

STRATIGRAPHIC ICHTHYOFAUNA ASSEMBLAGES OF THE DEVONIAN DEPOSITS IN THE EAST AND SOUTHEAST OF BELARUS

D.P. Plax

Belarusian National Technical University,
Nezavisimosti Avenue, 65, 220013, Minsk, Belarus
E-mail: agnatha@mail.ru

The paper presents the results of the palaeoichthyological study of the core from fifteen boreholes drilled in the territory of the eastern part of the Pripyat Trough, Bobruysk Buried Ridge, Zhlobin Saddle and the northwestern slope of the Voronezh Antecline. Some references with data of the Devonian ichthyofauna within the investigated area are cited to complete the information. The vertebrate assemblages and guide taxa of the agnathans and fishes that have been established were used to make the stratigraphic division of the Devonian deposits. Apart from that data of vertebrates were used to correlate these deposits with the synchronous sediments developed both in the territory of Belarus and abroad, namely, in the adjacent territories of Ukraine, Russia and the Baltic States. The paper supplements the previously known composition of the stratigraphic vertebrate assemblages of the Lower, Middle and Upper Devonian in this area and provides their full list and stratigraphic distribution, as well as considers their facies restrictions. The Stratigraphic Chart of the Devonian deposits of Belarus (2010) has been taken as a stratigraphic basis of the division of the Devonian deposits in the studied area.

INTRODUCTION

Devonian deposits are widespread in the eastern and southeastern parts of Belarus (Geology of Belarus, 2001). Tectonically, these are confined to the Pripyat Trough, Bobruysk Buried Ridge, the southern part of the Orsha Depression, Zhlobin and Bragin-Loev Saddles and the northwestern slope of the Voronezh Antecline. Devonian sediments are represented by all three series: Lower, Middle and Upper ones (Stratigraphic..., 2010). The Lower Series includes deposits of the Vitebsk Regional Stage of the Emsian Stage. The Middle Devonian (Eifelian Stage) is represented by the Adrov, Osveya, Gorodok, Kostyukovich Regional Stages and the Givetian Stage is represented by the Polotsk and Ubor Regional Stages. Deposits of the Upper Series are represented within the considered territory by the Frasnian and Famennian Stages. Deposits of the Famennian Stage are not considered in this paper because the vertebrates have not been studied from them. Frasnian deposits in the studied territory are represented by the Zhelon, Sargaevo, Semiluki, Rechitsa, Voronezh Regional Stages, Evlanov Regional Superstage and Chernin Regional Stage. The ichthyofauna was studied well enough only from deposits of the Zhelon, Sargaevo and Rechitsa Regional Stages. The Middle Devonian deposits are mostly common in the studied area.

The stratigraphic division of the Devonian deposits was justified there by the brachiopods, conodonts, vertebrates, miospores and others organic remains (Geology of Belarus, 2001). However, for the division of terrigenous and carbonate-terrigenous rocks in the considered territory, besides miospores, the agnathans and fishes are primary importance. These are quite common in the sedimentary deposits of the above-mentioned series and are represented by two large groups (subclasses) of agnathans – thelodonts and heterostracans and four classes of fishes – the acanthodians, placoderms, chondrichthyans and osteichthyans.

The vertebrates are found mainly as discrete skeleton elements: scales, fin spines, teeth, tesserae, dentine tubercles, isolated plates of exoskeleton, etc. Despite the discrete material and the lack of articulated skeleton elements in it, it is of great importance for the stratigraphy. The established ichthyofaunas allow a sufficiently accurate age determination of the enclosing rocks and their division and correlation with coeval deposits in well-studied areas of the East European Platform. Deposits that do not contain vertebrates were divided on the basis of data available of the other groups of fossil organisms, as well as by involving logging data, the material composition of rocks and their stratigraphic position in the section.

ICHTHYOASSEMBLAGES AND STRATIGRAPHY OF THE DEVONIAN DEPOSITS OF THE STUDIED AREA

The palaeoichthyological study of deposits from sections of the boreholes drilled in the territory of the eastern part of the Pripyat Trough (Azeretskaya 2p, Antonovskaya P1, Babinets P28), Bobruysk Burial Ridge (Osipovichi 6, Bobruysk 691/2), Zhlobin Saddle (Luchin 753, Luchin 763; Luchin 772д, Zhlobin 389, Rogachev 736, Rogachev 732, Berdyzh 1) and the northwestern slope of the Voronezh Anticline (Khotimsk 1, Svetilovichi 7, Svetilovichi 18) provided the factual data, which analysis allowed the author to identify the vertebrate assemblages and to use them to date and divide the rocks of the Lower, Middle and Upper Devonian (Text-Figure 1).

The paper contains a Table showing the generalized data on the stratigraphic distribution of the Devonian ichthyofauna in the studied area based on the studies and the literature information (Plaksa, 2005; 2006; 2007; Plax, 2008a; 2008b; 2009; 2012; 2013 2014a; 2014b), as well as the plates (Plates I, II, III, IV and V) demonstrating some skeleton elements of the agnathans and fishes. The ichthyofauna and stratigraphy of the above-named borehole sections are described below.

So, the representative ichthyoassemblage of the Lepel Beds of the **Vitebsk Regional Stage** of the Upper Emsian Substage of the Lower Devonian was established in two boreholes: Osipovichi 6 (depth range of 105.8 to 124.0 m) (Text-Figure 2) and Berdyzh 1 (depth range of 403.6 to 431.0 m) (Text-Figure 3), and some single finds of vertebrates were found in the core of the boreholes: Bobruysk 691/2 (depth range of 229.0 to 249.1 m), Rogachev 736 (depth 293.0 m), Luchin 763 (depth 236.8 m) and Luchin 772 д (depth 249.8 m). The taxonomic composition of the vertebrates of this Regional Stage is quite diverse. The acanthodians are mainly dominant, placoderms are less numerous, thelodonts, heterostracans, chondrichthyans and osteichthyans are few in number. The thelodonts are represented by scales of the zonal species of *Skamolepis fragilis* Kar.-Tal. The heterostracans are represented by dentine tubercles of *Psammosteiformes* gen. et sp. indet. and fragments of the plates of *Schizosteus* sp.; placoderms – by isolated small fragments of the plates, a fragment of the left anterior ventral plate, preorbital plates, a fragment of the right paranuchal plate of cf. *Diadsomaspis*, a fragment of the right paranuchal plate of *Euarthrodira* gen. indet., separate small fragments of plates of *Phlyctaeniina* gen. indet., a fragment of the left paranuchal plate of *Actinolepididae* gen. indet., a small plate fragment of *Ptyctodontida* gen. indet., the left mixilateral plate of *Antiarcha* gen. nov. Plax, plate fragments of

Holonematidae gen. indet., *Placodermi* indet., small plate fragments of the distal part of the pectoral fin of *Antiarcha* gen. indet., isolated tubercles of *Acanthothoraci* gen. indet. Isolated scales and fragments of fin spines of the acanthodians in the rock of the Vitebsk Regional Stage are abundant in quantity and diverse. The genera and species composition of the acanthodians are as follow: *Laliacanthus singularis* Kar.-Tal., *Cheiracanthus* sp., *C. crassus* Valiuk., *C. brevicostatus* Gross, *C. longicostatus* Gross, *Ptychodictyon ancestralis* Valiuk., *Rhadinacanthus primaris* Valiuk., *Cheiracanthoides* sp., *Acanthoides* ? sp. and *Haplacanthus* sp. The chondrichthyans in the deposits of this Regional Stage are very scarce and are represented by single scales of *Chondrichthyes* gen. et sp. indet., *Ctenacanth*-type scale. The osteichthyans (sarcopterygians and actinopterygians) occur more frequently than the placoderms, but are much fewer than the acanthodians in number and less diverse in the composition of taxa. There are scales of *Glyptolepis* sp., *?Heimania* sp., *Parolepis* sp., *Osteolepididae* gen. et sp. indet., *Cheirolepis* sp., *Actinopterygii* indet. and teeth of *Onychodus* sp., *Sarcopterygii* indet. Along with the vertebrates the rocks the Regional Stage contain miospores (Obukhovskaya, 1999), prints of phyllopoets and small fragments of shells of the inarticulate brachiopods.

The deposits of the Vitebsk Regional Stage in their ichthyofauna composition corresponds to the sediments of the Regional Stage of the same name in the territory of the Orsha Depression, Latvian Saddle and northeastern southeastern slopes of the Belarusian Anticline (Plax et al., 2008; Kruchek et al., 2012a. 2012b), Rēzekne Regional Stage (Formation) of the Baltic States (Kleesment et al., 1975; Lyarskaya, 1978; The Devonian..., 1981). In the central part of the East European Platform the Vitebsk Regional Stage corresponds to the lower part of the Ryazhsk Regional Stage (Novobasovo Beds) (Stratigraphic..., 2010).

The deposits of the **Adrov Regional Stage** of the Eifelian Stage of the Middle Devonian were established in three boreholes: Berdyzh 1 (depth range of 399.4 to 403.6 m), Khotimsk 1 (depth range of 510.0 to 522.6 m) (Text-Figure 4) and Rogachev 732 (depth range of 230 to 240 m). A rather rich assemblage of the vertebrates of this Regional Stage was found in the Khotimsk 1 borehole, an assemblage established in the Rogachev 732 borehole is somewhat poorer. It contains mainly placoderms, acanthodians, sarcopterygians, to a lesser degree, heterostracans, chondrichthyans and actinopterygians. The acanthodians in this assemblage are most abundant and diverse taxonomically. These are represented by scales of *Laliacanthus singularis* Kar.-Tal., *Cheiracanthus* sp., *C. longicostatus* Gross, *C. brevicostatus* Gross, *C. crassus* Valiuk.,



Text-Figure 1 – Location of the studied borehole sections with the representation of the basic tectonic structures (by R.G. Garetsky, R.E. Aizberg from Geology of Belarus, 2001). 1 – borehole sections in which ichthyofauna remains were found; fractures: 2 – superregional, 3 – regional and subregional, 4 – local. Boreholes: 1 – Osipovich 6; 2 – Bobruysk 691/2; 3 – Luchin 753; 4 – Luchin 763; 5 – Luchin 772д; 6 – Zhlobin 389; 7 – Rogachev 732; 8 – Rogachev 736; 9 – Berdyzh 1; 10 – Khotimsk 1; 11 – Svetilovich 18; 12 – Svetilovich 7; 13 – Azeretskaya 2p; 14 – Antonovskaya P1; 15 – Babinets P28.

Cheiracanthoides sp., *Nostolepis* sp., *Acanthoides* ? sp. and fin spines of *Haplacanthus marginalis* Ag., *Homacanthus* cf. *gracilis* (Eichw.), *Archaeacanthus* sp., *A. quadrisulcatus* Kade., *Acanthodii* gen. indet. From the above-mentioned list of taxa of the acanthodians the species of *Laliacanthus singularis* Kar.-Tal. is the zonal one for both for deposits of the Adrov Regional Stage, and Vitebsk Regional Stage. The heterostracans are represented by single dentine tubercles of *Psammosteiformes* gen. et sp. indet., mesomeric plates of *Schizosteus* sp. and small indefinable skeleton elements of *Heterostraci* indet. The placoderms are represented by plate fragments of *Holonematidae* gen. indet., *Byssacanthus* sp., *Placodermi* indet., small plates and scales of *Antiarcha* gen. indet., as well as a spinal plate of *Actinolepididae* gen. indet. The

chondrichthyans are shown by only rare Euselachian-type scales and *Ctenacanth*-type scales. The representatives of the sarcopterygians are scales of *Glyptolepis* sp., *Osteolepididae* gen. et sp. indet., teeth of *Onychodus* sp., *Sarcopterygii* indet. and fragments of indefinable bones and jaws of *Sarcopterygii* indet. The actinopterygians are quite rare and represented by scales of *Cheirolepis* sp. and *Actinopterygii* indet. Together with the vertebrates there are shells of lingulids and miospores in the deposits of this Regional Stage.

The age analogue of the Adrov Regional Stage in the territory of the Central Devonian Field is the upper part of the Ryazhsk Regional Stage (Osetrov Beds) of the Eifelian Stage which psammosteids of *Schizosteus heterolepis* (Preobr.) are known (The Devonian..., 1995; Stratigraphic..., 2010). In the territo-

Table continuation

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
(Ac) <i>Acanthoides</i> ? sp.																									
(Ac) <i>Acanthodii</i> gen. indet.																									
(Cb) <i>Ctenacanth</i> -type scale																									
(Ch) <i>Chondrichthyes</i> gen. et sp. indet.																									
(S) <i>Onychodus</i> sp.																									
(S) <i>Glyptolepis</i> sp.																									
(S) ? <i>Heimonia</i> sp.																									
(S) <i>Porolepis</i> sp.																									
(S) Osteolepididae gen. indet.																									
(S) Sarcopterygii indet.																									
(At) <i>Cheirolepis</i> sp.																									
(At) Actinopterygii indet.																									
(H) Heterostraci indet.																									
(P) <i>Byssacanthus</i> sp.																									
(Ac) <i>Nostolepis</i> sp.																									
(Ac) <i>Haplacanthus marginalis</i> Ag.																									
(Ac) <i>Homacanthus</i> cf. <i>gracilis</i> (Eichw.)																									
(Ac) <i>Haplacanthus</i> sp.																									
(Ac) <i>Archaeanthus</i> sp.																									
(Ac) <i>Archaeanthus quadrisulcatus</i> Nade																									
(Ch) Euselachian-type scale																									
(P) <i>Asterolepis</i> sp.																									
(Ac) <i>Psychodictyon rimosum</i> Gross																									
(At) <i>Orvikina vardiaensis</i> Gross																									
(H) <i>Pycnosteus</i> sp.																									
(H) <i>Ganosteus</i> sp.																									
(Ac) <i>Cheiracanthoides proprius</i> Valiuk.																									
(Ac) <i>Nostolepis kernavensis</i> Valiuk.																									
(At) <i>Orvikina</i> sp.																									
(H) <i>Schizosteus</i> ? sp.																									
(H) <i>Psammosteus</i> sp.																									
(H) <i>Psammosteus</i> ? sp.																									
(H) <i>Psammosteus</i> ? sp.																									
(H) <i>Ganosteus stellatus</i> Rohon																									
(P) <i>Asterolepis dellei</i> Gross																									
(P) Coccosteidae gen. indet.																									
(P) <i>Euarthrodra</i> gen. indet.																									
(Ac) <i>Psychodictyon</i> sp.																									

