

Revision of the plectorthoid brachiopod *Platystrophia dentata* (Pander, 1830) from the Middle Ordovician of the East Baltic

Michael A. Zuykov^a, David A. T. Harper^b, Sergei S. Terentiev^c and Emilien Pelletier^a

^a Institut des sciences de la mer de Rimouski (ISMER), Université du Québec à Rimouski, Rimouski, 310, allée des Ursulines, QC G5L 3A1, Canada; m.zuykov@mail.ru

^b Geological Museum, Natural History Museum of Denmark, Øster Voldgade 5-7, DK-1350 Copenhagen, Denmark; dharper@snm.ku.dk

^c All Russian Geological Institute, Sredny 74, 199106 St Petersburg, Russia; serge_terentiev@yahoo.com

Received 11 February 2011, accepted 7 April 2011

Abstract. Due to the scanty description of *Porambonites dentata* Pander, 1830 and loss of its single type specimen, the name *dentata* has been subsequently attributed to various Ordovician to Silurian species of the genus *Platystrophia s.l.* with two costae in the sulcus and three on the fold. In The Natural History Museum, London, there is a complete shell identified presumably by Christian Pander himself as *Spirifer dentatus* from Pulkowa. That specimen is selected here as neotype to *Platystrophia dentata*, i.e. to a species, which on the basis of new material is restricted to the lower Darriwilian in the St Petersburg region. Considering differences in the interior of the dorsal valve, the other species (some with subspecies) of the so-called *dentata*-group, especially from the stratigraphically younger strata, are discussed and excluded from the material described here of *P. dentata*.

Key words: Brachiopoda, Plectorthoidea, *Platystrophia*, Ordovician, East Baltic.

INTRODUCTION

Pander (1830, p. 96, pl. XI, fig. 4) described his new species as ‘*Porambonites dentata* n. sp. feiner gerippt. In der breiteren Bucht zwei Längsrippen’. This description was supported by the schematic illustration of a single specimen. However, no data regarding its type locality or age are actually known. The specimen illustrated in Pander’s monograph is unfortunately lost like many other Pander types (Jaanusson & Bassett 1993). Specimens with definitive labels or indeed similar to *Platystrophia dentata* in remnants of Pander’s collection in the Mining Museum of the St Petersburg Mining Institute, St Petersburg, Russia (mentioned below as MMI) are also lacking. Thus, it was virtually impossible for subsequent authors to correctly understand the specific concept of this important species, generating considerable confusion. For example, Alikhova (1951, p. 12) noted: ‘Usually, the name *Platystrophia dentata* (Pander) is applied to many different species. The only one reason for that is the number of costae in the sulcus – two and three on the fold.’ Such an approach to the specific discrimination of *Platystrophia*-like brachiopods has been criticized by many authors (see, e.g., Zuykov & Harper 2007). Therefore, *P. dentata* as well as seven ‘allied’ taxa, which are considered as varieties or subspecies of the nominate form, require revision (Zuykov 2001).

The main goal of this paper is to clarify the original concept of *P. dentata* based on a well-preserved complete shell labelled as ‘*Spirifer dentatus* Pander, Silur, Pulkowa’ in The Natural History Museum, London (below NHM). It is suggested that this specimen was identified thus after publication of the monograph by von Buch in 1837 and before King’s monograph on the Permian Fossils of England in 1850. In the former paper Pander’s platystrophiids were referred initially to the genus *Spirifer*; in the latter they were moved to King’s new genus *Platystrophia*. However, Davidson (1848, 1871), whose large brachiopod collections from the Silurian are deposited in the NHM, described *Platystrophia*-like taxa under the generic name *Orthis*. A comparison of the label accompanying the specimen from the NHM by V. Stolbova at the MMI with those written by Pander himself supported probable Pander’s implication here. Further, the Pulkowka River (Fig. 1) was one of the most popular places amongst Ordovician workers in the 19th century with numerous important fossiliferous localities. It was also mapped by Pander (1830, map). Today, these localities along the river are not sufficiently exposed. In terms of the modern stratigraphy of the St Petersburg region, the NHM specimen (as well as Pander’s original) of *P. dentata* may have been collected from a stratigraphic interval within the following four regional stages: Volkhov, Kunda, Aseri and Lasnamägi. The platystrophiids from the first two stages in the East

