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## AGASTOGRAPTUS FROM THE MULDE BEDS OF GOTLAND

KOZŁOWSKA-DAWIDZIUK, A: *Agastograptus* from the Mulde Beds of Gotland. Acta Palaeontol. Polonica, 36, 2, 143—149, 1991.

*Agastograptus lawsoni* (Holland, Rickards et Warren 1969), known previously as *Holoretiolites* (*Balticograptus*) *lawsoni* Holland, Rickards et Warren 1969 from upper Wenlock of Shropshire is described from Mulde Beds of Gotland. A new diagnosis of the species, basing on abundant and well preserved fossils, has been formulated. Former *Retiolites balticus* Eisenack is removed from the genus *Agastograptus*.

Key words: graptolites, retiolitids, taxonomy, Wenlock, Sweden.

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## INTRODUCTION

*Holoretiolites* (*Balticograptus*) *lawsoni* was described from upper Wenlock of Shropshire by Holland, Rickards and Warren in 1969. The authors compared its three imprints with *Retiolites balticus* Eisenack and *Retiolites clathrospinosus* Eisenack. Present author assigned the species to the genus *Agastograptus* Obut et Zaslavskaya, 1983 because of the presence of paired supraapertural processes with reticulofusellar structure<sup>1</sup>, of the clathrium forming a zigzag pattern on lateral walls, of the virgula located centrally in the rhabdosome, and of the finite rhabdosome.

I propose also to exclude *Retiolites balticus* Eisenack from the genus *Agastograptus* because the species shows single supraapertural processes situated in the medial part of supraapertural list, lack of pleural lists and of the zigzag pattern on lateral wall, which would be typical for *Agastograptus*.

<sup>1</sup> The term "reticulofusellar apertural processes" is intended to replace the term "spinoreticular" used by Obut and Zaslavskaya (1983) to express a structural similarity between the lists contributing to the apertural processes and fusellar fabric in sclerotized graptolites (see Holland, Rickards and Warren 1969).

The material studied comes from the upper part of Mulde Beds (upper Wenlock) of Gotland. It was provided by Prof. Lech Teller and prepared by Dr. Piotr Mierzejewski (both from the Institute of Paleobiology, Polish Academy of Sciences). The latter have also identified Crustoidea and Tuboidea in the samples. The collection is housed in the Institute of Paleobiology of the Polish Academy of Sciences, (abbreviated as ZPAL). The photographs were taken with an Olympus microscope at the Institute of Paleobiology.

*Acknowledgement.* — The author wishes to express her gratitude to Prof. Lech Teller for providing the material and for reading the manuscript, and to Prof. Adam Urbanek (Institute of Paleobiology of the Polish Academy of Sciences) for critical remarks.

#### SYSTEMATIC PART

Family **Plectograptidae** Bouček et Münch, 1952  
 Subfamily **Plectograptinae** Bouček et Münch, 1952  
 Genus *Agastograptus* Obut et Zaslavskaya, 1983

*Agastograptus lawsoni* (Holland, Rickards et Warren, 1969)  
 (pls. 9, 10; figs. 1, 2)

1969. *Holoretiolites (Balticograptus) lawsoni* Holland, Rickards and Warren: 666—668, text-fig. 1a—c.

*Associated species.* — *Bulmanicrusta latialata* Kozłowski, 1962, *Urbanekicrusta reversa* Mierzejewski, 1986, *Kozłowskitubus erraticus* (Kozłowski, 1963), *Epigraptus kozłowskii* Mierzejewski, 1978, *Epigraptus ex gr. bilnguis* (Kozłowski, 1949) (see Mierzejewski 1988).

*Diagnosis.* — Rhabdosome finite. Reticulum poorly developed in proximal and medial parts of the rhabdosome. Unbranched, paired supraapertural processes with reticulofusellar structure, 0.32—0.64 mm in length. Medial lists in proximal and medial parts of the rhabdosome involuted towards the rhabdosome axis at 1/3 of thecal height.

*Material.* — 70 well preserved specimens, mostly juvenile; four finite rhabdosomes (ZPAL G-XIII/50—120).

*Description.* — Finite rhabdosome is 4.0—4.5 mm long; width of the corona is 0.8—1.0 mm, with of the lateral wall in proximal part is 0.6—0.9 mm and at the level of the second pair of thecae is 0.8—1.0 mm. Rhabdosome width decreases to about 0.2—0.4 mm in the distal part. Finite rhabdosomes consist of 9 to 11 thecae. Thecal density is 6.5 to 7 thecae per 5 mm.

Parietal and dorsal lists of lateral walls form a regular zigzag pattern, except the distal part of rhabdosome, where their arrangement becomes irregular.

