

A review of the Andrarum Limestone and the upper alum shale (Middle Cambrian) of Bornholm, Denmark

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The lithology and fossil content of the Middle Cambrian Andrarum Limestone on Bornholm is briefly reviewed. Trilobites, brachiopods and hyolithids are common, acid residues contain a rich fauna of pelagiellaceans, rostroconchs and echinoderm fragments. Most of these are phosphatized with well preserved micro- and ultrastructures. A revised list of trilobites is presented. New finds of trilobites in the lowermost upper alum shale show the lower part of the *Lejopyge laevigata* Zone to be no more than 10 cm thick. The occurrence of the Upper Cambrian conodont *Westergaardodina tricuspidata* permits a more exact placement of the Middle-Upper Cambrian boundary. The Middle Cambrian deposits are shown to be $3 \text{ m} \pm 10 \text{ cm}$ in total thickness in the two localities known on Bornholm.

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Introduction

Except for the lower Middle Cambrian of Sweden and Norway, the Middle Cambrian of Baltoscandia is usually developed as black shale facies with two significant limestone units. These units – the Exsulans and Andrarum limestones – are found at several localities throughout Scandinavia. Even when the limestones are absent, their characteristic trilobite fauna occurs in the black shales and correlation is possible.

This paper presents a preliminary study of the Andrarum Limestone microfossils, whereas the trilobites are only discussed briefly. The microfauna is less diversified than that found in the Exsulans Limestone/Kalby marl (Berg-Madsen, 1981) but rostroconchs, some pelagiellaceans and echinoderms appear for the first time and details of their individual micro- and ultrastructure are in many cases externally well preserved.

Information from new fossil occurrences in the upper alum shale permits location of the Middle-Upper Cambrian boundary to 0.7 m (Læså) and 1.6 m (Øleå) above the Andrarum Limestone, within a succession of black shales (26 m).

Previous investigations

Forchhammer (1835) was the first to describe the geology of Bornholm including the Cambrian-Silurian lithology and fossils, although only very superficially. However, he noted the Middle Cambrian alum shale and its associated limestone beds as well as the use of the limestone for a certain type of strong cement due to the clay content. From this, it is evident that he described the Andrarum Limestone, its name first coming to use much later (Angelin 1854, Nathorst 1869). Thus, Seebach (1865) still used the term *Regio Conocorypharum* of Angelin when he described his visit to Bornholm. *Regio Conocorypharum* roughly corresponds to the *Paradoxides forchhammeri* beds, whereas the *P. paradoxissimus* beds were placed in *Regio Olenorum* and by that means incorrectly placed in the stratigraphical succession. This knowledge helps in the interpretation of Seebach whose locality descriptions are repeatedly inaccurate and confusing.

Johnstrup (1874, 1891) made the first detailed description of the Palaeozoic of Bornholm. He listed 23 species of trilobites, brachiopods and

hyoliths from the Andrarum Limestone without specifying the locality (Læså or Øleå). Although his collecting methods were dubious and have long caused stratigraphical problems (Berg-Madsen, 1985), his determinations from the Andrarum Limestone and overlying alum shale are generally correct.

Grönwall (1899, 1902) investigated the Middle Cambrian thoroughly. Johnstrup's list was repeated and several new species added. The overlying upper alum shale yielded only very few fossils as did the anthraconite (stinkstone) lenses. Both the shale and the lenses were described as extremely hard. This was confirmed by C. Poulsen (1923) who estimated the position of the Middle-Upper Cambrian boundary on the presence of a presumed ostracode, *Svealuta primordialis*, at 0.8 m (Middle Cambrian) and the agnostid trilobite *Agnostus pisiformis* at 2.1 m above the Andrarum Limestone at Øleå. As the agnostid *A. pisiformis* is also found in the Middle Cambrian *Lejopyge laevigata* Zone (Table 2), the value of its occurrence in delimiting the Upper Cambrian in this case is debatable.

Hansen (1945) described the Middle and Upper Cambrian rocks of Bornholm lithologically as did Hadding (1958). Apart from short reviews by C. Poulsen (1960) and V. Poulsen (1966), neither the Andrarum Limestone nor the Middle Cambrian upper alum shale have been investigated for fossils. More attention has been drawn to the Middle Cambrian limestones in general with regard to their diagenetic changes reflected in their $^{13}\text{C}/^{12}\text{C}$ and $^{18}\text{O}/^{16}\text{O}$ isotope compositions (Berg-Madsen 1981, 1985, Buchardt & Nielsen 1985).

