

PERMIAN FAUNA OF THE KRKONOŠE PIEDMONT BASIN (BOHEMIAN MASSIF, CENTRAL EUROPE)

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Abstract. A complete faunal list was compiled for the Early Permian lake deposits of the Krkonoše Piedmont Basin. Fauna-bearing sites and boreholes belong to two local zones of the Bohemian Massif. Sedimentary facies together with the faunal content and taphonomy of the fossil-bearing sites enabled an interpretation of the intrabasinal palaeogeography of both main Early Permian lakes. Stratigraphy, changes within the fish communities and inter-basin correlations are discussed.

■ Faunal lists, palaeogeography, palaeoenvironment, stratigraphy, Early Permian, Krkonoše Piedmont Basin, Bohemian Massif

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This paper is dedicated to the 100th year anniversary of Antonín Frič's death (1832–1913). Due to editorial reasons it was not included in volume 69/3–4 2013 in which other papers on Frič were published.

Introduction

A complete faunal list was compiled for the Late Carboniferous lake deposits of the Krkonoše Piedmont Basin some years ago (Zajíc 2007). A similar compilation for the Early Permian fauna-bearing sites and boreholes will be presented here.

The Krkonoše Piedmont Basin belongs to a system of post-orogenic extensional/transensional basins which formed in the Bohemian Massif (Text-fig. 1) in the early post-orogenic phase of the Variscides during the Westphalian and Saxonian (approximately Moscovian to Sakmarian, c. 310–280 Ma) times (Martínek et al. 2006). This system of basins is called the Sudetic basin complex. Its eastern part is located on the Saxo-Thuringian basement and is subdivided into the Mnichovo Hradiště, Krkonoše Piedmont and Intra-Sudetic basins, which are separated from each other by prominent NW-SE striking faults (Opluštil et al. 2013). The most significant Early Permian fossil-bearing strata of the Krkonoše Piedmont Basin are traditionally called horizons. The nature of at least the main ones (the Rudník and Kalná “Horizons”) is, however, wholly different. Their common thickness of several tens of meters suggests that they represent members, not horizons. Recent papers concerning the Permian sediments referred to “horizons”, such as the Kalná Lake deposits (Blecha et al 1999) or the Rudník member where the lower case indicates the undefined lithostratigraphic unit (Martínek et al. 2006). This paper prefers the term “Horizons” because no exact definitions of members have yet been provided within the Vrčhlabí and Prosečné Formations. Both of them include one prominent fossiliferous “Horizon” and other less important “Horizons” and occurrences (see Text-fig. 2).

Antonín Frič (=Anton Fritsch in German transliteration) described and mentioned the Permian faunas of the Krkonoše Piedmont Basin in numerous publications (e. g. Frič 1864, 1877, 1880, 1912; Fritsch 1889, 1890, 1894, 1895a, 1895b, 1901). The fundamental compilation of the Permian faunas of the Krkonoše Piedmont Basin was recently published by Štamberg and Zajíc (2008). An unpublished report by Blecha et al. (1997) also includes a faunal list. The list presented here is more detailed and covers additional or corrected data from subsequent investigations and evaluations (e. g. Opluštil et al. 2013; Šimůnek et al. 2010; Štamberg 2010, 2012, 2013a, 2013b; Zajíc 2009, 2010, 2011, 2012).

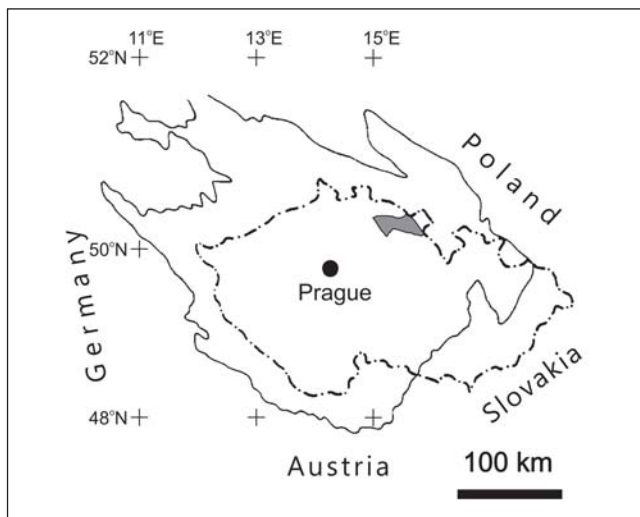
The fauna-bearing localities and boreholes are supplemented below with potential older names in the first parentheses, with the appropriate sheet numbers of the 1: 25,000 scale maps in the second parentheses and with important references (earlier or later than Štamberg and Zajíc 2008, if necessary) in the third parentheses.

Fauna-bearing localities and boreholes

Vrčhlabí Formation, Asselian

(Lower Rotliegend; *Acanthodes gracilis* zone)

This complex of fluvial to lacustrine deposits is up to 530 m thick along the tectonically active northern basin margin but only 300 m or less in its southern half (Opluštil et al. 2013). The most important Rudník “Horizon” in the Lower Vrčhlabí Formation is of basin-wide extent, traceable over a distance of more than 30 km. The only fauna-bearing unit of the Upper Vrčhlabí Formation is the Kozinec “Horizon”.



Text-fig. 1. Sketch of the Bohemian Massif and the Czech Republic (dash-and-dot line) with marked position of the Krkonoše Piedmont Basin (grey). Modified after Martínek et al. 2006.

Locality with unknown exact stratigraphic level in the formation:

- Želechy (= Želechov; Želechov-Rudoltic bei Lomnitz a P.); (03-431 Lomnice nad Popelkou); (Fritsch 1907; Štamberg and Zajíc 2008)

Two specimens of presumed oligochaetid worms on one rock sample were described as *Lumbricopsis distinctus* by Fritsch (1907), who obtained this sample from the schoolmaster Benda. The original sample is deposited in the National Museum in Prague. The exact locality and the stratigraphic level from where it came are unknown.

Lower Vrchlabí Formation

Locality:

- Vrchlabí - road cut; (03-414 Vrchlabí); (Blecha et al. 1997; Šimůnek, Zajíc and Drábková 1990; Štamberg and Zajíc 2008; Zajíc 2012)

Fossiliferous layer no. 9 (Šimůnek, Zajíc and Drábková 1990) is considered to be the underlayer of the Rudník "Horizon". Only pseudestheriid conchostracans were found here.

The Rudník "Horizon"

The thickness of the lacustrine deposits including intercalated unfossiliferous beds is 30–150 m (Prouza and Tásler 2001). The fauna of the Rudník lake deposits is the richest and most diversified among all fossiliferous sediments of the Krkonoše Piedmont Basin.

Localities:

- Dolní Lánov - Kovářsko (=Schmidtdorf; Prostřední Lánov - Kovářsko); (03-423 Svoboda nad Úpou); (Štamberg and Zajíc 2008; Zajíc 2011)

Actinopterygian *Paramblypterus rohani* (body fragments, scales).

- Dolní Sytová; (03-413 Semily); (Štamberg and Zajíc 2008; Zajíc 1988)

Acanthodes sp. (fin spines) is as yet the only determined taxon.