Table continuation

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
(Ac) <i>Diplacanthus</i> sp.																									
(Ac) <i>Diplacanthus gravis</i> Valiuk.																									
(Ac) <i>Diplacanthus carinatus</i> Gross																									
(Ac) <i>Rhadinacanthus</i> sp.																									
(Ac) <i>Hemacanthus gracilis</i> (Eichw.)																									
(Ac) <i>Devononchus</i> sp.																									
(Ac) <i>Devononchus concinnus</i> (Gross)																									
(Ch) <i>Protacrodus</i> sp.																									
(Ch) <i>Phoebodus</i> ? sp.																									
(Ch) <i>Protacrodus</i> ? sp.																									
(Al) <i>Moythomastia</i> ? sp.																									
(H) <i>Psammiosteus</i> sp.																									
(P) <i>Holonema</i> sp.																									
(P) <i>Actinolepis</i> sp.																									
(Ac) <i>Diplacanthus</i> cf. <i>gravis</i> Valiuk.																									
(Ac) <i>Gemelacanthus torosus</i> Plaksa																									
(S) <i>Laccognathus</i> sp.																									
(H) <i>Psammolepis paradaxa</i> Ag.																									
(P) <i>Asterolepis ornata</i> (Eichw.)																									
(H) <i>Psammiosteus praecursor</i> Obr.																									
(S) <i>Glyptolepis baltica</i> Gross																									
(P) <i>Asterolepis radiata</i> Rohon																									
(P) <i>Bothriolepis</i> sp.																									
(P) <i>Plauridosteus</i> sp.																									
(S) <i>Panderichthys</i> sp.																									
(S) <i>Holoptychius</i> sp.																									
(S) <i>Laccognathus panderi</i> Gross																									
(P) <i>Bothriolepis cf. cellulosa</i> (Pander)																									
(Al) <i>Moythomastia</i> sp.																									
(P) <i>Bothriolepis maxima</i> Gross																									
(Ac) <i>Devononchus laevis</i> (Gross)																									
(S) <i>Rhinodipterus</i> sp.																									
(S) <i>Holoptychius cf. nobilissimus</i> Ag.																									

Note – Zonal taxa are shown by bold italics.

Ac – Acanthodii, At – Actinopterygii, Ch – Chondrichthyes, H – Heterostraci, P – Placodermi, S – Sarcopterygii.

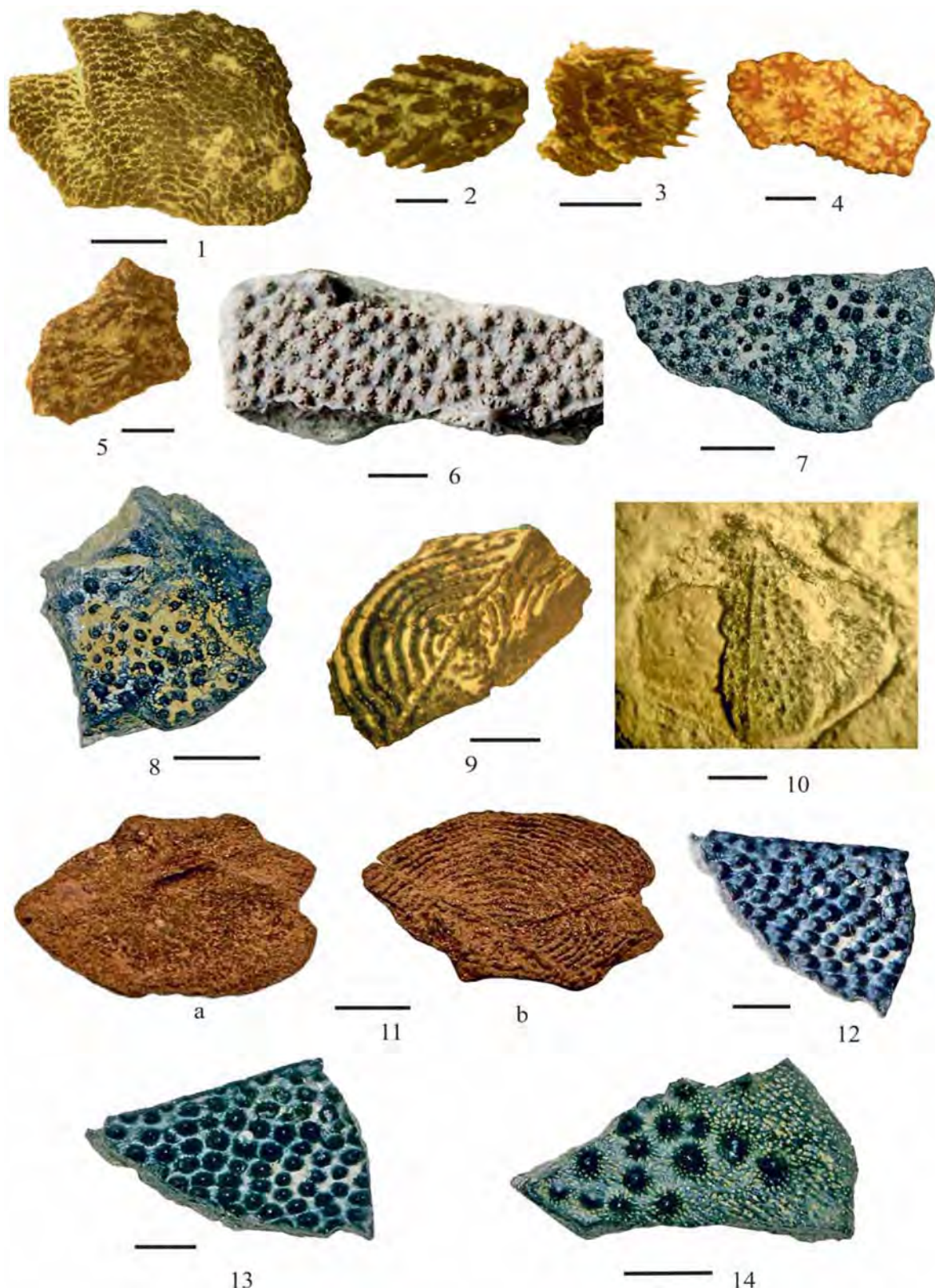


Plate I – Heterostracan exoskeleton elements and placoderm plate fragments from the Osipovichi 6, Berdyzh 1 and Svetilovichi 7 boreholes. The skeleton elements of agnathans and fishes are from the Emsian, Givetian and Frasnian Stages, Lower, Middle and Upper Devonian. Scale bar of 5 mm for Figures 7, 8, 10, 11 and 13; 4.5 mm for Figure 14; 3.5 mm for Figure 9; 2.5 mm for Figures 1 and 12; 2 mm for Figures 5 and 6; 1 mm for Figures 3 and 4; 0.5 mm for Figure 2.

Figure 1 – *Schizosteus* sp. Specimen N^o 44/1-2. Osipovich 6 borehole, depth 113.5 m, plate fragment in external view, Vitebsk Regional Stage, Lepel Beds. Figure 2 – *Psammolepis* ? sp. Specimen N^o 86/35-15a. Berdyzh 1 borehole, depth 230.8 m, scale in external view, Polotsk Regional Stage, Stolin Beds. Figure 3 – *Psammosteus* ? sp. Specimen N^o 86/36-8a. Berdyzh 1 borehole, depth 230.5 m, scale in external view Polotsk Regional Stage, Stolin Beds. Figure 4 – *Ganosteus* sp. Specimen N^o 86/35-2a. Berdyzh 1 borehole, depth 230.8 m, plate fragment in external view Polotsk Regional Stage, Stolin Beds. Figure 5 – *Ganosteus stellatus* Rohon Specimen N^o 86/36-9. Berdyzh 1 borehole, depth 230.5 m, plate fragment in external view Polotsk Regional Stage, Stolin Beds. Figure 6 – *Ganosteus stellatus* Rohon. Specimen N^o 4/4-4. Svetilovichi 7 borehole, depth 276.7 m, plate fragment in external view, Ubort Regional Stage. Figure 7 – *Euarthrodira* gen. indet. Specimen N^o 4/3-18. Svetilovichi 7 borehole, depth 246.5 m, plate fragment in external view, Zhelon Regional Stage. Figure 8 – *Euarthrodira* gen. indet. Specimen N^o 4/7-2. Svetilovichi 7 borehole, depth 246.7 m, plate fragment in external view, Zhelon Regional Stage. Figure 9 – cf. *Diadsumaspis*. Specimen N^o 44/1-6. Osipovich 6 borehole, depth 113.5 m, plate fragment in external view, Vitebsk Regional Stage, Lepel Beds. Figure 10 – *Actinolepididae* gen. indet. Specimen N^o 44/2-1. Osipovich 6 borehole, depth 113.8 m, fragment of the left paranuchal plate in external view, Vitebsk Regional Stage, Lepel Beds. Figure 11 – cf. *Diadsumaspis*. Specimen N^o 44/1-21. Osipovich 6 borehole, depth 118.8 m, fragment of the right paranuchal plate: a – in internal view, b – in external view, Vitebsk Regional Stage, Lepel Beds. Figure 12 – *Actinolepis* sp. Specimen N^o 4/6-13. Svetilovichi 7 borehole, depth 327.6 m, plate fragment in external view, Polotsk Regional Stage, Moroch Beds. Figure 13 – *Actinolepis* sp. Specimen N^o 4/6-14. Svetilovichi 7 borehole, depth 327.6 m, plate fragment in external view, Polotsk Regional Stage, Moroch Beds. Figure 14 – *Homostius* sp. Specimen N^o 4/6-19. Svetilovichi 7 borehole, depth 326.6 m, plate fragment in external view, Polotsk Regional Stage, Moroch Beds.

ry of the Main Devonian Field it is correlated with the Parnu Regional Stage, which is characterized by the identical ichthyofauna (Mark-Kurik, 2000; The Devonian..., 1981; Valiukevičius, Golubtsov, 1986). The Adrov Regional Stage of the studies area in its ichthyofauna composition is well correlated with the same-name Regional Stage that is widespread within the Orsha Depression, Latvian Saddle and the northeastern slopes of the Belarusian Antecline (Plax et al., 2008; Kruchek et al., 2012a).

The ichthyofauna of the Osveya Regional Stage of the Eifelian was determined in the boreholes Berdyzh 1 (depth range of 373.5 to 399.4 m) and Rogachev 732 (depth range of 197.8 to 230.0 m). The vertebrates are represented there by very few scales of *Cheiracanthus longicostatus* Gross, single scales of sarcopterygians of *Glyptolepis* sp. and *Osteolepididae* gen. indet. The age of the rocks of this Regional Stage was determined from miospores and its stratigraphic position in the section.

Within the territory of Belarus the Osveya Regional Stage in its ichthyofauna composition is generally correlated with the Vadja Regional Substage of the Narva Regional Stage of Lithuania (Valiukevičius, 1985; Valiukevičius, 1994; Mark-Kurik, 2000) and the Dorogobuzh Regional Stage of the Moscow Syncline (Stratigraphic..., 2010).

The vertebrates of the **Gorodok Regional Stage** of the Eifelian Stage are established in boreholes as follow: Berdyzh 1 (depth range of 328.7 to 373.5 m), Luchin 753 (depth range of 154 to 182 m) (Text-Figure 5), Rogachev 732 (depth range of 170.0 to 197.8 m). Taxonomically, the ichthyofauna which was found in deposits of this Regional Stage is not very diverse. Placoderms, acanthodians, sarcopterygians and actinopterygians were established there.

Fragments of the skeleton elements of placoderms, sarcopterygians and actinopterygians are quite few in number. The placoderms are represented by rare plate fragments of *Asterolepis* sp. Osteichthyans are represented by some scales of *Osteolepididae* gen. et sp. indet., *Orvikuina vardiaensis* Gross, *Actinopterygii* indet. and teeth of *Onychodus* sp., as well as of *Sarcopterygii* indet. and *Actinopterygii* indet. Several more common the acanthodians are represented by the scales of *Cheiracanthus* sp., *C. longicostatus* Gross, *Ptychodictyon rimosum* Gross, *Acanthoides* ? sp. and small fragments of fin spines of *Acanthodii* gen. indet. The species *Ptychodictyon rimosum* Gross included in this assemblage is the zonal one. Besides the vertebrates, the deposits of this Regional Stage contain single scolecodonts, shell fragments of lingulids, miospores.

Deposits of the Gorodok Regional Stage in its ichthyofauna composition is correlated with the sediments of the same-name Regional Stage developed in the territory of the Orsha Depression, Latvian Saddle, northeastern slopes of the Belarusian Antecline and western part of the Pripyat Trough (Plax et al., 2008; Plax, Kruchek, 2014), with deposits of the Leivu Regional Substage of the Narva Regional Stage of Lithuania, as well as with the Klintsov and Mosolovo Regional Stages of the Moscow Syncline (Valiukevičius, Golubtsov, 1986; Valiukevičius, 1994; Valiukevičius et al., 1995; Stratigraphic..., 2010; Mark-Kurik, 2000).

