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# New Conodont Species from the Kasimovian Stage (Upper Carboniferous) of Moscow and Moscow Basin

**N. V. Goreva* and A. S. Alekseev****

**Geological Institute, Russian Academy of Sciences, Pyzhevskii per. 7, Moscow, 119017 Russia*
*e-mail: goreva@ginras.ru*
***Moscow State University, Vorob'evy gory, Moscow, 119899 Russia*
*e-mail: aaleks@geol.msu.ru*

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**Abstract**—Three new conodont species, *Streptognathodus neverovensis, S. isakovae*, and *Idiognathodus mestsherensis*, which are widespread in the Kasimovian Stage of central Russia, are described.

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*Key words*: Conodonts, new species, Upper Carboniferous, Kasimovian, Russia.

## INTRODUCTION

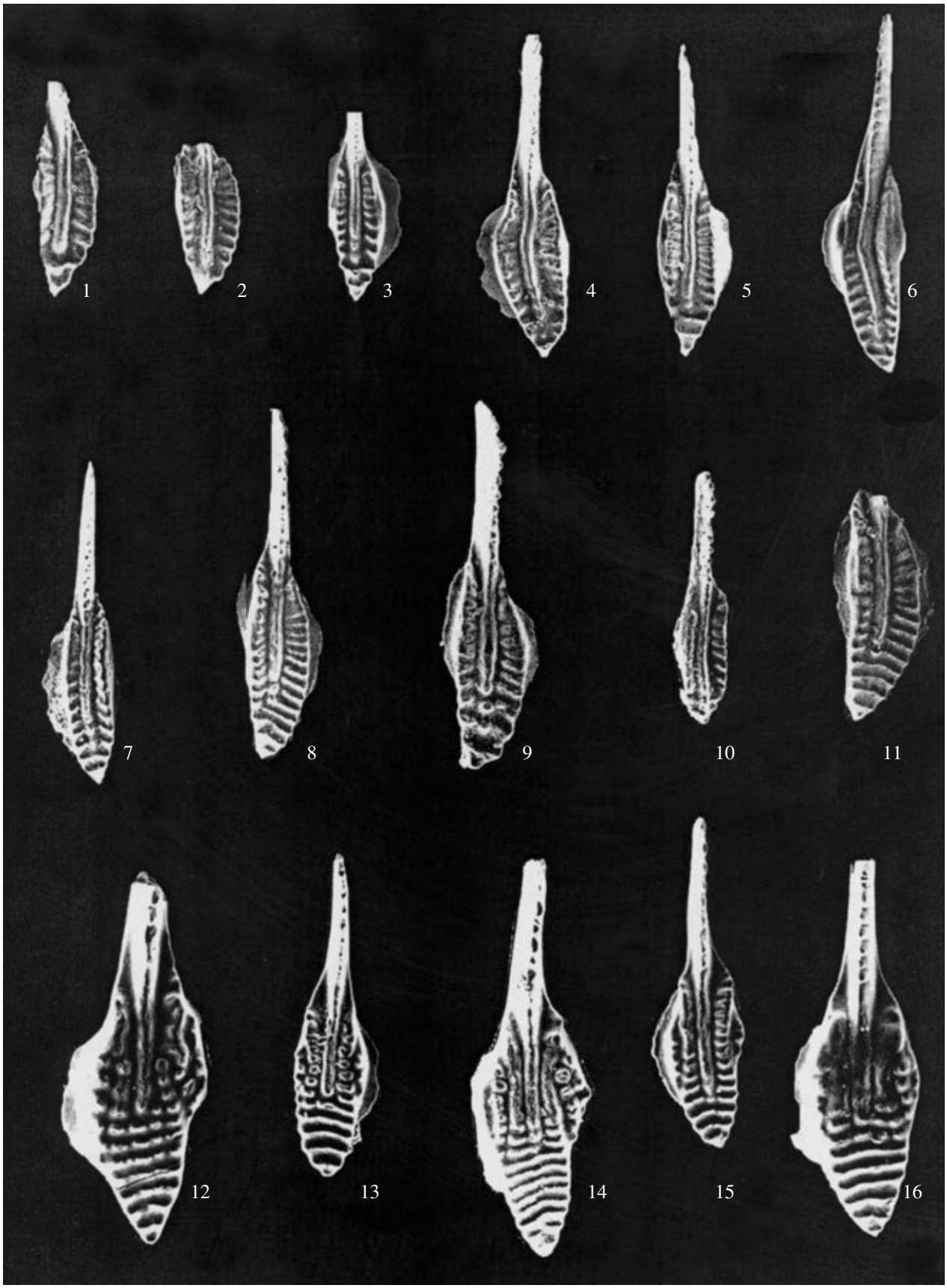
Conodonts were found for the first time in the Upper Carboniferous of Moscow and Moscow Basin by the pioneer of this group, Pander (1856), who described *Gnathodus mosquensis* Pander from red clays of Dorogomilovo (nowadays the Troshkovo Formation of the Dorogomilovian Regional Substage, Kasimovian Stage). Because Pander did not illustrate the oral surface of the Pa element, and due to so far unsuccessful attempts to locate his conodont collection (Barskov and Alekseev, 1977, 1982), the International Commission of Zoological Nomenclature placed *G. mosquensis* on the list of invalid and rejected names. One hundred and twenty years later, Upper Carboniferous conodonts were rediscovered by Barskov and Alekseev (1975), who proposed a zonation of this interval of the Carboniferous and figured a number of typical forms. Subsequently, Barskov and Alekseev (1976) described two new species, *Idiognathodus trigonolobatus* and *I. arendti*, from the lower part of the Kasimovian Stage of the Moscow Basin. In addition, they studied the distribution of conodonts in the basal Kasimovian Stage in Myachkovo (Turaevo quarry) and in the Krevyakinian Regional Substage through the lower part of the Khamovnikian Regional Substage of the Afanasievo section (in the vicinity of the town of Voskresensk). They also described and figured a number of the forms encountered of the genera *Idiognathodus* and *Streptognathodus* (Barskov and Alekseev, 1979). During the same period, the conodont-based zonation of the Upper Carboniferous of the Moscow Basinwas slightly refined and some species were figured (Barskov *et al.*, 1979). In particular, the Afanasievo section in the upper part of the Krevyakinian Regional Substage yielded characteristic forms with a deep groove, which were determined then as *Streptognathodus excelsus* Stauffer et Plummer.

