

Genus *Ancyrodella* succession in earliest Frasnian (?) of the northern Chernyshev Swell

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ABSTRACT. A succession of *Ancyrodella* genus has been studied in the lowermost Frasnian(?) deposits of the Dershor Brook section (the Chernyshev Swell, Ural region). This succession was divided into four intervals: Beds with *Ancyrodella soluta*, Beds with *A. rotundiloba*, Beds with *A. alata sensu stricto*, and the Beds with *A. rugosa*. An abrupt appearance of ancyrodeliids and mesotaxids in the Frasnian sequence was controlled by facies being in possible relationship with a subtle hiatus that seems to span the intervals with *Ancyrodella binodosa*, and *A. pristina*. The former was recognised by the author in the Lowermost Frasnian sequences in the Syv'yu River section (the Subpolar Urals) and the latter in the Iz'ya - el'River section (the southern Chernyshev Range). The base of Frasnian in the Dershor River Section, which is marked by the first appearance of ancyrodeliids, can be placed to the base of the Beds with *A. soluta* in the upper part of the Kyn Horizon. A different boundary level, established according to the proposal of Racki and Wrzolek in 1989, corresponds to the base of the Beds with *Ancyrodella rotundiloba*, i.e. to the basalmost parts of the Sargaev Horizon. However, this lower Frasnian boundary is obviously drawn in the base of the Kedzydshor Suite. The first appearance of *A. soluta* is 2.3 m above of latter; the first appearance of *A. rotundiloba* is 5.4 m higher. Visible facies control of the first occurrences of different ancyrodeliids must be considered during the next investigations of the "pre-asymmetric" global biotic events.

KEYWORDS: conodonts, facies, Frasnian, Devonian, Chernyshev Swell, Urals.

Introduction

Traditionally, the Middle / Upper Devonian (Givetian / Frasnian) boundary in the Russian Platform and western Urals is considered to be at the base of the Pashiya Horizon which is regarded as approximately corresponding with the base of the *Schmidtoognathus hermanni* - *Polygnathus cristatus* Zone (Rzhonsnitskaya and Kulikova, eds, 1990). However, the correlation of the Pashiya Horizon with the standard conodont zonation is still problematic.

According to the decision of the Subcommittee on Devonian Stratigraphy (SDS), this boundary is placed at the base of the Lower *asymmetricus* Zone, the lower limit of which is defined by the first occurrence of *Ancyrodella rotundiloba* (Bryant) (Klapper et al. 1987). In the Urals and Russian Platform the first representatives of this species appear at the base of the regional *Ancyrodella rotundiloba* Zone, which corresponds with the Sargaev Horizon (Rzhonsnitskaya and Kulikova eds, 1990). But the exact position of the Middle / Upper Devonian boundary in these regions and other regions remains unclear.

As noted by Sandberg et al. (1989), the global stratotype section point of the series boundary (GSSP) in the Montagne Noire in France, was placed within the Lowermost *asymmetricus* Zone. However, this designation was influenced by a misconception of the *Ancyrodella* genus taxonomy and phylogeny. In addition, there are also other concepts of this boundary mostly based on the cryptogenic or biofacially controlled first occurrences of different *Ancyrodella* index species. The proposed revision is to place the boundary at the *Ancyrodella rotundiloba sensu stricto* first appearance datum. It is nearly in accordance with the original definition of the boundary by SDS, i.e., at the base of the Lower *asymmetricus* Zone (Racki and Wrzolek 1989). Thus, regardless of future decisions about the Middle / Upper Devonian boundary position, a study of *Ancyrodella* genus phylogeny in early Frasnian is of great importance. The present communication represents the preliminary results of the study of *Ancyrodella* genus succession throughout one of

the Upper Devonian sequences in the northern part of the Chernyshev Swell.

General setting

The Chernyshev Swell is a large linear-folded structure within the northern Pre-Urals foredeep. The latter is situated in the eastern part of the Pechora Plate (Fig. 1; Anonymous 1989). It forms a narrow, slightly raised plateau. It extends from the western slope of the Urals in the south-west to the Chernov Swell in the north-east. The Chernyshev Swell is more than 400 km long and 7-10 km wide in the southern part, and 30-40 km wide in the northern part. In the middle part, the Chernyshev Swell is cut by the Usa River. The Chernyshev Swell is composed of strongly folded Lower Silurian to Jurassic rocks. The sedimentary cover of the swell is subdivided into three structural complexes mostly separated by stratigraphical, sometimes angular unconformities. The complexes were formed during three periods: the Ordovician - Carboniferous preorogenic, the Permian - Triassic orogenic, and the Mesozoic - Cainozoic postorogenic one (Timonin, 1972).