The agnathans and fishes of the **Kostyukovich Regional Stage** of the Eifelian Stage were established in four boreholes as follow: Berdyzh 1 (depth range of 320.9 to 328.7 m), Khotimsk 1 (depth range

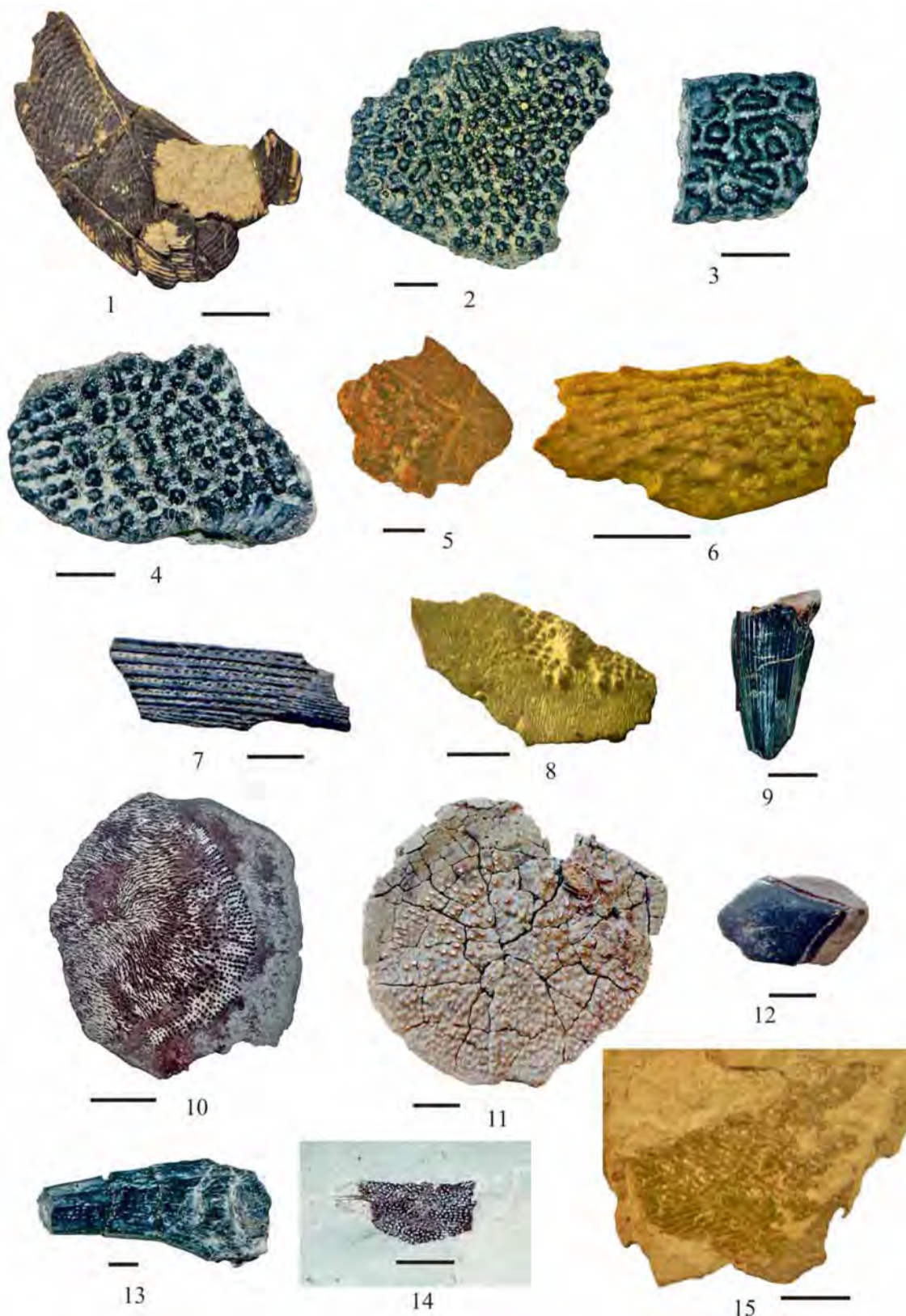


Plate II – Placoderm plate fragments, an acanthodian fin spine, as well as sarcopterygian scales and a teeth from the Osipovich 6, Bobruysk 691/2, Berdyzh 1, Azeretskaya 2p, Svetilovichi 7 and Svetilovichi 18 boreholes. The skeleton elements of fishes are from the Emsian, Givetian and Frasnian Stages, Lower, Middle and Upper Devonian. Scale bar of 1 cm for Figure 10; 8 mm for Figure 1; 5 mm for Figures 2, 3, 4, 9 and 5; 4 mm for Figure 6; 2.5 mm for Figures 12, 13, 14 and 15; 2 mm for Figures 7 and 8; 1.5 mm for Figure 5. Figure 1 – Holonematidae gen. indet. Specimen N^o 6/1-1. Rogachev 736 borehole, depth 293.0 m, plate fragment in external view, Vitebsk Regional Stage, Lepel Beds. Figure 2 – *Asterolepis radiata* Rohon. Specimen

№ 4/1-5. Svetilovichi 7 borehole, depth 225.8 m, plate fragment in external view, Zhelon Regional Stage. Figure 3 – *Bothriolepis* sp. Specimen № 4/3-22a. Svetilovichi 7 borehole, depth 246.5 m, plate fragment in external view, Zhelon Regional Stage. Figure 4 – *Asterolepis radiata* Rohon. Specimen № 4/1-7a. Svetilovichi 7 borehole, depth 225.8 m, plate fragment in external view, Zhelon Regional Stage. Figure 5 – *Asterolepis* sp. Specimen № 86/34-15. Berdyzh 1 borehole, depth 231.2 m, plate fragment in external view, Polotsk Regional Stage, Stoln beds. Figure 6 – *Asterolepis dellei* Gross Specimen № 86/34-7a. Berdyzh 1 borehole, depth 231.2 m, plate fragment in external view, Polotsk Regional Stage, Stoln beds. Figure 7 – *Gomelacanthus torosus* Plaksa. Holotype № 17/1-1. Svetilovichi 18 borehole, depth 204.6 m, fragment of fin spine, Polotsk Regional Stage, Moroch beds. Figure 8 – ? *Heimania* sp. Specimen № 44/1-4. Osipovichi 6 borehole, depth 113.5 m, scale fragment in external view, Vitebsk Regional Stage, Lepel Beds. Figure 9 – Sarcopterygii indet. Specimen № 4/3-15. Svetilovichi 7 borehole, depth 246.5 m, tooth in lateral view, Zhelon Regional Stage. Figure 10 – *Glyptolepis* sp. Specimen № 86/36-1. Berdyzh 1 borehole, depth 230.5 m, scale in external view, Polotsk Regional Stage, Stoln beds. Figure 11 – *Laccognathus* sp. Specimen № 2/3-1. Azeretskaya 2p borehole, depth 2938.3 m, scale in external view, Polotsk Regional Stage, Moroch beds. Figure 12 – Osteolepididae gen. indet. Specimen № 4/5-7. Svetilovichi 7 borehole, depth 281.3 m, scale in external view, Ubor Regional Stage. Figure 13 – Sarcopterygii indet. Specimen № 4/1-9. Svetilovichi 7 borehole, depth 225.8 m, tooth in lateral view, Zhelon Regional Stage. Figure 14 – Actinopterygii indet. Specimen № 19/1-1. Bobruysk 691/2 borehole, depth 234.5 m, fragment of the cranial bone in external view, Vitebsk Regional Stage, Lepel Beds. Figure 15 – Actinopterygii indet. Specimen № 44/2-7. Osipovichi 6 borehole, depth 113.8 m, fragment of the tail part of fish in external view, Vitebsk Regional Stage, Lepel Beds.

of 390.8 to 415.0 m), Luchin 753 (depth range of 136.6 to 154.0 m), Rogachev 732 (depth range of 157 to 170 m). These are more diverse taxonomically, than the vertebrates from deposits of the Gorodok Regional Stage. The heterostracans identified there are *Pycnosteus* sp., *Ganosteus* sp., *Psammosteiformes* gen. et sp. indet. The acanthodians are represented by scales of *Cheiracanthoides* sp., *C. proprius* Valiuk., *Nostolepis kernavensis* Valiuk., *Acanthoides* ? sp.; placoderms – by mesomeric plate fragments of *Asterolepis* sp., small fragments of plates from the distal part of the pectoral fin of *Antiarcha* gen. indet.; sarcopterygians – by teeth of *Onychodus* sp., Sarcopterygii indet. and scales of *Glyptolepis* sp., Osteolepididae gen. indet., the actinopterygians – by scales of *Orvikuina* sp., Actinopterygii indet. The acanthodians form the dominant group of fishes. The representatives of the sarcopterygians occur more rarely; representatives of the heterostracans, placoderms and actinopterygians are even fewer in number. The guide species of the vertebrates for just this stratigraphic level are *Nostolepis kernavensis* Valiuk. and *Cheiracanthoides proprius* Valiuk. Along with the vertebrates the rocks of this Regional Stage contain shells of inarticulate brachiopods, scolecodonts, conodonts and miospores.

The deposits of the Kostyukovichi Regional Stage are correlated in their ichthyofauna composition with the sediments of the same-name Regional Stage which are widespread in the territory of the Orsha Depression, Latvian Saddle, northeastern slopes of the Belarusian Antecline and western part of the Pripyat Trough (Plax et al., 2008; Plax, Kruchek, 2014), with deposits of the Veliky Most Subformation of the lower part of the Lopushany Formation of the Eifelian Stage in the Volyn-Podolia

region (Plax, 2011), with deposits of the Chernyi Yar Regional Stage in the Central Devonian Field (Russia) (Valiukevičius, Kruchek, 2000), with rocks of the Kernavė Regional Substage of the Narva Regional Stage in the territory of Lithuania (Valiukevičius, 1985; Valiukevičius, Golubtsov, 1986; Valiukevičius, Kruchek, 2000).

The vertebrates from the deposits of the **Goryn Beds** of the Polotsk Regional Stage of the Givetian Stage of the Middle Devonian have not been established in the studied territory. Therefore, the age of deposits of these beds in the borehole sections was determined from the data on miospores with involvement of the rock material composition and stratigraphic position in the section, as well as by comparison of their log data with the palaeontologically studied borehole sections from the adjacent territories.

An abundant and taxonomically diverse ichthyofauna in deposits of the **Stoln Beds** of the Polotsk Regional Stage of the Givetian Stage was found only in the Berdyzh 1 borehole (depth range of 229.9 to 277.0 m). There are dentine tubercles, tesseræ, scales and plate fragments of the following taxa of the heterostracans: *Pycnosteus* sp., *Schizosteus* ? sp., *Psammolepis* sp., *Psammolepis* ? sp., *Psammosteus* ? sp., *Ganosteus* sp., *G. stellatus* Rohon, *Psammosteiformes* gen. et sp. indet. Remains of the exoskeleton of the placoderms are there rather abundant. These are represented by small fragments of plates of the distal part of the pectoral fin of *Antiarcha* gen. indet., scales and small plates of *Antiarcha* gen. indet., a triter of *Ptyctodontida* gen. indet., small plates and a fragment of the medio-ventral plate of *Asterolepis* sp., plates of *Asterolepis dellei* Gross, Holonematidae

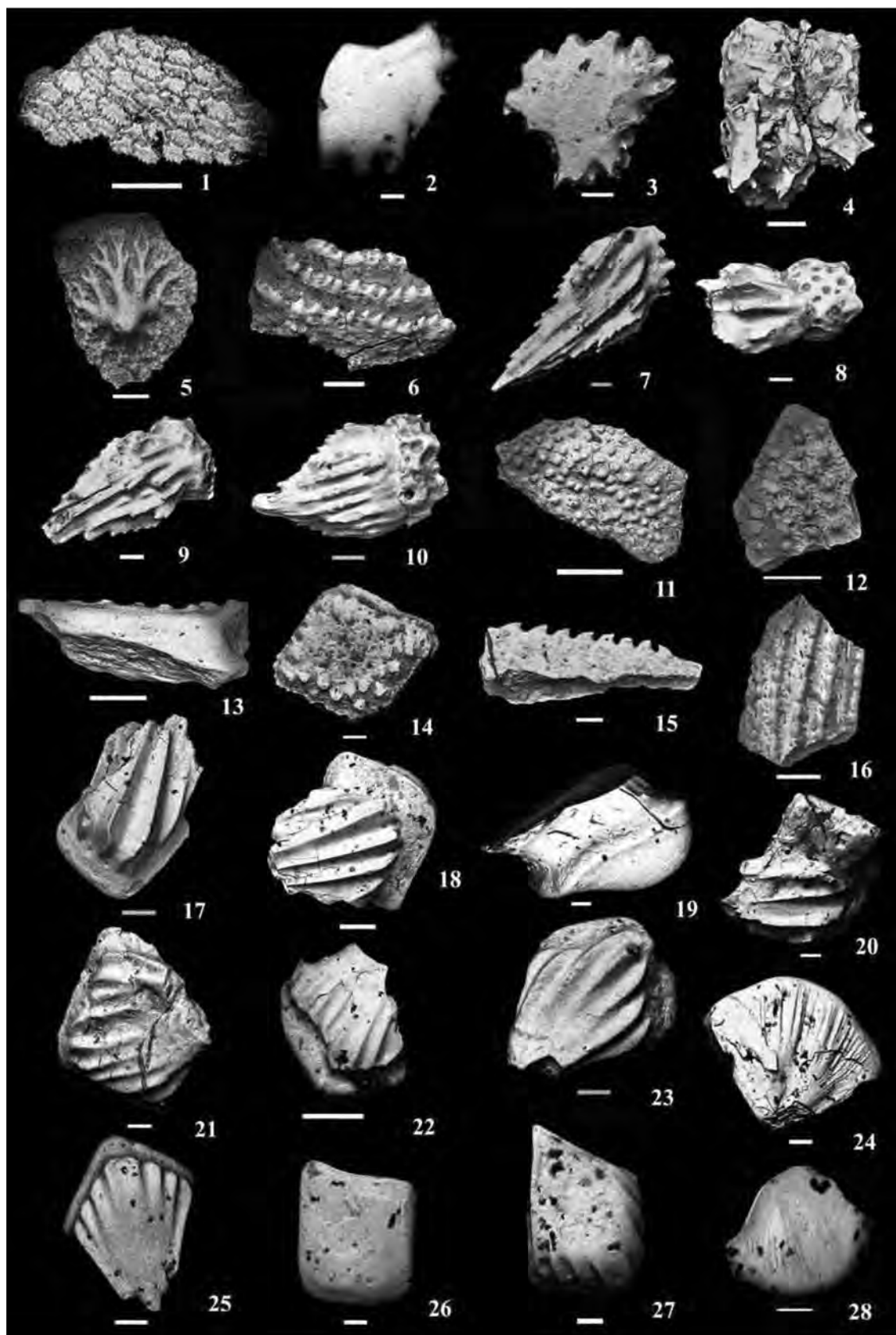


Plate III – Heterostracan plate fragments and dentine tubercles, placoderm skeleton elements, as well as acanthodian scales from the Luchin 772д, Luchin 763, Berdyzh 1, Bobruysk 961/2 and Khotimsk 1 boreholes. The skeleton elements of fishes are from the Emsian, Eifelian and Givetian Stages, Lower and Middle Devonian. Scale bar of 1 mm for Figures 1, 5, 11, 12 and 13; 500 μ m for Figures 6 and 16; 200 μ m for