Goreva (1984) analyzed the distribution of conodonts in the Krevyakinian Regional Substage based on materials of several outcrops and a considerable number of boreholes drilled in the Moscow Basin and presented illustrations of the forms studied. Simultaneously, Kozitskaya (Shchegolev and Kozitskaya, 1984; Shchegolev *et al.*, 1984) studied conodonts from the lower part of the Krevyakinian Regional Substage in the sections of Myachkovo and Afanasievo. Alekseev provided a preliminary list of conodonts from the complete section of the Kasimovian Stage exposed by a borehole in the center of Moscow, in Sakharov Avenue (Alekseev *et al.*, 1998).

Due to large scale construction operations and drilling in recent years, we managed to study in detail the stratigraphy and conodonts of the Kasimovian Stage in Moscow and its surrounding area, in particular, in the foundation ditch of "Moscow-City" (Alekseev *et al.*, 2000), at the metro station Kurskaya, in Serebryanicheskii Lane, at the *Oktyabr'* cinema, and at a number of sites in northwestern Moscow along the circular railroad. The information collected during these investigations provided the basis of a new version of the zonal scale for this interval based on conodonts (Makhlina *et al.*, 2002; Alekseev *et al.*, 2002, 2004; Alekseev and Goreva, 2003). This revision required the description of a number of new species.

