# A new species of the conodont genus *Siphonodella* Branson & Mehl (late Tournaisian)

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**Abstract.** A new upper Tournaisian (Lower Carboniferous) siphonodellid conodont species *Siphonodella carinata* n. sp. is described. The material comes from the shallow-water carbonate sediments of the Pechora Swell (Timan-Pechora region or NE of European Russia). The co-occurrence of conodonts *Hindeodus cristulus* (Youngquist & Miller), *Bispathodus stabilis* (Branson & Mehl) Morphotype 1, *Polygnathus longiposticus* Branson & Mehl and *Pseudopolygnathus nodomarginatus* (Branson) suggests the late Tournaisian (Lower *Siphonodella crenulata* Zone) age of the deposits. Morphologically the new species is similar to *Siphonodella semichatovae* Kononova & Lipnjagov and *S. ludmilae* Zhuravlev & Plotitsyn, but differs in possessing three rostral ridges at the late stages of ontogeny and Class III symmetry. The presence of the shallow-water siphonodellids *Siphonodella bella* Kononova & Migdisova and *S. quasinuda* Gagiev, Kononova & Pazuhin in the upper part of the Tournaisian is detected for the first time.

**Key words:** Conodonta, new species, *Siphonodella carinata* n. sp., Lower Carboniferous, Tournaisian.

## INTRODUCTION

Traditionally species of the genus *Siphonodella* are used for biostratigraphy of the lower part of the Tournaisian (Sandberg et al. 1978; Ji 1985; Ji & Ziegler 1992; Kaiser et al. 2009; Kaiser & Corradini 2011; Corradini et al. 2017). The FAD of *Siphonodella sulcata* marks the boundary of the Devonian and Carboniferous (Paproth et al. 1991).

A number of siphonodellids that dwelt in shallow-water facies are known in Eastern Europe, including *Siphonodella bella* Kononova & Migdisova, *S. quasinuda* Gagiev, Kononova & Pazuhin, *S. semichatovae* Kononova & Lipnjagov and *S. ludmilae* Zhuravlev & Plotitsyn. The specific morphology of these species, differing from that of the other species of the genus, consists of a poorly ornamented platform in association with a wide depressed keel and S-like bowed carina. Another group of shallow-water siphonodellids is known from China only. These endemic species, including *Siphonodella simplex* Ji, *S. levis* (Ni), *S. sinensis* Ji, *S. homosimplex* Ji & Ziegler, *S. dasaibaensis* Ji, Qin & Zhao and *S. eurylobata* Ji, were considered in detail by Ji (1985) and Ji & Ziegler (1992). Although evidently forming a separate lineage, Chinese siphonodellids share some features with the European shallow-water siphonodellids. All these species have a poor ornamentation of the platform and a wide pseudokeel or depressed keel at the aboral side of Pa elements.

The shallow-water siphonodellids of the Chinese branch appeared in the earliest Tournaisian and ranged up to the late Tournaisian (Ji & Ziegler 1992). The species of the European branch have been known from the latest Famennian through the early Tournaisian (Ji & Ziegler 1992; Zhuravlev et al. 1998, 1999). New data obtained from the shallow-water succession of the Pechora Swell (Timan-Pechora region or NE of European Russia) expand the information about the ranges and speciation of shallow-water siphonodellids.

## MATERIAL AND METHODS

The Lower Carboniferous (Upper Tournaisian) conodont elements were collected from a section located in the Pechora region (North Russia, Pechora Swell, N 65°4′21″, E 56°43′13″), where the host rocks represent the Idzhid Formation (Figs 1, 2). All the species of shallow-water siphonodellids of the European branch are known form this area (Zhuravlev et al. 1998, 1999). The upper part of the succession, cropping out at the right bank of the Kamenka River, was studied in detail in 1996 and 2016. This part of the section is represented by the alternation of bioclastic wacke- and packstones rich in conodonts.