Figures 4, 10, 14, 15, 17, 18 and 25; 100 μm for Figure 2, 3, 7, 8, 9, 19, 21, 20; 22, 23, 24, 26, 27 and 28. Figure 1 – *Schizosteus* sp. Specimen N^o86/3-1a. Berdyzh 1 borehole, depth 407.0 m, $\times 25$, plate fragment in external view, Vitebsk Regional Stage, Lepel Beds. Figure 2 – *Psammosteiformes* gen. indet. Specimen N^o 84/2-10g. Khotimsk 1 borehole, depth 511.2 m, $\times 100$, dentine tubercle, top view, Adrov Regional Stage. Figure 3 – *Psammosteiformes* gen. indet. Specimen N^o 86/2-2f. Berdyzh 1 borehole, depth 411.0 m, $\times 150$, dentine tubercle, top view, Vitebsk Regional Stage, Lepel Beds. Figure 4 – *Psammosteiformes* gen. indet. Specimen N^o 60/17a-3a. Luchin 763 borehole, depth 236.8 m, $\times 75$, plate fragment in external view, Vitebsk Regional Stage, Lepel Beds. Figure 5 – *Ganosteus* sp. Specimen N^o 86/35-14a. Berdyzh 1 borehole, depth 230.8 m, $\times 18$, dentine tubercle, top view, Polotsk Regional Stage, Stolin beds. Figure 6 – *Phlyctaeniina* gen. indet. Specimen N^o 59/6-2a. Bobruysk 691/2 borehole, depth 233.0 m, $\times 35$, plate fragment in external view, Vitebsk Regional Stage, Lepel Beds. Figure 7 – *Acanthothoraci* gen. indet. Specimen N^o 86/2a-4a. Berdyzh 1 borehole, depth 410.0 m, $\times 100$, isolated tubercle in external view, Vitebsk Regional Stage, Lepel Beds. Figure 8 – *Acanthothoraci* gen. indet. Specimen N^o 86/2a-4d. Berdyzh 1 borehole, depth 410.0 m, $\times 100$, isolated tubercle in external view, Vitebsk Regional Stage, Lepel Beds. Figure 9 – *Acanthothoraci* gen. indet. Specimen N^o 86/2a-4b. Berdyzh 1 borehole, depth 410.0 m, $\times 100$, isolated tubercle in external view, Vitebsk Regional Stage, Lepel Beds. Figure 10 – *Acanthothoraci* gen. indet. Specimen N^o 86/2a-4c. Berdyzh 1 borehole, depth 410.0 m, $\times 80$, isolated tubercle in external view, Vitebsk Regional Stage, Lepel Beds. Figure 11 – *Euarthrodira* gen. indet. Specimen N^o 84/4-1a. Khotimsk 1 borehole, depth 512.6 m, $\times 25$, plate fragment in external view, Adrov Regional Stage. Figure 12 – *Coccosteidae* gen. indet. Specimen N^o 61/18-3a. Luchin 772д borehole, depth 249.8 m, $\times 25$, plate fragment in external view, Vitebsk Regional Stage, Lepel Beds. Figure 13 – *Antiarcha* gen. indet. Specimen N^o 84/2-11a. Khotimsk 1 borehole, depth 511.2 m, $\times 25$, plate fragment from a pectoral fin, Adrov Regional Stage. Figure 14 – *Antiarcha* gen. indet. Specimen N^o 86/31-9a. Berdyzh 1 borehole, depth 231.7 m, $\times 60$, scale in crown view, Polotsk Regional Stage, Stolin beds. Figure 15 – *Antiarcha* gen. indet. Specimen N^o 86/33-4a. Berdyzh 1 borehole, depth 231.5 m, $\times 65$, plate fragment from a pectoral fin, Polotsk Regional Stage, Stolin beds. Figure 16 – *Holonematidae* indet. Specimen N^o 61/18-2a. Luchin 772д borehole, depth 249.8 m, $\times 40$, plate fragment in external view, Vitebsk Regional Stage, Lepel Beds. Figure 17 – *Laliacanthus singularis* Kar.-Tal. Specimen N^o 84/2-10f. Khotimsk 1 borehole, depth 511.2 m, $\times 70$, scale in crown view, Adrov Regional Stage. Figure 18 – *Laliacanthus singularis* Kar.-Tal. Specimen N^o 84/2-10q. Khotimsk 1 borehole, depth 511.2 m, $\times 80$, scale in crown view, Adrov Regional Stage. Figure 19 – *Laliacanthus singularis* Kar.-Tal. Specimen N^o 84/2-10t. Khotimsk 1 borehole, depth 511.2 m, $\times 100$, scale in lateral view, Adrov Regional Stage. Figure 20 – *Laliacanthus singularis* Kar.-Tal. Specimen N^o 84/4-3g. Khotimsk 1 borehole, depth 512.6 m, $\times 100$, scale in crown view, Adrov Regional Stage. Figure 21 – *Cheiracanthoides* sp. Specimen N^o 84/4-3p. Khotimsk 1 borehole, depth 512.6 m, $\times 100$, scale in crown view, Adrov Regional Stage. Figure 22 – *Cheiracanthoides* sp. Specimen N^o 84/2-10h. Khotimsk 1 borehole, depth 511.2 m, $\times 50$, scale in crown view, Adrov Regional Stage. Figure 23 – *Nostolepis* sp. Specimen N^o 84/4-3m. Khotimsk 1 borehole, depth 512.6 m, $\times 150$, scale in crown view, Adrov Regional Stage. Figure 24 – *Cheiracanthus* sp. Specimen N^o 84/2-10u. Khotimsk 1 borehole, depth 511.2 m, $\times 100$, scale in crown view, Adrov Regional Stage. Figure 25 – *Nostolepis* sp. Specimen N^o 84/2-10b. Khotimsk 1 borehole, depth 511.2 m, $\times 70$, scale in crown view, Adrov Regional Stage. Figure 26 – *Acanthoides* ? sp. Specimen N^o 86/2-2d. Berdyzh 1 borehole, depth 411.0 m, $\times 100$, scale in crown view, Vitebsk Regional Stage. Figure 27 – *Nostolepis* sp. Specimen N^o 84/2-10n. Khotimsk 1 borehole, depth 511.2 m, $\times 100$, scale in crown view, Adrov Regional Stage. Figure 28 – *Cheiracanthus* sp. Specimen N^o 86/2a-1b. Berdyzh 1 borehole, depth 410.0 m, $\times 200$, scale in crown view, Vitebsk Regional Stage, Lepel Beds.

gen. indet., *Coccosteidae* gen. indet., *Placodermi* indet., fin spines of *Byssacanthus* sp., small infragathal plate of *Euarthrodira* gen. indet., one spinal plate of *Actinolepididae* gen. indet. The acanthodians established in the rocks of these beds and represented by scales and ichthyodorulites, are the most taxonomically diverse vertebrates. There are known scales of *Ptychodictyon* sp., *Cheiracanthus* sp., *C. longicostatus* Gross, *C. brevicostatus* Gross, *Diplacanthus* sp., *D. gravis* Valiuk., *D. carinatus* Gross, *Rhadinacanthus* sp., *Acanthoides* ? sp. and fin spines of *Archaeacanthus* sp., *Haplacanthus* sp., *H. marginalis* Ag., *Homacanthus gracilis* (Eichw.), *Devononchus* sp., *D. concinnus* (Gross), *Acanthodii* gen. indet. Among the representatives of the acanthodians there are the zonal species of *Diplacanthus gravis* Valiuk., which can characterize the deposits of the Polotsk Regional Stage in general. The chon-

drichthyans are few in number and represented by scales of *Chondrichthyes* gen. et sp. indet., as well as teeth of *Protacrodus* sp., *Protacrodus* ? sp., *Phoebodus* ? sp. The osteichthyans are rather abundant. These are represented by a small fragment of a jaw of *Sarcopterygii* indet., scales of *Glyptolepis* sp., *Osteolepididae* gen. et sp. indet., *Cheirolepis* sp., *Orvikuina* sp., *O. vardiaensis* Gross, *Moythomasia* ? sp., *Actinopterygii* indet. and teeth of *Onychodus* sp., *Sarcopterygii* indet. Besides the vertebrates, the shells of lingulids, plant remains and miospores have been identified the rocks of the Stolin Beds.

The vertebrates of the **Moroch Beds** of the Polotsk Regional Stage of the Givetian Stage were found in the boreholes as follow: Azeretskaya 2p (depth range of 2884 to 2950 m), Berdyzh 1 (depth range of 215.5 to 229.9 m), Svetilovichi 18 (depth range of 204.4 to 239.5 m) and Svetilovichi 7

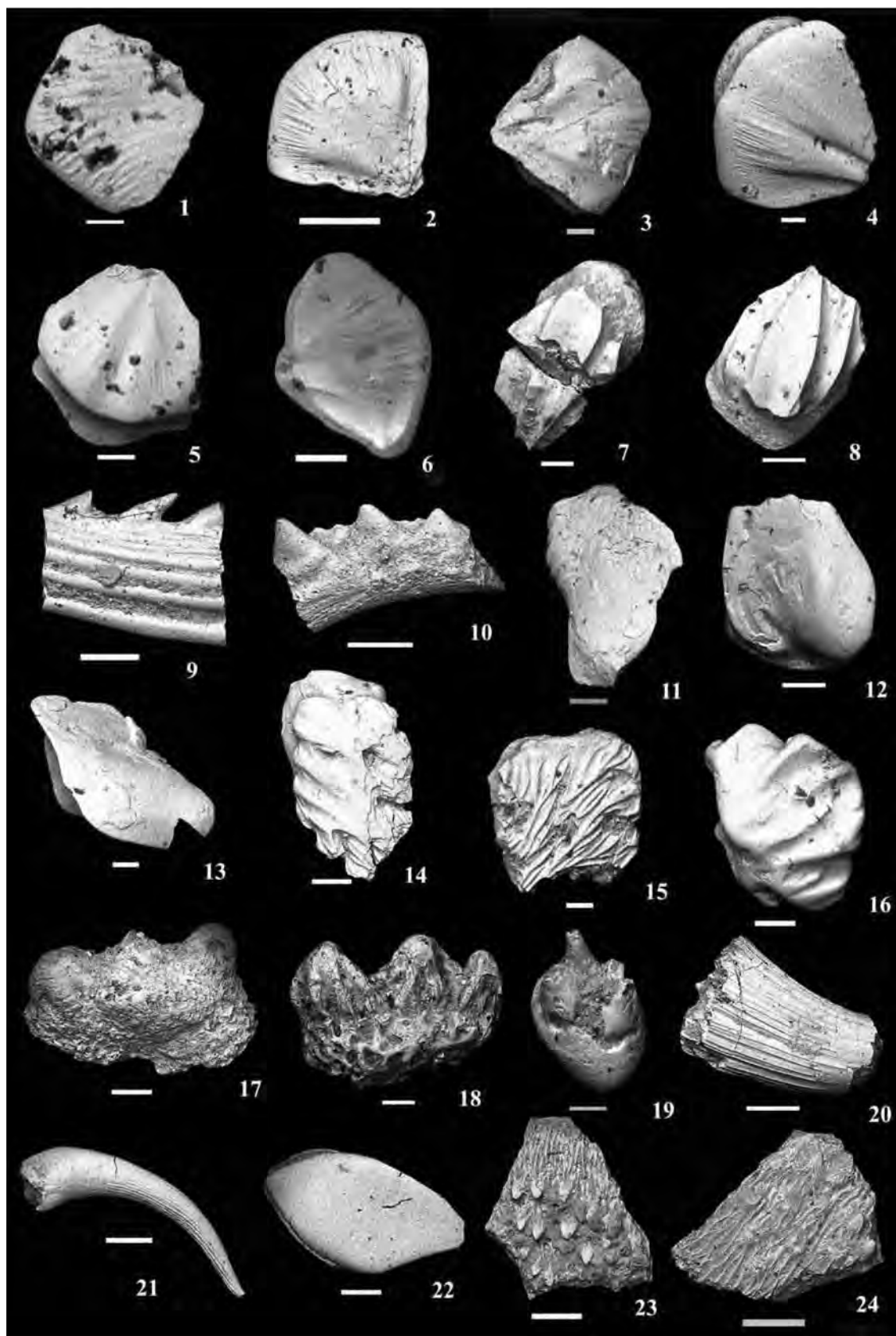


Plate IV – Acanthodian scales, fin spine fragment and jaw fragment, chondrichthyan and sarcopterygian scales and teeth from the Luchin 753, Luchin 763, Berdyzh 1, Bobruysk 961/2 and Khotimsk 1 boreholes. The skeleton elements of fishes are from the Emsian, Eifelian and Givetian Stages, Lower and Middle Devonian. Scale bar of 1 mm for Figures 10; 500 μ m for Figures 2, 9, 17, 20, 21, 22, 23 and 24; 200 μ m for Figures 8, 11, 12, 14, 18 and 19; 100 μ m for Figure 1, 3, 4, 5, 6, 7, 13, 15 and 16.

