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Early Ordovician scolecodonts and chitinozoans from Tallinn, North Estonia

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Abstract

In the Lower Ordovician siliciclastic succession of Kadriorg, Tallinn, North Estonia, scolecodonts were recorded at different stratigraphical levels starting from the lower Tremadocian, and a rich assemblage of chitinozoans was found from the *Paroistodus proteus* Conodont Zone. This is one of the earliest records of scolecodonts in the world and extends the range of this fossil group for more than 15 m.y. in Baltica. Based on fused and reconstructed jaw apparatuses, the new genus *Kadriorgaspis* and two new species, *Kadriorgaspis kaisae* and "*Xanioprion*" *viivei*, are introduced and the diagnosis of the family Conjungaspidae is emended. In addition, two species are described under open nomenclature and several isolated jaws with unclear affinities are discussed. This discovery indicates the importance of conjungaspids and xanioprionids in the early diversification history of eunicidans.

The chitinozoan assemblage is characterised by unusually high abundance and diversity. In one sample, 12 species were identified, including representatives of *Lagenochitina*, *Eremochitina*, *Cyathochitina*?, *Euconochitina*, *Desmochitina*, *Velachitina*, *Rhabdochitina*, and *Clavachitina*. These chitinozoans display considerable variability of many morphologic characters that become diagnostic at the species and genus level during the Mid- and Late Ordovician. The general taxonomic composition of the chitinozoan assemblage indicates close biogeographical connections between Baltica and North Gondwana.
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Keywords: scolecodonts; polychaete jaws; chitinozoans; Early Ordovician; Estonia; palaeobiogeography

1. Introduction

Scolecodonts and chitinozoans are among the most common and diverse organic-walled microfossils in various types of Ordovician marine sedimentary rocks. Scolecodonts represent jaws of polychaete annelids—worms that are also very common in present-day seas. The biologic affinities of chitinozoans are still debatable, but most likely they represent an ontogenetic stage of unknown metazoans (e.g., Paris and Nõlvak, 1999). Scolecodont-bearing polychaetes are usually regarded as part of the benthic fauna, whereas the distribution of chitinozoans indicates planktic mode of existence. Undoubtedly both groups played important roles in Ordovician marine communities.

Chitinozoans have gained a wide biostratigraphical utility in many regions of the world, and an Ordovician global chitinozoan zonation has also been developed (Paris et al., 1999b). The utility of scolecodonts is yet to be fully evaluated, however, after the introduction of apparatus-based classification (which is opposed to the earlier element-based one; see discussion in Eriksson and Bergman, 1998 and Eriksson et al., 2000), this

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group also shows potential for biostratigraphy, but even more for palaeoecology and palaeobiogeography (e.g., Hints, 1998, 2000; Eriksson et al., 2004).

Although our knowledge about scolecodonts and chitinozoans has increased considerably during recent decades, Early Ordovician representatives of both groups are still poorly documented compared to their Mid and Late Ordovician record. Until recently, in the Baltic region, which is generally known for its well-preserved Ordovician fossils, the oldest record of scolecodonts was the early Mid Ordovician Volkhov Regional Stage (Hints, 2000). Baltic chitinozoans are known from the Lower Ordovician (Nõlvak, 1999), but their abundance and diversity were very low. This is partly due to the fact that many of the Lower Ordovician rocks in the Baltic area are not particularly suitable for preservation of organic-walled microfossils (coarse-grained siliciclastics, red-beds, dolomitisation). On the other hand, sampling and study bias (e.g., wrong types of rocks collected, insufficient sample size, inappropriate methods) have to be kept in mind, as indicated also by the present report.

A recent examination of the Lower Ordovician succession in Kadriorg, North Estonia, in search of microfossils revealed numerous conodonts, scolecodonts and diverse chitinozoans. The studied interval comprises the Tremadocian and possibly the lowermost part of the "Second Ordovician Stage" and is characterised by siliciclastic rocks; sandstones and argillites in particular. The microfossils discussed in this paper were extracted from argillites using hydrogen peroxide and in some cases repeated heating with sodium hyposulphite. Clays and weakly cemented sandstones were disintegrated in water. The sample size ranged from 300 to 1000 g. The residues were sieved through a 63 μm screen and hand-picked using a finely drawn glass pipette. The microfossils are stored in glycerine, except for those which were selected for SEM photography and glued on stubs.

In spite of the fact that the entire collection is rather small—some tens of thousands of chitinozoans and few hundreds of scolecodonts were recovered, and most of the material is from one highly productive sample—the new information is valuable in several aspects. With regard to scolecodonts, which range into the lower Tremadocian, this find is one of the oldest records in the world. In the Baltic region, it extends the range of jaw-bearing polychaetes for more than 15 million years. Moreover, it also fills a gap in our knowledge on the early evolution and diversification of jaw-bearing polychaetes. This discovery reveals a rather high chitinozoan diversity for the Tremadocian of Baltica. It also provides clues about palaeobiogeography of this group.

2. Locality and stratigraphy

During the construction of the new Art Museum of Estonia building, a huge excavation was blasted into the bedrock just on the edge of the Baltic Klint in the southern part of Kadriorg, Tallinn, North Estonia, in 2003 (Fig. 1A; Lat. 59°26′10″N, Long. 24°47′53″E). In this excavation, a succession beginning with Lower Cambrian sandstones and extending up to Middle Ordovician limestones was temporarily exposed (Figs. 1B and 2). Several samples were collected for mineralogical and micropalaeontological examination from the Lower Ordovician part of the sequence.

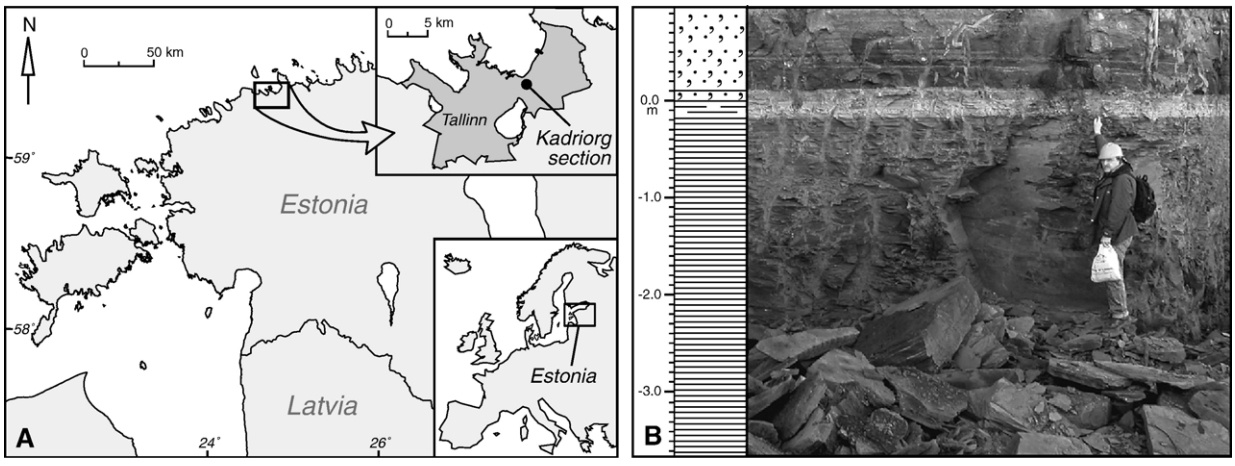

Fig. 1. (A) Generalised locality map. (B) Overview of the Kadriorg section. The second author points to the boundary between the Türisalu and Varangu formations. See Fig. 2 for lithological legend.

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