

## SHORT COMMUNICATION

**First record of the trace fossil *Oikobesalon* from the Ordovician (Darriwilian) of Baltica**Olev Vinn<sup>a</sup> and Ursula Toom<sup>b</sup><sup>a</sup> Department of Geology, University of Tartu, Ravila 14A, 50411 Tartu, Estonia; Olev.Vinn@ut.ee<sup>b</sup> Institute of Geology, Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn, Estonia; Ursula.Toom@ttu.ee

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**Abstract.** The ichnogenus *Oikobesalon* is here described from the Ordovician of Baltica for the first time. All the specimens in this study were found on Osmussaar Island, Estonia. They belong to the ichnospecies *Oikobesalon coriaceum*. In the Cambrian and Ordovician, *Oikobesalon* seems to have occurred only in cold to temperate seas. The *Oikobesalon* trace-maker presumably used its burrow permanently for dwelling and searched for its food through the burrow aperture that likely opened to the sediment–water interface.

**Key words:** trace fossils, Middle Ordovician, carbonate platform, *Oikobesalon*, terebellid polychaetes, Estonia.

**INTRODUCTION**

The Ordovician of Baltica has a rich record of trace fossils. They are often mentioned in the geological literature, but seldom described systematically. The fossils of the Ordovician of Estonia are relatively well studied, especially in the context of stratigraphy. This contrasts with the trace fossil record of Estonia. Trace fossils are known from the entire carbonate succession of the Ordovician of Estonia, but they have usually remained systematically undescribed, especially the soft sediment traces. Previously only amphora-shaped traces of *Amphorichnus* Männil, 1966 and conical traces of *Conichnus* Männil, 1966 have been described from the Darriwilian and Sandbian of Estonia (Männil 1966). The record of hard substrate trace fossils is much more complete, comprising *Trypanites* borings in brachiopods (Vinn 2005) and bryozoans (Wyse Jackson & Key 2007). Recently bioclastrations have also been described from the Ordovician of Estonia (Vinn & Mõtus 2012).

*Oikobesalon* was originally a soft sediment burrow with a thin organic lining (Brood 1980; Thomas & Smith 1998). It had previously been considered a body fossil of worms (Brood 1980), but its assignment to trace fossils is better justified (Thomas & Smith 1998). *Oikobesalon* traces are common in the Silurian (Thomas & Smith 1998), but they have previously not been known from the Ordovician of Baltica. However, a collection in the Institute of Geology, Tallinn University of Technology, assembled by Ralf Männil in 1971–1986, contains seven specimens identified as *Keilorites*.

The aims of this paper are to (1) determine whether the burrows with mineralized cover belong to *Oikobesalon*

or *Keilorites*; (2) determine the ichnospecies; (3) discuss the ecology of the trace-makers and (4) discuss the palaeobiogeographic distribution of the trace fossil.

**GEOLOGICAL BACKGROUND**

The total thickness of the Ordovician system in Estonia varies from 70 to 180 m (Nestor & Einasto 1997). The Ordovician limestones form a wide belt in northern Estonia, extending from the Narva River in the northeast to Hiiumaa Island in the northwest (Nestor & Einasto 1997). In the Middle Ordovician and early Late Ordovician, the western part of the East European Platform was covered by a shallow, epicontinental sea and was slowly subsiding. This sea had a little bathymetric differentiation and an extremely low sedimentation rate. Along the extent of the ramp of the basin a series of grey calcareous to argillaceous sediments accumulated, which later formed argillaceous limestones and marls. There was a trend of increasing clay and decreasing bioclast contents in the offshore direction (Nestor & Einasto 1997).

During the Ordovician, the Baltica palaeocontinent moved from the temperate to the subtropical realm (Cocks & Torsvik 2005). This climatic change caused an increase in carbonate production and sedimentation rate on the shelf during the Middle and Late Ordovician. The first carbonate buildups are recorded in the Upper Ordovician. These buildups are characteristic of the tropical climate and emphasize a striking change in the overall character of the palaeobasin (Nestor & Einasto 1997).

## MATERIAL AND METHODS

Seven specimens of *Oikobesalon coricaceum* were collected from the cliff on the eastern coast of Osmussaar Island (Fig. 1). All specimens were digitally photographed. The studied specimens are deposited at the Institute of Geology at Tallinn University of Technology (GIT).

## SYSTEMATIC PALAEOONTOLOGY

Ichnogenus *Oikobesalon* Thomas & Smith, 1998

*Type species.* *Oikobesalon coricaceum* (Phillips, 1848).

