, the Norwegian species has 5.0 slits per mm.

Until more and better preserved material is discovered, the species will remain uncertain. However, at present it seems that the Norwegian material is more closely related to *C. anatformis* than any other species.

### Echinoderms of uncertain affinities

Crinoid plate(?) (Figs. 2, 4B, C).

*Material.* – One thecal plate showing external and internal impressions (PMO 91568, 91569).

*Characteristics.* – The plate is pentagonal in outline, and is provided with five axial and several minor ridges. Its centre is almost flat or slightly concave.

*Plate exterior* (Figs. 2B, 4C). – On the cast of the external plate surface, the central portion is almost flat or slightly concave (Fig. 2C). There are two circular poreholes about 0.2 mm in diameter on this flat area. Towards the plate margins the flat area slopes down towards the sides, but the concavity is more pronounced in one particular direction (Fig. 2C). Five main ridges extend perpendicularly to the plate margins, at which point they decrease in diameter. Several minor ridges running parallel to the major ones are constant in width near the plate centre and also towards the margins.

*Plate interior* (Figs. 2A, 4C). – As well as minor ridges which run parallel to the major grooves, the plate interior shows five main grooves which correspond to the ridges on the exterior. In one of these grooves there are three small mounds (Fig. 2A) which might possibly be pores. The plate thickness

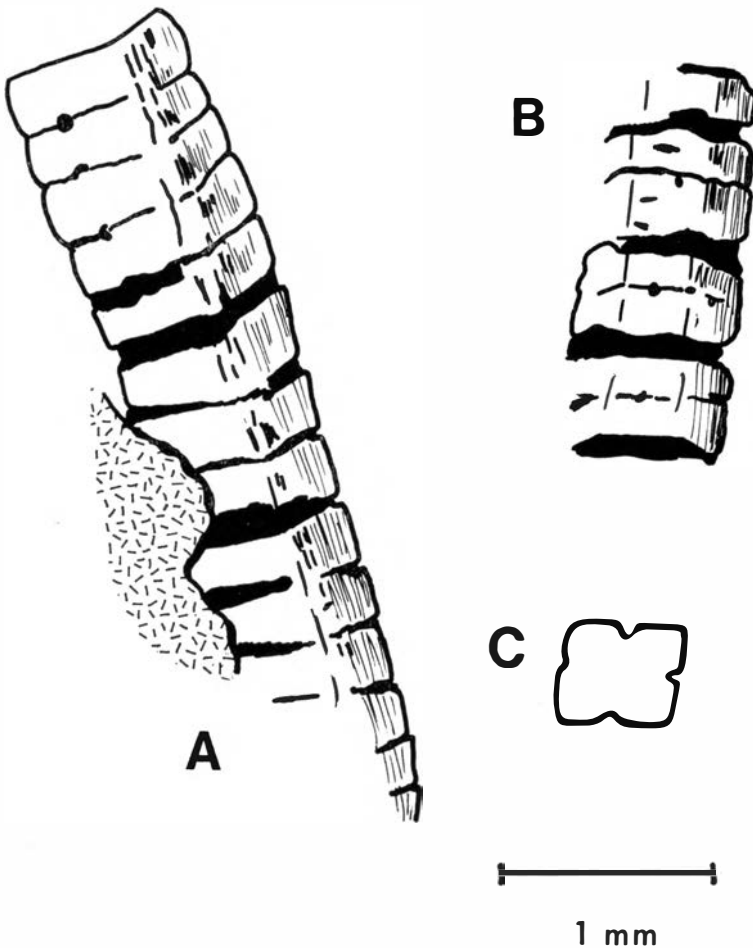


Fig. 3. Pelmatozoan stem.

A: PMO 91570, B: PMO 91563, C: reconstructed cross-section of a columnal. All specimens of same scale.