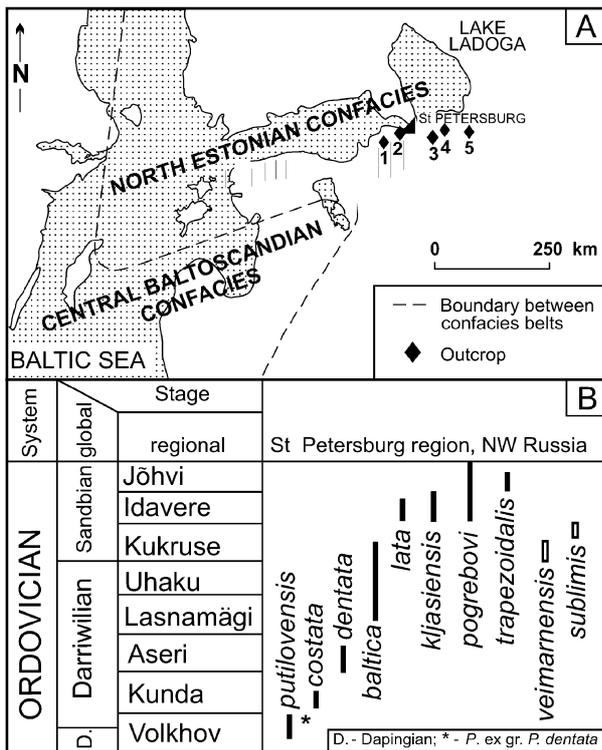


Fig. 1. **A**, map showing localities of *Platystrophia dentata* described in this paper: 1, Vilpovitsy quarry; 2, Pulkowka River (locality was destroyed in the middle of the 20th century); 3, Mga River; 4, Putilovo quarry; 5, Volkhov River. **B**, stratigraphical distribution of *P. dentata* and other discussed species; black rectangle – data obtained by the authors; white rectangle – data from Alikhova (1951); *P. sublimis* = *P. sublimis rectangularis*.

Baltic have been revised by Zuykov (1999), and forms with external (and internal) morphologies similar to those of the specimens illustrated here have not been reported. At the same time, more than 20 specimens newly collected from the upper part of the Simankovo Formation and in the entire Duboviki Formation of the Aseri Stage in the St Petersburg Region (Fig. 1) form a well-defined species, to which the NHM specimen (as well as Pander’s lost original) can be assigned; the name *Platystrophia dentata* is thus applicable to all of these specimens. It is interesting to note that both Öpik (1930, p. 105) and Alikhova (1951, p. 13) suggested that Pander’s original specimen was derived from the Aseri Stage. This suggestion, however, has not been supported by any original sources or by further study.

The material illustrated and discussed in the present paper is deposited in the Natural History Museum, London (prefix BM), Central Scientific-Research Geological Exploration Museum (named after F. N. Chernyshev), St Petersburg (prefix CNIGR) and Mining Museum of the St Petersburg Mining Institute, St Petersburg (prefix MMI).

SYSTEMATIC PALAEOLOGY

Order ORTHIDA Schuchert & Cooper, 1932
 Suborder ORTHIDINA Schuchert & Cooper, 1932
 Superfamily PLECTORTHOIDEA Schuchert in Schuchert & LeVene, 1929
 Family PLATYSTROPHIIDAE Schuchert in Schuchert & LeVene, 1929, emend. Zuykov & Harper, 2007
 Genus PLATYSTROPHIA King, 1850, emend. Zuykov & Harper, 2007

Type species. *Porambonites costatus* Pander, 1830; Obukhovo Formation, Kunda Regional Stage, St Petersburg region, northwest Russia. Designated by Zuykov & Harper 2004; discussed by Zuykov & Harper 2007.