Methods

About 6 kg Andrarum Limestone were crushed into pieces and dissolved in 10% acetic acid. Due to the clay content the dissolution was very slow. In order to avoid unnecessary etching or total dissolution of the fossils, the pieces were regularly examined under a binocular microscope. Thus three stages of collecting have been maintained: 1) pure limestone pieces with macrofossils, 2) partly dissolved limestone containing macro- and microfossils on the surfaces, and 3) microfossils picked manually from the insoluble residue. The residue consists of a more or less coherent spongy

mass of clay and bituminous matter which had to be broken before picking under a binocular microscope. 40 samples of upper alum shale, each covering a 10 cm level, were collected from bottom to top of the main profiles at Læså and Øleå. Each sample on average weighted 1.5 kg. Cleaned, broken samples were examined under a binocular microscope.

The Andrarum Limestone

Læså. – The Andrarum Limestone is exposed at two well known localities: the rivulet Læså near



Fig. 1. Map of Bornholm showing the sub-Quaternary distribution of Cambrian rocks (stippled) and the position of Kalby and Borregård.

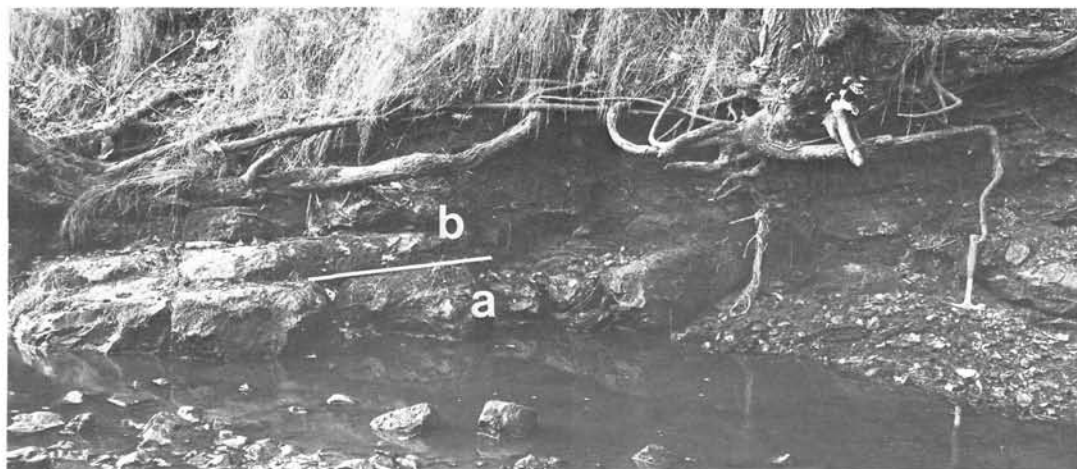


Fig. 2. The Middle part of the main exposure at Læså. The Hyolithes limestone (a) is overlain by Andrarum Limestone (b), the strata dipping below the water level to the left. The same part of the exposure is figured in Hansen (1945, fig. 9, p. 22). Photograph: A. Philip.

the Kalby farms and the rivulet Øleå at Borregård farm (Fig. 1). At Læså it crops out in the right bank of the rivulet and can be followed for more than 20 m. Due to the dip of the strata most of the exposure occurs in the stream bed. The limestone overlies the Hyolithes limestone (Fig. 2), from which it is separated by a thin layer of "fragment limestone" (Hadding 1958, Berg-Madsen 1985). Immediately overlying is the upper alum shale. The Andrarum Limestone is heavily weathered and almost devoid of calcium carbonate where it overlies the Hyolithes limestone and the Kalby marl in the northern part of the exposure. Except for the weathered part, the Andrarum Limestone is extremely hard and difficult to break due to the combination of clay (>25%) and calcium carbonate.

Øleå. – The exposure at Øleå is a former cement quarry where the limestone can be followed for 25 m at the main exposure. The strata are almost horizontal (Fig. 3) and the exposure shows the almost complete Middle Cambrian sequence. The basal Middle Cambrian Exsulans Limestone is seen in the stream bed near the right bank. The basal anthraconite is absent here and the lower alum shale forms the remaining stream bed and the base of the cliff. As already noticed by Johnstrup (1874, 1891), the thickness of the lower alum shale at this exposure hardly exceeds 0.1 m. Overlying the lower alum shale, the Hyolithes limestone is found just above the average water

level, separated from the Andrarum Limestone by 10–30 mm of alum shale. Overlying the Andrarum Limestone are more than 2.2 m of upper alum shale with anthraconite lenses. Johnstrup (1874, 1891) collected his samples at the former crushing mill 200 m WNW of the quarry, W of Borregård farm, because of the hardness of the limestone.

