The Presence of *Prunocystites* (Cystoidea) in Stage 9e of Ringerike, Norway

JOHAN FREDRIK BOCKELIE

Bockelie, J. F.: The presence of *Prunocystites* (Cystoidea) in Stage 9e of Ringerike, Norway. *Norsk Geologisk Tidsskrift,* Vol. 53, pp. 317–321. Oslo 1973.

From Stage 9e at Ringerike, a British Wenlockian cystoid, *Prunocystites fletcheri* Forbes, is described and on this evidence it is suggested that most or all of Stage 9 is of Wenlockian age, and that the lowermost part of Stage 10 was deposited in Early Ludlovian and possibly Latest Wenlockian times.

J. F. Bockelie, Paleontologisk Museum, Sars gt. 1, Oslo 5, Norway.

Silurian cystoids have not previously been recorded from the Oslo Region. In 1971, however, two genera each represented by a single species were collected, i.e. *Cheirocrinus* n.sp. from Stage 6b at Malmøya, Oslo, and *Prunocystites fletcheri* from Stage 9e at Nes, Ringerike. Cystoids are uncommon in the Silurian of the Baltoscandian Basin and have so far not been recorded from Estonia nor the Leningrad District. Two Silurian species have been described from Gotland, Sweden (Regnéll 1945), *Gomphocystites gotlandicus* Angelin, and *Lovenicystis angelini* Jaekel, the former from the Wenlockian and the latter from the Ludlovian. Seven genera and eight species have been described from Great Britain (Paul 1967), ranging from Wenlock to Ludlow. Among them is *Prunocystites.*

Systematic description

Family CALLOCYSTIDAE

Genus *Prunocystites* Forbes, 1848

Diagnosis: See Paul 1967, p. 334.

Prunocystites fletcheri Forbes, 1848.

Pl. 1; Figs. 1–2.

☐ 1848. *P. fletcheri* Forbes (partim). ☐ 1967. *P. fletcheri* Forbes (Paul, p. 335).

Material. – One specimen, PMO 93699.

Horizon and locality. – Stage 9e, *Amplexopora* Beds. Middle Silurian. Roadsection at Nes, Ringerike, Norway.

Description. – The theca is ovate in outline and small, only 6 mm high and 4 mm greatest diameter. The thecal plates are arranged in a definite order, but due to a parasitic growth on the lower half of the theca some plate-sutures are not visible. The plate arrangement of the specimen indicates a close relationship with specimens referred to *Prunocystites* by Paul (1967, p. 335). The configuration of the RR and OO plates is not known in detail, but a fairly complete picture of the other thecal plates can be given (Fig. 2). The ILL and LL plates form closed circlets, and the individual thecal plates are generally of the same shape as those in *P. fletcheri* Forbes (Paul 1967). L4 is not in contact with the periproct. In the British material some variation occurs, but the same features as mentioned above may be present. The thecal surface is sculptured with fine tubercles (as in specimens described by Paul 1967, Pl. 8:4). Apart from this sculpture, the thecal surface appears smooth.

Two pectinirhombs are present. In L4:R3 the half rhombs (1.8 mm wide) are well preserved and surrounded by a rim, which in L4 is raised and strong. This suggests that the rhomb was fully grown, and thus that the theca was mature. L1:R5 is less favourably preserved, and somewhat com-

