

## **HOLORHYNCHUS (PENTAMERIDA, BRACHIOPODA) IN THE UPPER ORDOVICIAN OF ESTONIA**

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**Abstract.** In Estonia the first finds of the Upper Ordovician index genus *Holorhynchus* are remarkable because of their stratigraphical position. *Holorhynchus* sp. occurs in the upper part of the Pirgu Regional Stage corresponding possibly to the *Dicellograptus anceps* Chronozone. The beds with *Holorhynchus* are overlain by dolomites with the *Elsaella* Association and lithologically variable strata with the *Streptis* Association of the uppermost Ordovician stage in the East Baltic, the Porkuni Regional Stage, which corresponds to the Hirnantian Stage of the other regions. The distribution of the *Holorhynchus* Association in the East Baltic region coincides presumably with a short-time regression phase that preceded the terminal Ordovician glacio-eustatic lowering of the sea level.

**Key words:** *Holorhynchus* Association, biostratigraphy.

The purpose of this paper is to call attention to the first finds of the well-known Upper Ordovician brachiopod genus *Holorhynchus* in Estonia, the northern East Baltic. These finds add some new information to the late Ordovician brachiopod associations in the Baltic basin and the stratigraphy of the boundary beds of the two uppermost Ordovician stages, Pirgu and Porkuni regional stages.

In the East Baltic the brachiopod genus *Holorhynchus* Kiaer, 1902 was noted for the first time by Paškevičius in the Lithuanian Ziežmariai, Kauno Vokė, Ukmergė, and Taučionys core sections (Пашкевичюс, 1963, 1968) (Fig. 1). In terms of the lithostratigraphic units the beds with *Holorhynchus giganteus* Kiaer or *Holorhynchus* sp. are known as the Taučionys Formation distributed in southern and southeastern Lithuania, eastern Latvia, and the western part of the Pskov District, Russia (Мяньниль, 1966; Мяньниль et al., 1968; Ульст et al., 1982; Лашков et al., 1984; Nõlvak et al., 1989). Different stratigraphers have considered the formation either as the upper part of the Pirgu or as the lower part of the Porkuni regional stages. Evidently the formation corresponds to the upper part of the *Dicellograptus anceps* Chronozone (Nõlvak et al., 1989; Männil, 1990). In Estonia a possible gap in sedimentation has been recorded on the stratigraphical level of the Taučionys Formation. Some earlier references to the occurrence of *Holorhynchus* sp. in Estonia (for example by Brenchley & Cocks, 1982) evidently base on the Lithuanian material.



In Estonia the genus *Holorhynchus* was identified recently (in 1991) in the Lassi core (K-39) on Hiiumaa Island (western Estonia; Fig. 1). The incomplete pedicle valve of *Holorhynchus* sp. (Pl., figs. 1—4) in this core and some supposedly conspecific large thick-shelled fragments in the K lak la core (K-29) come from the cryptocrystalline nodular limestone 0.75—1.00 m below the dolomites of the R a Member (the lowermost member of the  rina Formation; Мянниль & Рыымусокс, 1984) (Fig. 2). On the mainland of Estonia a fragment of the brachiopod valve probably belonging to *Holorhynchus* has been found by G. Carden from the topmost Ordovician in the Tartu core.

In the Hiiumaa sections the bioturbated cryptocrystalline nodular limestone intercalating with marls rich in trace fossils (burrows) and containing *Holorhynchus* sp. of the upper part of the Pirgu Regional Stage has been ascribed tentatively to the Kabala Formation by Suuroja (pers. comm.). The co-occurrence of *Holorhynchus* sp. or *H. giganteus* and the specific morphotypes of the chitinozoa *Ancyrochitina ancyrea* in the upper part of the Pirgu Stage in the Lassi core and in the T u ionys Formation in the southern East Baltic sections indicate the existence of temporal analogues of the last formation and *Holorhynchus* Association at least in some places in Estonia.

In the Estonian sections the succession of the late Pirgvan and Porkunian faunas can be observed beginning from the level of the appearance of *Holorhynchus*. In the Lithuanian and Latvian sections the *Holorhynchus* bearing T u ionys Formation is known first of all as the topmost fossiliferous part of the Ordovician overlain by barren oolitic limestones (Мянниль et al., 1968; Ульст et al., 1982). Earlier three ecologically different late Ordovician brachiopod associations — the *Holorhynchus*, *Streptis*, and *Hirnantia* associations — have been mentioned in the East Baltic (named as biofacies in Мянниль, 1966; fauna in Хинтс, 1986; communities in Kaljo et al., 1988). The first two are comparable with the associations established by Brenchley & Cocks (1982) in Norway. The last association is used here in a wider sense according to the term “Hirnantia fauna” of Rong Jia-yu & Harper (1988). Provisionally these associations were considered as contemporaneous (Пашкевич с, 1963; Мянниль, 1966; Brenchley & Cocks, 1982).