Reticulum of lateral walls in proximal and medial parts of the rhabdosome is built of thin lists bordering relatively large polygonal mesh. Reticulum of ventral walls is poorly developed or absent.

Virgula situated centrally, extending up to the fourth pair of thecae.

Medial lists at 1/3 of thecal height bent towards axis of rhabdosome (pl. 9: 1a, 3a; fig. 1: 1b). In medial and distal parts they are underdeveloped or absent.

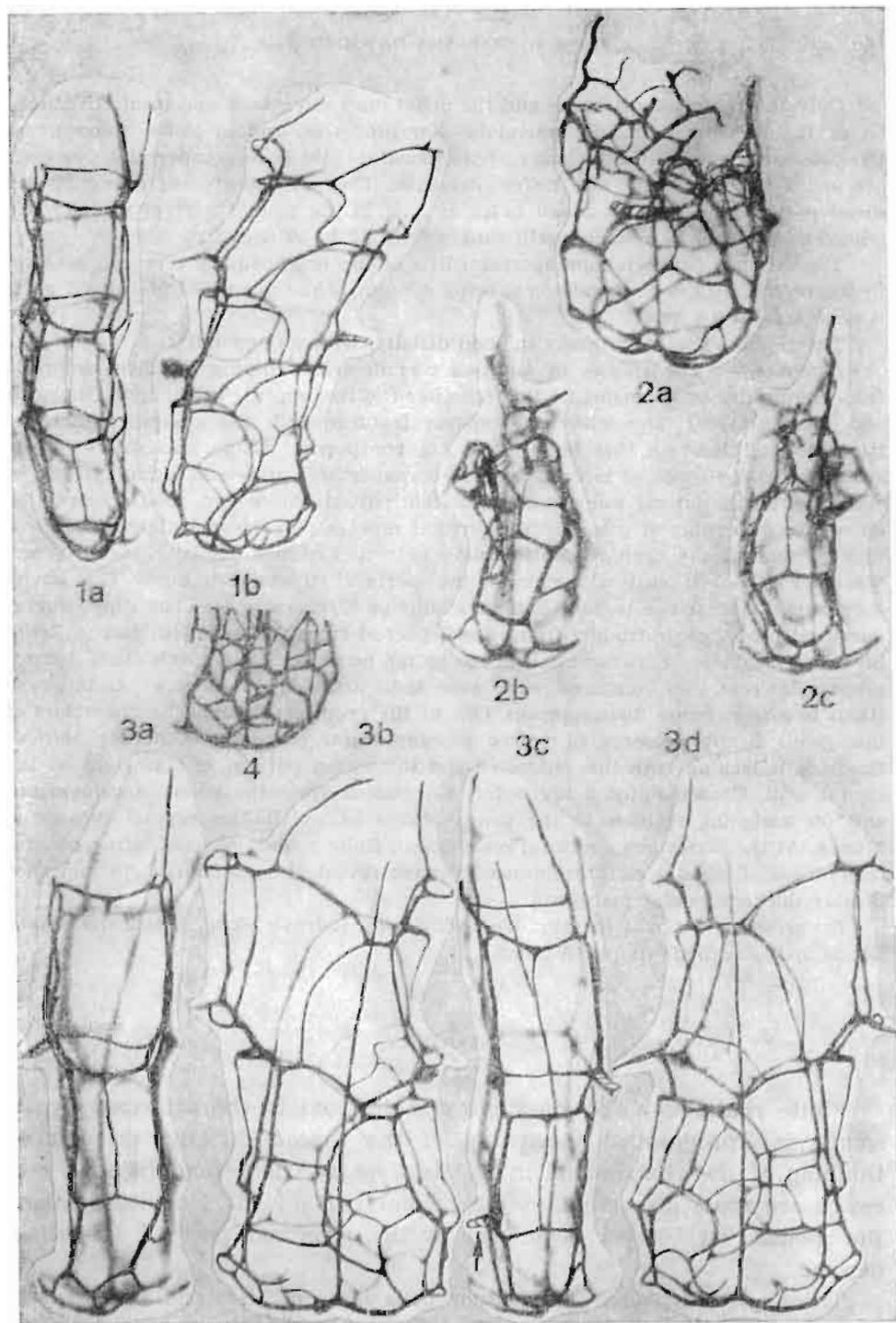


Fig. 1. *Agastograptus lawsoni* (Holland, Rickards et Warren, 1969): 1. Rhabdosome bent in the ventral plane: a lateral view, b lateral view,  $\times 22$ . ZPAL GXIII/54. 2. Fragment of an abnormal rhabdosome with distorted second order thecae: a lateral view, b and c ventral views,  $\times 26$ . ZPAL GXIII/56. 3. Young rhabdosome: a ventral view, b lateral view, c ventral view, note apertural process projecting from the pleural list of the theca 2' (arrow), d lateral view,  $\times 26$ . ZPAL GXIII/55. 4. Fragment of an aberrant rhabdosome — coronal part note the apertural processes pointing inwards,  $\times 24$ . ZPAL GXIII/67.