The thickness of the Andrarum Limestone varies between 0.5 and 0.7 m; it is thickest at Øleå, and averages 0.6 m at both localities. It should be noted, though, that the Hyolithes limestone is included in older literature where the thickness averages 0.8 m (Grönwall, 1902).

Lithology. – Two different lithological developments can be distinguished: (1) dark grey and fine grained limestone and (2) light grey and coarse grained limestone. The dark grey limestone is compact and the single calcite grains are coated by bitumen and clay minerals. Pyrite and phosphorite occur. The light grey crystalline parts contain quartz and glauconite grains. The latter are similar to the moulds of inorganic origin found in the Exsulans Limestone/Kalby marl and thus regarded as authigenic glauconite (Berg-Madsen, 1983). The Andrarum Limestone on Bornholm differs from that of the type locality in Scania (Skåne) by its content of quartz, glauconite and phosphorite (Hadding, 1958). The phosphorite occurs as diffuse bodies or aggregates rather than in discrete lumps and nodules.



Fig. 3. The eastern part of the main exposure at Øleå. The thick arrow (lower left) indicates large scale cross-bedding, the thin arrow (upper right) at the cavity left by an anthraconite lense. The middle part to the right of the levelling rod is also figured in Grönwall (1899, pl. 2) and Hansen (1945, fig. 6, p. 15). Photograph: A. Philip.

Phosphorite is most common in the upper part of the unit and is often associated with microfossils. An analysis (EDAX) of the insoluble residue showed 39.9 wt.% Si, 26 wt.% Al (enriched),

13.5 wt% Mg, 6.2 wt% K, 4.5 wt.% Fe and 2.6 wt% P as the main constituents. Large gypsum crystals recorded by Grönwall (1902) have not been found in the present investigation.

protaspis sp. indet.

Agraulos aculeatus

A. acuminatus

A. difformis

Anomocare laeve

Anomocarina excavata subsp. indet.

A. e. dentata

A. extornata

Anomocarioides limbatus

Bailiaspis glabrata

Centropleura loveni

C. steenstrupi

Dasometopus breviceps

Eccaparadoxides sjoegreni nepos

Elyx laticeps

Groenwallia microphthalma

G. platyrrhina

Paradoxides forchhammeri

Solenopleura brachymetopa subsp. indet.

S. b. alutacea

S. bucculenta

S. canaliculata

S. holometopa subsp. indet.

S. h. humilis

Grandagnostus glandiformis

Hypagnostus brevifrons

H. exsculptus

Lejopyge laevigata

L. lundgreni

Peronopsis fallax ferox

P. f. minor

P. quadrata

Phalagnostus bituberculatus

Ptychagnostus aculeatus

Table I. The trilobite fauna of the Andrarum Limestone on Bornholm compiled after Johnstrup (1891), Grönwall (1902) and finds by the author. Revised after Westergård (1946, 1948, 1953a), Jago (1976), and Robison (1984).

	ZONAL GROUPS	TRILOBITE ZONES	REVISED DIVISIONS
MIDDLE CAMBRIAN	<i>Paradoxides forchhammeri</i>	<i>Lejopyge laevigata</i>	upper alum shale
		<i>Solenopleura brachymetopa</i>	Andrarum Limestone
	<i>Paradoxides paradoxissimus</i>		Hyolithes limestone
		<i>Ptychagnostus punctuosus</i>	lower alum shale
			anthraconite
		<i>Hypagnostus parvifrons</i> subzone	
		<i>Ptychagnostus atavus</i>	
		<i>Tomagnostus fissus</i> subzone	
	<i>Ptychagnostus gibbus</i>	Exsulans limestone	
	<i>Eccaparadoxides oelandicus</i>	NOT PRESENT	

Table 2. The Middle Cambrian stratigraphy of Bornholm (after Berg-Madsen, 1985).