*Species included.* *O. coricaceum* (Phillips, 1848); *O. citrimorion* Thomas & Smith, 1998; *O. lijevalli* (Brood, 1980); *O. squamosum* (Phillips, 1848); *O. erraticum* Schallreuter & Hinz-Schallreuter, 2010.

*Oikobesalon coricaceum* (Phillips, 1848)

Figure 2A–F

*Material.* Seven specimens.

*Locality.* Osmussaar Island, middle part of the eastern coast.

*Stratigraphy.* Uppermost layers of the Osmussaar cliff, Uhaku Stage, Darriwilian, Middle Ordovician.

*Notes.* Unbranched burrows are almost straight to straight with elliptical cross section. They are covered with thin brown-coloured mineralized (pyritized?) lining, which

can have fine extensions into the surrounding sediment. No internal structures are observed within the burrows. Their diameter is relatively constant, but can vary slightly. Maximum width of the traces is 1.5–5.0 mm. The burrows are covered with irregular, variably developed transverse ornamentation in the form of fusiform annulation. The transverse bands are 0.27–0.55 mm wide.

*Remarks.* The Osmussaar material is assigned to *Oikobesalon coricaceum* (Phillips, 1848) because of similarity in the general shape and size of the burrows. The described specimens also have analogous transverse ornamentation composed of bands of similar size. The Osmussaar specimens also somewhat resemble *Oikobesalon squamosum* (Phillips, 1848) in having a relatively small diameter and similar transverse ornamentation. They differ from *O. squamosum* by a smaller diameter and finer transverse ornamentation. The described specimens were previously identified by Ralf Männil as *Keilorites* Allan, 1927, but they lack a thick sediment wall characteristic of *Keilorites* burrows.

## DISCUSSION

### Early Palaeozoic palaeobiogeography and stratigraphy of *Oikobesalon*

The earliest representative of the ichnogenus *Oikobesalon* sp. comes from the Cambrian of Britain (Thomas & Smith 1998). In the Ordovician *Oikobesalon coricaceum* is only known from Baltica, but the ichnogenus possibly occurs also in Britain as it is known there both from the Cambrian and Silurian. A large species of

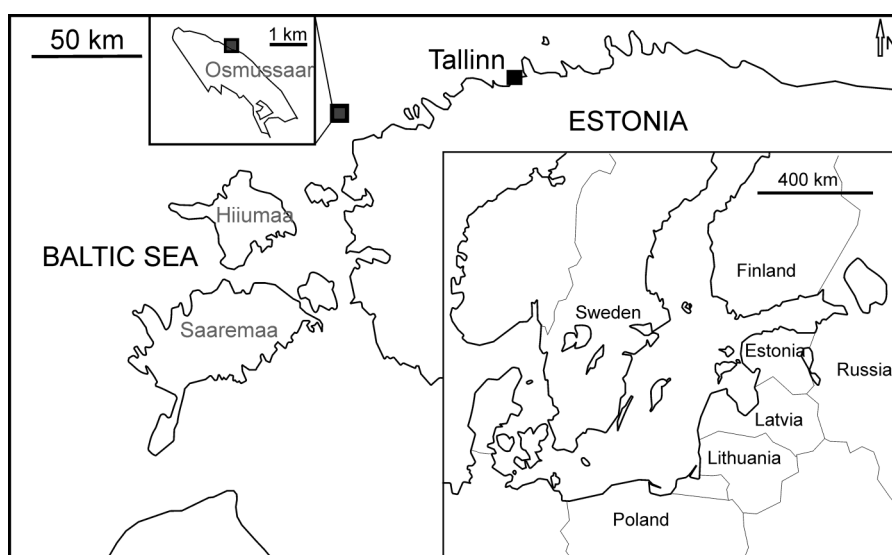
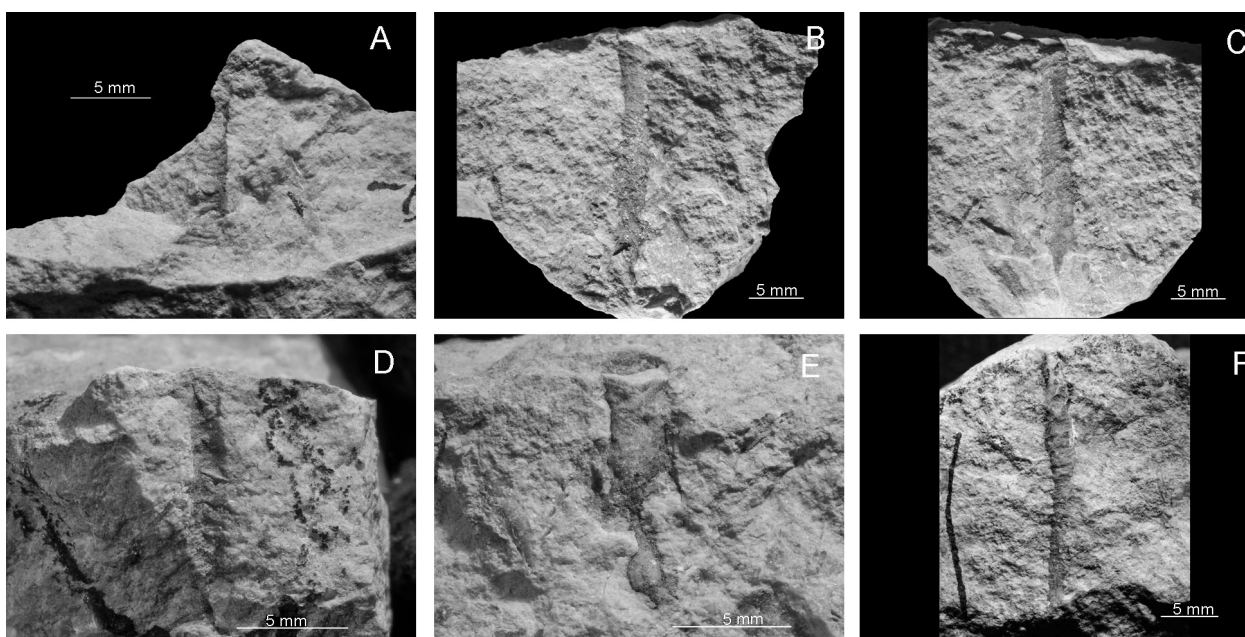