Only the first pair of thecae and the distal ones often lack apertural structures. Other thecae show uniformly reticulofusellar processes, and in finite rhabdosomes the processes have their outer margins thickened (pl. 10: 8). Supraapertural processes are about 0.09 mm wide, and differ in length. They are shorter in proximal and distal parts (about 0.32 mm), and twice as long in the medial part of rhabdosome, where the number of reticulofuselli ranges from 12 to 20 (fig. 2).

The distance between supraapertural lists of the neighbouring thecae is greatest in the proximal part of rhabdosome, being 0.9 mm, while in medial and distal parts it decreases to 0.8 mm.

The rhabdosome is markedly thinned distally, with no appendix.

*Remarks.* — The species in question was described basing on three imprints from Shropshire as belonging to *Holoretiolites* (*Balticograptus*) by Holland, Rickards and Warren (1969). The following common features with the examined material from Gotland indicate that both forms are conspecific: shape and size of finite rhabdosomes, presence of reticulofusellar supraapertural processes, zigzag pattern of clathrium on the lateral walls and reticulation pattern. Moreover, good preservation allows for discerning of paired supraapertural processes in the investigated material, thus eliminating the similarity to *Retiolites balticus* Eisenack. Holland, Rickards and Warren were not in position to examine the apertural structures in detail. That is why they sought similarities to both *Retiolites balticus* Eisenack, which has single supraapertural processes protruding from medial part of supraapertural list, and to *Retiolites clathrospinosus* Eisenack, which has paired processes. Both species that *Agastograptus lawsoni* was compared with were then assigned by Obut et Zaslavskaya (1983) to a new genus *Agastograptus*. One of the prominent diagnostic characters of this genus is the presence of paired supraapertural processes. *Retiolites balticus* Eisenack is lacking both this character and the zigzag pattern of clathrium on the lateral wall. Consequently, I argue for its removal from the genus *Agastograptus* and for assigning it back to the genus *Holoretiolites* (*Balticograptus*) Bouček et Münch. At the same time apertural processes in finite rhabdosomes of *Agastograptus lawsoni* and *Retiolites clathrospinosus* Eisenack reveal close similarity, in that they display thickened outer margins.

*Occurrence.* — Great Britain: Wenlock Series, ludensis Zone; Sweden, Gotland, Däpps 2, Mulde Beds (upper Wenlock).

#### ASTOGENY

Finite rhabdosome of *Agastograptus lawsoni* is characterized by its small size, progressive shortening of the thecae distally, pronounced thinning of the rhabdosome in its distal part. The reticulofusellar processes are most prominent in the medial part of the rhabdosome, and the medial list is best developed in the proximal part of the rhabdosome.

The growth pattern of *Agastograptus lawsoni* (Holland, Rickards et Warren) is similar to that of *Gothograptus*. The development of the clathrium also precedes the formation of the reticulum, and the formation of supraapertural processes starts after completion of thecal growth, then continues during rhabdosome growth, and probably prolongs beyond termination of rhabdosome growth. During elongation of the processes,

their outer margin progressively thickens. Also development of the medial lists is retarded in relation to other elements of the clathrium. They often do not fully develop in medial and distal parts, thus remaining as one or two unfused lists extending from supraapertural lists of the neighbouring thecae (pl. 9: 4a, b).

#### ABNORMAL RHABDOSOMES

In the investigated assemblage of *Agastograptus lawsoni* about 20% of rhabdosomes show various structural deviations, such as curvature of the rhabdosome axis (possibly being a diagenetic deformation rather than pathology), supplementary elements or lack of typical ones. The deformations are often accompanied by fractures of rhabdosomes or, perhaps, cessations of their growth. (fig. 1: 2). The rhabdosome axis may be bent in the lateral (pl. 10: 10) or ventral plane (fig. 1: 1b, pl. 9: 1a).