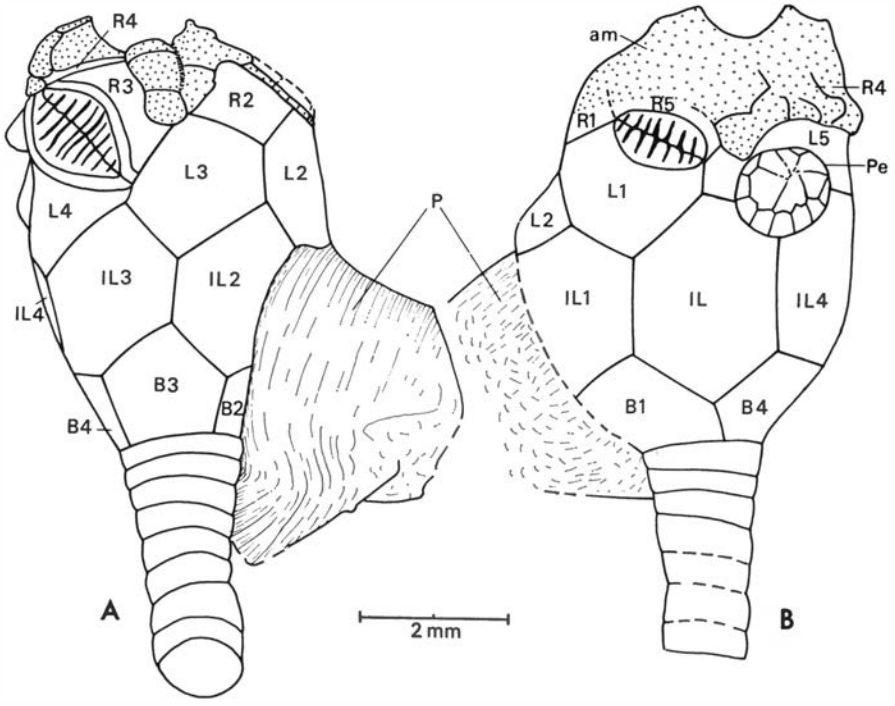

Fig. 1. *Prunocystites fletcheri* Forbes. Camera lucida drawing of the thecal plates visible in PMO 93699. A and B: two views of the same specimen. am and dotted area – ambulacral area; B1–B4 – basals; IL1–IL5 – infra-laterals; L1–L5 – laterals; R1–R5 – radials; Pe – periproct; P – parasitic animal, probably a mollusc. Note that the pore-rhombs are present in R3–L4 and R5–L1, but not in B2–IL2.

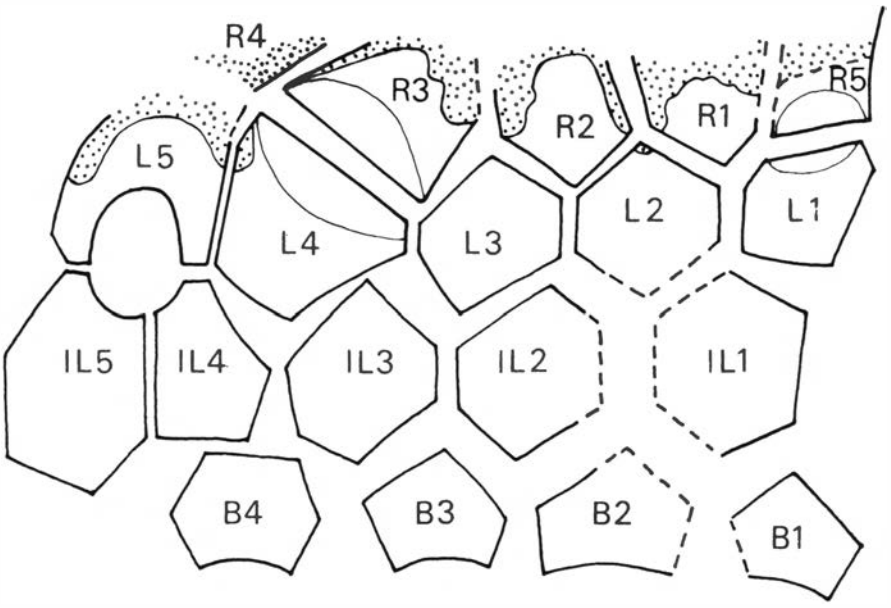

Fig. 2. *Prunocystites fletcheri* Forbes. Camera lucida drawing of the thecal plates and their presumed outline (stippled lines) in PMO 93699. The outlines of the plates show great similarities to those of British specimens. B1–B4 – basals; IL1–IL5 – infra-laterals; L1–L5 – laterals; R1–R5 – radials. Dotted: ambulacral area.

pressed (width probably close to 1.1 mm). Seven dichopores occur in L1:R5 and 10 in L4:R3. In the better preserved rhomb the slits are about 0.05 mm wide and separated by 0.10–0.15 mm in half rhomb R3.

The oral plates do not show sutures well enough for their number and positions to be determined. Four ambulacra protrude from the peristomal region, occasionally reaching down to the upper part of the lateral plates (Figs. 1 and 2), but the number of brachioles cannot be evaluated. Flooring plates can be distinguished in the distal portion of the ambulacra as shown in Fig. 1. Brachioles are about 10 mm long.

The periproct is high up on the theca (Fig. 1B), probably a feature indicating immaturity (Paul 1967, p. 337). It is bordered by three thecal plates (IL4, IL5 and L5). An anal pyramid consisting of 6 plates and an outer circlet of 9 or more auxiliary plates is present. No gonopore nor hydropore has been observed. An incomplete stem (2.5 mm long) with the proximal portion containing 7 outer columnals is preserved.

Comparisons and remarks. – Paul (1967, pp. 334–335) discussed the uncertainties about the genus *Prunocystites* in relation to other genera and commented on the possibility that it is based on some immature specimens of other genera. In any case the Norwegian specimen shares essential characters with *P. fletcheri* Forbes. A certain degree of variation occurs within this species, but our specimen falls well within the limits of this variation.

During growth the Ringerike specimen was parasited by an organism bearing a calcitic shell, probably a mollusc. The cystoid grew almost normally in spite of the parasitic activity, which affected parts of the thecal plates B1, B2, IL1, IL2 and L2. The thecal plates covered by the parasitic animal are thinner than the other thecal plates.