- Janovice - František, Jindřich and Alžběta mine dumps; (03-423 Svoboda nad Úpou); (Havlena and Špinar 1954, 1955; Štamberg and Zajíc 2008; Zajíc 2011)

Pseudestheriid conchostracans; xenacanthid sharks *Bohemiacanthus carinatus* (teeth, skull fragment with articulated occipital spine, anterior part of a postcranial skeleton) and Xenacanthida indet. (e.g. calcified cartilage fragments); *Acanthodes* sp. (scales, fin spines, scapulocoracoid); actinopterygian fishes (whole specimens, body fragments, scales, cleithra and other bones) *Paramblypterus* sp. and Actinopterygii indet.; large shark spiral coprolites.

- Janovice – documentation point KM 042, mine dump; (03-423 Svoboda nad Úpou); (Zajíc 2011)

Acanthodes sp. (common fin spines, scales, tangles of similarly directed small fin spines and scales, articulated bodies and head fragments); Actinopterygii indet. (sporadic isolated scales); large shark spiral coprolites.

- Košťálov – unspecified site; (= Košťalov; Libštát = Liebštát) (03-413 Semily); (Štamberg 2010; Štamberg and Zajíc 2008; Zajíc 2009)

Most of the older specimens were labelled only as coming from Košťálov or Libštát. Conchostracan *Pseudestheria tenella*; xenacanthid shark *Bohemiacanthus carinatus* (articulated specimens and various isolated elements); acanthodians *Acanthodes gracilis* and *Acanthodes* sp. (articulated specimens and various isolated elements), dipnoan *Ctenodus tardus* (almost complete specimen); actinopterygians *Paramblypterus rohani*, *Paramblypterus caudatus*, *Paramblypterus reussii* and *Neslovicella elongata*; amphibians "*Ptyonius bendai*" (a juvenile eryopoid), ?*Branchiosaurus* sp., ?*Cheliderpeton* sp. and *Archegosaurus dyscriton*.

- Košťálov - behind the hostel; (03-413 Semily); (Štamberg and Zajíc 2008; Zajíc 2009)

Pseudestheriid conchostracans; *Acanthodes* sp. (scales, fin spines); actinopterygian fish *Paramblypterus* sp. (scales, bones, body fragments).

- Košťálov - behind the tavern; (03-413 Semily); (Blecha et al. 1997, Štamberg 2010, personal communication 2013; Štamberg and Zajíc 2008; Zajíc 2009)

Rich fauna of pseudestheriid conchostracans; xenacanthid shark *Bohemiacanthus carinatus* (occipital spine, teeth); acanthodians (juvenile up to adult specimens, body fragments, scales, fin spines, mandibular bones, scapulocoracoids, tangles of similarly directed small fin spines and scales) *Acanthodes gracilis* and *Acanthodes* sp.; actinopterygian fishes (complete specimens, body fragments, bones, scales, segments of lepidotrichia) *Neslovicella elongata*, *Letovichthys tuberculatus*, *Paramblypterus rohani*, *Paramblypterus* sp. and Actinopterygii indet.

- Košťálov - Kovář's mill; (03-413 Semily); (Blecha et al. 1997, Štamberg and Zajíc 2008; Werneburg and Zajíc 1990; Zajíc 2009)

Pseudestheriid conchostracans; xenacanthid sharks *Bohemiacanthus carinatus* (toothed skull fragments, neurocranium, teeth) and Xenacanthida indet. (skull fragments, neurocranium, teeth); *Acanthodes gracilis* and *Acanthodes* sp. (juvenile to

Global Scale			Regional Scale	Lithostratigraphy of the Krkonoše Basin			Local Zonation	
System	Series	Stage	Stage	Formation	Member	“Horizon”	Zone	
Permian	Lopingian	Changhsingian	Zechstein	Hiatus				
				Bohuslavice				
		Wuchiapingian		Hiatus				
		Guadalupian	Capitanian	Upper Rotliegend II	Trutnov	Suchovršice		
	Wordian		Havlovice					
			Vlčice					
	Roadian		Horní Město & Náchod Conglomerates					
	Cisuralian	Kungurian	Upper Rotliegend I	Hiatus				
		Artinskian		Chotěvice				
				Hiatus				
		Sakmarian	Lower Rotliegend	Prosečné	Upper	* Kalná		<i>Xenacanthus decheni</i>
				Lower	* Arkosic			
		Asselian		Vrchlabí	Upper = Čistá Sandstones			* Kozinec
		Lower = Stará Paka Sandstones			* Rudník			

Text-fig. 2. Permian units of the Krkonoše Piedmont Basin: age, lithostratigraphy and local zonation.

adult specimens, body fragments, scales, fin spines, mandibular bones, scapulocoracoids, tangles of similarly directed small fin spines and scales); actinopterygian fishes *Paramblypterus rohani*, *Paramblypterus* sp. (body fragments, skull bones, scales) and Actinopterygii indet. (body fragments, bones, scales, fulcra, segments of lepidotrichia); amphibian *Melanerpeton* sp. K.; indeterminable coprolites.

- Košťálov – Valdice; (03-413 Semily); (Blecha et al. 1997, Štamberg and Zajíc 2008; Zajíc 2009)

Conchostracan *Pseudestheria tenella*.

- Košťálov - near open air pool; (03-413 Semily); (Štamberg and Zajíc 2008; Zajíc 2009)

Pseudestheriid conchostracans.

- Kundratice – Doly; (03-413 Semily); (Blecha et al. 1997; Štamberg 2010; Štamberg and Zajíc 2008; Štamberg et al. 2008; Zajíc 2009)

The outcrop is situated on the border of cadastral units Kundratice and Libštát. The selected one (Kundratice) complies with both geomorphology and accessibility. Pseudestheriid conchostracans; xenacanthid sharks *Bohemiacanthus carinatus* (skull fragments with articulated occipital spines, teeth) and Xenacanthida indet. (male postcranial skeleton, teeth); *Acanthodes gracilis* and *Acanthodes* sp. (juvenile to adult specimens, body fragments, scales, fin spines, mandibular bones, tangles of similarly directed small fin spines and scales); actinopterygian fishes (complete specimens, body fragments, bones, scales) *Paramblypterus rohani*, *Paramblypterus* sp., *Neslovicella elongata*, “*Elonichthys*” sp. and Actinopterygii indet.; shark spiral coprolites and other indeterminable coprolites.

- Kundratice – gorge (=Košťálov – rokle v lese); (03-413 Semily); (Blecha et al. 1997; Štamberg 2010)

Pseudestheriid conchostracans; xenacanthid shark *Bohemiacanthus carinatus* (teeth); actinopterygian fishes *Neslovicella elongata* (body fragment) and Actinopterygii indet. (body fragments and scales); shark spiral coprolites and other indeterminable coprolites.

- Prostřední Lánov - behind the factory (=LA/2/54); (03-414 Vrchlabí); (Blecha et al. 1997; Havlena and Špinar 1955; Rieger 1971; Štamberg and Zajíc 2008; Zajíc 2012)

Rich and well preserved fauna consists of pseudestheriid conchostracans; acanthodians (juvenile to adult specimens) *Acanthodes gracilis* and *Acanthodes* sp.; xenacanthid shark *Bohemiacanthus carinatus* (teeth); actinopterygians (complete specimens, body fragments, bones and scales) *Paramblypterus* sp. and Actinopterygii indet.; branchiosaurid amphibians (complete specimens and skulls) *Apateon* cf. *umbrosa*, and Branchiosauridae indet.; indeterminable coprolites.

