The oldest records of the stem amniote *Discosauriscus* (Seymouriamorpha, Discosauriscidae) from the European Carboniferous–Permian boundary

Jozef Klembara, Ralf Werneburg, Marika Mikudíková, Juraj Šurka & Stanislav Štamberg

The skeletal remains of early tetrapod *Discosauriscus* (Seymouriamorpha) are known from the lower Permian deposits of the Central and Western Europe. We describe here two specimens of *Discosauriscus*: one from the Czech Republic (*D. pulcherrimus*) and the second from Germany (*D.* cf. *pulcherrimus*). *Discosauriscus pulcherrimus* is represented by the complete skull and partial anterior postcranial skeleton, and represents the oldest record of this species from the Czech Republic. To identify the diagnostic characters of *D. pulcherrimus*, we used the high-resolution X-ray microcomputed tomography. This enabled us to identify all three characters typical for this species, in contrast to the morphology of the contemporaneous *D. austriacus*. The discosauriscid from Germany, known on the basis of the postcranial skeleton (*Discosauriscus* cf. *pulcherrimus*), represents the first record of the genus *Discosauriscus* from the Upper Carboniferous. • Key words: Germany, latest Carboniferous, Czech Republic, early Permian, Seymouriamorpha, Discosauriscidae, skeletons.

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The group Seymouriamorpha includes early tetrapods with the amphibian reproductive strategy recorded previously in the Permian of the North America, Europe, and Asia (White 1937; Špinar 1952; Bulanov 2003; Klembara 1997, 2011; Klembara & Mikudíková 2019 and references therein). The fossil record of Seymouriamorpha includes specimens in the pre-metamorphic stage (with external gills and found in the lacustrine sediments), as well as the post-metamorphic specimens of various grade of ossification, size, and age (Bulanov 2003, Sanchez *et al*. 2008, Klembara 2009).

The species of the family Discosauriscidae (Romer 1947) are so far known from the European localities in the Lower Permian of the Czech Republic, Poland, Germany and France: *Discosauriscus austriacus*, *D. pulcherrimus*, *Makowskia laticephala*, *Spinarerpeton brevicephalum* and one unidentified discosauriscid specimen (for review see Klembara 2016). The sixth discosauriscid species is *Ariekanerpeton sigalovi* from the Lower Permian of Tadzhikistan (Klembara & Ruta 2005). The stratigraphically oldest known seymouriamorph species is *Utegenia spinari* (Utegeniidae) from the upper Carboniferous(?)–lower Permian of Kazakhstan (Klembara & Ruta 2004). However, there is no certainty as for the potential Upper Carboniferous age of *Utegenia* (Bulanov 2003). An another discosauriscid, *Urumquia liudaowanensis* (Zhang *et al.* 1984), is from China. According to the latest investigations, the locality of *Urumquia* is of Middle Permian age (Jiang *et al*. 2020). Previously, no discosauriscid remains have been recorded in the upper Carboniferous sediments.

The aims of the present paper are: 1) description of two new specimens belonging to *Discosauriscus* (Discosauriscidae) from the Czech Republic and Germany; and 2) their stratigraphic evaluation.

Material and methods

Skull length of the specimen (NHMS-WP10870) from the locality Semily is about 28 mm (measured in the median plane). The postcranial skeleton of the specimen from the locality Sembachtal (NHMS-WP12069) may belong to a specimen with about 30 mm skull length. The study of the sequence of the ontogenetic stages of *Discosauriscus* shows that both here described specimens represent the larval ontogenetic stages (Klembara 1995, 1997, 2009).

We used high-resolution X-ray microcomputed tomography to obtain the morphology of bones completely or partially embedded in the sediment and which are crucial for the determination of the specimen NHMS-WP10870. Microcomputed tomography (μ-CT) imaging was performed with phoenix v|tome|x L 240 device, developed by GE Sensing & Inspection Technologies at the Earth Science Institute of the Slovak Academy of Sciences in Banská Bystrica. Investigated specimen was analyzed by using 240 kV/320W microfocus tube. Scanning parameters were set as follows: voltage 200 kV, current 200 μA, projections 1900, average 3, skip 1, timing 333 ms, voxel size 40 μm, detector sensitivity 2, and 0.1Cu filter.

The photographs of the postcranial skeleton of *Discosauriscus* from Sembachtal, Germany (NHMS-WP12069), was taken with Nikon D5100 camera. The drawing of this specimen was made with the help of a drawing mirror ('camera lucida') on a Zeiss binocular Discovery.V12.

Institutional abbreviations. – NHMS – Naturhistorisches Museum Schloss Bertholdsburg, Schleusingen, Germany; SCD – Collection of Credner, State Museum for Mineralogy and Geology, Dresden, Germany.