The time-responsive succession of the *Holorhynchus* and *Streptis* associations has ensued from the stratigraphical position of the T u ionys and  rina formations in the Ordovician stratigraphical correlation chart (Мянниль, 1987). The finds of *Holorhynchus* sp. in the Hiiumaa sections confirm this point of view. Moreover, in Estonia the strata with *Holorhynchus* are separated from the lithologically variable deposits of the Porkuni Regional Stage with the *Streptis* Association by the dolomites of the R a Member of the  rina Formation containing a specific association of brachiopods. The full list of fossils of the last member is given by R  musoks (Рыымусокс, 1991). In core sections the R a Member is characterized first of all by *Elsaella bekkeri* (Rosenstein) and *Thaerodonta* sp. The former represents a convenient nominal genus for a new association — the *Elsaella* Association succeeding the *Holorhynchus* and preceding the *Streptis* Association. In the Lithuanian Ukmerg  core (depth 498.95 and 499.6 m; Хинтс, 1975, p. 81; see also Мянниль et al., 1968, fig. 12) *Elsaella* cf. *bekkeri* occurs on the same stratigraphical level — above the strata with *Holorhynchus*.

The data on the occurrence of *Elsaella* below the strata with *Holorhynchus* seem to be questionable, particularly of *Elsaella bekkeri* (Rosenstein) in the R usa core (Central Estonia) and *E. cf. bekkeri* in the Ukmerg  core, at a depth of 507.1 m (Хинтс, 1975, p. 81). Unfortunately, the first core is destroyed and the provisional interpretation of the litho-



stratigraphical units cannot be checked. The Ukmergė specimen comes from the beds occurring obviously in a wrong place in the core as suggested by the succession of chitinozoans in the beds immediately below the Taučionys Formation (int. 506—508 m; Нылвак, 1988).

By Paškevičius (pers. comm.; see also Мянниль, 1987, p. 32) some southern East Baltic sections have shown the intercalation of beds with the uppermost finds of *Holorhynchus* and the lowermost elements of the *Hirnantia* Association (s.l.). In most of the studied sections the *Holorhynchus* Association seems to be older than the *Hirnantia* Association. For example, in the Ilijnskoje core the zonal chitinozoan for the Pirgu—Porkuni (in the East Baltic) and Jerrestad—Hirnantian (in Sweden) boundary beds "*Conochitina*" *taugourdeaui* Eisenack occurs immediately above the highest finds of *Holorhynchus* sp. (Nölvak et al., 1989; Nölvak & Grahn, in press).

Following the view of Rõõmusoks (Рыымусокс, 1991) about the late Pirguan age of the Rõa dolomites, the *Holorhynchus* Association from the underlying deposits has in Estonia naturally the same age. So, the distribution of *Holorhynchus* in the East Baltic in general supports the conclusion of Rong Jia-yu & Harper (1988) about the pre-Hirnantian age of the *Holorhynchus* Association. A possible exception from Lithuania has been mentioned before. Still, we should note that the lower boundary of the Rõa dolomites marked by pyritized discontinuity is more distinct than the upper boundary in about 10 sections studied on Hiiumaa Island. In some publications the Rõa Member is considered entirely as the lower part of the Porkuni Regional Stage (Мянниль, 1987; Kaljo et al., 1988). The question concerning the boundary between Pirgu and Porkuni stages will presumably be understood more unambiguously only after the lower boundary stratotype of the last stage is established.