Figure 1 – *Rhadinacanthus primaris* Valiuk. Specimen № 86/2a-7a. Berdyzh 1 borehole, depth 410.0 m, ×150, scale in crown view, Vitebsk Regional Stage, Lepel Beds. Figure 2 – *Cheiracanthus* sp. Specimen № 84/2-10e. Khotimsk 1 borehole, depth 511.2 m, ×50, scale in crown view, Adrov Regional Stage. Figure 3 – *Cheiracanthus longicostatus* Gross. Specimen № 86/2-2g. Berdyzh 1 borehole, depth 411.0 m, ×100, scale in crown view, Vitebsk Regional Stage, Lepel Beds. Figure 4 – *Cheiracanthus longicostatus* Gross. Specimen № 86/3-3a. Berdyzh 1 borehole, depth 407.0 m, ×100, scale in crown view, Vitebsk Regional Stage, Lepel Beds. Figure 5 – *Cheiracanthus brevicostatus* Gross. Specimen № 86/2a-1c. Berdyzh 1 borehole, depth 410.0 m, ×150, scale in anterior crown view, Vitebsk Regional Stage, Lepel Beds. Figure 6 – *Cheiracanthus* sp. Specimen № 60/17a-1d. Luchin 763 borehole, 236.8 m, ×200, scale in crown view, Vitebsk Regional Stage, Lepel Beds. Figure 7 – *Nostolepis kernavensis* Valiuk. Specimen № 89/10-1b. Luchin 753 borehole, 136.7 m, ×130, scale in crown view, Kostyukovichi Regional Stage. Figure 8 – *Nostolepis kernavensis* Valiuk. Specimen № 89/11-1a. Luchin 753 borehole, 136.6 m, ×90, scale in crown view, Kostyukovichi Regional Stage. Figure 9 – *Homacanthus gracilis* (Eichw.). Specimen № 86/31-1a. Berdyzh 1 borehole, depth 231.7 m, ×50, fragment of the fin spine in lateral view, Polotsk Regional Stage, Stolin beds. Figure 10 – *Ischnacanthiformes* gen. indet. Specimen № 86/35-1b. Berdyzh 1 borehole, depth 230.8 m, ×25, jaw fragment in lateral view, Polotsk Regional Stage, Stolin beds. Figure 11 – Euselachian-type scale. Specimen № 84/2-10ч. Khotimsk 1 borehole, depth 511.2 m, ×70, scale in crown view, Adrov Regional Stage. Figure 12 – Euselachian-type scale. Specimen № 84/2-10и. Khotimsk 1 borehole, depth 511.2 m, ×90, scale in crown view, Adrov Regional Stage. Figure 13 – Euselachian-type scale. Specimen № 84/2-10o. Khotimsk 1 borehole, depth 511.2 m, ×100, scale in lateral view, Adrov Regional Stage. Figure 14 – Ctenacanth-type scale. Specimen № 84/2-10п. Khotimsk 1 borehole, depth 511.2 m, ×75, scale in crown view, Adrov Regional Stage. Figure 15 – Ctenacanth-type scale. Specimen № 86/3-3b. Berdyzh 1 borehole, depth 407.0 m, ×100, scale in crown view, Vitebsk Regional Stage, Lepel Beds. Figure 16 – Ctenacanth-type scale. Specimen № 59/4-2c. Bobruysk 691/2 borehole, depth 229.5 m, ×150, scale in crown view, Vitebsk Regional Stage, Lepel Beds. Figure 17 – *Protacrodus* ? sp. Specimen № 86/35-1a. Berdyzh 1 borehole, depth 230.8 m, ×35, tooth in lateral view, Polotsk Regional Stage, Stolin beds. Figure 18 – *Protacrodus* sp. Specimen № 86/35-1c. Berdyzh 1 borehole, depth 230.8 m, ×70, tooth in lateral view, Polotsk Regional Stage, Stolin beds. Figure 19 – Sarcopterygii indet. Specimen № 86/27-3a. Berdyzh 1 borehole, depth 234.0 m, ×80, element from a palate part, Polotsk Regional Stage, Stolin beds. Figure 20 – Sarcopterygii indet. Specimen № 89/10-1a. Luchin 753 borehole, 136.7 m, ×50, tooth in lateral view, Kostyukovichi Regional Stage. Figure 21 – *Onychodus* sp. Specimen № 86/2a-5a. Berdyzh 1 borehole, depth 410.0 m, ×45, tooth in lateral view, Vitebsk Regional Stage, Lepel Beds. Figure 22 – Osteolepididae gen. indet. Specimen № 86/13-3a. Berdyzh 1 borehole, depth 340.0 m, ×35, scale in crown view, Gorodok Regional Stage. Figure 23 – *Glyptolepis* sp. Specimen № 86/2-5a. Berdyzh 1 borehole, depth 411.0 m, ×40, fragment of scale in external view, Vitebsk Regional Stage, Lepel Beds. Figure 24 – *Glyptolepis* sp. Specimen № 86/2-5b. Berdyzh 1 borehole, depth 411.0 m, ×50, fragment of scale in external view, Vitebsk Regional Stage, Lepel Beds.

(depth range of 297.4 to 340.0 m). These are represented here by an assemblage very depleted taxonomically and few or in number as compared with the Stolin one. The psammosteids are represented here by small plate fragments of *Pycnosteus* sp. and *Psammosteus* sp.; the placoderms – by isolated plate fragments of *Asterolepis* sp., *Byssacanthus* sp., *Holonema* sp., *Homostius* sp., *Actinolepis* sp. and *Antiarcha* gen. indet. There are very few acanthodians. These are scales of *Diplacanthus* cf. *gravis* Valiuk., *Cheiracanthus* sp., *Acanthoides* ? sp. and a fin spine of *Gomelacanthus torosus* Plaksa. The finds of scales and teeth of the sarcopterygians (*Glyptolepis* sp., *Onychodus* sp., *Laccognathus* sp., Osteolepididae gen. indet. and Sarcopterygii indet.) are more numerous. Invertebrates are represented by lingulids. Among the plant remains in the rocks these beds miospores and carbonified plant remains can be mentioned.

In the composition of the acanthodians the Polotsk Regional Stage of the Givetian Stage of the Middle Devonian corresponds, in general, to the *Diplacanthus gravis* zone (Valiukevičius, 1994; Valiukevičius et al., 1995; Valiukevičius, Kruchek, 2000).

The Goryn beds and the lower part of the Stolin Beds of the Polotsk Regional Stage are age analogues of the Arukūla Regional Stage of the Givetian Stage of the Middle Devonian of the Main Devonian Field (The Devonian..., 1981; Mark-Kurik, 2000; Ivanov and Lebedev, 2011). The upper part of the Stolin Beds and the Moroch Beds are correlated with the Burtneki Regional Stage of the Givetian Stage of the Middle Devonian of the Main Devonian Field. The upper part of the Stolin Beds correspond to the *Asterolepis dellei* zone of placoderms and to the *Pycnosteus tuberculatus* zone of heterostracans, and the Moroch Beds correspond in their placoderm composition to the *Microbrachius* zone. In the central regions of the East European Platform the Polotsk Regional Stage shows a correlation with the Vorob'ev, Ardatov and Mullin Regional Stages of the Staryi Oskol Regional Superstage of the Givetian Stage of the acanthodian zone of *Diplacanthus gravis* (Valiukevičius, Kruchek, 2000), and in the Volyn-Podolia region – with the Podliptsy Subformation of the upper part of the Lopushany Formation, the Pelcha, Kryzhov and Batyatykh Formations (Plax, 2011). It should also be noted that de-

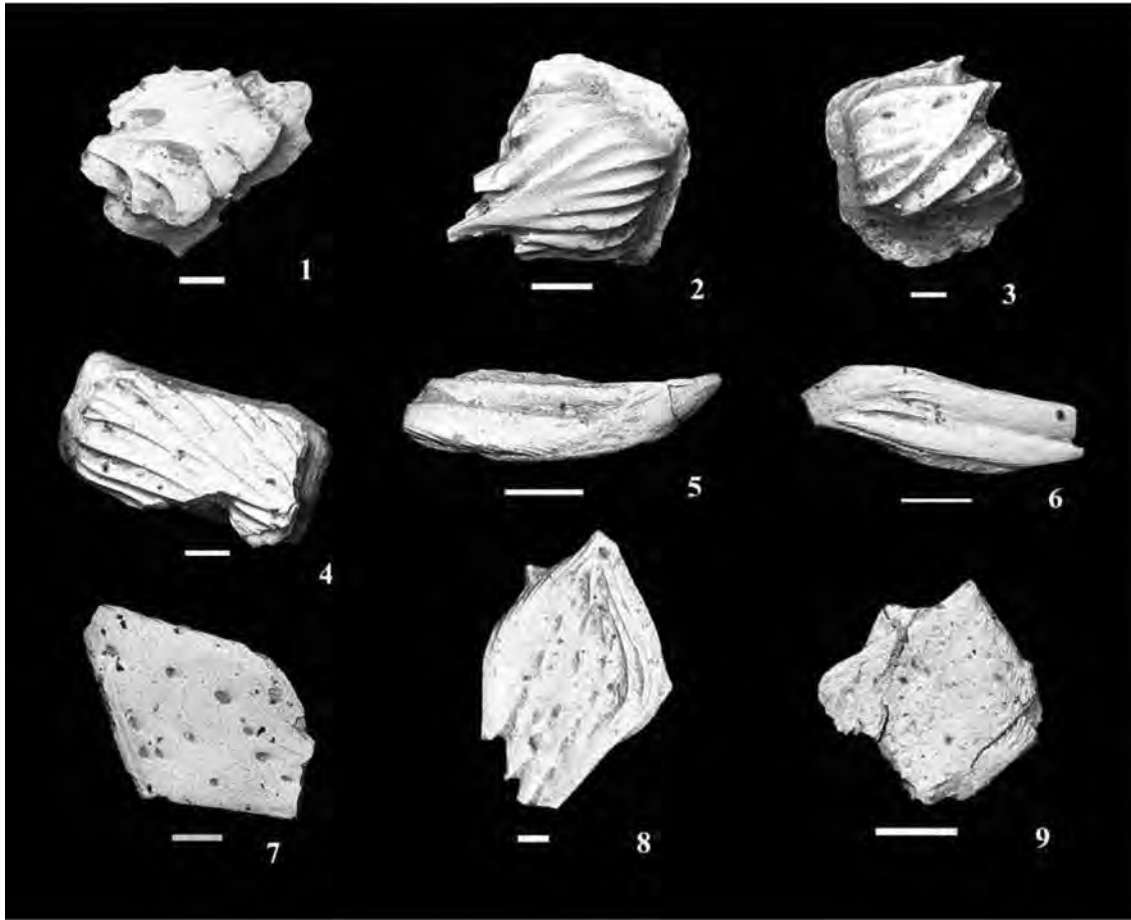


Plate V – Actinopterygian scales from the Bobruysk 961/2, Berdyzh 1 and Khotimsk 1 boreholes. The skeleton elements of fishes are from the Emsian, Eifelian and Givetian Stages, Lower and Middle Devonian.

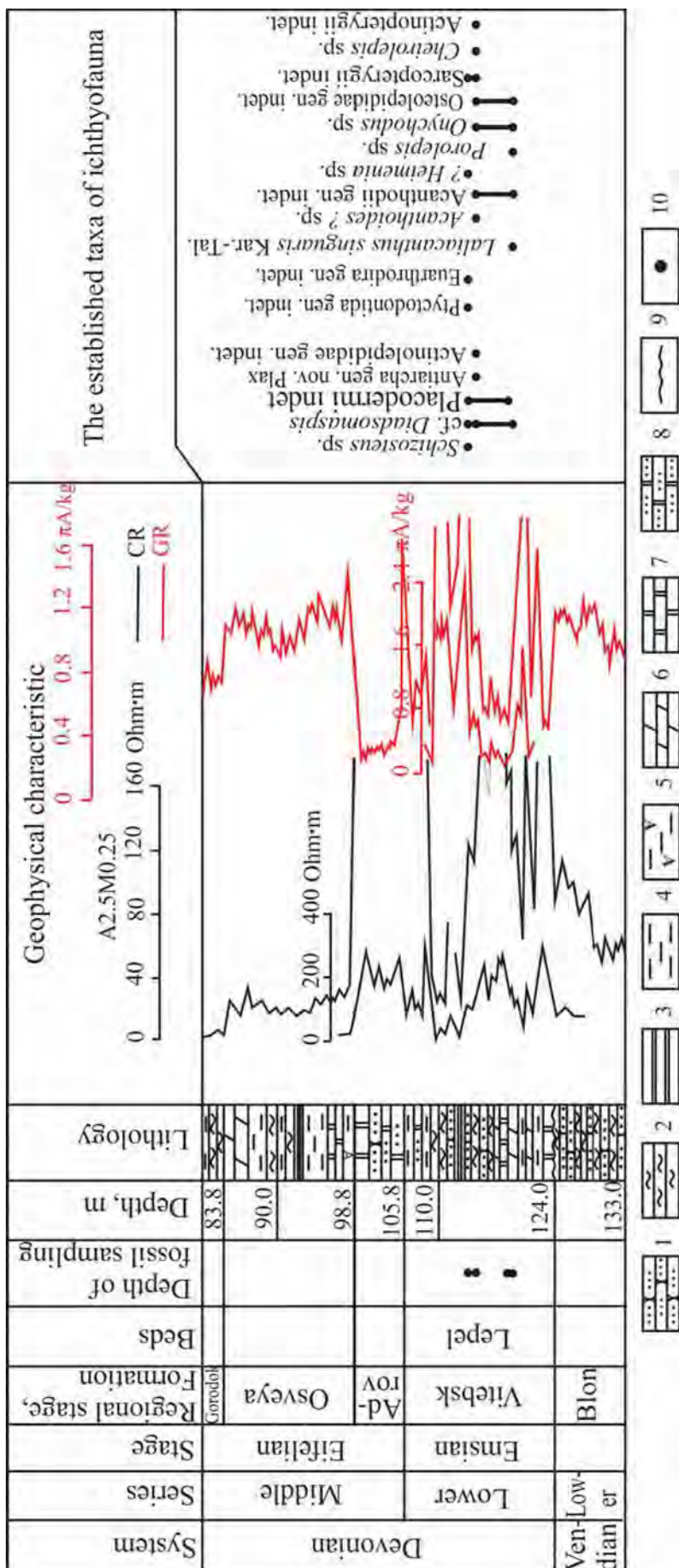
Scale bar of 500 μm for Figures 5, 6 and 9; 200 μm for Figures 1 and 7; 100 μm for Figure 2, 3, 4 and 8.