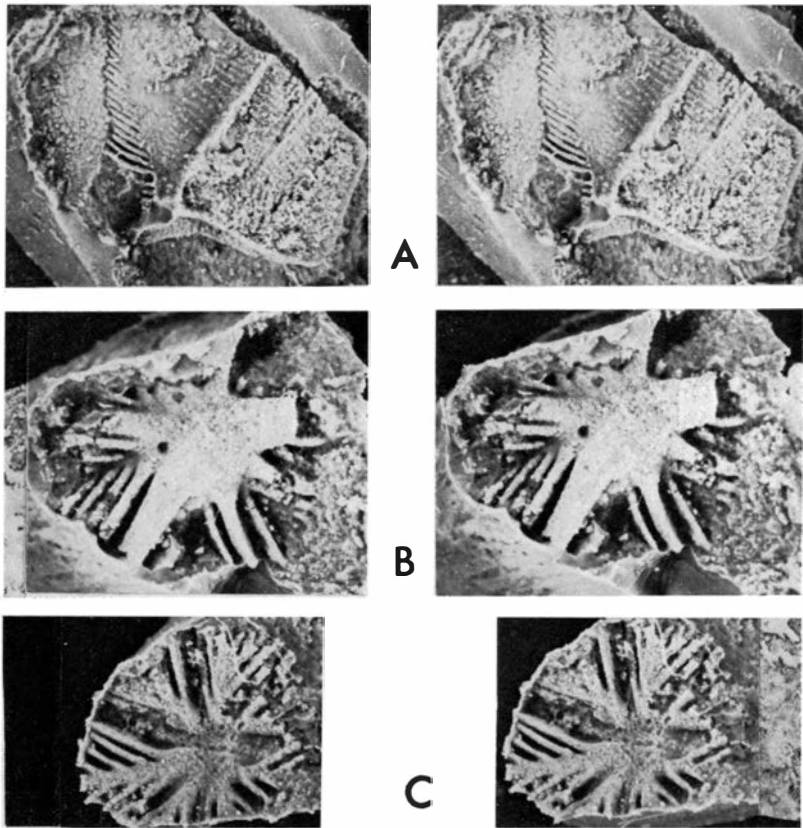


Fig. 4. Echinoderms from Trotland Farm, Trondheim Region.  
 A: *Cheirocrinus* sp. Basal plate (?). Stereopair of silicone-rubber cast of PMO 51566.  $5 \times$   
 B: crinoid plate (?) Stereopair of external surface of PMO 91568. Rubber cast;  $5 \times$ . C:  
 crinoid plate (?) Stereopair of internal surface. Rubber cast of PMO 91569.  $5 \times$ .

is difficult to determine because of the many ridges, but it could be about 0.5-0.6 mm in the centre.

*Discussion.* – A slight difference between each side of the plate can be observed. No typical cystoid pores of either the diploporitic type or the rhombiferid type are present. There is a slight similarity to the paracrinoids, but this is most probably a plate belonging to a crinoid. According to C. R. C. Paul (pers. comm.), the plate bears strong resemblance to plates found in the Llanvirn-Caradoc of Wales.

### Pelmatozoan stem, gen. and sp. indet. (Fig. 3)

Among the material from Trotland were three pelmatozoan stems all belonging to the same species. Two of them have been illustrated (Fig. 3). The

columnals are quadrangular in outline with one small depression on each side (Fig. 3C). No articulation area can be seen. The columnals are grouped together in twos, but this feature is not equally clear along the entire length of the stem. The material is not well enough preserved for detailed studies. Stems of this type have been recorded from Arenig strata in Britain (Ramsbottom, pers. comm.).

## Stratigraphy

The mere presence of *Cheirocrinus* plates indicates an Ordovician age, but the actual type of plates indicates a likeness to *C. anatiformis*, which is present in the Trentonian of the U.S.A. The crinoid plate shows great similarities to undescribed plates from the Llanvirn-Caradoc of Wales, and the pelmatozoan stem belongs to a group which was more common during the Arenig than later. It therefore seems that the echinoderms — generally being good index fossils — indicate an Arenig-Llanvirn age for the sediments from Trotland farm.

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