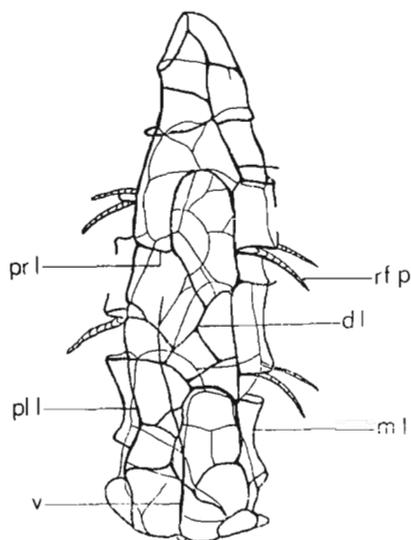


Fig. 2. Diagrammatic restoration of a rhabdosome of *Agastograptus lawsoni* (Holland, Rickards et Warren, 1969). Abbreviations: *dl* dorsal list, *ml* medial list, *pl l* pleural list, *pr l* parietal list, *rf p* reticulofusellar process, *v* virgula.

The aberrant growth of the apertural parts of the second pair of thecae resulted in tangential downward or sideward orientation of reticulofusellar processes (fig. 1: 2a-c). In the corona of lateral wall appear atypically situated reticulofusellar processes pointing outwards (pl. 10: 9) or inwards (fig. 1: 4). Such rhabdosomes show also distorted zigzag pattern of the clathrium (pl. 10: 10a), deficiency of pleural lists or the overthickening of lists (fig. 1: 2a-c). Sometimes reticulofusellar processes occurs atypically on the pleural list (fig. 1: 3c).

Additional pleural list in the distal part of the rhabdosome was also

observed. The normally developed (though somewhat thinner) pleural list is here accompanied with the second one, protruding from the theca.

In one case the virgula forms a loop in its distal part, by bifurcating and fusing back together (pl. 9: 3a).

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## AGASTOGRAPTUS Z WARSTW MULDE GOTLANDII

(pls. 9—10; fig. 1, 2)

*Streszczenie*

Zbadano około 70 dobrze zachowanych okazów retiolitidów, pochodzących z warstw Mulde (górnny wenlok) Gotlandii, co umożliwiło zbadanie astogenezy i wyróżnienie cech diagnostycznych gatunku. Stwierdzono też kilkanaście anormalnie wykształconych rabdosomów. Gatunek ten opisany był z górnego wenlocku Shropshire przez Holanda, Rickardsa i Warrena (1969) jako *Holoretolites (Balticograptus) lawsoni*, jednak zły stan zachowania materiału nie pozwolił im ustalić liczby wyrostków aperturalnych. Zdaniem autorki należy on do rodzaju *Agastograptus* Obut et Zaslavskaya 1983.

Jednocześnie autorka proponuje wyłączyć z rodzaju *Agastograptus* dawny gatunek *Retiolites balticus* Eisenack z uwagi na występowanie pojedynczego wyrostka aperturalnego oraz brak beleczek pleuralnych i zygzakowatego wzoru klatrium ścian lateralnych.

## EXPLANATION OF PLATES 9—10

All specimens from Däpps 2 (Gotland), upper part of Mulde Beds (upper Wenlock)

## Plate 9

*Agastograptus lawsoni* (Holland, Rickards et Warren, 1969)

1. Almost finite rhabdosome: *a*, *b* lateral and ventral views,  $\times 24$ . ZPAL GXIII/50.
2. Finite rhabdosome: *a*, *b* lateral and ventral views,  $\times 22$ . ZPAL GXIII/51.
3. Young rhabdosome: *a* lateral view, note a loop in the distal part of the virgula (arrow), *b* ventral view,  $\times 25$ . ZPAL GXIII/52.
4. Young rhabdosome: *a* lateral view, note primordia of apertural processes (arrows), *b* ventral view, note incompletely developed medial (arrows),  $\times 26$ . ZPAL GXIII/53.

## Plate 10

*Agastograptus lawsoni* (Holland, Rickards et Warren, 1969)

1. Ancora stage,  $\times 40$ , ZPAL GXIII/65.
2. Ancora stage,  $\times 40$ , ZPAL GXIII/68.
3. Ancora stage with the first theca (*a* — aperture): *a* latero-ventral view, *b* lower view,  $\times 40$ , ZPAL GXIII/66.
4. Young rhabdosome with developing theca 2<sup>1</sup>,  $\times 30$ . ZPAL GXIII/63.
5. Young rhabdosome with developing theca 2<sup>2</sup>,  $\times 30$ . ZPAL GXIII/59.
6. Young rhabdosome,  $\times 36$ . ZPAL GXIII/64.
7. Young rhabdosome,  $\times 30$ . ZPAL GXIII/58.
8. Upper view into the rhabdosome, *a* aperture, note apertural processes (one is missing),  $\times 35$ , ZPAL GXIII/57.
9. Fragment of an aberrant rhabdosome, note the apertural process projecting from the lateral side of the corona (arrow),  $\times 30$ . ZPAL GXIII/62.
10. Rhabdosome bent in the lateral plane: *a* lateral view, *b* ventral view,  $\times 25$ . ZPAL GXIII/61.