- Prostřední Lánov - SW slope of Špička hill (=LA/3/54; Prostřední Lánov, Lánovský kopec; Prostřední Lánov, východní svah údolí Malého Labe; Mittel Langenau, Zirmkoppe); (03-423 Svoboda nad Úpou); (Blecha et al. 1997; Havlena and Špinar 1955; Rieger 1971; Štamberg and Zajíc 2008; Zajíc 2011)

Fragment of cockroach wing Blattodea indet.; Actinopterygii indet. (complete specimens, body fragments, scales); branchiosaurid amphibian (complete specimen).

- Příkrý - Honkův creek; (03-413 Semily); (Blecha et al. 1997; Štamberg 2000, personal communication 2013; Štamberg and Zajíc 2008; Zajíc 2009)

Pseudestheriid conchostracans; syncarid *Monicaris rudnicensis* (described by Štamberg 2000; type locality); *Acanthodes gracilis* and *Acanthodes* sp. (body fragments, fin spines, scales); xenacanthid shark *Bohemiacanthus carinatus*

(teeth); actinopterygian fishes (complete specimens, skulls, body fragments, bones, scales, segments of lepidotrichia) "*Elonichthys*" sp., *Igornichthys* sp., *Letovichthys tuberculatus*, *Paramblypterus rohani* and *Paramblypterus* sp.; indeterminable coprolites.

- Příkrý - tributary of Honkův creek; (03-413 Semily); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2009)

Xenacanthid shark *Bohemiacanthus carinatus* (teeth); actinopterygian fishes ?*Paramblypterus* sp. (bones) and Actinopterygii indet. (body fragments, bones, fulcra, scales, segments of lepidotrichia); indeterminable coprolites.

- Rudník (= Hermannseifen, Herrmannsseifen, Sajfy, Heřmanovy Sejfy); (03-423 Svoboda nad Úpou); (Blecha et al. 1997; Frič 1912; Hertach 1907; Štamberg and Zajíc 2008; Zajíc 2011)

This locality probably consists of several outcrops. Fauna consists of xenacanthid sharks; *Acanthodes gracilis* (complete specimen) and *Acanthodes* sp.; Actinopterygii indet.; branchiosaurid amphibian Dissorophoidea indet.

- Rybnice - Hrádecký creek; (03-413 Semily); (=Háje nad Jizerou sensu Štamberg 1993; Roprachtice sensu Rieger 1971; Loukov - Dábloviny, Loukov – Dáblův mlýn sensu Štamberg and Zajíc 2008); (Blecha et al. 1997; Rieger 1971; Štamberg 1993, 1994, 2010, personal communication 2013; Štamberg and Zajíc 2008; Zajíc 2009)

Pseudestheriid conchostracans; xenacanthid shark *Bohemiacanthus carinatus* (teeth); *Acanthodes gracilis* and *Acanthodes* sp. (juvenile to adult specimens, body fragments, mandibular bones, fin spines, scales); actinopterygian fishes (complete specimens, juvenile specimens, body fragments, scales, segments of lepidotrichia) *Paramblypterus rohani*, *Paramblypterus gelberti* (complete specimen), *Paramblypterus* sp. (bones), *Neslovicella elongata*, *Letovichthys tuberculatus* and Actinopterygii indet. (body fragments, scales); branchiosaurid amphibians ?*Melanerpeton* sp. (almost complete specimen, skulls) and Branchiosauridae indet.; indeterminable coprolites.

- Semily (unspecified); (03-413 Semily); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2009)

Xenacanthid shark *Bohemiacanthus carinatus* (teeth); *Acanthodes gracilis* (complete specimens, fin spines); actinopterygians (complete specimens, scales).

- Semily - left bank of Jizera river; (03-413 Semily); (Blecha et al. 1997; Štamberg personal communication 2013; Štamberg and Zajíc 2008; Zajíc 2009)

Pseudestheriid conchostracans; xenacanthid sharks *Bohemiacanthus carinatus* (complete head, occipital spine, teeth) and Xenacanthida indet. (teeth); actinopterygian fishes *Paramblypterus* sp. (complete specimens, skull roof, skull bones), *Igornichthys* sp. (complete specimen, scales), *Neslovicella elongata* and Actinopterygii indet. (complete and juvenile specimens, body fragments, skull bones, cleithra, supracleithra, opercula, jaws, parasphenoid, scales, segments of lepidotrichia); indeterminable coprolites.

- Semily - ravine in Nouzov (=Nouzov – strž); (03-413 Semily); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2009)

Xenacanthid shark *Bohemiacanthus carinatus* (teeth); Actinopterygii indet. (body fragments).

- Semily – trench near road in Nouzov (=Nouzov – silnice); (03-413 Semily); (Blecha et al. 1997)

Xenacanthida indet. (tooth); Actinopterygii indet. (scales).

- Škodějov - Větrná hora mine; (03-413 Semily); (Blecha et al. 1997; Štamberg and Zajíc 2008)

Xenacanthid sharks *Bohemiacanthus carinatus* (tooth) and Xenacanthida indet. (teeth); Actinopterygii indet. (bones, scales).

- Valteřice - near the mill (=Waltersdorf); (03-414 Vrchlabí); (Blecha et al. 1997; Rieger 1971; Štamberg and Zajíc 2008; Zajíc 2012)

The adit dump yielded pelecypods Myalinidae indet.; Actinopterygii indet. (body fragments); indeterminable coprolites.

- Víchová; (03-413 Semily); (Blecha et al. 1997; Rieger 1971; Štamberg and Zajíc 2008; Zajíc 2009)

Pseudestheriid conchostracans; xenacanthid sharks *Bohemiacanthus carinatus* (teeth) and Xenacanthida indet. (fragments of calcified cartilage); *Acanthodes* sp. (fragments of juvenile specimens, lower jaws, mandibular bones, fin spines, scales, tangles of similarly directed small fin spines and scales); Actinopterygii indet. (fin fragment, fulcrum, scales); indeterminable coprolites.

- Vrchlabí (unspecified); (03-414 Vrchlabí); (Geinitz 1861; Zajíc 2012)

Actinopterygian fishes *Paramblypterus rohani* (described by Geinitz 1861 as *Amblypterus luridus*) and *Paramblypterus* sp.

- Vrchlabí - near the stone bridge (=Vrchlabí - řečiště Labe u hotelu Leningrad); (03-414 Vrchlabí); (Havlena and Špínar 1956; Zajíc 2012)

Indeterminable coprolites.

- Vrchlabí - western edge of the town; (03-414 Vrchlabí); (Blecha et al. 1997; Rieger 1971; Zajíc 2012)

Actinopterygii indet. (body fragments, scales) were mentioned by Rieger (1971) from the locality on the slope southward from the sawmill.