Platystrophia dentata (Pander, 1830)
 Figures 2, 3, 4A–H; Table 1

- 1830 *Porambonites dentata* n. sp.; Pander, p. 96, pl. XI, fig. 4.
- ?1845 *Spirifer biforatus* var. *dentatus* (Pander); Verneuil, p. 138, pl. 3, fig. 5.
- 1930 *Platystrophia dentata* (Pander); Öpik, p. 105 (pars), non pl. 5, figs 51–61, pl. 6, figs 62, 63.
- non 1951 *Platystrophia dentata* var. *veimarnensis* Alikhova, p. 12, pl. 1, figs 3, 4.
- non 1951 *Platystrophia dentata* var. *lata* Alikhova, p. 13, pl. 1, figs 5, 6.
- non 1951 *Platystrophia dentata* var. *trapezoidalis* Alikhova, p. 14, pl. 1, fig. 7.
- non 1956 *Platystrophia dentata* var. *trapezoidalis* Alikhova; Oraspöld, p. 43, pl. 1, figs 1, 2.
- non 1956 *Platystrophia dentata* var. *triata* Oraspöld, p. 45, pl. 1, fig. 9.
- non 1956 *Platystrophia dentata* var. *evari* Oraspöld, p. 44, pl. 1, figs 6–8.
- non 1999 *Platystrophia* ex gr. *P. dentata* (Pander); Zuykov, p. 207, pl. 2, figs 6–9.

Neotype. Complete shell BM 26089, Fig. 4A–E; Ordovician, Pulkowka River, St Petersburg Region, NW Russia. Designated here (see discussion above).

Material and distribution. 10 complete shells, 6 ventral and 9 dorsal valves from the Simankovo and Duboviki formations, Aseri Regional Stage, middle part of the Darrivilian, Middle Ordovician in localities Vilpovitsy village, Mga River, Putilovo village, Volkhov River, St Petersburg Region, Russia.

Diagnosis. Small *Platystrophia*, shell slightly dorsibiconvex, both valves uniformly swollen, transverse suboval in outline. Ventral sulcus and dorsal median fold moderate

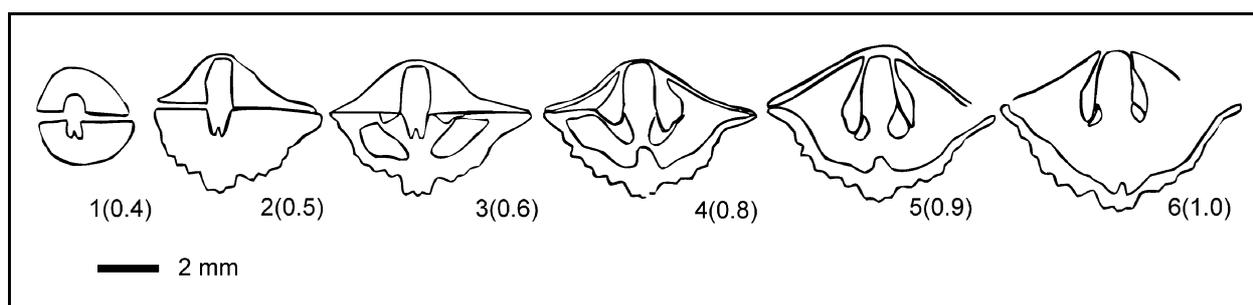


Fig. 2. Serial sections of *Platystrophia dentata* based on the shell CNIGR 2/13221, Vilpovitsy quarry, Aseri Stage. The distance from the umbo shown in brackets.

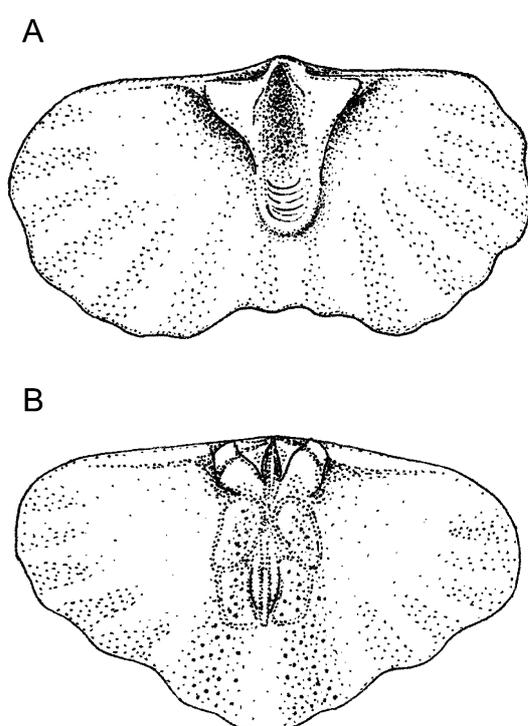


Fig. 3. Reconstruction of the interior morphology of *Platystrophia dentata*. **A**, ventral valve CNIGR 6/13221. **B**, dorsal valve CNIGR 7/13221.

in size. Radial ornament of rounded costae; ventral sulcus with two costae; dorsal fold with three costae; 5–6 costae on flanks. Notothyrial cavity narrow. Brachiophores small. Dorsal adductor scars weakly impressed, separated by short and low median ridge between anterior pair.