Figure 1 – *Cheirolepis* sp. Specimen N^o 86/2a-7c. Berdyzh 1 borehole, depth 410.0 m, $\times 80$, scale in crown view, Vitebsk Regional Stage, Lepel Beds. Figure 2 – *Cheirolepis* sp. Specimen N^o 86/28-2b. Berdyzh 1 borehole, depth 233.0 m, $\times 200$, scale in crown view, Polotsk Regional Stage, Stolín beds. Figure 3 – *Cheirolepis* sp. Specimen N^o 86/28-2c. Berdyzh 1 borehole, depth 233.0 m, $\times 120$, scale in crown view, Polotsk Regional Stage, Stolín beds. Figure 4 – *Cheirolepis* sp. Specimen N^o 86/2-2b. Berdyzh 1 borehole, depth 411.0 m, $\times 150$, scale in crown view, Vitebsk Regional Stage, Lepel Beds. Figure 5 – *Orvikuina vardiaensis* Gross. Specimen N^o 86/15-1a. Berdyzh 1 borehole, depth 337.0 m, $\times 50$, scale in external view, Gorodok Regional Stage. Figure 6 – *Orvikuina vardiaensis* Gross. Specimen N^o 86/30-1a. Berdyzh 1 borehole, depth 232.0 m, $\times 50$, scale in external view, Polotsk Regional Stage, Stolín Beds. Figure 7 – Actinopterygii indet. Specimen N^o 59/6-3a. Bobruysk 691/2 borehole, depth 233.0 m, $\times 80$, scale in external view, Vitebsk Regional Stage, Lepel Beds. Figure 8 – *Moythomasia* ? sp. Specimen N^o 86/30-1b. Berdyzh 1 borehole, depth 232.0 m $\times 100$, scale in external view, Polotsk Regional Stage, Stolín Beds. Figure 9 – Actinopterygii indet. Specimen N^o 84/4-1b. Khotimsk 1 borehole, depth 512.6 m, $\times 50$, scale in external view, Adrov Regional Stage.

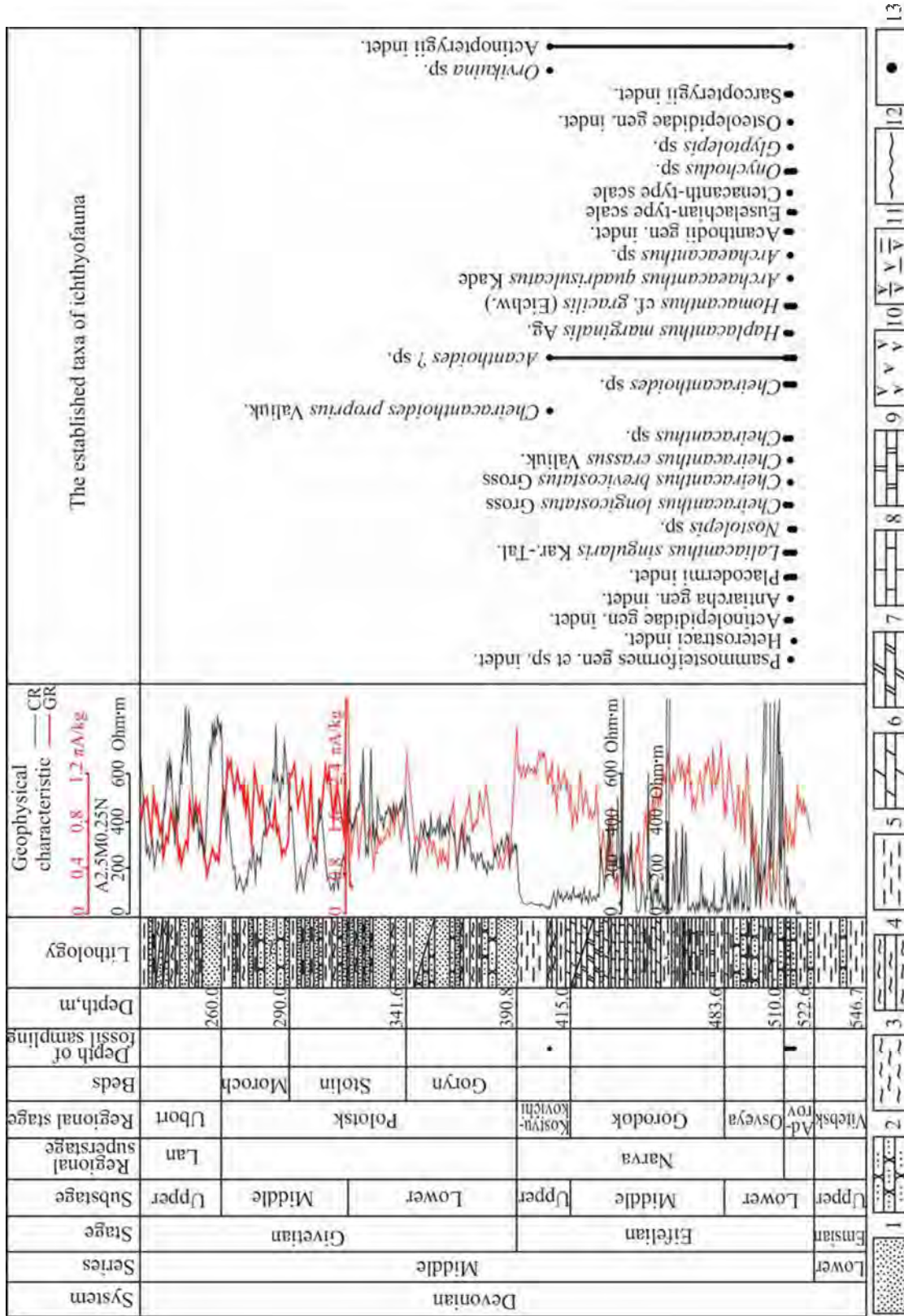
posits of the Polotsk Regional Stage of the studied area are well correlated in their ichthyofauna composition with same-name deposits which are widespread within the Orsha Depression, Latvian Saddle, northeastern slopes of the Belarusian Antecline and the western part of the Pripyat Trough (Plax et al., 2008; Plax, Kruczek 2014).

The vertebrates of the **Ubert Regional Stage** of the Lan Regional Superstage of the Givetian Stage were established in two boreholes: Azeretskaya 2p (depth of 2871 m) and Svetilovichi 7 (depth range

of 273.0 to 297.4 m). The heterostracans, placoderms and osteichthyans have been found there. The heterostracans are few in number and are represented by dentine tubercles and isolated plates of *Ganosteus stellatus* Rohon, *Psammolepis paradoxa* Ag., *Psammosteus* sp. and *Psammosteiformes* gen. et sp. indet. The placoderms are also scarce and represented by the plate fragments of *Asterolepis ornata* (Eichw.). The osteichthyans do not show a diversity of taxa. There are some scales of *Laccognathus* sp., *Glyptolepis baltica* Gross,

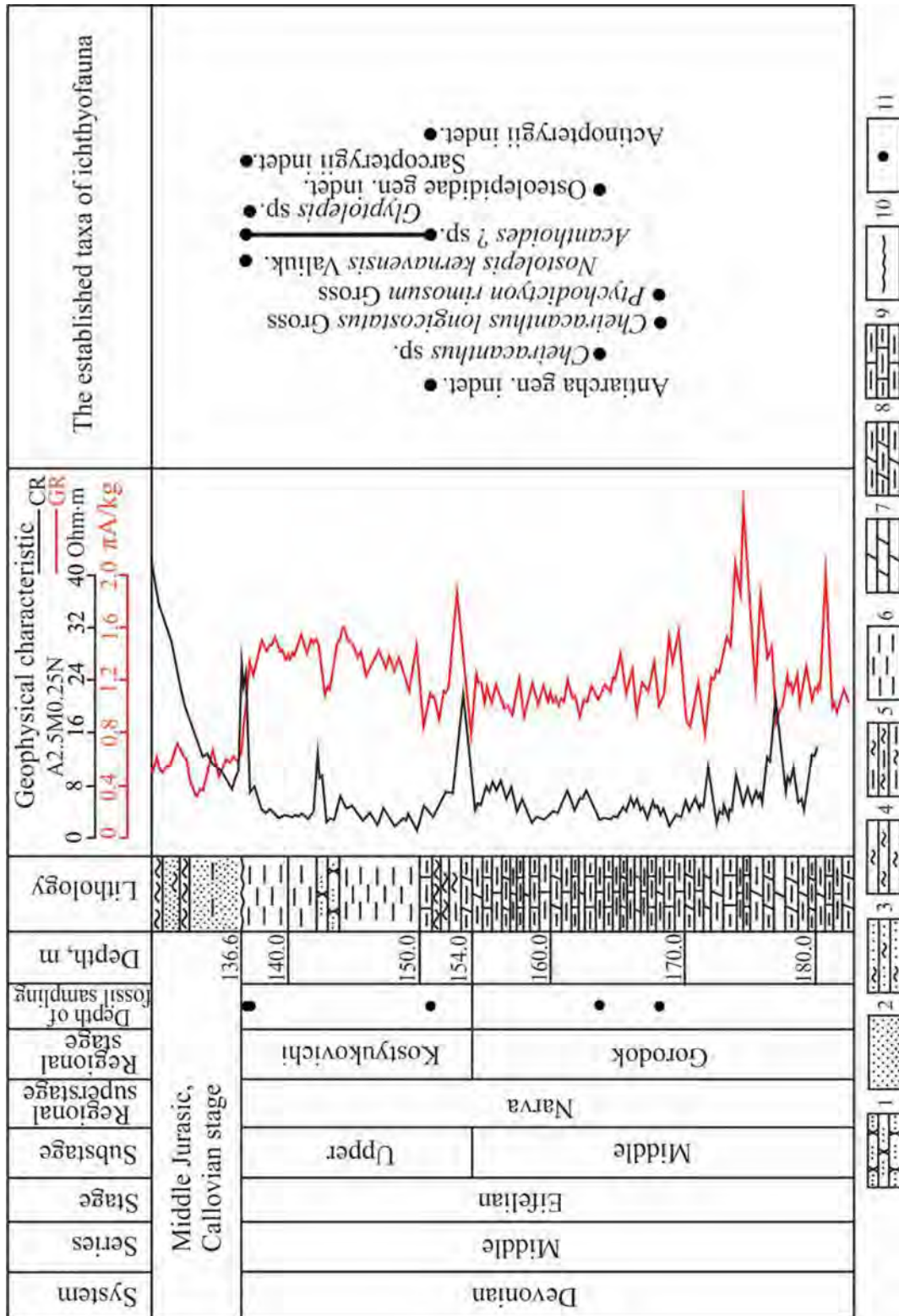


Text-Figure 2 – Geological section of the Lower Devonian and Vendian deposits of the Osipovich 6 borehole with the ichthyofauna distribution.
 Legend. Rocks: 1 – sandstones, 2 - siltstones, 3 – argillaceous clays, 4 – clays, 5 – clayey sulfate rocks, 6 - marls, 7 – dolomites, 8 – sandy dolomites. Other symbols: 9 – discontinuity surfaces, 10 – fossil sampling sites.

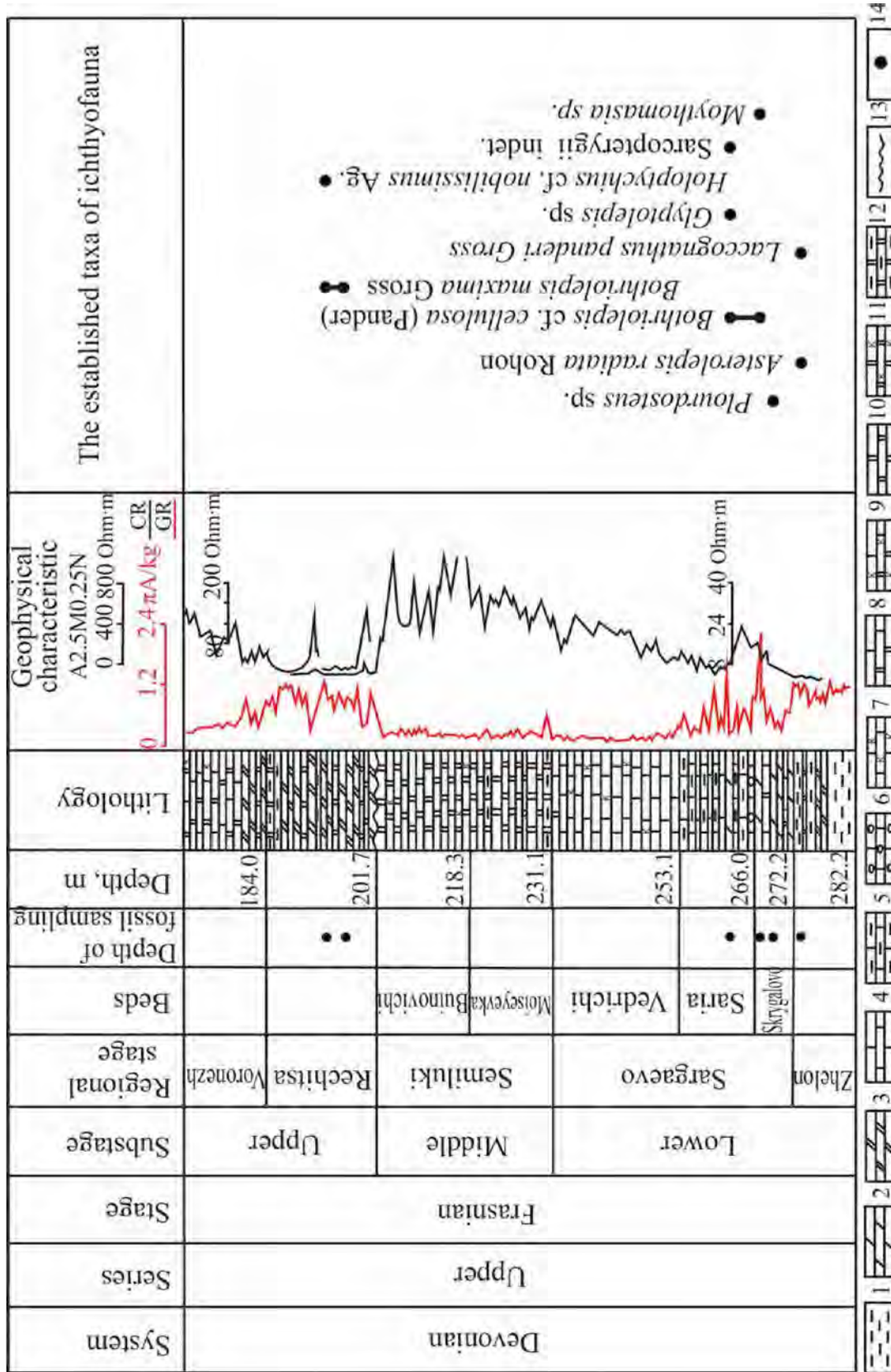


Text-Figure 4 – Geological section of the Lower and Middle Devonian deposits of the Khotimsk 1 borehole (by T.G. Obukhovskaya (Obukhovskaya, 1999; Text-Figure 4) with D.P. Plax's refinements and additions) with the ichthyofauna distribution. Legend. Rocks: 1 – sands, 2 – sandstones, 3 – silts, 4 – siltstones, 5 – clays, 6 – marls, 7 – dolomitic marls, 8 – limestones, 9 – dolomites, 10 – sulfate rocks (gypsums and anhydrites), 11 – clayey sulfate rocks. Other symbols: 12 – discontinuity surfaces, 13 – fossil sampling sites.