- Vrchlabí - Road cut; (03-414 Vrchlabí); (Blecha et al. 1997; Šimůnek, Zajíc and Drábková 1990; Štamberg and Zajíc 2008; Zajíc 2012)

Fossiliferous layers no. 1 to 8 were distinguished by Šimůnek, Zajíc and Drábková (1990) within the Rudník "Horizon". The following taxa were determined: pseudestheriid conchostracans *Pseudestheria* aff. *breitenbachensis* and Lioestheriidae indet.; pelecypods Myalinidae indet.; fragment of an insect wing; xenacanthid sharks *Bohemiacanthus carinatus* (skull and postcranial skeleton fragments, occipital spines, teeth) and Xenacanthida indet. (teeth); *Acanthodes gracilis* and *Acanthodes* sp. (complete specimens, body fragments, heads, fin spines, scales); actinopterygian fishes *Paramblypterus* sp. (complete specimens, body fragments,

scales) and Actinopterygii indet. (complete specimens, body fragments, scales, segments of lepidotrichia); amphibians *Melanerpeton* sp. (almost complete specimens, skulls, body fragments); shark spiral coprolites and indeterminable coprolites. Layer no. 4 is extraordinary because of the mass accumulation of acanthodian remains on the bedding planes and by far the largest number of amphibian remains discovered in the Rudník "Horizon".

Boreholes:

- F-1 Fořt borehole; (03-423 Svoboda nad Úpou); depth 58.85–64.65 m; (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2011)

Pseudestheriid conchostracans; *Acanthodes* sp. (fin spine); actinopterygian fishes *Paramblypterus* sp. (frontal) and Actinopterygii indet. (body fragment, fin fragment, scales, segments of lepidotrichia).

- F-2 Fořt borehole; (03-423 Svoboda nad Úpou); depth 74.60–78.70 m; (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2011)

Pseudestheriid conchostracans; Xenacanthiformes indet. (teeth); *Acanthodes* sp. (body fragment); Actinopterygii indet. (body fragment with head, fin fragment, supracleithrum and other bone fragments, scales, segments of lepidotrichia).

- F-3 Fořt borehole; (03-423 Svoboda nad Úpou); depth 161.05–164.60 m; (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2011)

Pelecypods Myalinidae indet.; pseudestheriid conchostracans; *Acanthodes* sp. (small body fragment, tangle of similarly directed small fin spines and scales); Actinopterygii indet. (body fragment, scales, and fulcra).

- HK-1 Horní Kalná borehole; (03-414 Vrchlabí); depth 519.85–560.80 m; (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2012)

Pseudestheriid conchostracans; xenacanthid sharks *Bohemiacanthus carinatus* (teeth) and Xenacanthiformes indet. (teeth, multicuspid dermal denticle); *Acanthodes gracilis* (pectoral fin spine articulated with dermatotrichia) and *Acanthodes* sp. (body fragments, fin spines, scapulocoracoids, scales, tangle of similarly directed small fin spines and scales); Actinopterygii indet. (body fragments, bone fragment, caudal fin fragment, scales, fulcra, segments of lepidotrichia); indeterminable coprolites.

- HPK-4 Horní Olešnice borehole (03-441 Hostinné); depth 225.30 m; (Blecha et al. 1997; Štamberg and Zajíc 2008)

Actinopterygii indet. (body fragments, scales, segments of lepidotrichia); indeterminable coprolites.

- Jk-6 Javorník borehole (03-423 Svoboda nad Úpou); depth 75.85–129.85 m; (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2011)

Pseudestheriid conchostracans; ostracods *Carbonita* sp.; xenacanthid shark *Bohemiacanthus carinatus* (teeth); *Acanthodes* sp. (body fragments, fin spines, scapulocoracoids, tangle of similarly directed small fin spines and scales); Actinopterygii indet. (body fragments, skull bones, scales, fulcrum, segments of lepidotrichia); large shark spiral coprolites.

- Ko-5 Košťálov borehole (03-413 Semily); depth 49.80 m; (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2009)

Actinopterygii indet. (scales, segments of lepidotrichia); indeterminable coprolite.

- Lt-1 Libštát borehole (03-413 Semily); depth 216.70 m; (Blecha et al. 1997; Štamberg and Zajíc 2008)

Actinopterygii indet. (scales, segments of lepidotrichia); indeterminable coprolites.

- Pl-1 Prostřední Lánov borehole (03-423 Svoboda nad Úpou); depth 68.00–68.50 m; (Blecha et al. 1997; Rieger 1971; Zajíc 2011)

Actinopterygii indet. (body fragments, scales).

- Rk-1 Rudník borehole (03-423 Svoboda nad Úpou); depth 24.50–24.90 m; (Blecha et al. 1997; Rieger 1971; Zajíc 2011)

Actinopterygii indet. (scales).

- Rk-2 Rudník borehole (03-423 Svoboda nad Úpou); depth 33.80–40.00 m; (Blecha et al. 1997; Rieger 1971; Zajíc 2011)

Actinopterygii indet. (complete specimen, body fragment, scales); indeterminable coprolites.

- Rk-4 Rudník borehole (03-423 Svoboda nad Úpou); depth 55.90–56.00 m; (Blecha et al. 1997; Rieger 1971; Zajíc 2011)

Actinopterygii indet. (scale).

- Rk-7 Janovice borehole (03-423 Svoboda nad Úpou); depth 44.10–46.70 m; (Blecha et al. 1997; Rieger 1971; Zajíc 2011)

Actinopterygii indet. (body fragment, scale).

- Rk-9a Rudník borehole (03-423 Svoboda nad Úpou); depth 52.45–55.50 m; (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2011)

Pseudestheriid conchostracans; *Acanthodes* sp. (scapulocoracoid, articulated postthyoid gill rakers, sclerotic plate, scales and tangle of similarly directed small fin spines and scales); Actinopterygii indet. (maxilla, scales and segments of lepidotrichia).

- Se-1 Semily borehole (03-413 Semily); depth 51.50 m; (Blecha et al. 1997; Zajíc 2009)

Actinopterygii indet. (scale).

- Ve-1 Valteřice borehole (03-414 Vrchlabí); depth 89.50–153.50 m; (Blecha et al. 1997; Rieger 1971; Zajíc 2012)

Pelecypod Myalinidae indet.; Actinopterygii indet. (scales); indeterminable coprolite.

- Ve-2 Valteřice borehole (03-414 Vrchlabí); depth 39.40–67.40 m; (Blecha et al. 1997; Rieger 1971; Zajíc 2012)

Pelecypods Myalinidae indet.; Actinopterygii indet. (scales); indeterminable coprolite.

- Ví-1 Vrchlabí borehole (03-414 Vrchlabí); depth 139.00–175.00 m; (Blecha et al. 1997; Rieger 1971; Zajíc 2012)

Pseudestheriid conchostracan; Actinopterygii indet. (body fragment and scales); indeterminable coprolite.

Upper Vrchlabí Formation

The Háje and Kozinec “Horizons” record the existence of local lakes which developed during a period of increased humidity, but only in the NW part of the basin (Opluštil et al. 2013).

Fauna is known only from the slightly younger Kozinec “Horizon”.

Kozinec “Horizon” fluviolacustrine deposits

This unit of limited extent consists predominantly of conglomerates and sandstones. The thickness is about 15 to 20 m (Prouza and Tásler 2001).

Locality:

- Kozinec hill near Jilemnice (03-413 Semily); (Štamberg and Zajíc 2008; Zajíc 2009)

The old dumps of copper ore mining provided pelecypods *Palaeonodonta castor* and the rib fragment of a tetrapod.

Prosečné Formation, Sakmarian

(Lower Rotliegend; *Xenacanthus decheni* zone)

This complex of alluvial-lacustrine deposits is up to 400 m thick in the eastern part of the basin (full development of the unit) and only around 300 m thick in the western part according to Prouza and Tásler (2001) and Štamberg et al. (2008). The most important fauna-bearing Kalná “Horizon” (the Upper Prosečné Formation) occurs in the central and eastern parts of the basin. A supposed equivalent is known as the Veselá “Horizon” from the westernmost part of the basin which is isolated from the rest of the basin by the basaltandesite and trachyandesite of the Kozákov Belt (Zajíc 2004).