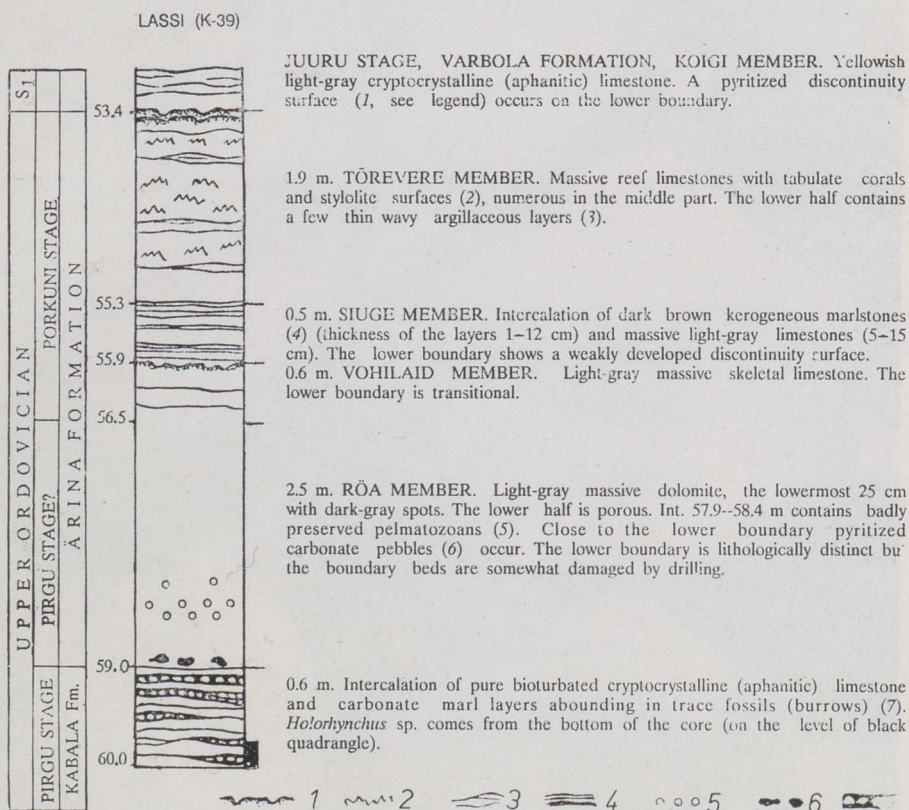
Some stratigraphical complications arise in case of the Kabala Formation (= Aiamaa Formation in Мянниль, 1987; Männil, 1990). In some publications the whole Kabala Formation or its upper part is included within the Porkuni Stage (Мянниль, 1987; Kaljo, 1984; Kaljo et al., 1988; Männil, 1990). If the *Holorhynchus* bearing strata in the Hiiumaa sections really represent the analogues of the Kabala Formation in Central Estonia, then supposedly the last formation is at least partly of Pirguan age and its upper boundary may be diachronous.

In the Baltoscandian region the *Holorhynchus* Association is distributed beside the East Baltic in Norway and Sweden (Brenchley & Cocks, 1982; Jaanusson, 1982). The patchy distribution complicates the establishing of its environmental position. Still, in Norway it is considered as the association of the inner shelf environments (Owen et al., 1990, p. 36). In Estonia it presumably remains within the limits of shallow water environments close to the zone of nonsedimentation. A tendency of gradual sea-level lowering during the late Pirguan time may be suggested (Опачпыльд, 1975). On Hiiumaa Island the studied sections have shown upward increases in the role of trace fossils, the degree of bioturbation, and the amount of the terrigenous material. The taphonomy of *Holorhynchus* sp. (occurrence of coquina, see Pl., fig. 8), and the distribution of oolitic limestones overlying the Taučionys Formation in the south-eastern East Baltic refer to the same trend (Пашкевичус, 1962; Лашков & Яковлева, 1977). The sea-level lowering event on the Pirgu—Porkuni boundary complicates the correlation of the Upper Ordovician deposits in the East Baltic region. Still, it is considerable as an event presumably marking a short-time regression phase preceding the main Ordovician glacio-eustatic sea-level lowering (see Brenchley, 1989).