In this article we describe three new conodont species: *Streptognathodus neverovensis* sp. nov., *S. isakovae* sp. nov., and *Idiognathodus mestcherensis* sp. nov. common for the Kasimovian Stage of central Russia. The collection studied is housed as no. 244 in the Department of Paleontology, Faculty of Geology, Moscow State University (KP MGU).

Plate 10



## SYSTEMATIC PALEONTOLOGY

### Family Idiognathodontidae Harris et Holligsworth, 1933

### Genus *Streptognathodus* Stauffer et Plummer, 1932

***Streptognathodus neverovensis* Goreva et Alekseev, sp. nov.**

Plate 10, figs. 1–6

*Streptognathodus oppletus*: Barskov and Alekseev, 1975, text-fig. 2: 13 (only); Kozitskaya *et al.*, 1978, pl. 27, figs. 7, 15, and 16 (only); Barskov *et al.*, 1979, pl. 2, fig. 22; Goreva, 1984, pl. 3, figs. 38–41, 44; Barskov *et al.*, 1987, pl. 21, fig. 2 (only); Nemyrovska *et al.*, 1999, text-fig. 5: 9.

*Streptognathodus cancellosus*: Kozitskaya *et al.*, 1978, pl. 26, figs. 8 and 9 (only).

Etymology. From the village of Neverovo.

Holotype. KP MGU, no. 244/508, left Pa element; Afanasievo quarry, sample AF5-53; Khamovnikian Regional Substage, Neverovo Formation (Pl. 10, fig. 6).

Description. Pa element with elongated, straight, or, less frequently, weakly curving inside narrow platform with a pointed posterior end. The length to width ratio of the platform is 4 : 1. The platform is widest in its middle part, with lateral sides approaching each other at the anterior end of the element. The carina is straight, smooth, or weakly denticulate; it is highest in the middle part and closely approaches the posterior end of the platform. The posterior end of the carina in adult specimens can bear a detached denticle. The parapets are ribbed, decorated with 8–10 short, distinct ridges narrowing towards the groove. The parapets are subparallel to the carina along almost the entire length of the element; they do not merge with it and reach the posterior end of the platform. The parapets are as high as the carina and separated from it by narrow but deep troughs. The outer parapet is sometimes slightly wider than the inner one. The parapets of adult specimens are more gently sloping, with the posterior end bearing one or two (sometimes even three) transverse ridges partly interrupted by protruding denticles of the carina. Young specimens lack ridges, and have high, narrow parapets, which meet at the posterior edge to form a pointed tip. The completely developed additional lobes are absent, although the inner and, very rarely, the outer margins sometimes bear one or two nodes. The free blade is approximately as long as the platform. In the lateral aspect, the platform is slightly inclined to the posterior end. The basal cavity is deep, asymmetrical, and, on the oral side of young specimens, has flanges, which are widest at the outer side of the platform.

Variability is expressed in the smoothness degree of the lateral parapets, in the presence or absence of separate denticles at the posterior end of the carina and transverse ridges on the posterior end of the platform. Within some regional stages, the population contains common specimens that have one or two nodes on each side of the platform.

Comparison. The new species differs from the most similar species *S. oppletus* Ellison, 1941 from Quivira Shale (Middle Missourian, Kansas-City Group, USA) in the absence of additional lobes, in the deep troughs, and the long carina reaching the posterior end of the platform. It differs from *S. confragus* (Gunnell, 1933) from the Stark Shale of the Dennis Formation of the same group in the absence of well-expressed transverse ridges at the posterior end of its wider platform and in the longer carina.

Remarks. Earlier, we attributed these forms to *S. oppletus.* New images of the holotype of this species (Barrick and Walsh, 1999) contradict this identification. Juvenile Pa elements can be mistaken for those of some other closely related species.

Occurrence. Khamovnikian Regional Substage, Neverovo Formation (most frequently in its basal and upper parts), Dorogomilovian Substage, Perkhurovo Formation; Moscow Syneclise.