Geological settings of specimen NHMS-WP10870 from Bohemia

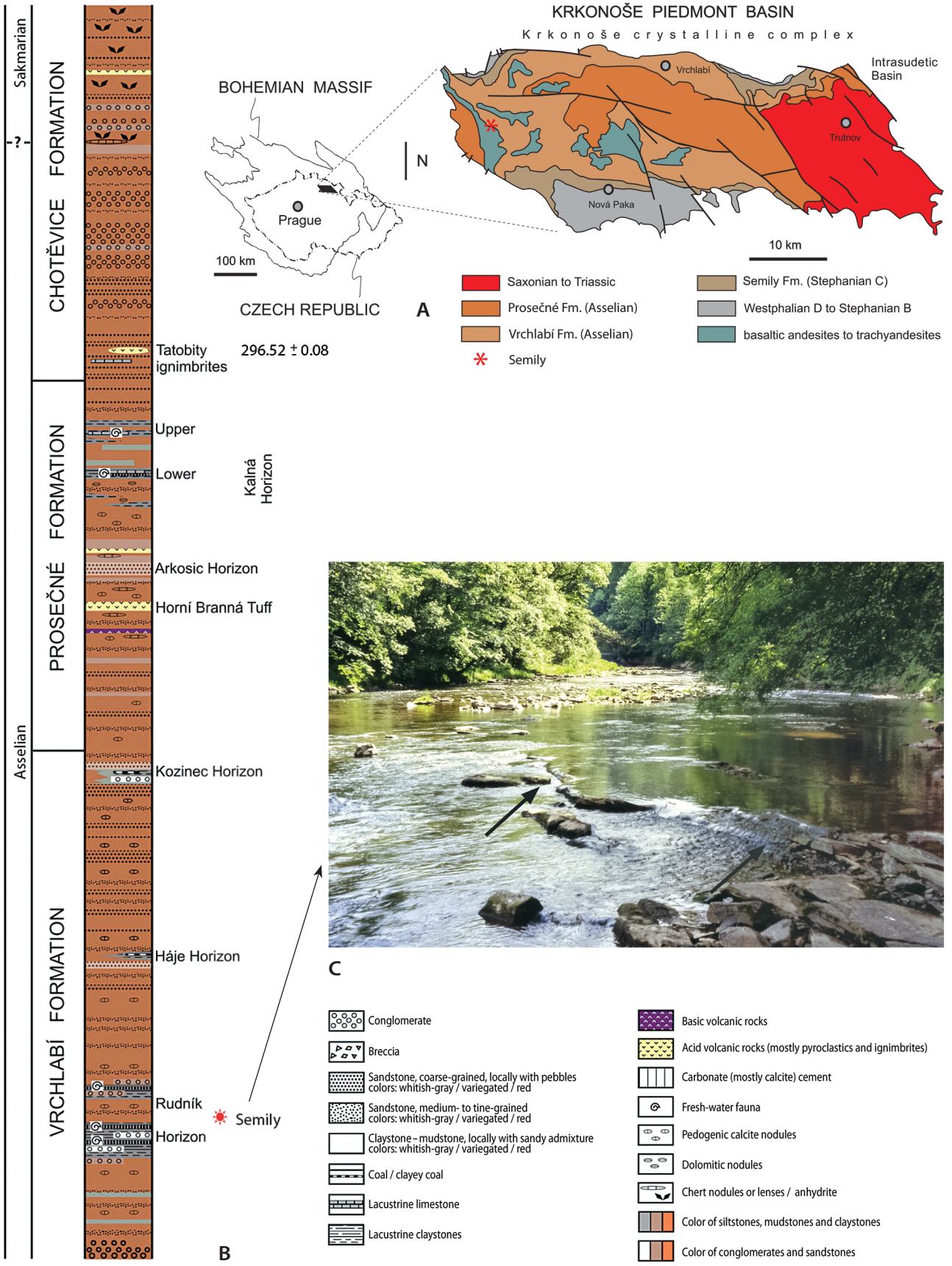
The intra-montane Krkonoše Piedmont Basin is a large Upper Paleozoic basin which occupies the north-eastern region of the Bohemian Massif (Fig. 1A). The area of the basin is more than 1100 km^2, and the maximum thickness of the volcano-sedimentary basin fill in its central part is nearly 1800 m. The basin was formed as part of a system of basins that opened in the Bohemian Massif during the late phases of the Variscan Orogeny. Deposition within the basin started during the Westphalian D (Moscovian), and it continued with several interruptions to the Early Permian (Sakmarian). The youngest units (Saxonian to Triassic) have been preserved only in the eastern part of the basin. The Early Permian filling is represented by the Vrchlabí Formation (Asselian), Prosečné Formation (Asselian) and Chotěvice Formation (Asselian-Sakmarian) (Opluštil *et al*. 2016). The specimen described here comes from the Rudník Horizon of the Vrchlabí Formation. Rudník Horizon (Fig. 1B) is important fossiliferous horizon, and its thickness varies from 30 to 150 m (Tásler *et al*. 1981, Martínek *et al*. 2006, Prouza *et al*. 2013). It consists of lacustrine gray mudstone with layers of organic rich gray-black calcareous claystone beds, carbonate, sandstone, and conglomerate with intercalation of volcanic beds. Present outcrops indicate the east-west extent of the Rudník Horizon which is more than 30 km in length, and its surface area is approximately 300–500 km^2, although it could be much larger, around 1000 km^2 (Martínek *et al.* 2006). The occurrence of early tetrapods, actinopterygians and other vertebrates is restricted to lacustrine organic rich gray-black calcareous claystone mostly, which outcrops in one or two beds. The organic rich gray-black shales with fauna are characterized by fine lamination, high organic matter content, and represent anoxic offshore sedimentation (Martínek *et al*. 2006).