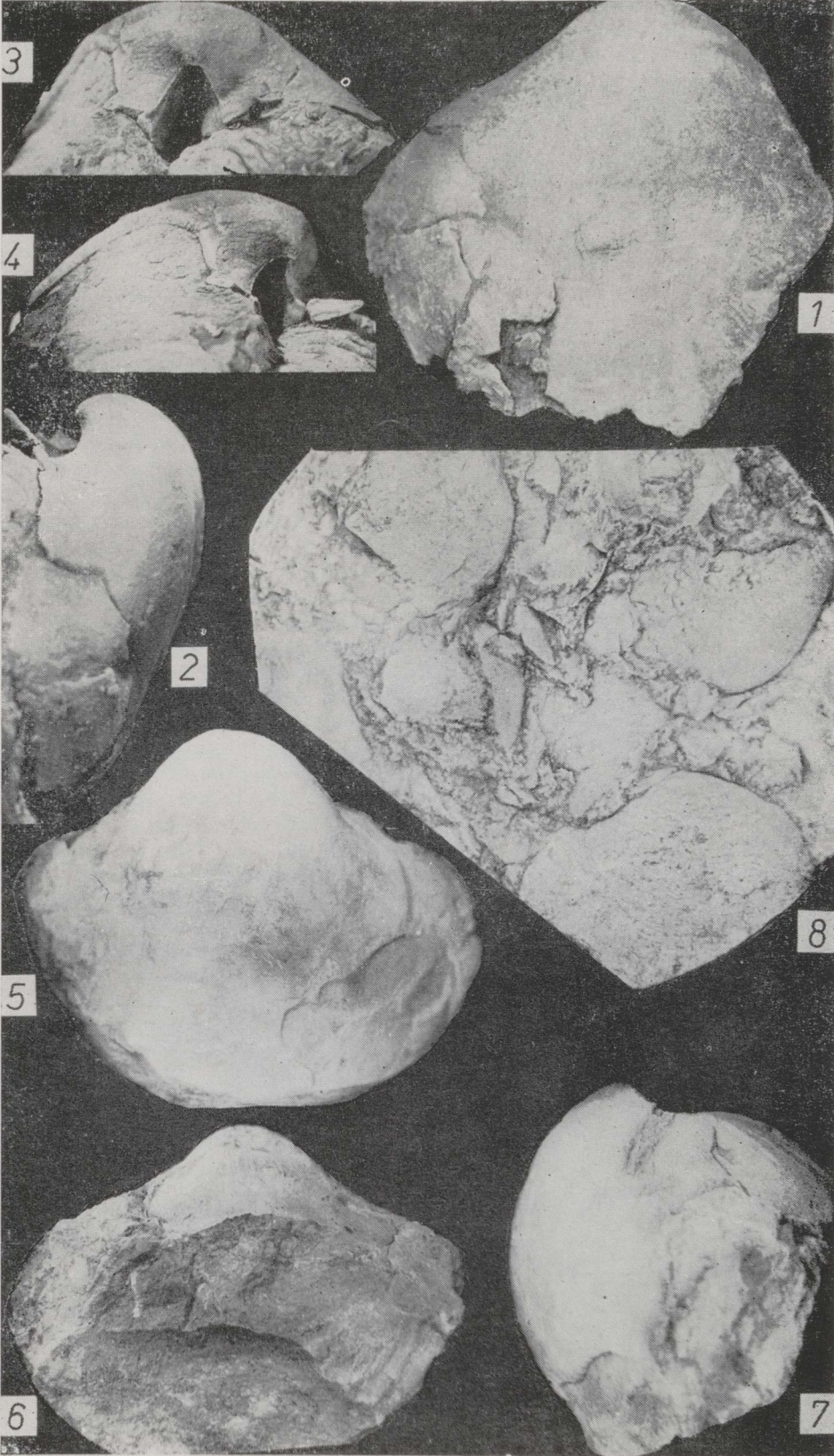
Finally a short description of the studied pentameroid brachiopod is given.

A map of the Baltic region, showing the borders of Estonia, Latvia, Lithuania, and Poland. The map includes several locations marked with symbols and names. In Estonia, Tallinn is marked with a solid circle, and Lassi (K39) is marked with a circle containing a cross. Kūlakūla (K29) is marked with a circle containing a cross. Tartu is marked with a circle containing a question mark. In Latvia, Riga is marked with a solid circle. Iljinskaja is marked with a circle containing a cross, and Ludza is marked with a circle containing a cross. In Lithuania, Aknīste is marked with a circle containing a cross, Butkūnai is marked with a circle containing a cross, Svēdasai is marked with a circle containing a cross, Pauksčiai is marked with a circle containing a cross, Ukmergė is marked with a circle containing a cross, Žiežmariai is marked with a circle containing a cross, Kauno-Yoke is marked with a solid circle, Vilnius is marked with a solid circle, Taurionys is marked with a circle containing a cross, and Jasiūnai is marked with a circle containing a cross. In Poland, Drūkšiai is marked with a star. The map also shows the locations of the K39 and K29 sites, which are marked with circles containing a cross. A legend in the bottom right corner indicates that a circle with a cross represents a site, a circle with a cross and a dot represents a site, and a circle with a cross and a dot represents a site.

Fig. 2. A scheme of the texture and description of the Upper Ordovician strata in the Lassi (K-39) core. The texture is marked by argillaceous matter on the bedding planes and stylolite surfaces, also by thin layers. For legend see the description of the section.