Lower Prosečné Formation

The lower part of the Prosečné Formation is formed by deposits of alluvial plains and shallow semipermanent lakes. Sporadic faunas are known from the Arkosic “Horizon” and from an unnamed layer detected in the HK-1 Horní Kalná borehole (see below).

Borehole:

- HK-1 Horní Kalná borehole; (03-414 Vrchlabí); depth 91.30–91.40 m; (Štamberg and Zajíc 2008; Zajíc 1989, 2012)

Pelecypods Myalinidae indet.

Horní Branná “Horizon”

This unit is only several meters thick (situated 15–25 m below the Arkosic “Horizon”) and is predominantly formed by tuffs and tuffites (Prouza and Tásler 2001).

Locality:

- Roprachtice - documentation point 409d (03-413 Semily); (Štamberg and Zajíc 2008; Zajíc 1996)

Actinopterygii indet. (scales, segments of lepidotrichia).

Arkosic “Horizon”

The unit is up to 15 m thick and consists mainly of arkoses and arkosic sandstones (Prouza and Tásler 2001).

Borehole:

- Kh-1 Kruh borehole (03-413 Semily); depth 14.50–19.50 m; (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2012)

Pseudestheriid conchostracans; xenacanthid sharks (teeth); actinopterygian fishes *Paramblypterus* sp. (skull bone) and Actinopterygii indet. (maxillae, jaws, cleithra, supracleithrum, operculum, bone fragments, scales, fulcra, segments of lepidotrichia); indeterminable coprolites.

Upper Prosečné Formation

The main fossiliferous units are known as the Veselá (westernmost area of the basin) and Kalná (the rest of the basin) “Horizons”.

Kalná “Horizon”

The unit is formed by 10 to 20 m of lacustrine mudstones, claystones, carbonates and siltstones of a deeper semi-permanent lake. Some layers are enriched with Cu-sulphides and were therefore mined in the 19th century and between 1949–1952 (Štamberg et al. 2008).

Localities:

- Arnultovice - left bank of Čistá stream (03-423 Svoboda nad Úpou); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc, 1996, 2012)

Xenacanthid sharks *Xenacanthus decheni* (teeth) and Xenacanthidae indet. (fragments of occipital spines); actinopterygian fishes *Paramblypterus* sp. (fragment of skull bone) and Actinopterygii indet. (body fragments, bones, bone fragments, fulcra, scales and segments of lepidotrichia); indeterminable coprolites.

- Arnultovice - right bank of Čistá stream (03-423 Svoboda nad Úpou); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc, 2012)

Actinopterygian fishes *Paramblypterus* sp. (complete specimens, bones) and Actinopterygii indet. (scales, fulcra); indeterminable coprolites.

- Dolní Kalná (unspecified) (= Kalna bei Starkenbach); (03-432 Nová Paka); (Blecha et al. 1997; Štamberg and Zajíc 2008)

Pelecypods *Palaeonodonta verneuili* (and synonym *Palaeonodonta petraschecki*); Actinopterygii indet. (small specimen).

- Dolní Kalná - little quarry (03-432 Nová Paka); (Blecha et al. 1997; Štamberg 2012; Štamberg and Zajíc 2008)

Xenacanthid shark *Xenacanthus decheni* (teeth); actinopterygian fishes *Paramblypterus zeidleri*, *Paramblypterus* sp. (frontals, jaw, parasphenoid, cleithrum, bone fragments) and Actinopterygii indet. (articulated specimens, frontal, jaws, opercula, cleithra, bone fragments, scales, fulcra, segments of lepidotrichia); indeterminable coprolites.

- Dolní Kalná – Nosek (03-432 Nová Paka); (Blecha et al. 1997; Štamberg and Zajíc 2008)

Pseudestheriid conchostracans; xenacanthid sharks *Xenacanthus decheni* (toothed jaw fragments, tooth, occipital spine) and Xenacanthidae indet. (fragments of calcified cartilage); actinopterygians ?*Paramblypterus* sp. (skull bones) and Actinopterygii indet. (complete specimens, body fragments, cleithra, jaws, parasphenoids, opercula, skull bones, fins, scales, fulcra, segments of lepidotrichia); shark spiral coprolites and indeterminable coprolites.

- Horní Kalná (unspecified) (= Kalna bei Starckenbach, Oberkalná, Ober-Kalna); (03-414 Vrchlabí and 03-432 Nová Paka); (Blecha et al. 1997; Štamberg and Zajíc 2008)

Pelecypod *Palaeonodonta sophiae*; pseudestheriid conchostracans; xenacanthid shark *Xenacanthus decheni*; actinopterygian fishes *Paramblypterus zeidleri*, *Paramblypterus* sp., "Amblypterus" *feistmanteli*, "Amblypterus" *kablikae* and "Amblypterus" *vratislaviensis*; amphibians *Apateon* sp., ?*Melanerpeton* sp. and ?*Cheliderpeton* sp.

- Horní Kalná - abandoned quarry (03-432 Nová Paka); (Havlena and Špinar 1952; Štamberg and Zajíc 2008)

Amphibian remain ?*Cheliderpeton* sp. (Havlena and Špinar 1952); Actinopterygii indet.

- Horní Kalná - outcrop in the wood (03-432 Nová Paka); (Havlena and Špinar 1953)

Xenacanthid sharks *Xenacanthus* sp.

- Horní Kalná - dump of the Adam mine (03-414 Vrchlabí); (Blecha et al. 1997; Havlena and Špinar 1953; Maňourová 1981; Štamberg 1982; Štamberg and Zajíc 2008; Werneburg 1986; Zajíc 2012)

Pseudestheriid conchostracans; xenacanthid shark *Xenacanthus decheni* (teeth, occipital spines); actinopterygian fishes *Paramblypterus zeidleri*, *Paramblypterus rohani*, *Paramblypterus* sp., "Amblypterus" *feistmanteli*, "Amblypterus" *kablikae* and "Amblypterus" *vratislaviensis*; amphibians *Apateon* sp. and Branchiosauridae indet.; indeterminable coprolites.

- Horní Kalná - dump of the Eva mine (= Dolní Branná - dump of the Eva mine); (03-414 Vrchlabí); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2012)

Actinopterygii indet.; indeterminable coprolites.

- Horní Kalná - behind the garage (03-414 Vrchlabí); (Blecha et al. 1997; Štamberg 2012; Štamberg and Zajíc 2008; Zajíc 2012)

Xenacanthid sharks *Xenacanthus decheni* (teeth) and Xenacanthidae indet. (teeth, fragments of calcified cartilage); actinopterygian fishes *Paramblypterus zeidleri*, *Paramblypterus* sp. (skull and opercular bones) and Actinopterygii indet. (bones, scales, fulcra, segments of lepidotrichia); indeterminable coprolites.

- Horní Kalná - Fortuna mine (03-414 Vrchlabí); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2012)

Actinopterygian fishes *Paramblypterus* sp. and Actinopterygii indet.