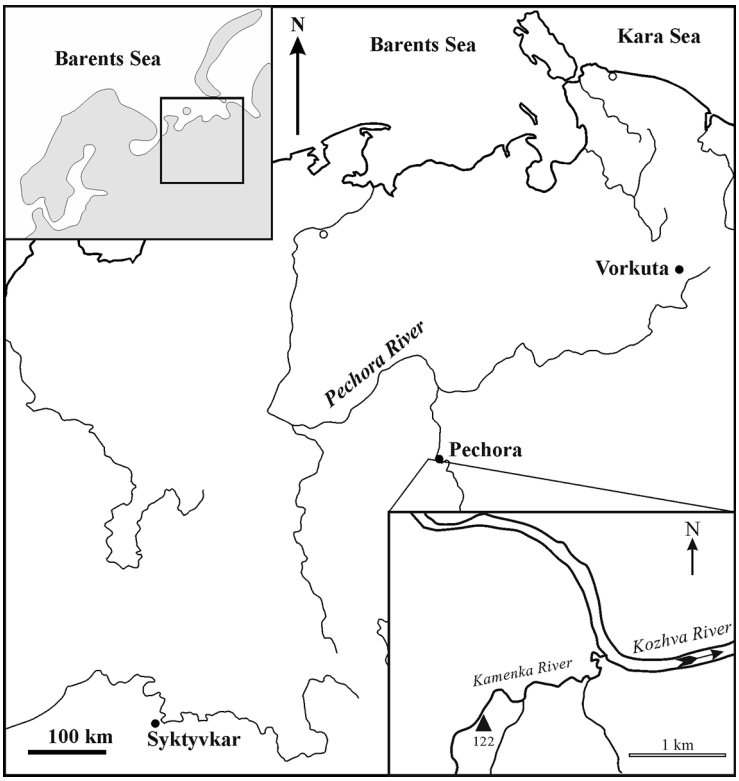


**Fig. 1.** The location of the Kamenka River section. The black triangle marks the location of section 122.

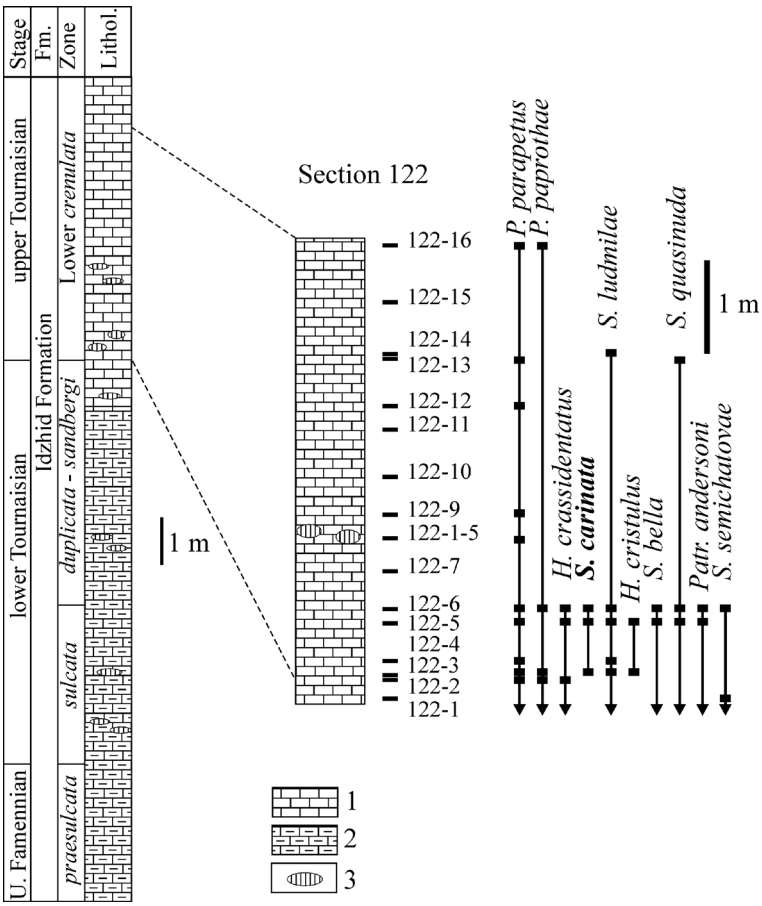


**Fig. 2.** The distribution of selected conodont species in the Kamenka River section. Legend: 1, detritic limestones (wacke- and packstones); 2, clayey detritic limestones (mainly wackestones); 3, cherty concretions. Fm., Formation.