ТЕАВОНІЯ



Text-Figure 5 – Geological section of the Middle Devonian deposits of the Luchin 753 borehole with the ichthyofauna distribution.
 Legend. Rocks: 1 – sandstones, 2 – sands, 3 – sandy siltstones, 4 – siltstones, 5 – clayey siltstones, 6 – clays, 7 – marls, 8 – clayey marls, 9 – clayey limestones. Other symbols: 10 – discontinuity surfaces, 11 – fossil sampling sites.



Text-Figure 6 – Geological section of the Upper Devonian deposits of the Zhlobin 389 (Plaksa, 2006) borehole with the ichthyofauna distribution. Legend. Rocks: 1 – clays, 2 – marls, 3 – dolomitic marls, 4 – limestone, 5 – clayey limestones, 6 – organogenic-clastic limestones, 7 – cavernous limestones, 8 – dolomitic limestones, 9 – dolomitic cavernous limestones, 10 – dolomites, 11 – cavernous dolomites, 12 – clayey dolomites. Other symbols: 13 – discontinuity surfaces, 14 – fossil sampling sites.

Osteolepididae gen. indet. and teeth of Sarcopterygii indet. The guide species of this Regional Stage are *Psammolepis paradoxa* Ag. and *Asterolepis ornata* (Eichw.). Together with the vertebrates the lingulid shells, plant remains and miospores have been found in the deposits this Regional Stage.

The age analogue of the Ubert Regional Stage of the Lan Regional Superstage in the territory of the Main Devonian Field is the Gauja Regional Stage (The Devonian..., 1981; Esin et al., 2000; Ivanov and Lebedev, 2011). The Ubert Regional Stage is also correlated in its ichthyofauna composition with the Yastrebovka Formation in the territory of the Central Devonian field (Obrucheva, Obrucheva, 1977), as well as with the Pashija Regional Stage widespread on the western slope of the Urals, in the Volga-Ural region and in the east central regions of the East European Platform (The Devonian..., 1995) and with the same-name Regional Stage which is widespread within the western part of the Pripyat Trough (Plax, Kruchek, 2014).

The agnathans and fishes of the **Zhelon Regional Stage** of the Lan Regional Superstage of the Frasnian Stage of the Upper Devonian were established in the Svetilovichi 7 borehole (depth range of 224.6 to 273.0 m) and Zhlobin 389 borehole (depth range of 272.2 to 282.2 m) (Text-Figure 6). In the deposits of this Regional Stage the placoderms of *Asterolepis radiata* Rohon, *Bothriolepis* sp., *Plourdosteus* sp., Euarthrodira gen. indet. are mostly abundant, as well as the scales and teeth of the sarcopterygians of *Panderichthys* sp., *Holoptychius* sp., Osteolepididae gen. indet., *Laccognathus panderi* Gross, Sarcopterygii indet., small plate fragments of *Psammosteus praecursor* Obr. and dentine tubercles of the heterostracans of *Psammosteiformes* gen. indet. are less numerous. Besides the vertebrates, the deposits of this Regional Stage include single fragments of the lingulid shells, plant remains and miospores.

The Zhelon Regional Stage in its ichthyofauna composition may be correlated with the Chaplygin Formation of the Central Devonian Field (Obrucheva, Obrucheva, 1977; Esin et al., 2000; Moloshnikov, 2008), with the Timan Regional Stage of the South Timan (Ivanov, 1991), with the Amata Regional Stage of the Main Devonian Field (The Devonian..., 1981; Esin et al., 2000) and with same-name Regional Stage which is developed in the territory of the Orsha Depression, Latvian Saddle and within the western part of the Pripyat Trough (Plaksa, 2004; Plax et al., 2008; Plax, Kruchek, 2014).

The deposits of the **Sargaevo Regional Stage** of the Frasnian Stage within the studied area are poorly described by the ichthyofauna. The vertebrates were established in the **Skrygalovo** and **Saria**

Beds of the Regional Stage only in the Zhlobin 389 borehole (depth range of 253.1 to 272.2 m). The vertebrates of the Skrygalovo Beds are represented by single plates of *Plourdosteus* sp. and *Bothriolepis* cf. *cellulosa* (Pander), and the Saria Beds – by the mesomeric plates of *Bothriolepis* cf. *cellulosa* (Pander) and rare scales of *Moythomasia* sp. Together with the vertebrates there are some invertebrates (brachiopods, molluscs, etc.), as well as miospores.

The age analogue of the Skrygalovo and Saria Beds of the Sargaevo Regional Stage in the territory of the Main Devonian Field are the Snetnaya Gora and Pskov Beds of the Plavinas Regional Stage (The Devonian..., 1981; Ivanov, Lukševičs, 1996; Esin et al., 2000), in the Southern Timan are – the lower part of the Ust-Yarega Formation (Ivanov, 1991) and in the territory of the Orsha Depression – the same-name beds of the Sargaevo Regional Stage (Plaksa, 2004).

The vertebrates from the **Vedrichi Beds** of the Sargaevo Regional Stage and the **Semiluki Regional Stage** of the Frasnian Stage in the considered territory have not yet been established.

The ichthyofauna in deposits of the **Rechitsa Regional Stage** of the Frasnian Stage was identified in the boreholes: Babinets P28 (depth range of 3965.7–3985.8 m), Antonovskaya P1 (depth 4029.4 m) and Zhlobin 389 (depth range of 184.0–201.7 m). According to the literature data (Stratigraphic..., 1978; Uriev et al., 1992; Esin et al., 2000) and the research by Plax D.P. (Plax, 2008b), there are fishes which belong to the placoderms, acanthodians and sarcopterygians. The placoderms are represented by numerous individual plates of *Bothriolepis maxima* Gross, the acanthodians – by single scales of *Devononchus laevis* (Gross); the sarcopterygians – by rare scales and teeth of *Holoptychius* cf. *nobilissimus* Ag., *Onychodus* sp. and *Rhinodipterus* sp. The guide and zonal species of this assemblage is the species of *Bothriolepis maxima* Gross.

The deposits of the Rechitsa Regional Stage correspond in its ichthyofauna composition to the Snezha Regional Stage of the Main Devonian Field (The Devonian..., 1981; Esin et al., 2000), as well as to the Petin Regional Stage of the Central Devonian Field (Obrucheva, Obrucheva, 1977; Esin et al., 2000).

The ichthyofauna of the deposits of the Voronezh Regional Stage and the Evlanovo Regional Superstage of the Frasnian Stage within the studied area is few in number and has not yet been studied. The vertebrates of the Chernin Regional Stage of the Frasnian are as yet unknown. The division and correlation of the stratigraphic units were done from the other groups of organic remains.

THE FACIES RESTRICTIONS OF THE ICHTHYOFAUNA IN THE DEVONIAN DEPOSITS WITHIN THE STUDIED AREA

The Lower Devonian (Upper Emsian, notably, the Vitebsk Regional Stage) shallow-marine terrigenous and terrigenous-carbonate rocks developed within the Bobruysk Burial Ridge and the Zhlobin Saddle contain numerous and taxonomically diverse ichthyofauna species. It is restricted mainly within the interlayers of assorted, fine- and medium-grained sandstones and clayey sandstones, siltstones, clays, argillites, clayey limestones and marls. Taxonomically, the ichthyofauna is represented there by two reliably established subclasses of the agnathans – thelodonts and heterostracans and four classes of the fishes – acanthodians, placoderms, chondrichthyans and osteichthyans. Among the ichthyofauna taxa isolated scales, fin spines of various genera and species of the acanthodians are most abundant in the deposits of the Vitebsk Regional Stage, discrete plates of some poorly studied placoderm representatives are more scarce. The chondrichthyans, sarcopterygians and actinopterygians are significantly inferior to the acanthodians, to a lesser degree – to placoderms in the amount of found skeleton elements and their taxonomic diversity. The thelodonts and heterostracans occur very rarely. The thelodonts are represented by single scales and the heterostracans – by separate dentine tubercles and small fragments of exoskeleton plates. Together with the vertebrates the phyllopo­ds, inarticulate brachiopods and miospores occur very often.

The agnathans and fishes of the Middle Devonian Eifelian (Adrov, Osveya, Gorodok and Kostyukovich Regional Stages) shallow-marine terrigenous and terrigenous-carbonate deposits, as well as of lagoonal-sea sulfate-carbonate-clayey sediments developed within the Zhlobin Saddle and the northwestern slope of the Voronezh Antecline taxonomically differ from the representatives of the agnathans and fishes that were established in the deposits of the Lower Devonian (Upper Emsian). The heterostracans are represented by rare isolated fragments of dentine tubercles and small fragments of psammosteid plates. Thelodont scales are absent, or have not been identified so far. The chondrichthyans occur very rarely and are few in number. The finds of placoderm exoskeletons and the osteichthyans (sarcopterygians and actinopterygians) essentially increase in amount. Their taxonomic composition is also different. The generic and species composition of the acanthodians is changed. These are again dominating fishes. Their scales, to a lesser degree, fin spines are rather abundant there. As to the lithological restriction of the skeleton elements of the Eifelian vertebrates these

are mainly confined to interstratified sandstones, siltstone, clays, clayey limestones and marls. Carbonate-clayey deposits containing gypsum and anhydrite veins, interbeds and nests do not include the ichthyofauna, as their enrichment in sulfate rocks is not favourable to the agnathans and fishes. The above-named types of rocks include besides the vertebrates single scolecodonts, shells of lingulids, conodonts and miospores.

The vertebrates of the Middle Givetian (Polotsk and Ubort Regional Stages) shallow-marine terrigenous deposits developed within the eastern part of the Pripyat Trough, Zhlobin Saddle and the northwestern slope of the Voronezh Antecline contain numerous and taxonomically diverse ichthyofauna, which is somewhat richer than that of the Eifelian. The agnathans and fishes are confined to interstratified sands, sandstones, clays, siltstones and marls. These are represented by such groups of the vertebrates, as heterostracans, placoderms, chondrichthyans and osteichthyans, of which the first three groups of vertebrates are the most numerous and taxonomically diverse. The heterostracans are represented by separate dentine tubercles, tesseræ, scales and small fragments of exoskeleton plates; the placoderms – by scales and small plates and the osteichthyans – by scales, teeth, jaws, small fragments of bones. As for the chondrichthyans, these are few in number and rarely occur as separate scales and teeth. Along with the agnathans and fishes, the inarticulate brachiopods, miospores, carbonified plants occur rather frequently, scolecodonts – more rarely.

The restriction of the Upper Devonian vertebrates within specific lithological varieties and facies is somewhat different than the lithofacies distribution of the Lower and Middle Devonian agnathans and fishes mentioned above. So, the finds of Frasnian (Zhelon, Sargaevo and Rechitsa Regional Stages) vertebrates within the eastern part of the Pripyat Trough, Zhlobin Saddle and the northwestern slope of the Voronezh Antecline are quantitatively and taxonomically inferior to the Lower and Middle Devonian ichthyofauna, and these are confined mainly to shallow normal-marine carbonate, terrigenous and terrigenous-carbonate deposits, or more specifically mainly to siltstones, clays, limestones, clayey limestones, marls and dolomitic marls. Clayey dolomites and dolomitic limestones which occur in areas within these deposits do not contain vertebrates. This fact may be possibly explained by an adverse effect of the secondary limestone dolomitization processes on the safety of fossils, or by insufficient paleoichthyological knowledge of the containing rocks. Rocks where the skeleton elements of the vertebrates were found include mainly the isolated placoderm plates, teeth, scales and bones of sarcopterygians. The den-

tine tubercles and plates of the heterostracans, acanthodian and actinopterygian scales occur rarely there. The chondrichthyans have not yet been discovered. Sometimes together with the vertebrates there are scolecodonts, brachiopods, molluscs, conodonts, plants and miospores.

CONCLUSIONS

Some characteristic ichthyofauna assemblages have been established and studied from terrigenous, carbonate-terrigenous, to a lesser extent, from carbonate deposits of the Lower, Middle and Upper Devonian of the eastern and southeastern parts of the territory of Belarus. Their taxonomic composition has been analyzed, their vertical and lateral distribution has been traced. The facies restrictions within the studied area were demonstrated. On the basis of the studies of some-new boreholes the list of the representatives of different groups of the ichthyofauna at the level of genera and species not previously known in the territory of Belarus was supplemented. The distinguished stratigraphic assemblages of the agnathans and fishes with their systematic belonging ascertained and their taxonomic composition changes allowed rather detailed division of the Devonian deposits. An analysis of the ichthyofauna permitted the division of their enclosing rocks into the regional stages and beds, dating their age and making their stratigraphic correlation with well-studied sections in the territory of Belarus and the neighboring re-

gions (Ukraine, Russia and the Baltic States), which have a rich taxonomically ichthyofauna with characteristic taxa for each specific age. This makes for the importance of using the ichthyofauna in the stratigraphic division and correlation of coeval Lower, Middle and Upper Devonian deposits and also supplements the ichthyofaunistic description of a number of subdivisions of the new Stratigraphic Chart of the Devonian deposits of Belarus (2010). The study of fossil agnathans and fishes is also of basic importance for the needs of geological practice: for solving some specific problems of exploratory, surveying and other works.

ACKNOWLEDGEMENTS

The author is grateful to Dr. E. Mark-Kurik and Dr. A.O. Ivanov for their help in clarifying the identifications of some taxa of agnathans and fishes, to Dr. S.A. Kruchek for his comments on a preliminary version of the paper, as well as to translator V.G. Filippova for help in editing the English version of the paper.