- Horní Kalná - dump of the Vítěz mine (03-414 Vrchlabí); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2012)

Pseudestheriid conchostracans; Actinopterygii indet. (supracleithrum, scales, segments of lepidotrichia); indeterminable coprolites.

- Klášteřská Lhota (= Mönchsdorf an der Kleinen Elbe); (03-441 Hostinné); (Blecha et al. 1997; Štamberg 2002, 2012, 2013a; Štamberg and Zajíc 2008)

Scyphozoans *Medusina* sp.; pelecypods *Palaeonodonta castor*; xenacanthid sharks. *Xenacanthus* sp. (teeth, occipital spines); actinopterygians *Paramblypterus zeidleri*, *Paramblypterus* sp. (skull and opercular bones), *Amblypterus* sp. (skull and opercular bones), Aeduellidae indet. (almost complete specimens, frontals, supracleithrum, maxilla, subopercula, opercula) and Actinopterygii indet. (scales, fulcra, segments of lepidotrichia); indeterminable coprolites.

- Koclěřov - Lysé Hills (03-441 Hostinné); (Blecha et al. 1997; Holub 1966; Štamberg and Zajíc 2008)

The affiliation of this locality to the Kalná "Horizon" is uncertain.

Actinopterygii indet. (scales); indeterminable coprolites.

- Kruh 1 (03-413 Semily); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2009)

Xenacanthid sharks *Xenacanthus* cf. *decheni* (teeth) and Xenacanthida indet. (teeth, fragments of calcified cartilage); actinopterygians *Paramblypterus* sp. (skull bones) and Actinopterygii indet. (complete specimen, maxillae, jaws, frontals, parasphenoids, parietals, clavicles, opercula, praeopercula, cleithra, supracleithra, ?ceratohyal, bone fragments, scales fulcra, segments of lepidotrichia); indeterminable coprolites.

- Kruh 2 (03-413 Semily); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2009)

Xenacanthid shark *Xenacanthus* cf. *decheni* (tooth); Actinopterygii indet. (juvenile specimens, body fragments, jaws, cleithra, supracleithra, bone fragments, scales fulcra, segments of lepidotrichia); indeterminable coprolites.

- Prosečné - documentation point KM 085 (03-423 Svoboda nad Úpou); (Zajíc 2011) Actinopterygii indet. (body, heads, cleithrum scales); indeterminable coprolites.

- Zálesní Lhota - trial pit (= Huttendorf); (03-414 Vrchlabí); (Štamberg and Zajíc 2008; Zajíc 2012)

Actinopterygii indet.; indeterminable coprolites.

Borehole:

- Kh-1 Kruh borehole (03-413 Semily); depth 14.50–19.50 m; (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2009)

Pseudestheriid conchostracans; xenacanthid sharks *Xenacanthus* sp. (teeth) and Xenacanthidae indet. (teeth); actinopterygians *Paramblypterus* sp. (skull bones) and Actinopterygii indet. (jaws, maxillae, cleithra, supracleithrum, operculum, bone fragments, scales, fulcra, segments of lepidotrichia); dipnoan ?*Ctenodus* sp. (scales); crossopterygian Osteolepiformes indet. (scales); indeterminable coprolites.

Veselá “Horizon”

This unit is the equivalent of the Kalná “Horizon” from the small western area of the Krkonoše Piedmont Basin. The area is separated from the rest of the basin by the basaltandesites and trachyandesites of the Kozákov Belt.

Localities:

- Bítouchov (near Veselá; unspecified) (= Bítouchov, Bítouchov u Lomnice, Vitouchov unweit Lomnitz, Bituchow bei Lomnitz, Bytouchov, Vitochov); (03-342 Rovensko pod Troskami); (Blecha et al. 1997; Daněk 1901; Zajíc 2010)

Supposed oligochaetes *Lumbricopsis permicus*; pelecypods *Palaeonodonta compressa* and *Palaeonodonta* cf. *parallela*; pseudestheriid conchostracans; actinopterygians “*Amblypterus*” *feistmanteli* and Actinopterygii indet.

- Bítouchov - documentation point S-342 (03-342 Rovensko pod Troskami); (Blecha et al. 1997; Zajíc 2010)

Actinopterygii indet. (complete specimens, bones, scales); indeterminable coprolites.

- Bítouchov - documentation point 235 (03-342 Rovensko pod Troskami); (Blecha et al. 1997; Zajíc 2010)

Actinopterygii indet. (complete specimens, supracleithrum, bones, scales, segments of lepidotrichia); indeterminable coprolites.

- Bítouchov – road cut (03-342 Rovensko pod Troskami); (Blecha et al. 1997; Holub and Kozur 1981; Kamarád 1959; Zajíc 2011)

Pseudestheriid conchostracans *Pseudestheria tenella* and *Pseudestheria ultima* (according to Kamarád 1959) or *Protolimnadia calcarea* (according to Holub and Kozur 1981); Actinopterygii indet. (scales).

- Křečovice pod Troskami (= Křečovic bei Rowensko, Křečovice u Rovenska); (03-342 Rovensko pod Troskami); (Blecha et al. 1997; Zajíc 2010)

Ostracods *Carbonita* sp. (originally labelled as *Carbonita salteriana*).

- Veselá - Veselka brook (03-342 Rovensko pod Troskami); (Blecha et al. 1997; Rieger 1968; Štamberg 1996; Štamberg and Zajíc 2008; Zajíc 2010); type locality of the Veselá “Horizon” (Rieger 1968)

Pseudestheriid conchostracans; xenacanthid shark *Xenacanthus* cf. *decheni* (teeth); actinopterygians (complete specimens, body fragments, maxilla, supracleithra, cleithra, opercula, bone fragments, scales, fulcra, segments of lepidotrichia) *Paramblypterus rohani*, *Paramblypterus* sp. and Actinopterygii indet.; amphibians ?*Apateon* sp. (skull with incomplete vertebral column) and one specimen of another genus (lower jaw); indeterminable coprolites and shark spiral coprolites.

- Žlábek (03-342 Rovensko pod Troskami); (Blecha et al. 1997; Štamberg and Zajíc 2008; Zajíc 2010)

Actinopterygians (complete specimens, scales, segments of lepidotrichia) *Paramblypterus* sp. and Actinopterygii indet.

Borehole:

- Bv-2 Bítouchov borehole (03-342 Rovensko pod Troskami); depth 106.10–155.00 m; (Blecha et al. 1997; Zajíc 2010)

Actinopterygii indet. (scales).

Palaeogeography and palaeoenvironment

Rudník Lake

The Rudník Lake deposits represent the most extensive lacustrine deposits in the Krkonoše Piedmont Basin. Grey to black and variegated lacustrine mudstones, laminites and carbonates of the Rudník “Horizon” have a thickness up to 60-70 meters (in the central part of the basin) and laterally extend for more than 400 km² (Martínek et al. 2006).

The fossil contents and taphonomic conditions of the great majority of the fauna-bearing sites correspond with a large stratified lake with anoxic hypolimnion and periodic eutrophications. Only local differences are recognizable within the fauna found in the facies of blackish grey and dark grey laminated to finely laminated mudstones. The relatively deepest water conditions occurred in the western (localities in the neighbourhood of Semily and Košťálov) and partly in the northern (Vrchlabí) areas.