Description. Shell slightly dorsibiconvex, with weakly swollen central part; transverse suboval in outline, with maximum width at middle of shell length; cardinal extremities obtuse. Anterior commissure uniplicate.

Ventral sulcus and dorsal median fold moderately developed, originating in umbonal area. Beak in ventral valve slightly curved; umbonal area in dorsal valve flattened. Interareas low, slightly concave. Radial costae rounded, two in sulcus, three on fold, 5–6 on flanks of both valves. Spine bases ('granulation') in low density (40–60 spines per 1 mm²).

Ventral interior with small teeth; muscle field narrow, elongate, thickened marginally. Dorsal interior with high, blade-like cardinal process extended through narrow notothyrial platform. Brachiophores small with slightly divergent massive basal plates. Sockets shallow. Adductor scars quadripartite, weakly impressed, suboval in outline; anterior pair separated by low and rounded ridge.

Discussion. In features of external morphology *P. dentata* is similar to the majority of platystrophiids in its juvenile growth stages, being clearly different in the internal characters of the dorsal valve. The shell size in *P. dentata* is always small, as noted already by Verneuil (1845, p. 138). However, without data on the internal morphology, the taxonomic position of the two specimens illustrated in that monograph (see synonymy) cannot be confirmed with any confidence.

Öpik (1930, p. 105), nevertheless, suggested an extended stratigraphical distribution for *P. dentata*, from the Aseri to upper Kukruse stages of North Estonia, but without illustration or discussion of the internal morphology of the oldest specimens. External and internal morphologies of the youngest specimens, as shown in Öpik (1930, pl. 5, figs 51–61, pl. 6, figs 62, 63), are quite different from those of *P. dentata* described here. For instance, blade-like, divergent brachiophores of the dorsal valve in pl. 5, fig. 56 seem to be similar to those of *P. dentata lata* Alichova.

The morphology of *P. costata* and three selected species of the 'dentata-group' from the sequences older and younger than those where *P. dentata* occurred is shown for comparative purposes in Fig. 4I–Q. In