In general, the Upper Devonian succession in the Pechora Plate is important member of the Upper Devonian - Carboniferous transgressive-regressive cycle (Tsyganko and Iudina 1994). In this region, there are three facies complexes, corresponding to three zones of the Urals palaeo-ocean: shelf (inner shallow-water, middle, external deep shelves), continental slope and foot (bathyal) (Iudin and Dedeev 1987; Iudin 1990).

Within the Chernyshev Swell, the Upper Devonian rocks were formed mainly in a middle-shelf environment. The Upper Devonian facies plan was established as a result of the basal Frasnian onlap, drowning large areas of the Russian Platform's eastern margin. The Upper Devonian deposits of the Chernyshev Swell are represented by shallow-water platform and reef carbonates, bituminous sediments of starved basins, with siliceous, terrigenous, and carbonate components ("Domanic" fa-

cies), and terrigenous carbonate deposits (so-called depressional basin fills). The Upper Devonian stratigraphy in the swell has been studied mainly during the small-scale mapping, which has been carried out since the 1930s. Beginning in the 1960s, the detailed stratigraphic research has been carried out by Pershina (1962), and by Tsyganko, Pershina and Iudina (1985). The Upper Devonian conodont zonation in the Chernyshev Swell was established by this author earlier (Iudina 1985, 1987; Iudina et al. 1994).

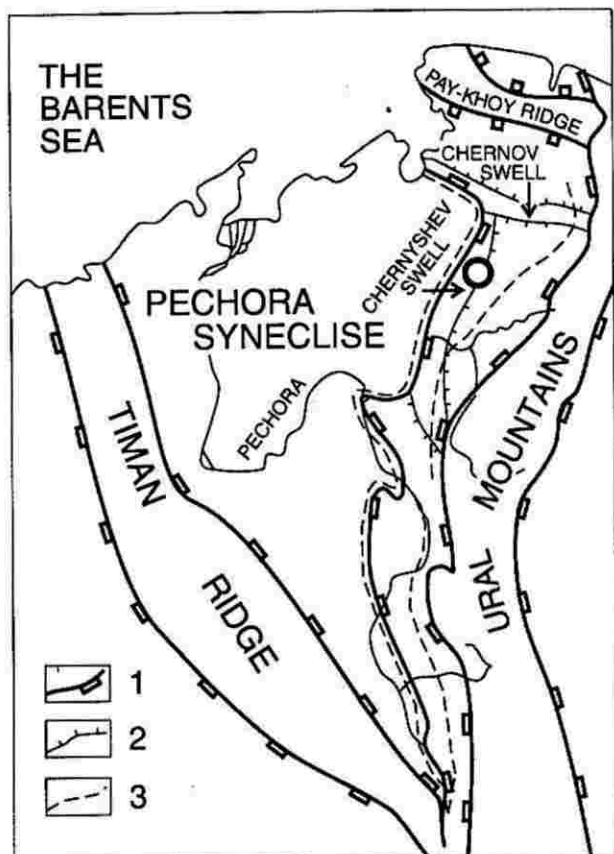


Figure 1. Schematic structure map of the Pechora Plate. 1-3 the boundaries of different-order structures. The black spot within the Chernyshev Swell shows the Dershor-River Section's location.

Ancyrodella genus succession

In the Northern Chernyshev Swell, the Dershor Brook section is one of the most complete Upper Devonian sequences of shallow water carbonate-terrigenous (lower part), "Domanic" (middle part), and shallow water carbonate (upper part) types. There, the Frasnian stage deposits are represented by beds of the Kedzydshor and Vorotskaya suites. The former is 4.8 m thick; it consists of clayey shales, glauconite-rich limestones, sandy limestones, and crinoidal limestones. The Vorotskaya Suite consists of richly fossiliferous detrital limestones, interbedded with black, bituminous, carbonaceous-clayey and siliceous-clayey shales (lower part), and carbonate-clayey shales and richly fossiliferous limestones (upper part). The thickness of the Frasnian part of the suite is about 20 m. The Kedzydshor Suite unconformably overlies the Lower Devonian dolomites.