Bedding within the limestone unit has not been observed in thin sections or on larger polished sections. Not even the fossils can be related to specific levels but occur scattered or as minor concentrations in certain parts of the unit but are absent in other parts. However, bedding and large scale cross bedding can be recognized on eroded surfaces at the quarry at Øleå (Fig. 3).

The Andrarum Limestone is a primary marine deposit as opposed to the diagenetic limestone beds (basal anthraconite and Hyolithes limestone) and lenses (Bucharadt & Nielsen, 1985).

Fossil content. – trilobites have been used as the basis for correlation (Westergård 1946, 1948, 1950, 1953a). A revised list of trilobites is pre-

sented in Table 1. Most of the trilobites listed here are restricted to the zone of *Solenopleura brachymetopa* (Table 2) to which the Andrarum Limestone and at least the upper part of the Hyolithes limestone belong (Berg-Madsen, 1985). The Bornholm fauna is limited when compared with the 80 trilobite species known from the type locality at Andrarum in Skåne. Some species are even endemic to Bornholm.

The large hyolithid *Hyolithes tenuistriatus* was recorded by Johnstrup (1874, 1891) and the determination was confirmed by Holm (1893). Additional specimens have not been found but fragment of hyolithids are common.

Inarticulate brachiopods were studied by See-

bach (1865) who described *Acrotreta socialis*, whose identity has remained somewhat obscure. Linnarsson (1876) selected some type specimens from the Andrarum Limestone on Bornholm in his description of Palaeozoic brachiopods from Sweden. Johnstrup (1874, 1891) and Grönwall (1899, 1902) recorded mostly the same species as Linnarsson. Walcott (1912) included all the described species in his monograph on Cambrian brachiopods and tried to elucidate the problematic *Acrotreta socialis*. C. Poulsen (1942) described species new to Bornholm from the Exsulans Limestone/Kalby marl from where a number of new species is known to be present. This also goes for the Andrarum Limestone (Bassett & Berg-Madsen, unpublished results). Acrotretids, acrothelids and lingulellids occur, but *Micromitra* and *Dictyonina* are among the most commonly occurring genera (Figs. 4A-C).

Minute phosphatic and glauconitic internal moulds referable to pelagiellaceans are common, especially in the phosphatic bodies in the upper part of the unit. Stopping dissolution at an early stage, it was possible to obtain moulds partly imbedded in the matrix together with imprints or remnants of the surrounding shell. In Fig. 5G the internal mould forms only the first part of the first whorl. The gap between the mould suggests a two-layer shell. Thus the here shown extremely thin, phosphatic layer may represent the inner part of the outer layer (Figs. 5G, I). Occasionally more complete moulds occur (Fig. 5H) with the outer shell layer attached and freed from the matrix. The shell ornament is extremely well preserved and clearly indicates a different species from that of Grönwall (1902). Grönwall compared his species (Fig. 5J) with material found and described by Brøgger (1878) as