Occurrences of terrestrial faunal elements (insects) and some semi-aquatic animals (branchiosaurid amphibians) in the localities Vrchlabí – road cut, Rybnice - Hrádecký creek, and in the Prostřední Lánov outcrops indicate (temporary) shallow water near shore conditions. Branchiosaurids represent the larval or paedomorphic temnospondyls (e.g. Schoch and Milner 2008) which usually preferred shallow lakes and protected nearshore areas of large lakes. However, branchiosaurids were also occasionally found at the Košťálov and Rudník localities. Most possibly they were sporadically washed into deeper lake deposits.

Deposits at the base of the Rudník “Horizon” in the Vrchlabí – road cut outcrop correspond to a gradually deepened lake (aerated lake or epilimnion of a stratified lake) with periodic eutrophications.

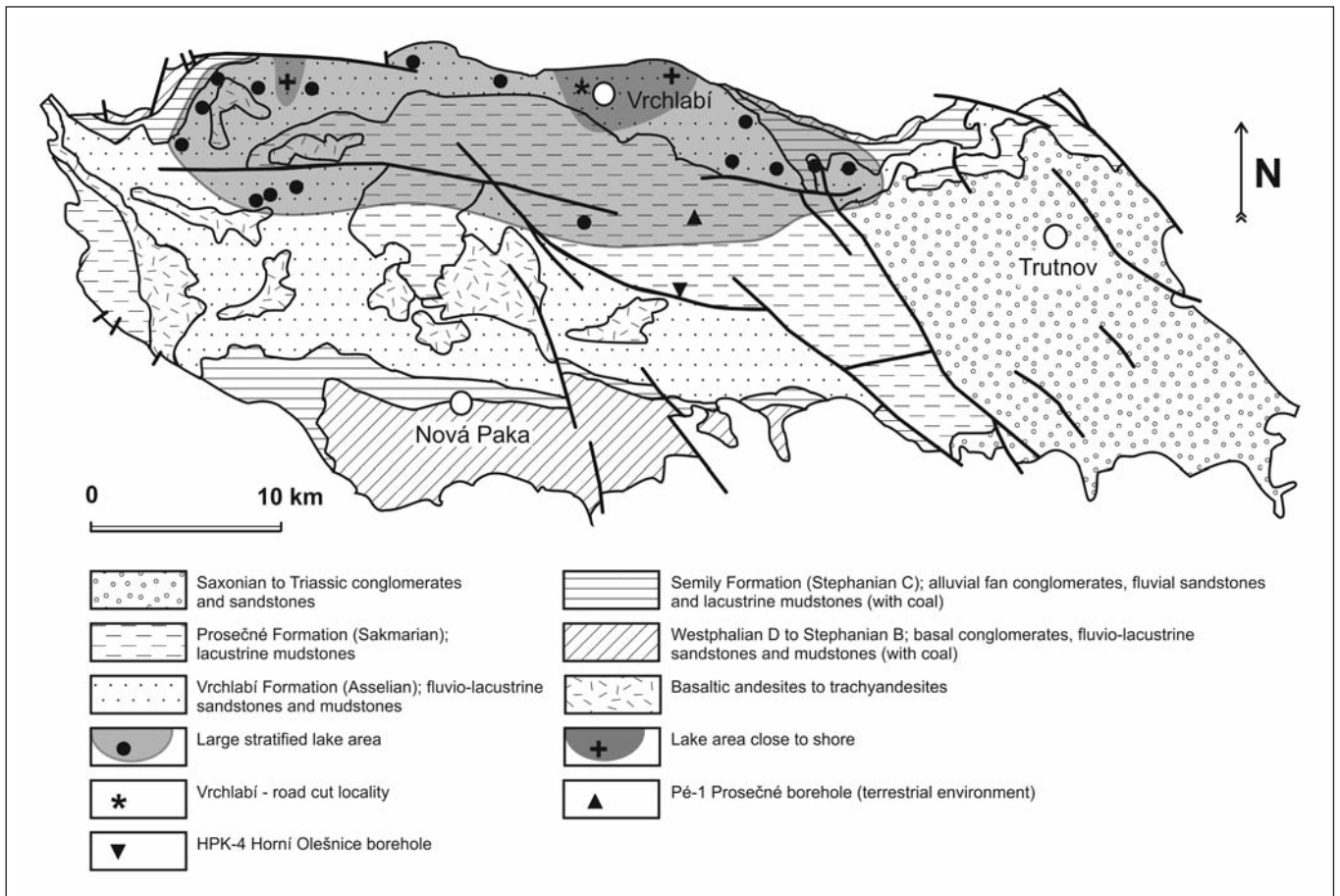
Terrestrial environments around the lake are indicated by tetrapod footprints in the Pé-1 Prosečné borehole (depth 753.30 m; Blecha et al. 1997; Rieger 1971).

The greyish violet finely laminated clayey limestone found in the HPK-4 Horní Olešnice borehole is frequently correlated with the Rudník “Horizon”. This southernmost occurrence of a lake sediment of this age has not yet been evaluated.

Kalná Lake

The Kalná “Horizon” is represented by a 10 to 20 m thick package of grey-black lacustrine mudstones, claystones, carbonates and siltstones of a rather extensive and relatively deep lake or lake system. The lateral extent of the Kalná Lake is difficult to determine because of the restricted number of outcrops and boreholes.

Most localities indicate the environment of a stratified lake with frequent eutrophications. The more distant locality, Kocléřov, in the south-east of the basin possibly also pertains



Text-fig. 3. Simplified geological map of the Krkonoše Piedmont Basin (based on Blecha et al. 1997) with the palaeogeographic outline of the Rudník lake deposits. The site of Vrchlabí – road cut represents the complete Rudník “Horizon” sequence with record of various developmental stages of the lake. Numbers of sites are simplified.

to this biofacies. The deepest lake conditions were detected at the Kruh localities.

The locality Arnultovice - left bank of Čistá stream corresponds to a nearshore environment because the ichthyoliths, including shark teeth of *Xenacanthus decheni*, are worn most probably by wave actions.

Terrestrial environments surrounding the lake are demonstrated at the Prosečné locality where tetrapod footprints and arthropod trails were found.

Western localities of the Veselá “Horizon” probably represent the western area of the Kalná Lake, but the existence of a separate lake area cannot be excluded.