This study is based on 16 samples collected from the upper part of the Idzhid Formation (Fig. 2).

The morphology of the conodont elements was studied with SEM (VEGA3 TESCAN of the Institute of Geology Komi SC UrB RAS, Syktyvkar, Russia), X-ray micro CT (SkyScan 1272 of St. Petersburg Mining University, St. Petersburg, Russia) and optical microscopy. The morphological terminology of Sandberg et al. (1978) and Ji & Ziegler (1992), and the traditional conodont element notation introduced by Sweet & Schönlaub (1975) are used. All the figured specimens are stored in the A. A. Chernov Museum of the Institute of Geology Komi SC UrB RAS, Syktyvkar, collection No. 517 (Fig. 3).

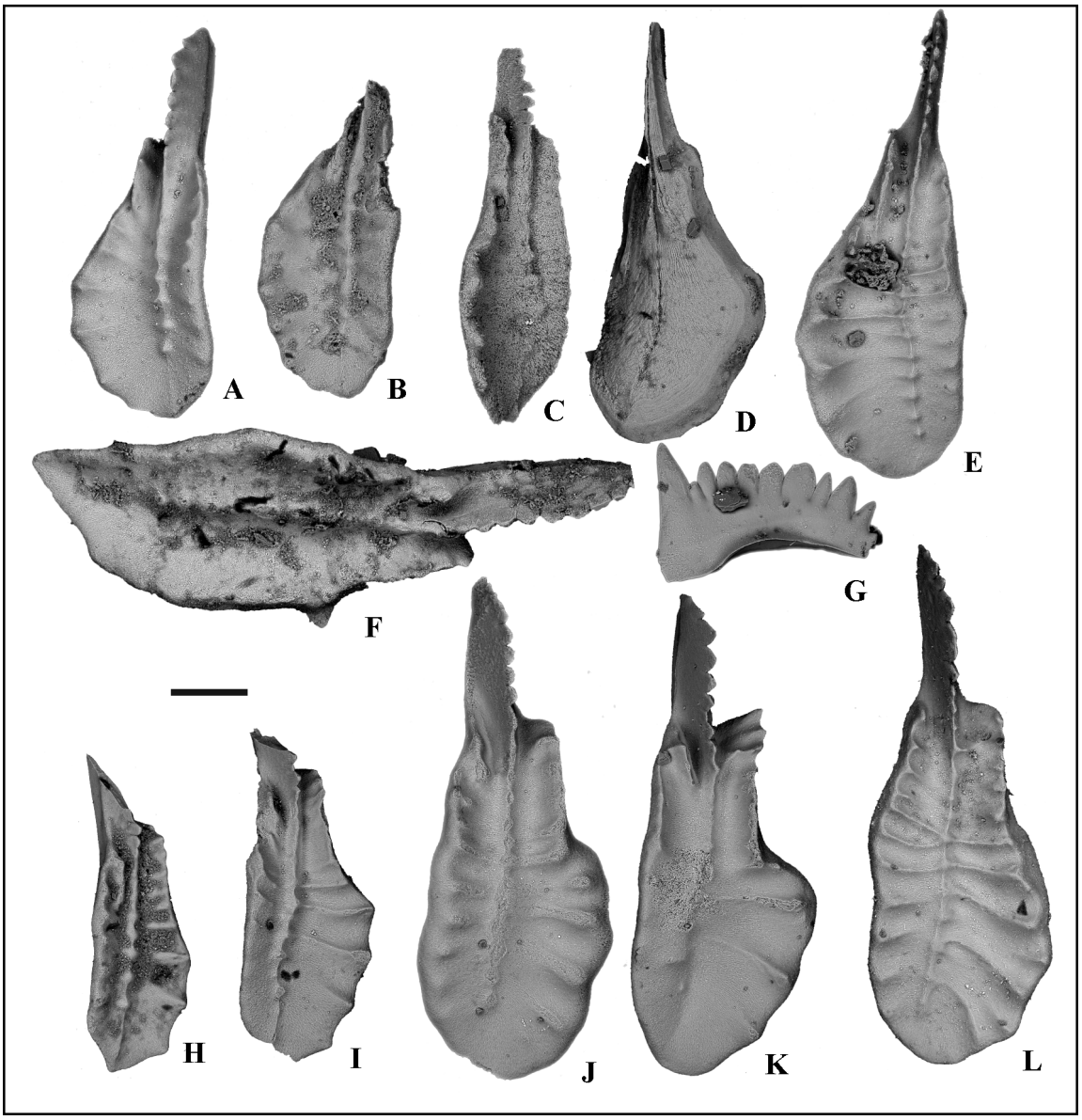


**Fig. 3.** Selected conodonts from the Kamenka River section. **A**–**E**, **H**–**K**, *Siphonodella carinata* n. sp.: A, sinistral element, specimen 517/17, sample 122-3/16; B, sinistral element, specimen 517/6, sample 122-6/16; C, sinistral element, specimen 517/5, sample 122-6/16; D, aboral view of sinistral element, specimen 517/1, sample 122-6/16; E, sinistral element, specimen 517/7, sample 122-5/16; H, dextral element, specimen 517/4, sample 122-6/16; I, dextral element, specimen 517/3, sample 122-6/16; J, dextral element, specimen 517/8, sample 122-5/16; K, dextral element, specimen 517/2, sample 122-6/16. **F**, *Siphonodella quasinuda* Gagiev, Kononova & Pazuhin, dextral element, specimen 517/22, sample 122-7/16. **G**, *Hindeodus cristulus* (Youngquist & Miller), dextral element, specimen 517/9, sample 122-5/16. **L**, *Siphonodella ludmilae* Zhuravlev & Plotitsyn, dextral element, specimen 517/15, sample 122-3/16. The scale bar represents 200 μm.

## RESULTS

The conodont association of the studied section consists of *Polygnathus parapetus* Druce (dominates), *P. paprothae* Bouckaert & Groessens, *P. longiposticus* Branson & Mehl, *P. communis communis* Branson & Mehl, *Bispathodus stabilis* (Branson & Mehl) Morphotype 1, *Hindeodus crassidentatus* (Branson & Mehl), *Hindeodus cristulus* (Youngquist & Miller) (Fig. 3G), *Patrognathus andersoni* Klapper, *Patrognathus variabilis* Rhodes, Austin & Druce, *Pseudopolygnathus nodomarginatus* (Branson), *Ligonodina discreta* (Austin & Husri), *Siphonodella bella* Kononova & Migdisova, *S. quasinuda* Gagiev, Kononova & Pazuhin (Fig. 3F), *S. ludmilae* Zhuravlev & Plotitsyn (Fig. 3L) and *Siphonodella carinata* n. sp. (Fig. 3A–E, H–K). The co-occurrence of *Hindeodus cristulus* (Youngquist & Miller), *Bispathodus stabilis* (Branson & Mehl) Morphotype 1, *Polygnathus longiposticus* Branson & Mehl and *Pseudopolygnathus nodomarginatus* (Branson) suggests the late Tournaisian (Lower *Siphonodella crenulata* Zone) age of the deposits (Fig. 2).

Thus, according to the data obtained, the shallow-water siphonodellids of the European branch, including *Siphonodella bella* Kononova & Migdisova, *S. quasinuda* Gagiev, Kononova & Pazuhin, *S. ludmilae* Zhuravlev & Plotitsyn and *Siphonodella carinata* n. sp., range into the upper Tournaisian Lower *Siphonodella crenulata* Zone. Earlier *Siphonodella bella* and *S. quasinuda* were considered as characteristic of the lower part of the Tournaisian (*Siphonodella sulcata–S. sandbergi* zones) only (Ji & Ziegler 1992).

## SYSTEMATIC PALAEONTOLOGY

*Siphonodella carinata* n. sp.
Figure 3A–E, H–K

*Holotype*. Dextral Pa element, specimen 517/8, sample 122-5/16, Fig. 3J.

*Type horizon*. The upper part of the Idzhid Formation, Lower *crenulata* conodont Zone, Upper Tournaisian, Lower Carboniferous.

*Type locality*. The Kamenka River section, Pechora Swell, North Russia.

*Derivation of name*. From Latin carina – ridge.

*Diagnosis*. Pa-elements with spoon-like strongly asymmetrical platform, ornamented by wide fan-like transverse coarse costae in outer side and by wide short costae or nodes in inner side. Rostrum composed of up to three short ridges converging slightly or being parallel to carina. Depressed keel (*sensu* Sandberg et al. 1978) is present.