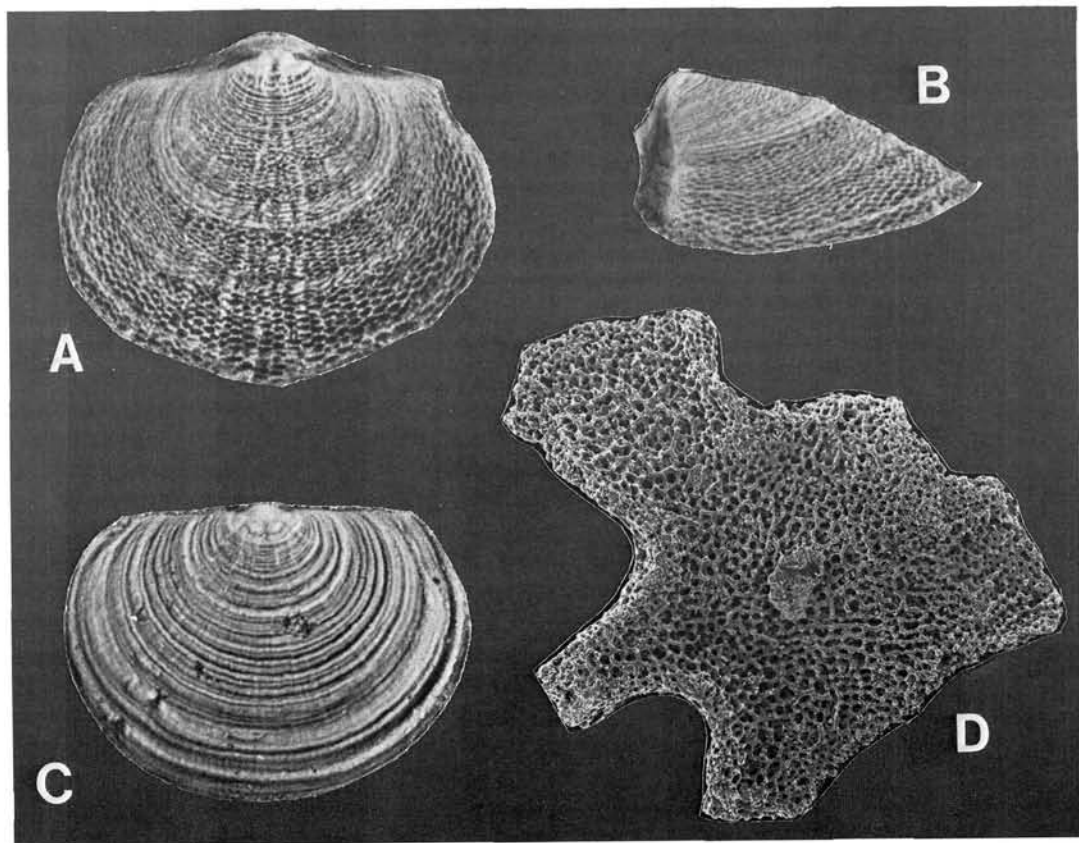


Fig. 4. A *Dictyonina* sp., pedicle valve $\times 15$. B. As A, lateral view $\times 15$. C. *Micromitra* sp., brachial valve $\times 15$. D. Dorsal plate of cornute stylophoran $\times 80$. Photographs A-C: M. G. Bassett; D: T. Westberg.