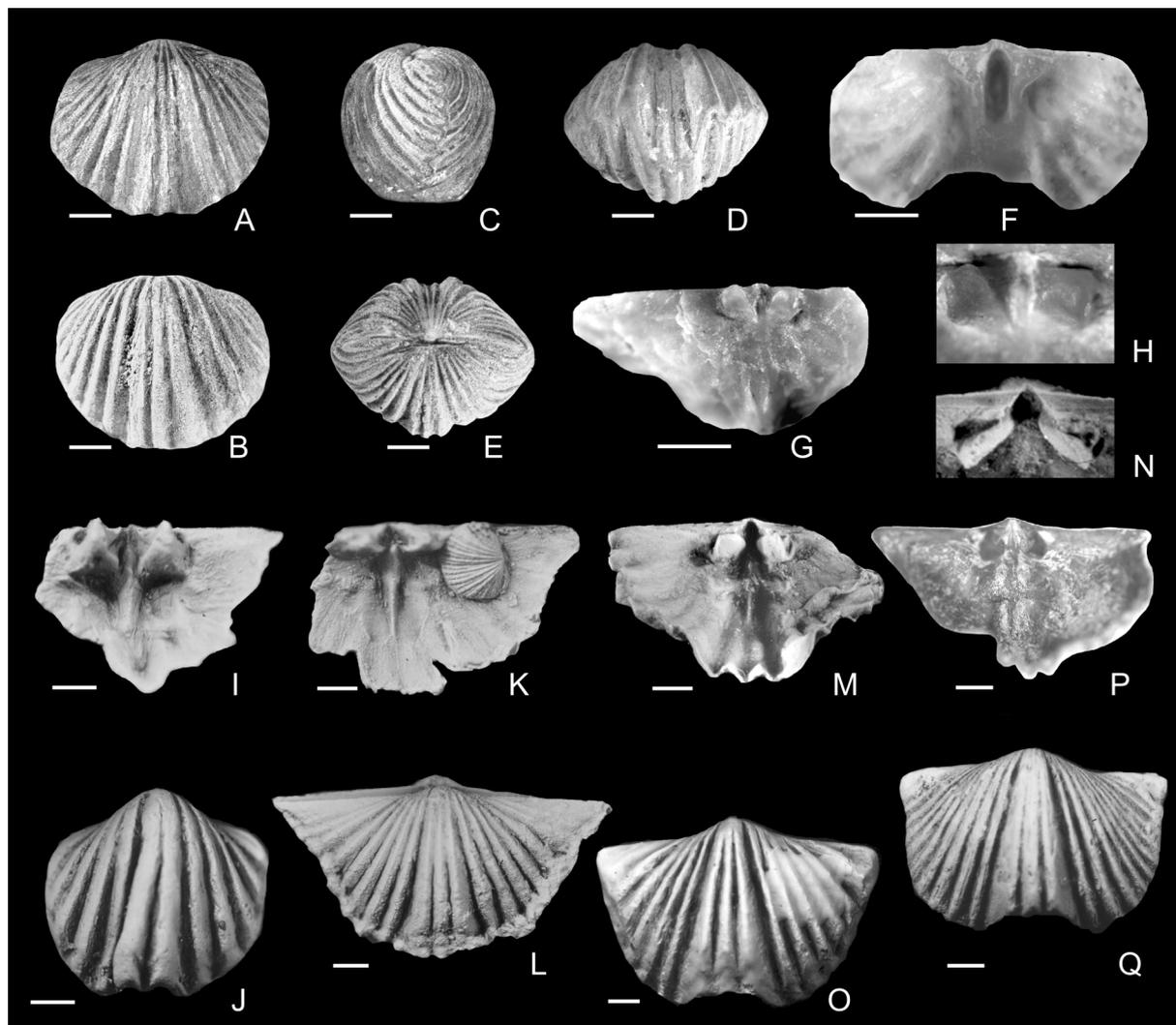


Fig. 4. A–H, *Platystrophia dentata* (Pander, 1830). A–E, complete shell BM 26089, neotype; ventral, dorsal, lateral, anterior and posterior views, Ordovician, Pulkowa River, St Petersburg Region, Russia; F, ventral valve interior, CNIGR 6/13221, Vilpovitsy quarry, Aseri Stage; G, H, dorsal valve interior showing cardinalia, CNIGR 7/13221, south of Putilovo quarry, Aseri Stage. I, J, *Platystrophia costata* (Pander, 1830). I, dorsal valve interior, CNIGR 7/12974, Putilovo quarry, Obukhovo Formation, Kunda Stage; J, dorsal valve exterior, MMI 1/373, neotype, Pulkowa River, coll. C. H. Pander. K, L, *Platystrophia putilovenssis* Zuykov (1999). K, dorsal valve interior, CNIGR 10/12974; L, dorsal valve exterior, CNIGR 9/12974, holotype, Putilovo quarry, Volkhov Formation, Volkhov Stage. M–O, *Platystrophia lata* Alichova (1951). M, N, dorsal valve interior showing cardinalia, CNIGR 2/13042, Klyasino quarry, Gryazno Formation, Idavere Stage; O, dorsal valve exterior, CNIGR 5/8047, holotype, Klyasino Village, Idavere Stage. P, Q, *Platystrophia trapezoidalis* Alichova (1951). P, dorsal valve interior, CNIGR 8/13221; Q, dorsal valve exterior, CNIGR 7/8047, holotype, Khrevitsa River, Khrevitsa Formation, Jõhvi Stage. Scale bars: 2 mm.

particular, *P. dentata* described here differs from *P. dentata veimarnensis* Alichova (1951), *P. d. lata* Alichova (1951) and *P. d. trapezoidalis* Alichova (1951) in the shape of its brachiophores and in the absence of a median septum between posterior adductors. *Platystrophia dentata triata* Oraspõld (1956) from the Oandu Stage of North Estonia was recently transferred to the genus *Neoplatystrophia* Zuykov & Harper (2007).