Most cystoids have restricted geographic distribution. The presence of *Prunocystites fletcheri* in the Oslo Region is somewhat surprising since this species had its main domain at Dudley in Worcestershire, occurring there together with 5 other genera. Most probably no previous records are known of this cystoid in Norway because of its small size and also because it lived in areas with special ecological conditions. *Prunocystites* may indicate that the conditions represented by the Upper Wenlock Limestone at Dudley (shallow water) were similar to those represented by Stage 9e at Ringerike. It has been suggested that the echinoderm fauna of the Wenlock Limestone at Dudley lived on a hard bottom and was periodically killed by sudden influxes of mud (cf. Paul 1967, p. 302). Cystoids may be rare in the Silurian of the Oslo Region because influxes of mud were more common here than at Dudley.

Stratigraphical remarks. – *Prunocystites fletcheri* was until now exclusively known from the Dudley area, where it occurs in the Wenlock Limestone, which seems to be older at Dudley than the Wenlock Limestone at Wenlock Edge (pers. comm. M. Basset). The presence of the species in Stage 9e strongly suggests a correlation between Stage 9e and the Wenlock Limestone at Dudley. Kiær (1908) suggested the boundary Wenlock/Ludlow to be situated at the Stage boundary 9b/9c, as based on the general appearance of the faunas (the species concept was then taken in a wide sense). Størmer (1933), working on the eurypterids from Ringerike, suggested the Stage 9d to be contemporaneous with the *Eurypterus fischeri* fauna of the Baltic, i.e. to be of Ludlovian age. Spjeldnæs (1966), indicated from studies of the boundary between Stages 9 and 10 at Kolsås near Oslo that this boundary may be anisochronous (p. 497). He suggested a SE-wards migration of the Ringerike Formation delta, causing marine conditions to cease earlier in the Ringerike area than in the Oslo-Asker area. He accepted Stage 9 as being of Ludlovian age. Gross (1968), discussing the agnaths from the Ringerike area, summarized his studies of Stage 9g as follows: 'Die Teleodontier-Fauna stimmt mehr mit der Halla-Schichten als mit der Kaarma-Schichten überein; ähnlich sind auch die Anaspiden-Reste. Von Osteostracen konnte *Oeselaspis* sicher nachgewiesen werden. Acanthodii fehlen gänzlich. Das alter dieser Schichten dürfte dem der Halla-Schichten oder dem Unter Ludlow von Oesel entsprechen. Sicher hat diese Fauna kein Ober Ludlow-Alter', thus indicating that Stage 9g is of either Uppermost Wenlock or Lowermost Ludlow age. Heintz (1969) suggested that the greater part of Stage 9 belongs to the Wenlockian and that the lower part of the Ringerike Sandstone (Stage 10) belongs to the Lower Ludlovian. Basset & Rickards

(1971) established Stage 9a as belonging to the zone of *Monograptus riccartonensis*. On the basis of this and from literature studies they suggested that the whole of Stage 9 is of Wenlockian age.

The presence of a Wenlock cystoid in Stage 9e further supports the view that the boundary Wenlock/Ludlow at Ringerike is present somewhere between Stage 9e and within Stage 10. The distance between Stage 9e beds and the red beds (non-marine?) of the Ringerike Formation is probably less than 10 m. This would indicate that very few or no marine Ludlow beds are present at Ringerike, and that the red bed conditions started either in latest Wenlockian or earliest Ludlovian times in the Ringerike district of the Oslo Region.

February 1973

REFERENCES

Basset, M. & Rickards, B. 1971: Notes on Silurian stratigraphy and correlation in the Oslo district. *Norsk geol. tidsskr. 51,* 247–260.

Gross, W. 1968: Die Agnathen-Fauna der Silurischen Kalla-Schichten Gotlands. *Geol. fören. Stockholm Förh. 90,* 369–400.

Heintz, A. 1969: New Agnaths from Ringerike Sandstone. *Skr. Norske Vidensk.-Akad. I Oslo, Mat.-naturv. Kl. I,* ny serie no. 26. Oslo.

Kiær, J. 1908: *Das Obersilur im Kristianiagebiete.* 1–596. Kristiania.

Paul, C. R. C. 1967: The British Silurian Cystoids. *Bull. British Museum (Nat. Hist.), Geology 13, 6,* 299–355.

Regnéll, G. 1945: Non-crinoid Pelmatozoa from the Paleozoic of Sweden. A taxonomic study. *Med. Lunds Geol.-Mineral. inst. 108,* I–VI+ 1–255.

Spjeldnæs, N. 1966: Silurian tidal sediments from the base of the Ringerike Formation, Oslo Region, Norway. *Norsk geol. tidsskr. 46,* 497–509.

Størmer, L. 1933: Eurypterid remains from the Ludlow zone 9d of Ringerike. *Norsk geol. tidsskr. 14,* 119–126.