The following conodont subdivisions were established in this section, in ascending order: the Beds with *Polygnathus dubius* (= *disparilis* Zone), the Beds with

Ancyrodella soluta, the Beds with *A. rotundiloba*, the Beds with *A. alata* and Beds with *A. rugosa* (Iudina 1994). Despite the occurrence of *A. rugosa* Branson et Mehl in the upper part of the section, these beds correspond to *falsiovalis* Zone because the index species of the younger *transitans* Zone is absent (cf. Sandberg, Ziegler, Bultynck, 1989). The Beds with *P. dubius* and *A. soluta* are in the uppermost part of the Kyn Horizon. The Beds with *A. rotundiloba*, *A. alata*, *A. rugosa* characterise the Sargaev Horizon deposits; they correspond to the regional *A. rotundiloba* Zone (Rzhonsnitskaya and Kulikova, eds, 1990). In this section, a four-step *Ancyrodella* sequence was found (Fig. 2):

- (1) Beds with *A. soluta* are characterised by an occurrence of representatives of *Ancyrodella* identified as *A. soluta* Sandberg, Ziegler et Bultynck, morphotype 3 (sample 353-1). There are two specimens that are characterised by a triangular platform with both anterior platform margins rounded. The upper-surface ornamentation consists of large laterally compressed nodes of moderate size with two on either side of the platform. They form two short secondary carinae, directed anteriorward in the inner platform and laterally in the outer platform. Marginal nodes are of moderate size. One node is inserted between the marginal nodes and the carina. In the outer platform, there are two nodes between the marginal nodes and secondary carina. The basal cavity is of moderately large size (25% of the platform width) having a cruciform-rhombic shape, with two distinct secondary keels projecting laterally and extending anteriorward almost to the platform margins. The upper-surface ornamentation is similar to that of *A. soluta* (cf. Sandberg et al. 1989). However, character of their lower surfaces differs in having secondary keels. It appears that they are more advanced forms of *A. soluta*. They are considered by Sandberg et al. (1989) as a transitional form between *A. rugosa* and *A. alata*. The described forms, however, cannot be regarded as intermediate between the two, because they have neither alate lobes as *A. alata*, nor both anterior directed secondary keels as *A. rugosa*. Moreover, such a pattern of differently directed secondary keels is characteristic not only for *A. alata*, but also for *Ancyrodella africana* Garcia-Lopez (Garcia-Lopez 1986) and *A. pramosica* Perri et Spalletta (Klapper 1985). In the interval described, *Ancyrodella* genus representatives occur together with *Polygnathus dubius* Hinde, *P. xylus xylus* Stauff., *P. aff. pennatus* Hinde, and *Icriodus* sp. that are characteristic for underlying Beds with *Polygnathus dubius* (Fig. 2; interval 0 - 4.3 m) (Iudina 1994).
- (2) Beds with *Ancyrodella rotundiloba* are characterised by the presence of *Ancyrodella soluta* (samples 358-4, 5; secondary keels present), *A. pristina* morphotype 2, with tendency to *A. rotundiloba* (sample 358-3, 359-7), *A. pristina* morphotype 3 (sample 359-8), and *A. rotundiloba* early form (sensu Sandberg et al. 1989; sample 358-6). In addition, six broken (reworked?) specimens of different size, which are identified here as *Ozarkodina sannemanni* (Bisch. et Ziegl.), were found in the lower part of the interval. They have a long blade, slightly bent laterally, consisting of flattened denticles. Their height increases gradually from the posterior end to anterior one. Lower edge of the blade possesses a high keel. In the anterior third, a narrow stout platform extends laterally. One of the specimens has an incipient posterior lobe with one very small marginal node. On the upper surface of the

inner platform, one large node occurs and on the outer platform, two or three other are present (third node is incipient). The large basal cavity is cruciform and sometimes with short incipient secondary keels. These forms are similar to *Ancyrodella binodosa* Uyeno (cf. Sandberg et al. 1989: Pl. 1, figs. 1-2) owing to thick platform extension, the basal cavity characteristics, and incipient posterior lobe. In contrast, described forms have more than one node on the outer platform and therefore they are not consistent with Sandberg and co-authors' concept of this species. It is possible, that our specimens are either more advanced forms of *Ozarkodina sannemanni* or a different *Ancyrodella* species, that could be ancestral to *Ancyrodella alata* sensu stricto. *Ancyrodella rotundiloba* (Bryant) early form (sample 358-6) is characterised by a heart-shaped platform which is covered by strong nodes and a big cruciform basal cavity. Later, the representatives of this species have a small rhombic basal cavity (samples 359-9; 377-10, 11; 381-18).