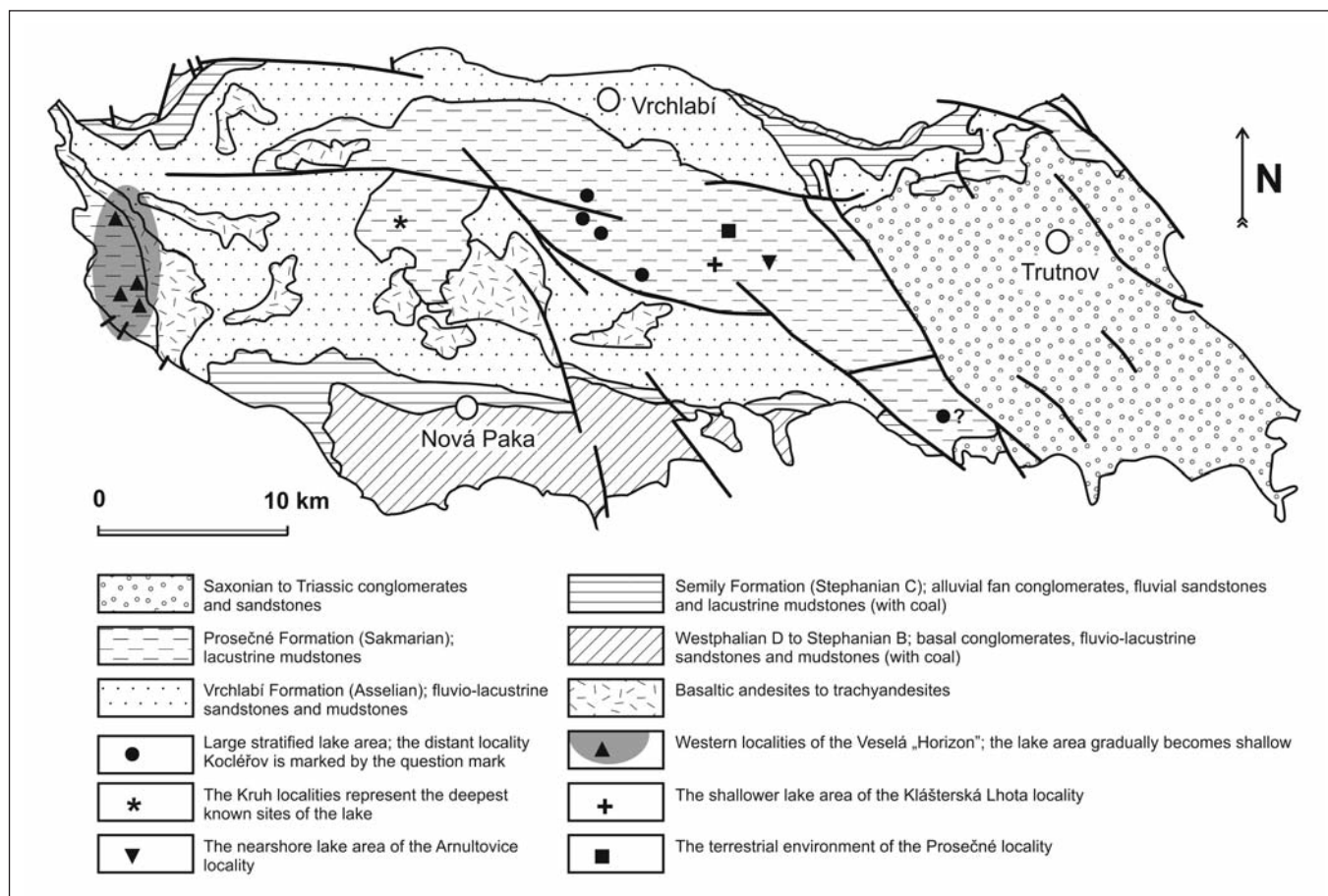
Discussion

The fish local biozonation (Zajíc 2000, 2004, 2005) was regarded by Lucas et al. (2006) as local ecostratigraphy in some Bohemian basins as the real range of the zone-species *Acanthodes gracilis* and *Xenacanthus decheni* is so far unknown. However, this is a common situation in non-marine fossil animals because fossiliferous beds are often separated by sterile units of considerable thickness. Should we therefore renounce biostratigraphy? Some features of ecostratigraphy are unquestionable, and the local character of the biozonation is always emphasised. The term ecozone is, however, predominantly used in biogeography. I therefore use here a neutral term - zone.

The Asselian fauna of the Rudník “Horizon” represents the local *Acanthodes gracilis* zone, which is particularly characterised by the nominal taxon and by the xenacanthid shark *Bohemiacanthus carinatus*. Faunas of the Upper Vrchlabí Formation lack these taxa. This could be caused by the poor fossil record and also by the distinct palaeo-environment. Recent stratigraphic investigations of the Lower Letovice Formation in the Boskovice Graben (Zajíc 2004, 2005; Zajíc and Štamberg 2004) revealed the special vertebrate association in the upper part of the local *Acanthodes gracilis* zone. *Acanthodes gracilis* is accompanied here by *Acanthodes stambergi* (see Zajíc 2005; Fig. 1), and shark remains (from the same Zboněk-Svitávka Horizon) that were identified by Schneider (1985) as *Triodus* cf. *sessilis* instead of *Bohemiacanthus carinatus*. No equivalent of the upper part of the zone is known from the Krkonoše Piedmont Basin.

The fauna of the Lower Prosečné Formation is poorly known and the affiliation of the unit with the local *Xenacanthus decheni* zone is based (only circumstantial evidence, of course) mainly on the absence of any acanthodian remains.

The identity of the Veselá and Kalná “Horizons” was evidenced by Prouza and Tásler (2001) based on the Že-1 Žernov u Tatobit borehole (the Veselá “Horizon”) in which the lithologic succession is clearly correlative with typical development of the Kalná “Horizon”.



Text-fig. 4. Simplified geological map of the Krkonoše Piedmont Basin (based on Blecha et al. 1997) with the palaeogeographic outline of the Kalná lake deposits. Numbers of sites are simplified.

Conclusions

Compilations of fossils sites and their fossil content provide the basis for further research towards a better understanding of the evolution of biotas in their environments. Here it concerns mainly the aquatic fauna of lake horizons. Comparing the diversity data of the freshwater fauna in the Carboniferous and Permian lake horizons of the Krkonoše Piedmont Basin, clear differences are immediately visible. The shark fauna in the Late Carboniferous lake horizons, especially the Ploužnice “Horizon” (Semily Formation), consist of the xenacanthid sharks *Orthacanthus*, *Xenacanthus*, *Bohemiacanthus* and euselachiid sharks such as *Sphenacanthus* and *Turnovichthys* (Štamberg and Zajíc 2008; Zajíc 2007). In the Early Permian (Asselian) Rudník “Horizon” only *Xenacanthus* and *Bohemiacanthus* are known and in the Sakmarian Kalná “Horizon” only *Xenacanthus* has been found. The impoverishment of the shark fauna at the transition from the Stephanian to the Lower Rotliegend, which corresponds roughly to the Gzhelian/Asselian boundary (Schneider et al. 2013), was first considered by Schneider and Zajíc (1994) as the effect of destruction of the Carboniferous lake and river systems during the Franconian volcano-tectonic event (Schneider et al. 1995; see also Schneider 1996, Fig. 10). A further impoverishment during the Sakmarian is indicated by the absence of *Bohemiacanthus* in the Kalná “Horizon” in which only *Xenacanthus* occurs.

This may be caused by the cyclical increasing aridisation and consequent increasing disappearance of stable rivers and lakes. A challenge for further research is the actinopterygian fauna of the Krkonoše Piedmont Basin and the Central Bohemian basins in general (Štamberg 2013b). In particular in view of the palaeobiogeography of these fishes this could provide valuable information on the Late Carboniferous and Early Permian drainage systems which may at times have connected the Central European basins. From the data compiled here a similar impoverishment as in the freshwater shark fauna from the Carboniferous into the Early Permian could be observed. In the early Asselian Rudník lake horizon a still diverse actinopterygian fauna occurs with numerous genera and species. In the following extended Kalná lake horizon, the actinopterygian fauna is restricted to only a few *Paramblypterus* and “*Amblypterus*” species. Both the lakes were mainly fish-dominated. The rare occurrences of amphibians, especially branchiosaurids, suggest the possibility for future more detailed interregional correlations of the deposits and biota of the Krkonoše Piedmont Basin.

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