Material. More than 600 mostly well-preserved Pa elements from the Afanasievo sections, borehole no. 1 (Perkhurovo), borehole no. 89 (Il'inskii Pogost), borehole no. 5k (Korenevo), borehole no. 6k (Gzhel'), borehole no. 2/3 (Vodniki), borehole no. 9/3 (Afanasievo), borehole no. 15/1 (Ul'yanovka), borehole

Explanation of Plate 10

All specimens are shown as viewed from above, ×70.

**Figs. 1–6.** *Streptognathodus neverovensis* sp. nov.: (1) KP MGU, no. 244/1300, right element; (2) KP MGU, no. 244/1301, right element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 65.15 m, specimen 1832/88; (3) KP MGU, no. 244/1302, right element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 62.35 m, sample 1832/82; (4) KP MGU, no. 244/1303, left element; Afanasievo quarry, sample AF5-53; (5) KP MGU, no. 244/506, right element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 62.35 m, sample 1832/82; and (6) holotype KP MGU, no. 244/508, left element; Afanasievo Quarry, sample AF5-53; all specimens are from the Khamovnikian Regional Substage, Neverovo Formation.

**Figs. 7–11.** *Streptognathodus isakovae* sp. nov.: (7) KP MGU, no. 244/1304, left element; (8) KP MGU, no. 244/1305, right element; (9) holotype KP MGU, no. 244/516, right element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 32.7 m, sample 1832/29; Dorogomilovian Substage, Myasnitskaya Formation; (10) KP MGU, no. 244/1307, left element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 40.3 m, sample 1832/38; Dorogomilovian Substage, Sadovaya Formation; and (11) KP MGU, no. 244/1308, right element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 32.7 m, sample 1832/29; Dorogomilovian Substage, Myasnitskaya Formation.

**Figs. 12–16.** *Idiognathodus mestsherensis* sp. nov.: (12) KP MGU, no. 244/1309, left element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 45.20 m, sample 1832/48; (13) KP MGU, no. 244/1310, right element; (14) holotype KP MGU, no. 244/519, left element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 42.75 m, sample 1832/44; (15) KP MGU, no. 244/1311, left element; and (16) KP MGU, no. 244/1313, left element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 45.2 m, sample 1832/48; all specimens come from the Dorogomilovian Substage, Meshchera Formation.

no. 17/1 (TETs, heat station), borehole no. 1832 (Sakharov Avenue), borehole no. 22/1 (Druzhba), and others.

***Streptognathodus isakovae* Goreva et Alekseev, sp. nov.**

Plate 10, figs. 7–11

*Streptognathodus oppletus*: Kozitskaya *et al.*, 1978, pl. 27, figs. 11 and 12.

Etymology. In honor of the micropaleontologist Tat'yana Nikolaevna Isakova.

Holotype. KP MGU, no. 244/516, right Pa element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 32.7 m, sample 1832/29; Dorogomilovian Substage, Myasnitskaya Formation (Pl. 10, fig. 9).

Description. Pa element has slightly asymmetrical platform becoming narrower toward the posterior end. The length to width ratio of the platform is approximately 4 : 1. The carina is straight in the anterior part, weakly denticulate and extends along two-thirds of the platform. At the posterior end of the platform, the carina continues by one or two separate denticles. In the posterior part, denticles of the carina merge with ridges of the outer parapet, which increases the asymmetry of the element. The parapets are decorated with well-expressed long ridges, which drop off abruptly at the narrow, deep troughs that separate the parapets from the carina. The outer parapet is wider than the inner one, more gently sloping, and usually arched. The inner parapet is almost straight, narrow, with shorter ridges; it is usually higher than the carina and extends slightly further anteriorly (especially in juvenile forms) than the outer one, and forms a weak curve. In the posterior third of the platform, parapets merge and form two to four transverse ridges. The oral surface in the posterior, ribbed part of the platform is weakly concave toward the center, ridges are occasionally interrupted. Additional lobes are absent, but senescent forms occasionally have an indistinct node on the internal side of the platform. Young specimens have a long carina, which frequently extends to the posterior end of the platform; transverse ridges on the posterior end are not expressed. In lateral view, starting from the middle of the element, the oral surface of the platform is weakly bent toward the posterior end. The basal cavity is deep, asymmetrical, with narrow flanges on both sides of the platform.