In this interval, *Polygnathus alatus* Hudd., *P. dubius* Hinde, *P. ex gr. dengleri* Bisch. et Ziegl., *P. xylus* xylus Stauff. occur. Moreover, the first representatives of *Nothognathella* genus appear at the base of this interval. The first occurrence of *Mesotaxis falsiovalis* Sand., Ziegl. et Bult., were established in sample 378 (Iudina, 1994).

(3) Beds with *Ancyrodella alata* begin with the first occurrence of *Ancyrodella alata* Glen. et Klapp. sensu stricto. The representatives of the species are char-

acterised by their strong alate-platform outline and regular nodose upper-surface ornamentation (small nodes), with two secondary carinae (adult specimens can have three ones; Fig. 2; sample 393-25). The small basal cavity is rhombic and has two secondary keels that can be different directed (samples 393-23 - 25; 397-26; 405-30) or both directed anteriorly (sample 404-28). The gradual transition from the free blade to the carinae together with absence of a break between them are characteristic of this species. The latter seems to be a diagnostic feature of *A. alata* sensu stricto. *Ancyrodella rotundiloba* (Bryant), *Ancyrognathus ancyrognathoides* (Ziegl.), *Mesotaxis asymmetricus* (Bisch. et Ziegl.), *Mesotaxis bogoslovskii* Ovn. et Kuzm. et al. occur in this interval (Iudina, 1994).

(4) Beds with *Ancyrodella rugosa* are established on the first occurrence of *Ancyrodella rugosa* Brans. et Mehl. This species has a triangular platform that is covered by strong nodes, high free blade, well-separated from a low strong carina, a small rhombic basal cavity with anteriorly directed secondary keels (sample 397-27; 405-31). In this interval, *Ancyrodella alata* Glen. et Klapp. sensu stricto, *A. rotundiloba* (Bryant), *A. ex gr. soluta* Sand., Ziegl. et Bult., *Mesotaxis asymmetricus* (Bisch. et Ziegl.), *M. falsiovalis* Sand., Ziegl. et Bult., *Nothognathella ornata* Tshernysh. et al. occur. In sample 405, the first occurrences of *Playfordia primitiva* (Bisch. et Ziegl.) and *Polygnathus timanicus* Ovn. are established (Iudina, 1994).