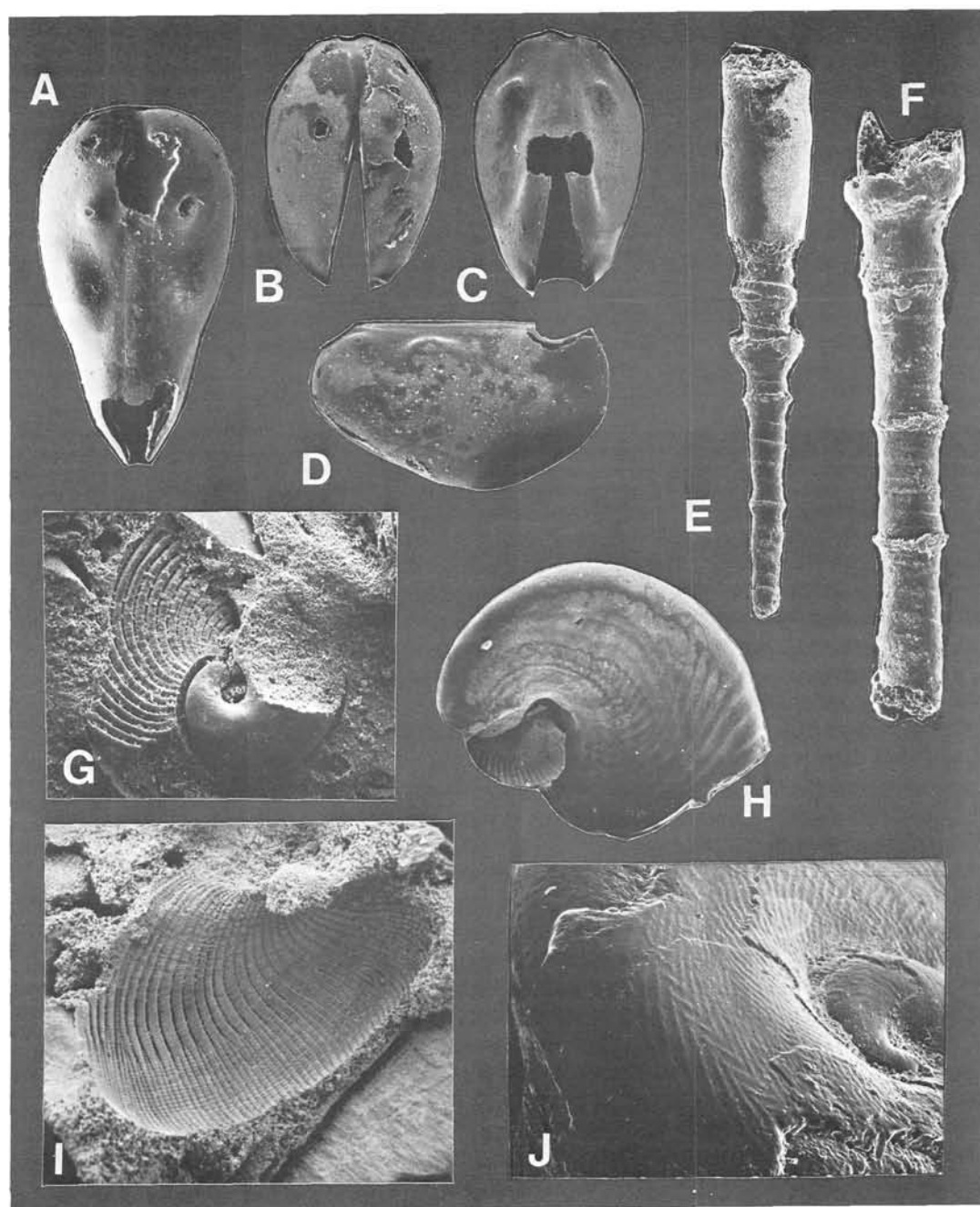


Fig. 5. A. Hesslandonid ostracode in dorsal view showing straight double hinge $\times 70$. B. Same, posterior view $\times 70$. C. Same, anterior view $\times 70$. D. Same, right lateral view $\times 70$. E. Internal mould of a tube with almost complete shaft and chamber $\times 50$. F. Shaft broken at both ends $\times 80$. G. Pelagiellacean internal mould with partial impression of the shell $\times 70$. H. Complete internal mould with adhering piece of (outer?) shell freed from the matrix $\times 70$. I. Imprint of shell in phosphatized matrix $\times 70$. J. *Pelagiella* (*Parapelagiella kreklingensis*) (Grönwall), MMH 203, detail of shell $\times 110$. Photographs A-D, G-J: J. Fuglsang, E-F: T. Westberg.

gastropod sp. indet. Brøgger's species, however, is conspecific with the present material that I have collected.

Rostroconchs are generally rare in the Middle Cambrian (Pojeta & Runnegar, 1976) and have not been recorded previously from the Middle Cambrian of Baltoscandia. The Andrarum Limestone yielded about 50 fragments of at least two ribeiriids, but without more and better preserved specimens, a more exact determination is impossible.

Ostracodes are rare, the few specimens found can be referred to the Hesslandonidae. The figured specimen (Figs. 5A-D) is rather small and may be a new species but a closer generic assignment is impossible.

Small calcitic and phosphatized echinoderm fragments are fairly common. The best preserved calcitic fragments were obtained when the dissolution of the limestone was stopped at an early stage (see Methods). As with the echinoderm fragments from the Exsulans Limestone/Kalby marl a reconstruction is not possible. Some of the fragments can be referred to eocrinoids and cornute stylophorans. Most phosphatized fragments show beautiful preservation of the stereom structure (Fig. 4D). Stem ossicles with different types of articulation, also known from the Exsulans Limestone/Kalby marl, are of special interest as these have not been recorded previously (Berg-Madsen, 1986).

Conodonts are not uncommon but contrary to the Exsulans Limestone/ Kalby marl (Berg-Madsen, 1981) *Gapparodus bisulcatus* exceeds *Amphigeisina* sp. in number. The latter is similar to *A. danica* but much more slender. Specimens of *G. bisulcatus* are also larger, up to 2.5 mm in length and a maximum of 0.3 mm in width.

A few specimens of *Lapworthella bornholmensis* have been found. Their presence in the Andrarum Limestone represents the highest stratigraphic level yet recorded. Primarily the genus occurs in the Lower Cambrian.

Spicules of *Protospongia fenestrata*, *Chanceloria eros* and cf. *Hintzespongia*, as well as unidentified sponge spicules, occur scattered throughout the unit. *C. eros* is occasionally found in the form of glauconitic moulds similar to the occurrence in the Exsulans Limestone/Kalby marl and preferentially in the lower part of the unit. In the diffuse phosphatic bodies in the up-

per levels clumps built from masses of miscellaneous spicules are found. These superficially resemble part of a tridimensional skeleton (J. K. Rigby, Provo, Utah; personal communication 1984).