Fig. 1. Location of Osmussaar Island and locality of *Oikobesalon* traces.



**Fig. 2.** A–F, *Oikobesalon coriaceum* Phillips, 1848 from the Darrivilian of Osmussaar Island, NW Estonia. A, GIT 697-596-2; B, C, GIT 569-1 part and counterpart; D, GIT 697-338; E, GIT 697-19-2; F, GIT 697-16-1.

*Oikobesalon* may occur in the Middle Ordovician of NW Russia (O. Vinn, personal observations). Three species are known from the Silurian of Britain (*O. coriaceum*, *O. squamosum* and *O. citrimorion*) (Thomas & Smith 1998) three species from the Silurian of Baltica (*O. liljevalli*, *O. squamosum* and *O. erraticum*) (Brood 1979, 1980; Thomas & Smith 1998; Schallreuter & Hinz-Schallreuter 2010), two species from the Silurian of Australia (*O. coriaceum* and *O. squamosum*) (Chapman 1910; Thomas & Smith 1998) and a single species has been recognized in the Silurian of North America (*O. citrimorion*) (Thomas & Smith 1998). In the Cambrian and Ordovician, *Oikobesalon* seems to have been formed only in cold to temperate seas. The ichnogenus *Oikobesalon* had a remarkable diversification in the Silurian. The distribution of *Oikobesalon* in the Silurian is associated with tropical palaeolatitudes.

#### Sedimentation environment and palaeoecology

The sedimentation environment of the Kõrgekallas Formation on Osmussaar Island was a relatively shallow-water carbonate shelf with moderate hydrodynamics. The *Oikobesalon* burrows were made in carbonate mud containing fine bioclasts of various invertebrates. They initially had an organic lining (Brood 1980; Thomas & Smith 1998) that presumably protected burrows against collapse and intrusion of sediment particles. *Oikobesalon* burrows were possibly made by suspension- or detritus-

eating terebellid polychaetes (Thomas & Smith 1998). The presence of a tube lining in *Oikobesalon* indicates that the trace was obviously not made during the search for food but as a domicile. The trace-maker probably used its burrow permanently for dwelling and searched for its food through the burrow aperture that likely opened at the sediment surface.

#### Preservation

The traces described here were presumably compressed during the lithification of the sediment, as indicated by their elliptical cross sections. Most likely they originally had a circular cross section that would best fit a terebellid or terebellid-like trace-maker. The original organic lining has been decomposed and preserved as a thin mineralized layer around the burrow infilling. The brown colour of the burrow cover may be caused by pyritization.

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## *Oikobesalon*'i jälgede esmaleid Baltika Ordoviitsiumist

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Perekond *Oikobesalon* on esmakordselt kirjaldatud Baltika Ordoviitsiumist. Kõik Osmussaarelt kirjeldatud eksemplarid kuuluvad liiki *O. coricaceum*. Kambriumis ja Ordoviitsiumis esines *Oikobesalon* jahedates meredes. *Oikobesalon*'i käikude tegija elas neis püsivalt ja toitus sette pinnale ulatunud käigu avause kaudu.