This research was conducted in the framework of the Belarusian-Polish scientific co-operation, supported by the National Research Centre (grant № UMO-2011/03/B/ST10/05468), as well as supported by the Belarusian Republican Foundation for Researches (agreement with the BRFR № XII ПЛШ-006 of 01.06.2011). It is a contribution to the IGCP Project 596 «Climate change and biodiversity patterns in the Mid-Palaeozoic».

REFERENCES

- ESIN D., GINTER M., IVANOV A., LUKŠEVIČS E., AVKHIMOVICH V., GOLUBTSOV V., PETUKHOVA L. Vertebrate correlation of the Upper Devonian and Carboniferous on the East European Platform // Courier Forschungsinstitut Senckenberg (Final Report of IGCP 328 project). – Vol. 223. – 2000. – P. 341–359.
- GEOLOGY of Belarus / A.S. Makhnach et al.; National Academy of Sciences of Belarus, Institute of Geological Sciences; Edited by A.S. Makhnach. – Minsk, 2001. – 815 p. (in Russian).
- IVANOV A.O. Complexes of the ichthyofauna of the Frasnian Stage of the Southern Timan area // Geology of the Devonian of northeast of the European part of the USSR / Abstracts (2–4 April 1991). Syktyvkar, 1991. – P. 23–24.
- IVANOV A. & LUKŠEVIČS E. Late Devonian vertebrates of the Timan // Daba un Muzejs. 1996. – № 6. – P. 22–33.
- IVANOV A. & LEBEDEV O. Devonian vertebrate localities in the Luga River basin (Leningrad Region, Russia) // Guidebook of the field trip. – St. Petersburg, 2011. – P. 1–37.
- KLEESMENT A.E., MARK-KURIK E.J., KARATAJŪTĒ-TALIMAA V.N., VAITIEKŪNIĒNE, G.K. & KAJAK, K.F. The oldest deposits of the Middle Devonian of Estonia // Geology of the crystalline basement and sedimentary cover of the Baltic States. – Riga: Zinātne Publ., 1975. – P. 168–183 (in Russian with English summary).
- KRUCHEK S.A., OBUKHOVSKAYA V.Yu., PLAX D.P. Boundaries between the Emsian-Eifelian deposits of Belarus and the problem of their correlation / Geological Science and Innovations. Proceedings of the International Scientific and Practical Conference (Minsk, November, 14–15, 2012). – Minsk, 2012a. – P. 94–98 (in Russian).
- KRUCHEK S.A., OBUKHOVSKAYA V.Yu., PLAX D.P. A type section of Devonian deposits of the Bobruysk buried ridge / Geological Science and Innovations. Proceedings of the International Scientific and Practical Conference (Minsk, November, 14–15, 2012). – Minsk, 2012b. – P. 99–103 (in Russian).
- LYARSKAYA L.A. Rēzekne Formation and its age equivalents / Phanerozoic Stratigraphy of the Baltic States. – Riga: Zinātne, 1978. – P. 22–39 (in Russian).
- MARK-KURIK E. The Middle Devonian fishes of the Baltic States (Estonia, Latvia) and Belarus // Courier Forschungsinstitut Senckenberg (Final Report of IGCP 328 project). – Vol. 223. 2000. – P. 309–324.
- MOLOSHNIKOV S.V. Devonian Antiarchs (Pisces, Antiarchi) from Central and Southern European Russia // Paleontol. J. – 2008. – Vol. 42. № 7. – P. 691–773.

- OBRUCHEVA O.P., OBRUCHEVA E.D. Fishes of the Central Devonian Field // Sketches on the phylogeny and systematics of extinct fishes and agnathans. – Moscow, 1977. – P. 24–28 (in Russian).
- OBUKHOVSKAYA T.G. Zonal subdivision of Middle Devonian deposits of eastern Belarus from the miospore evidences / *Lithosphere*. – 1999. – №10–11. – P. 76–85 (in Belarusian).
- PLAX D.P. Late Emsian ichthyofauna of Belarus // *Geobiosphere events and the organic world history. Proc. of the LIV Session of the Palaeontological Society of the Russian Academy of Sciences (St. Petersburg, April, 7–11, 2008)*. – St. Petersburg, 2008a. – P. 136–137 (in Russian).
- PLAX D. P. Devonian fish fauna of Belarus // *Lithosphere*. – 2008b. – № 2 (29). – P. 66–92 (in Russian).
- PLAX D.P., VALIUKEVIČIUS J.J. & KRUCHEK S.A. Zonal subdivision of Devonian deposits (Upper Emsian–Frasnian) of northern Belarus from the ichthyofauna data // *Actual problems of geology of Belarus and the adjacent territories. Materials of the International Conference dedicated to the 90th anniversary of academician A.S. Makhnach*. – Minsk, 2008. – P. 226–234 (in Russian).
- PLAX D.P. Some general palaeoecological and taphonomic features of the Early Frasnian ichthyofauna communities in the territory of Belarus and their relation to the facies / *All-Russian Conference «200 Years of Russian palaeontology»*. – Moscow, Moscow State University, 2009. – P. 105–107 (in Russian).
- PLAX D.P. Devonian ichthyofauna of the Volyn Monocline // *Lithosphere*. – 2011. – № 2 (35). – P. 12–21.
- PLAX D.P., KRUCHEK S.A. Stratigraphy of Middle Devonian deposits of the western part of the Pripjat Trough (according to results of the study of ichthyofauna) // *Lithosphere*. – 2014. – № 1 (40). – P. 24–42.
- PLAX D.P. Ichthyofauna from the bottom of the Middle Devonian (Adrov Regional Stage) of Belarus / *Vesnik of Brest University. Series 5. Chemistry. Biology. Sciences about Earth*. Brest, 2012. № 2. – P. 118–121 (in Russian with English summary).
- PLAX D.P. Ichthyofauna of the Kostyukovich Regional Stage of the Eifelian Stage of Belarus / *Problems of regional geology and searches for useful minerals. Proc. of VII University geological readings // Editorial board: M.A. Zhurkov (editor-in-chief), I.I. Pirozhnik (deputy editor-in-chief), A.F. Sanko (managing editor) [et al.]*. – Minsk: Belarusian State University, 2013. – P. 38–40 (in Russian).
- PLAX D.P. Ichthyofauna of the Polotsk Regional Stage of the Givetian Stage of Belarus / *Geology and Useful minerals of the Quaternary deposits. Proceedings of the VIII University geological readings (Minsk, April, 3–4, 2014)*. Sanko A.F. [eds.]. – Minsk: «Tsifrovaya pechat» Publ., 2014a. In two volumes. – Vol. II. – P. 16–19 (in Russian).
- PLAX D.P. Late Givetian ichthyofauna of Belarus // *Diversification and stage of evolutions of the organic world in the light of the palaeontological annals. Proc. of the LX Session of the Palaeontological Society of the Russian Academy of Sciences (St. Petersburg, April, 7–11, 2014)*. – St. Petersburg, 2014b. – P. 172–173 (in Russian).
- PLAKSA D.P. Palaeoichthyological analysis of the Upper Devonian of the Kulazhin area of the Orsha Depression // *Proc. of young scientists of the National Academy of Sciences of Belarus / Branch of Chemistry and Earth Sciences; Editorial Board: Ya.I. Anoshko [et al.]*. – Minsk, 2004. – Vol. I. – P. 320–324 (in Russian).
- PLAKSA D.P. New data of the acanthodians (Pisces, Acanthodii) of the Devonian of Belarus // *Lithosphere*. – 2005. – № 2 (23). – P. 33–37 (in Russian).
- PLAKSA D.P. Stratigraphy of the Middle and Upper Devonian deposits in the south-east of Belarus (according to results of the ichthyofauna study) // *Lithosphere*. – 2006. – № 2 (25). – P. 25–36 (in Russian).
- PLAKSA D.P. Devonian (Late-Emsian – Frasnian) fish fauna of Belarus and its stratigraphic importance. – *Theses for a Doctor Degree. Institute of Geochemistry and Geophysics of the National Academy of Sciences of Belarus*. – Minsk, 2007. – 23 p. (in Russian with Belarusian and English summary).
- STRATIGRAPHIC and palaeontological research in Byelorussia / V.K. Golubtsov [et al.]. – Minsk, 1978. – 248 p. (in Russian).
- STRATIGRAPHIC chart of Precambrian and Phanerozoic deposits of Belarus: Explanatory note (S.A. Kruchek, A.V. Matveyev, T.V. Yakubovskaya et al.). – Minsk. State Enterprise «BelNIGRI». 2010. – 282 p. with 15 stratigraphic charts appended (in Russian).
- THE DEVONIAN and Carboniferous of the Baltic states / V.S. Sorokin, L.A. Lyarskaya, L.S. Savvaitova et al. – Riga: Zinatne Publ., 1981. – 502 p. (in Russian).
- THE DEVONIAN of the Voronezh Antecline and Moscow Syncline / G.D. Rodionova, V.T. Umnova, L.I. Kononova et al. – Moscow, 1995. – 265 p. (in Russian).
- URIEV I.I., VALIUKEVIČIUS J.J., KARATAJŪTĖ-TALIMAA V.N. Rechitsa Regional Stage of the Pripjat Trough: structure and age from data of vertebrates // *Rep. Nation. Acad. Sci. Belarus*. 1992. – Vol. 36, № 5. – P. 457–460 (in Russian).
- VALIUKEVIČIUS J. Acanthodians from the Narva Regional Stage of the Main Devonian Field. – Vilnius, 1985. – 144 p. (in Russian).
- VALIUKEVIČIUS J., GOLUBTSOV V. K. The Devonian system // *Geological map of the USSR. Scale of 1:1,000,000 (new series). Explanatory Note. Sheet № – (34)*. – Vilnius, Leningrad, 1986. – P. 53–68 (in Russian).
- VALIUKEVIČIUS J. Acanthodian zonal sequence of Early and Middle Devonian in the Baltic basin // *Geologija*, 17. Vilnius, 1994. – P. 115–125.

- VALIUKEVIČIUS J., TALIMAA V. & KRUCHEK S. Complexes of vertebrate microremains and correlation of terrigenous Devonian deposits of Belarus and adjacent territories // *Ichthyolith Issues. Special Publication 1 Socorro*, – New Mexico, 1995. – P. 53–59.
- VALIUKEVIČIUS J., KRUCHEK S. Acanthodian biostratigraphy and interregional correlations of the Devonian of the Baltic States, Belarus, Ukraine and Russia // *Courier Forschungsinstitut Senckenberg (Final Report of IGCP 328 project)*. – Vol. 223. 2000. – P. 271–289.

Рецензенты Ю.В. Заика, С.А. Кручек

Поступила 10.03.2015

СТРАТИГРАФІЧНЫЯ КОМПЛЕКСЫ ІХТЫЯФАУНЫ
ДЭВОНСКИХ АДКЛАДАЎ УСХОДУ І ПАЎДНЁВАГА-ЎСХОДУ БЕЛАРУСІ
Дз.П. Плакс

У артыкуле выкладзены вынікі палеаіхтыялагічнага вывучэння керна свідравін Азярэцкая 2р, Анто-наўская Р1, Бабінец Р28, Асіповічы 6, Бабруйская 691/2, Лучынская 753, Лучынская 763; Лучынская 772д, Жлобін 389, Рагачоўская 736, Рагачоўская 732, Бердыж 1, Хоцімск 1, Свяцілавічы 7 і Свяцілавічы 18, прабураных ва ўсходняй і паўднёва-ўсходняй частках Беларусі ў межах усходняй часткі Прыпяцкага прагіну, Бабруйскага пахаванага выступу, Жлобінскай седлавіны і паўночна-заходняга схілу Варонежскай антэклізы, а таксама для паўнаты інфармацыі выкарыстаны літаратурныя крыніцы, у якіх апісаны або ўзгадваюцца знаходкі рэштак дэвонскіх хрыбетных ў межах вышэй адзначаных тэктанічных структур. Зроблена стратыграфічнае расчлененне дэвонскіх адкладаў па сустрэтых у іх комплексах хрыбетных і кіраўнічых таксонах бясківічных і рыб, а таксама выканана па хрыбетных супастаўленне адкладаў з утварэннямі таго ж самага ўзросту, якія развіты, як унутры Беларусі, так і па-за яе межамі – на сумежных тэрыторыях Украіны, Расіі і краін Балтыі. У артыкуле таксама істотна папоўнены вядомы раней склад стратыграфічных комплексаў хрыбетных, прадстаўлены поўны іх спіс і прыводзіцца іх стратыграфічнае распаўсюджанне і разгляджваецца іх фацыяльнае прыстасаванне.

СТРАТИГРАФИЧЕСКИЕ КОМПЛЕКСЫ ИХТИОФАУНЫ
ДЕВОНСКИХ ОТЛОЖЕНИЙ ВОСТОКА И ЮГО-ВОСТКА БЕЛАРУСИ
Д.П. Плакс

В статье приводятся результаты палеоихтиологического изучения керна скважин Азерецкая 2р, Антоновская Р1, Бабинец Р28, Осиповичи 6, Бобруйская 691/2, Лучинская 753, Лучинская 763; Лучинская 772д, Жлобин 389, Рогачевская 736, Рогачевская 732, Бердыж 1, Хотимск 1, Светиловичи 7 и Светиловичи 18, пробуренных в восточной и юго-восточной частях Беларуси в пределах восточной части Припятского прогиба, Бобруйского погребенного выступа, Жлобинской седловины и северо-западного склона Воронежской антеклизы, а также для полноты информации используются литературные источники, в которых описаны или упомянуты находки девонских позвоночных в пределах вышеуказанных тектонических структур. Выполнено стратиграфическое расчленение девонских отложений по установленным в них комплексам позвоночных и руководящим таксонам бесчелюстных и рыб, а также по позвоночным сделано сопоставление отложений с одновозрастными образованиями, развитыми как внутри Беларуси, так и за ее пределами, а именно, на смежных территориях Украины, России и стран Балтии. В статье также существенно пополнен известный ранее состав стратиграфических комплексов позвоночных, представлен полный их список, приведено их стратиграфическое распространение и рассмотрена их фациальная приуроченность.