Oraspõld (1956, p. 45) reported a number of minor, and probably insignificant, differences between *P. d. triata* and *P. d. evari*; both are probably the end members in a morphological range of the same species. The internal features of *P. d. dentatoides* Oraspõld (1956) and *P. d. trigonalis* Bondarev (1968) are known on the basis of too limited material for a detailed re-study of these subspecies at present.

Table 1. Measurements (in mm) of *Platystrophia dentata*. L = maximum length, W = width, T = thickness, S-F, FV = number of costae in the sulcus and on the fold, and on the flanks of valves

Specimen	L	W	T	Costae	
				S-F	FV
Neotype, shell BM 26089	9.1	10	8.9	2–3	5–6
Shell CNIGR 1/13221	7.7	10.4	7	2–3	6
Shell CNIGR 2/13221	5.3	8.5	5	2–3	6
Shell CNIGR 3/13221	7.3	10.6	7.3	2–3	5
Shell CNIGR 4/13221	6.3	8.3	6.7	2–3	4
Shell CNIGR 5/13221	8	10.3	6.8	2–3	7
Ventral valve CNIGR 6/13221	7	10		2	6
Dorsal valve CNIGR 7/13221	7	8.4		3	6

The width of the sulcus, rounded radial costae, characters of cardinalia and the presence of a median ridge only between the anterior adductors distinguish *P. dentata* from specimens of *P. ex gr. P. dentata* (Pander) described by Zuykov (1999, p. 207, pl. 2, figs 6–9).

Moreover, all other taxa identified by the name *P. dentata* or *P. ex gr. P. dentata* listed among the Ordovician and Silurian brachiopods from the Baltic basin and its margins (see Zuykov 2001) cannot be unambiguously confirmed without new material.

Acknowledgements. We are grateful to A. Kramorev for the donation of important specimens, V. Stolbova for assistance with study of the C. Pander collection in the Mining Museum (St Petersburg), S. Long and R. Cocks for access to brachiopod collections deposited in the NHM (London), L. Hints for helpful discussions. We specially thank M. Rubel and L. Popov for critical comments on the MS. During different stages of the work, M.Z. has been supported by grants from the Paleontological Society (PaSIRP) and by the Canada Research Chair Program (E.P.). D.A.T.H. acknowledges support from the Danish Council for Independent Research (FNU).