Small, phosphatic internal moulds of tubes (Figs. 5E-F) are common. They consist of a thin "shaft" with a ring-like ornamentation of alternating thickness ending in a wide chamber with a smooth surface. Usually the chamber is filled with clay and bituminous matter but empty chambers occur. These internal moulds are occasionally found inside small conical tubes (hyolithids?) of calcite with a surface ornamentation of tiny growth lines. In cross section the internal as well as the external tubes are circular. The nature of the specimens is unknown, but E. L. Yochelson (Washington, D. C.; personal communication 1981) found no resemblance to either *Volborthella* or *Salterella*.

In addition to the above mentioned large fossil groups problematic fossil fragments are commonly found.

The upper alum shale

Læså. – The main exposure of the lower (Middle Cambrian) part of the upper alum shale is above the weathered part of the Andrarum Limestone. A minor exposure crops out where the Andrarum Limestone dips below the water level in the rivulet. The thickness is 0.85–0.9 m, and the topmost part of the alum shale is covered with overhanging soil and vegetation. Anthraconite lenses are not found at Læså.

Øleå. – The Middle Cambrian part of the upper alum shale has its main exposure corresponding to that of the Andrarum Limestone (Fig. 3). At this exposure the maximum thickness of beds previously assigned to the Middle Cambrian is 2.1 m. An anthraconite lense (sensu stricto) immediately overlies the Andrarum Limestone and the cavity left by another lense occurs 1.3 m above the limestone (Fig. 3).

Lithology. – In spite of the weathering of the limestones in the northernmost part of the exposure at Læså, the upper alum shale is surprisingly unaffected. The fissility is good, but rather thick (≥ 5 cm) and massive levels occur. A level about 10 cm above the top of the weathered Andrarum

Limestone contains small nodules of partly weathered limestone, 3–5 cm in diameter. At Øleå the weathering of the shale is much more pronounced. The covering by jarosite is not limited to the outer part of the exposures but is also found on the bedding planes. The fissility is good, and the shales cleave into paper-thin pieces. Bedding plane surfaces are more uneven at Øleå than at Læså. The shale is black compared with the dark grey lower alum shale. Illite is the predominant clay mineral, and pyrite occurs finely dispersed throughout the sequence. In contrast to the lower alum shale quartz grains are extremely rare. Small, less than 2 mm, rosettes of flat gypsum crystals are common on the bedding planes.

Fossil content. – Several previous authors (Johnstrup 1874, 1891, Grönwall 1899, 1902, C. Poulsen 1923, Hansen 1945, V. Poulsen 1966) have commented that fossils are rare in the Middle Cambrian upper alum shale. The present investigation has shown the shale to be more fossiliferous than supposed. Trilobites are rare and mostly represented by fragments of pleurae. In the lowermost 10 cm above the Andrarum Limestone one agnostid found in the shale has been determined as *Peronopsis insignis*. The nodules forming the top of this level have yielded *Acrocephalites stenometopus*. Both species here mentioned have a range within the zone of *Lejopyge laevigata* but are found only at the top of the zone (Wallerius 1895, Westergård 1946, 1948). Thus, the lower part of the zone on Bornholm is represented by less than 10 cm of strata. This coincides well with the type locality in Skåne where *A. stenometopus* is recorded from a level 30 cm above the Andrarum Limestone (Westergård 1948). Only about 4 m of upper alum shale is here regarded as Middle Cambrian, and the topmost 3 m are unfossiliferous (Moberg 1910, Westergård 1946).

Inarticulate brachiopods are abundant in the lowermost 40 cm, especially at Læså, but occur throughout the whole section. *Micromitra* is the most common genus and has not been found higher than 1.5 m above the Andrarum Limestone at Øleå (65 cm at Læså). Acrotretids and lingulellids also occur.

Svealuta primordialis, the large (9 mm) presumed ostracode, has been found at Læså 0.3 m above the Andrarum Limestone. C. Poulsen

(1923) recorded the same species from Øleå, from a level 0.8 m above the limestone, but here it has now been found as high as 1.2 m. A small, (<2 mm long) hesslandonid ostracode with spines at the posterior-ventral rim of the valves is found at the same level as *S. primordialis* at Læså, while minute indeterminate species occur at slightly lower levels.