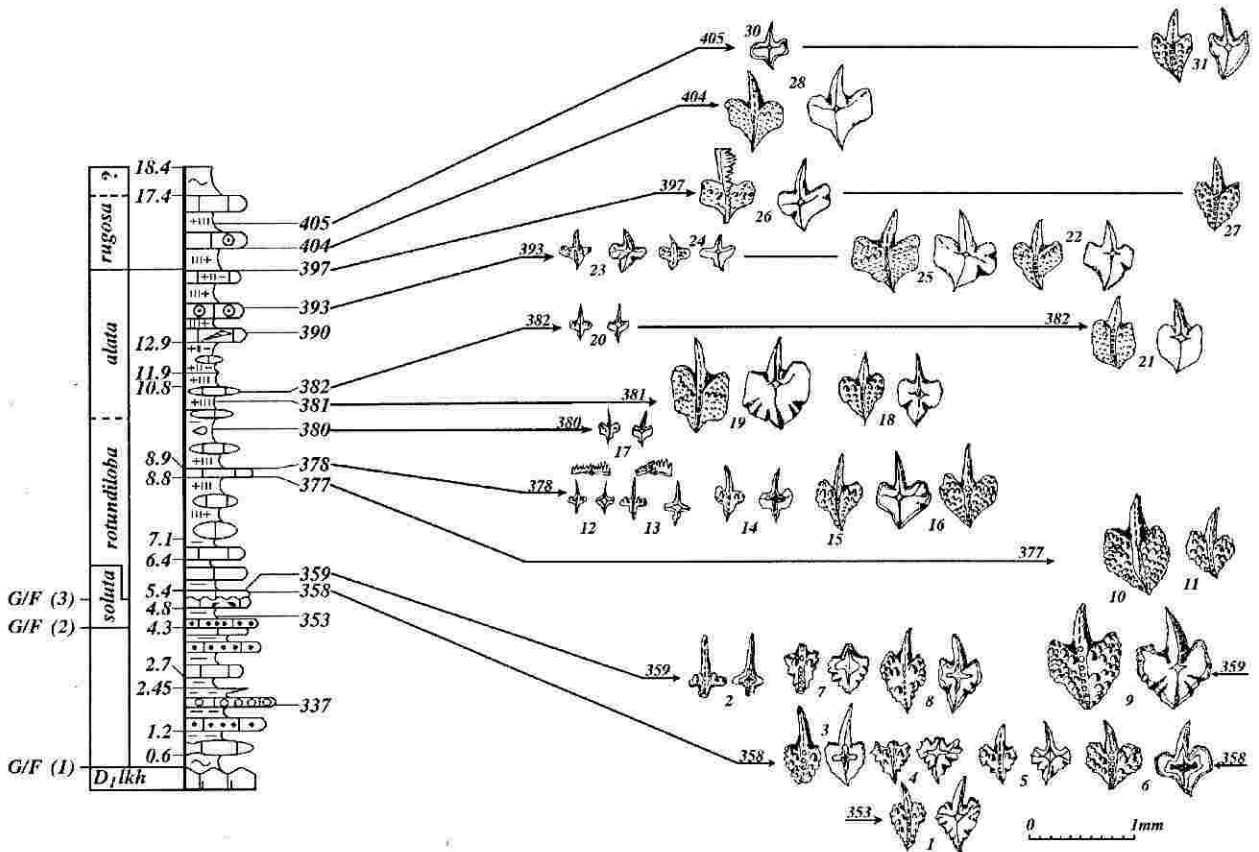


Figure 2. Succession of the early species of *Ancyrodella* in the Deshor Brook Section (Northern Chernyshev Swell). Sample 353-1; 358-4,5; 359-8 - *Ancyrodella soluta* Sand., Ziegl. et Bult.; Sample 358-3; 359-7 - *A. pristina* Khalym. et Tchern.; Samples 358-6; 359-9; 377- 10, 11; 382-21 - *A. rotundiloba* (Bryant) early form; Sample 359-2 *Ozarkodina* (?) *sannemanni* (Bisch. et Ziegl.); Sample 378-12 - 15, 16(?) - *A. alata* Glen. et Klapp, early forms; Sample 380-17, 18(?) - 19(?); 382-20; 393-22(?), 23 - 25; 397-26; 404-28, 29; 405-30 - *A. alata* Glen. et Klapp. sensu stricto; Sample 397-27; 405-31 - *A. rugosa* Brans. et Mehl. G / F(1) to G / F(3) - different placings of the Givetian / Frasnian boundary.

Conclusions

A four-step *Ancyrodella* evolution is described from the Lowermost Frasnian of the Dershor Brook section. The sequence comprises: the Beds with *Ancyrodella soluta*, Beds with *A. rotundiloba*, Beds with *A. alata* sensu stricto, and Beds with *A. rugosa*.

The abrupt appearance of ancyrodelids and mesotaxids in the Frasnian of the Northern Chernyshev Swell was primarily controlled by facies. A subtle hiatus in the Dershor Brook section seems to span intervals with *Ancyrodella binodosa*, and *A. pristina*. The former interval was recognised by the author in the Lowermost Frasnian sequences in the Sy'yu River section (the Subpolar Urals) and the latter one in the Iz'ya - el'River section (the southern Chernyshev Range) (Iudina 1994, 1995).

The base of the Frasnian in the Dershor River Section, established on the first appearance of ancyrodelids (Sandberg, Ziegler and Bultynck 1989), can be placed in the base of the Beds with *A. soluta* in the upper part of the Kyn Horizon. The second boundary level established in a way proposed by Racki and Wrzolek (1989) is in the base of the Beds with *Ancyrodella rotundiloba*, i.e. in the base (?) of the Sargaevo Horizon. However, in this section the lower Frasnian boundary is usually placed in the Kedzydshor Suite's base. The first appearance of *A. soluta* is 2.3 m above the latter, the first appearance of *A. rotundiloba* is 5.4 m higher.

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