*Material*. 5 dextral and 7 sinistral Pa elements.

*Description*. Pa-elements have a spoon-like strongly asymmetrical platform, which is ornamented by wide fan-like transverse coarse costae in the outer side and by wide short costae or nodes in the inner side. The outer part of the platform is much wider than the inner one. The rostrum is composed of three (at the late stages of ontogeny) short ridges that converge slightly or are parallel to the carina. The third rostral ridge appears in ontogeny on the outer side in the sinistral element (Fig. 3E), but on the inner side in the dextral element (Fig. 3J). Thus the species is characterized by the asymmetrical rostral structure corresponding to Class III symmetry of Lane (1968).

A low pseudokeel is located in the anterior part of the platform on its aboral side, however, the keel is depressed in the middle and posterior parts (Fig. 3D). In some cases the keel does not reach the posterior end of the platform. A small basal pit with lens-like flanks is situated in the anterior third of the platform (Fig. 3D).

*Remarks*. *Siphonodella carinata* differs from *S. semichatovae* and *S. ludmilae* in the asymmetry between the dextral and sinistral elements, Class III symmetry of Lane (1968). Each element has three rostral ridges at the late stages of ontogeny. The new species differs from *S. dasaibaensis* Ji, Qin & Zhao and *S. levis* (Ni) in having a prominent platform ornamentation represented by coarse transverse costae.

*Stratigraphic distribution*. Lower *Siphonodella crenulata* Zone, upper Tournaisian, Lower Carboniferous.

## CONCLUDING REMARKS

*Siphonodella carinata* n. sp. is the first late Tournaisian shallow-water European siphonodellid species possessing three rostral ridges. This species probably evolved from *Siphonodella ludmilae* by the development of an additional rostral ridge on the left side of both the sinistral and dextral Pa elements, and by the change of the symmetry class from II to III. A similar morphological sequence is observed in the deep-water siphonodellids in the *S. duplicata–S. quadruplicata* lineage (Zhuravlev & Plotitsyn in press).

According to the data obtained, the stratigraphical ranges of *S. bella*, *S. quasinuda* and *S. ludmilae* comprise the lower part of the Lower *Siphonodella crenulata* Zone (upper Tournaisian) as well, but the FAD of *S. carinata* corresponds approximately to the base of the zone in the shallow-water facies. The FAD of *S. carinata*

is close to the FAD of *Hindeodus cristulus* and can be used as a marker of the base of the upper Tournaisian in the shallow-water facies.

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## Uus liik konodondiperekonnas *Siphonodella* Branson & Mehl (Hilis-Tournai)

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On kirjeldatud siphonodelliid *Siphonodella carinata* n. sp., uus Ülem-Tournai (Alam-Karbon) konodont. Uuritud kollektsioon pärineb madalveelist tüüpi lubjakividest Petšoora kerkealalt Timaani-Petšoora regioonist Euroopa Venemaa kirdeosast. Koos kirjeldatud uue liigiga leitud konodondid *Hindeodus cristulus* (Youngquist & Miller), *Bispathodus stabilis* (Branson & Mehl), *Polygnathus longiposticus* Branson & Mehl ja *Pseudopolygnathus nodomarginatus* (Branson) näitavad, et tegemist on Hilis-Tournai vanusega kihtidega (vastavad Alumisele *Siphonodella crenulata* Tsoonile). Morfoloogiliselt on uue liigi Pa-element lähedane konodontide *Siphonodella semichatovae* Kononova & Lipnjagov ja *S.ludmilae* Zhuravlev & Plotitsyn Pa-elementidele, kuid erineb viimastest skulptuurilt: ontogeneesi hilises staadiumis kujuneb elemendi rostrumile kolmest ribist koosnev ornament. Ka iseloomustab *S. carinata* n. sp. Pa-elementi kolmandat tüüpi (Class III) sümmeetria. Esmakordselt tehti Tournai ülemises osas kindlaks madalveeliste siphonodelliidide *Siphonodella bella* Kononova & Migdisova ja *S. quasinuda* Gagiev, Kononova & Pazuhin esinemine.