Variability is expressed in the quantity of transverse ridges at the posterior end of the platform (2–4) and the number of separate denticles posterior to the carina.

Comparison. This species differs from the most similar species, *S. oppletus*, in the absence of additional lobes, deep narrow troughs, and longer carina. Juvenile specimens are very similar to those of *S. neverovensis* sp. nov., which is apparently ancestral to the species described. Adult specimens have a well-pronounced asymmetry of parapets.

Remarks. This species was earlier determined as *S. oppletus* Ellison, 1941. New images of the holotype of this species (Barrick and Walsh, 1999) contradict this identification.

Occurrence. Dorogomilovian Substage, Presnya, Sadovaya, and Myasnitskaya Formations; Moscow Syneclise. Limestone $O_2$; Donets Basin.

Material. More than 60 Pa elements of good preservation from sections of borehole no. 1832 (Sakharov Avenue), borehole no. 24 (Moscow-City), borehole no. 3 (Kurskaya metro station), borehole no. 4 (Serebryanicheskii Lane), and borehole no. 6k (Gzhel').

## Genus *Idiognathodus* Gunnell, 1933

***Idiognathodus mestsherensis* Goreva et Alekseev, sp. nov.**

Plate 10, figs. 12–16

Etymology. From the Meshchera Lowland situated in the southeastern Moscow Region.

Holotype. KP MGU, no. 244/519, left Pa element; Moscow, Sakharov Avenue, borehole no. 1832, depth of 42.75 m, specimen 1832/44; Dorogomilovian Substage, Meshchera Formation (Pl. 10, fig. 14).

Description. Pa element has a straight, lanceolate platform, which is widest in its middle part, and a bluntly pointed posterior end. The carina is long, anteriorly straight in the shape of a continuous ridge, then, consists of several (2–3) denticles, and usually passes to the middle of the platform. In juvenile specimens, it can extend along two-thirds of the platform length. Two additional denticulate lobes are at the same height as the oral surface of the platform. The external lateral lobe is narrow, long, extends along the platform as one row of closely spaced 4–7 nodes. The inner lobe is wider, usually shorter than the outer one, slightly shifted anteriorly, and ornamented by two arched rows of nodes. In juvenile specimens, the number of nodes of the internal row of the inner lobe is two or three; in young specimens, 3–4; and in adults, it can reach 7. The oral surface of the platform is lanceolate, constricted in the anterior third with the formation of the rostra expanding in both sides from the free blade. The internal rostrum is curved more strongly. The oral surface in the anterior half of the platform with rostra is raised, bears transversely elongated nodes that turn into short ridges at the junction of the free blade and the carina. In adult forms, the posterior half of the platform is decorated with 6–10 slightly twisting and sometimes interrupted transverse ridges and, in some cases, has an axial longitudinal depression. In lateral view, the platform is high. The basal cavity is asymmetrical, deep and wide.

Variability is expressed in the size of additional lobes and the number of nodes on them, in the degree of curvature and interruption of transverse ridges on the upper surface of the platform, the variation in the number of ridges from 6 to 10, and in the length of the carina at different age stages.

Comparison. The new species is distinct from *I. toretzianus* Kozitskaya, 1978 in the longer carina and appearance and arrangement of additional lobes; it dif-

fers from *I. bachmuticus* Kozitskaya, 1978 in the straight lanceolate platform and the longer carina. Based on the similarity of juvenile stages, the new species probably originated from *I. sagittalis* Kozitskaya.

O c c u r r e n c e. Dorogomilovian Substage, Meshchera Formation; Moscow Syneclise.

M a t e r i a l. More than 100 well-preserved Pa elements from borehole no. 1832 (Sakharov Avenue), borehole no. 7 (*Oktyabr'* cinema), borehole no. 24 (Moscow-City), etc.

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