Figs. 1—4. *Holorhynchus* sp. Pedicle valve Br 4112. Ventral, lateral, posterior, and postero-lateral views. Western Estonia, Hiiumaa Island, Lassi core (K-39), depth 59.9—90.0 m. Pirgu Regional Stage, Kabala Formation. Collection of the Institute of Geology, Tallinn, Estonia.  $\times 1.8$ .

Figs. 5—7. *Holorhynchus giganteus* Kiaer. Complete shell, ventral, lateral, and dorsal views. Eastern Latvia, Malta core, depth 464.7 m. Pirgu Regional Stage, Taučionys Formation. Collection of the Museum of Natural History, Riga, Latvia.  $\times 1$ .

Fig. 8. Bedding plane with fragments and valves of *Holorhynchus* sp. Eastern Latvia, Malta core, depth 471.0 m. Pirgu Regional Stage, Taučionys Formation. Collection of the Museum of Natural History, Riga, Latvia.  $\times 1.2$ .

*Holorhynchus* sp.  
Pl., figs. 1—4

**Material.** Incomplete pedicle valve Br 4112, western Estonia, Hiiumaa Island, Lassi core (K-39), depth 59.9 m, Pirgu Stage.

**Description.** Pedicle valve small, smooth, flattened in anterior half. Narrow and weak furrow occurs along the mid-line. Ventral umbo incurved, delthyrium open. The hinge teeth are 3 mm long, developed as pointed processes lenticular in cross-section. Anteriorly spondylium is almost as deep as wide.

**Discussion.** The described specimen is similar to the *Holorhynchus giganteus* Kiaer from Norway (Kiaer, 1902; Gauri & Boucot, 1968) and from Latvia (Pl., figs. 5—7). However, exact identification of one incomplete valve is complicated.

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# **HOLORHYNCHUS (PENTAMERIDA, BRACHIOPODA) EESTI ÜLEMORDOVIITSIUMIST**

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Käsijalgsse *Holorhynchus* esmasleiud Eesti ülemordoviitsiumist kinnitavad varasemat oletust selle perekonna ilmunisest Balti basseini pirgu ea lõpus. Kahes Hiiumaa puursüdamikus esineb *Holorhynchus* afaniitses muguljas lubjakivis, umbes 1 m madalamal Ärina kihistu Rõa kihistiku dolomiitidest. Pirgu lademe ülemise osa ja Porkuni lademe iseloomulike käsijalgsete leviku põhjal on eritletud kolm üksteisele ajaliselt järgnevat assotsiatsiooni — *Holorhynchus*'e, *Elsaella* ja *Streptis*'e assotsiatsioon. *Holorhynchus*'ega kaasnev kitinosoade koosseis lubab oletada neid sisaldavate kihtide üheaegsust Eestis ja Lõuna-Baltikumis, kus nimetatud käsijalgsed on juhtvormiks Taučionyse kihistus. Seega võib esmakordselt tõdeda, et viimase kihistu ajalised analoogid on esindatud ka Eestis, kuigi väga piiratud ulatuses.

Pirgu ja Porkuni lademe piirikihtide litoloogiline iseloom ja oluliste lünkade esinemine piirkonniti viitavad basseini märgatavale madaldumisele. See on tõenäoliselt seotud ühe lühiajalise regressiivse faasiga hilisordoviitsiumi glatsio-eustaatilise meretaseme languse foonil.

## **HOLORHYNCHUS (PENTAMERIDA, BRACHIOPODA) В ВЕРХНЕМ ОРДОВИКЕ ЭСТОНИИ**

Линда ХИНТС

Первые находки представителей рода *Holorhynchus* в Эстонии происходят из верхней части пиргуского горизонта, из отложений, подстилающих пачку доломитов низов самой верхней свиты ордовикского разреза. *Holorhynchus* и сопутствующие им хитинозои подтверждают присутствие аналогов таученской свиты Южной Прибалтики в Эстонии. Раньше предполагалось, что в Северной Прибалтике этой свите соответствует перерыв в осадконакоплении.

В последовательности появления позднепиргуских и поркуниских брахиопод в Северной и Южной Прибалтике выделяются три ассоциации с номинальными родами *Holorhynchus*, *Elsaella* и *Streptis* соответственно, причем последний известен только в Эстонии.

Прерывистость, вплоть до полного выклинивания, отложений с *Holorhynchus* в мелководных фациях Балтийского палеобассейна указывает, по-видимому, на кратковременную регрессивную фазу на фоне позднеордовикского глацио-эвстатического понижения Мирового океана.