REFERENCES

- Alikhova, T. N. 1951. *Brakhiopody srednej i verkhnej chasti nizhnego silura Leningradskoj oblasti i ikh stratigraficheskoe znachenie* [Brachiopods of the Middle and Upper Parts of the Early Silurian of Leningrad Region and Their Stratigraphical Significance]. Vsesoyuznyj Nauchno-Issledovatel'skij Geologicheskij Institut (VSEGEI), Gosgeolizdat, Moscow, 80 pp. [in Russian].
- Bondarev, V. I. 1968. Stratigraphy and typical brachiopods of the Ordovician deposits of the south of Novaya Zemlya, Vaigach Island and northern Pai-Khoi. In *Stratigrafiya, usloviya osadkonakopleniya i fauna ordovikskikh i nizhnedevonskikh otlozhenij Novoj Zemli, Vaigacha i Paj Khoya* [Stratigraphy, Sedimentary Conditions and Faunas of Ordovician and Lower Devonian Deposits of Novaya Zemlya, Vaigach Island and Pai-Khoi] (Bondarev, V. I., ed.), *Trudy Nauchno-Issledovatel'skogo Instituta Geologii Arktiki*, **157**, 3–144 [in Russian].
- Davidson, T. 1848. Memoire sur les brachiopodes du systeme superieur d'Angleterre. *Geological Society of France, Bulletin, Series 2*, **5**, 309–338.
- Davidson, T. 1871. A monograph of the British Fossil Brachiopoda, Vol. 3, Part 7, No. 4: The Silurian Brachiopoda. *Palaeontographical Society (London) Monographs*, **24**, 249–397.
- Jaanusson, V. & Bassett, M. G. 1993. *Orthambonites* and related Ordovician brachiopod genera. *Palaeontology*, **36**, 21–63.
- King, W. 1850. A monograph of the Permian Fossils of England. *Palaeontographical Society (London) Monographs*, **3**, xxxviii + 258 pp., 28 pls.
- Öpik, A. 1930. Brachiopoda Protremata der Estlandischen Ordovizischen Kukuruse-Stufe. *Acta et Commentationes Universitatis Tartuensis, Series A*, **17**, 1–262.
- Oraspöld, A. L. 1956. New brachiopods of the Jõhvi, Keila and Vasalemma stages. *Eesti NSV Teaduste Akadeemia Geoloogia Instituudi Uurimused*, **1**, 41–67 [in Russian].
- Pander, C. H. 1830. *Beiträge zur Geognosie des Russischen Reiches*, St.-Petersburg, xx + 165 pp.
- Schuchert, C. & Cooper, G. A. 1932. Brachiopod genera of the suborders Orthoidea and Pentameroidea. *Peabody Museum of Natural History Memoirs (New Haven)*, **4**(1), 1–270.
- Schuchert, C. & LeVene, C. M. 1929. Brachiopoda (generum et genotyporum index et bibliographia). In *Fossilium Catalogus, Vol. 1, Animalia, Pars 42* (Pompeckj, J. F., ed.), pp. 1–140. W. Junk, Berlin.
- Verneuil, E. P. 1845. Paleontologie, Mollusques, Brachiopodes. In *Geologie de la Russie d'Europe et des Montagnes de l'Oural, Volume 2, Part 3* (Murchison, R. I., Verneuil, E. & Keyserling, A., eds), pp. 17–395. London, Paris.
- Von Buch, C. L. 1837. Über *Delthyris* oder *Spirifer* und *Orthis*. *Physikalische Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin*, Aus dem Jahre 1871, 1–79, pls 1, 2.
- Zuykov, M. A. 1999. *Platystrophia* (Orthida, Brachiopoda) from the Arenig and lowermost Llanvirn of northwestern Russia. *Proceedings of the Estonian Academy of Sciences, Geology*, **48**, 195–212.

Zuykov, M. A. 2001. *Platystrophia* (Orthida) in the Ordovician and Early Silurian of the East Baltic. In *Fourth International Brachiopod Congress, London 10–14 July 2000, Systematics Association, Vol. 63*, pp. 327–334. Taylor & Francis, London and New York.

Zuykov, M. A. & Harper, D. A. T. 2004. *Platystrophia* King, 1850 (Brachiopoda, Orthida): proposed conservation of usage by designation of *Porambonites costatus* Pander,

1830 (currently *Platystrophia costata*) as the type species of *Platystrophia*. *Bulletin of Zoological Nomenclature*, **61**, 246–250.

Zuykov, M. A. & Harper, D. A. T. 2007. *Platystrophia* (Orthida) and new related Ordovician and Early Silurian brachiopod genera. *Estonian Journal of Earth Sciences*, **56**, 11–34.

Plektortoidse brahhiopoodi *Platystrophia dentata* (Pander, 1830) revisjon Baltikumi Kesk-Ordoviitsiumist

Michael A. Zuykov, David A. T. Harper, Sergei S. Terentiev ja Emilien Pelletier

Brahhiopoodi *Porambonites dentata* Pander, 1830 napp esmakirjeldus Peterburi lähistelt ja tema hiljem kaotsi läinud tüüp (ainus eksemplar) viisid selleni, et järgnevas töödes kasutati liiginime *dentata* väga mitmesuguste Ordoviitsiumi ja Siluri perekonna *Platystrophia s.l.* esindajate juures ainuüksi kahe/kolme rõõne olemasolu järgi koja siinusel/sadulal. Londoni loodusloo muuseumi vanades kogudes on arvatavasti Christian Panderi enda *Spirifer dentatus*'eks määratud koda, leiukohaga Pulkowa. Antud eksemplar sobib neotüübiks siin revideeritud Panderi liigile *Platystrophia dentata*, mille levik uute leidude järgi piirdub Peterburi ümbruse Darriwili alumise poolega, ja mille hulgast on välja arvatud temast erineva siseehitusega *dentata* liiginime all kirjeldatud materjal.