Whereas *Svealuta primordialis* and *Micromitra* are restricted to the Middle Cambrian, none of the other species are stratigraphically significant. Neither is the conodont *Gapparodus bisulcatus* which occurs as flattened specimens in the lowermost levels. Important, though, is the presence of *Westergaardodina tricuspadata* which is first known from the Upper Cambrian zone of *Agnostus pisiformis* (Westergård 1953b, Müller 1959, 1971). The preservation is generally poor although the characteristic M shape always is recognizable. Mostly they stand out as thin films on the bedding surfaces, some appear as cavities filled with charred organic matter. Cambrian conodonts are rather thin and do not sustain heat, in this case as a result of the deep burial diagenesis (Buchardt & Nielsen, 1985).

Grönwall (1899, 1902) recorded *Lejopyge laevigata* from anthraconite lenses and shale above the Andrarum Limestone at Læså. Lenses are not known from this locality today, and the lense immediately overlying the Andrarum Limestone at Øleå has not been investigated for fossils. Apart from the finds by Grönwall, *Lejopyge laevigata* has not been recorded in connection with recent investigations (V. Poulsen, Inst. Hist. Geol. & Pal., Copenhagen; personal comm. 1984).

The Middle-Upper Cambrian boundary on Bornholm

C. Poulsen (1923) placed the Middle-Upper Cambrian boundary somewhere between 0.8 and 2.1 m above the Andrarum Limestone from fossils found at the exposures at Øleå. The boundary is here now placed between 1.5 m (*Micromitra*, Middle Cambrian inarticulate brachiopod genus) and 1.6 m above the Andrarum Limestone on the basis of the first occurrence of the Upper Cambrian conodont *Westergaardodina tricuspadata*.

At Læså *Micromitra* is found no higher than 0.6 m above the Andrarum Limestone, whereas *W. tricuspidata* occurs at the 0.7 m level. Consequently the boundary is placed no higher than this level at Læså.

The maximum thickness of the Middle Cambrian on Bornholm has been estimated to be 4–5 m (V. Poulsen, 1966). This computed figure was based on the cumulative maximum thickness of each stratum. However, the maximum thickness of all strata is nowhere to be seen together. The identical thickness 3 m \pm 10 cm at both Læså and Øleå is coincidental. The lower alum shale, for example, is 1.4 m thick at Læså and only 10–15 cm thick at the main exposure at Øleå. The maximum thickness from another exposure at Øleå (0.8 m) was recorded by Grönwall (1899) but here it was overlain neither by the Hyolithes limestone nor the Andrarum Limestone.

None of the described modifications induce any stratigraphical changes. Thus the revised Middle Cambrian stratigraphy (Table 2) is to be regarded as definitive (Berg-Madsen, 1985).

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Dansk sammendrag

Den Mellem Kambriske Andrarumkalk på Bornholm er undersøgt specielt med henblik på mikrofaunaen. Denne er artsfattigere end den fra den noget ældre Exulanskalk og Kalbymergel, men bevaringsstilstanden er undertiden meget bedre. Dette gælder ikke mindst mikro- og ultrastrukturene hos blandt andet pelagiellaceer og echinodermer. En generel oversigt over de fundne grupper bliver givet, eftersom en mere detaljeret beskrivelse i flere tilfælde er under udarbejdelse. En revideret liste over trilobiter kendte fra Andrarumkalken på Bornholm præsenteres. Den inkluderer også nye fund. Den øvre alunskifers nederste 2 m har vist sig mere fossilrig end tidligere antaget. Fund af trilobiter har påvist, at den underste del af *Lejopyge laevigata* Zonen næppe overstiger 10 cm i mægtighed. Dette modsvarer omtrentligt forholdene på typelokaliteten Andrarum i Skåne. Foruden trilobiter forekommer brachiopoder,

ostracoder og conodonter. Forekomsten af en typisk mellemkambrisk brachiopod, *Micromitra*, og conodonten *Westergaardodina tricuspidata*, kun kendt fra Øvre Kambrium, fastlægger grænsen Mellem-Øvre Kambrium på et betydeligt lavere niveau end hidtil antaget. Samtidigt påvises også at mægtigheden af Mellem Kambrium ikke er mere end 3 m \pm 10 cm på de to lokaliteter hvorfra blotninger er kendte. Denne mægtighed ligger nær den kendt fra borerig.

Note added in proof: Lately about 10 fragments of a bivalve, assignable to Mallettiidae, and a single specimen of *Yochelsonella* sp. have been obtained from the Andrarum Limestone.

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