Specimen NHMS-WP10870 comes from the locality Semily "Left bank of Jizera River" (Štamberg & Zajíc 2008) (coordinates 50° 35′ 44.112″ N, 15° 20′ 31.353″ E). The firm gray-black claystone of the Rudník Horizon traverses across the Jizera River from the right to the left bank of the river (Fig. 1C). Rich aquatic vertebrate fauna is represented by actinopterygians *Parambylpterus rohani* and *Neslovicella elongata*, acanthodian *Acanthodes gracilis*, xenecanthid shark of the genus *Bohemiacanthus*, and rare small branchiosaurid amphibians (Štamberg 2017). New tetrapods material extend this list to include (NHMS): 12 branchiosaurids, 1 micromelerpetid, 1 eryopid larva, 2 stereospondylomorph larvae, and a unique specimen of *Discosauriscus pulcherrimus* described below. It represents stratigrafically the oldest record of *D. pulcherrimus* in the Czech Republic.

Geological setting of specimen NHMS-WP12069 from Thuringia

The Thuringian Forest Basin is a depression approximately 40 to 60 km wide NW–SE orientated. It is in large

Figure 1. A – simplified geological map of the Krkonoše Piedmont Basin with position of the locality Semily "Left bank of Jizera River" (see asterisk; coordinates 50° 35′ 44.112″ N, 15° 20′ 31.353″ E). After Blecha *et al*. (1999). • B – position of the locality Semily "Left bank of Jizera River" in idealized section of the Permian sediments of the Krkonoše Piedmont Basin. After Opluštil *et al.* (2016), based on data in Prouza & Tásler (2001), modified here. • C – locality Semily "Left bank of Jizera River" with gray-black claystone traverses across the river Jizera River to the left bank of the river. Outcrops of the gray-black claystone are indicated by arrows.


KRKONOŠE PIEDMONT BASIN
Krkonoše crystalline complex
BOHEMIAN MASSIF
Prague
100 km
CZECH REPUBLIC
A
N
Vrchlabí
Intrasudetic Basin
Trutnov
Nová Paka
10 km
Saxonian to Triassic
Prosečné Fm. (Asselian)
Vrchlabí Fm. (Asselian)
Semily
Semily Fm. (Stephanian C)
Westphalian D to Stephanian B
basaltic andesites to trachyandesites
Sakmarian
?
Asselian
CHOTĚVICE FORMATION
PROSEČNÉ FORMATION
VRCHLABÍ FORMATION
Tatobity ignimbrites
296.52 ± 0.08
Upper
Lower
Kalná Horizon
Arkosic Horizon
Horní Branná Tuff
Kozinec Horizon
Háje Horizon
Rudník Horizon
Semily
B
C
Conglomerate
Breccia
Sandstone, coarse-grained, locally with pebbles colors: whitish-gray / variegated / red
Sandstone, medium- to tine-grained colors: whitish-gray / variegated / red
Claystone – mudstone, locally with sandy admixture colors: whitish-gray / variegated / red
Coal / clayey coal
Lacustrine limestone
Lacustrine claystones
Basic volcanic rocks
Acid volcanic rocks (mostly pyroclastics and ignimbrites)
Carbonate (mostly calcite) cement
Fresh-water fauna
Pedogenic calcite nodules
Dolomitic nodules
Chert nodules or lenses / anhydrite
Color of siltstones, mudstones and claystones
Color of conglomerates and sandstones

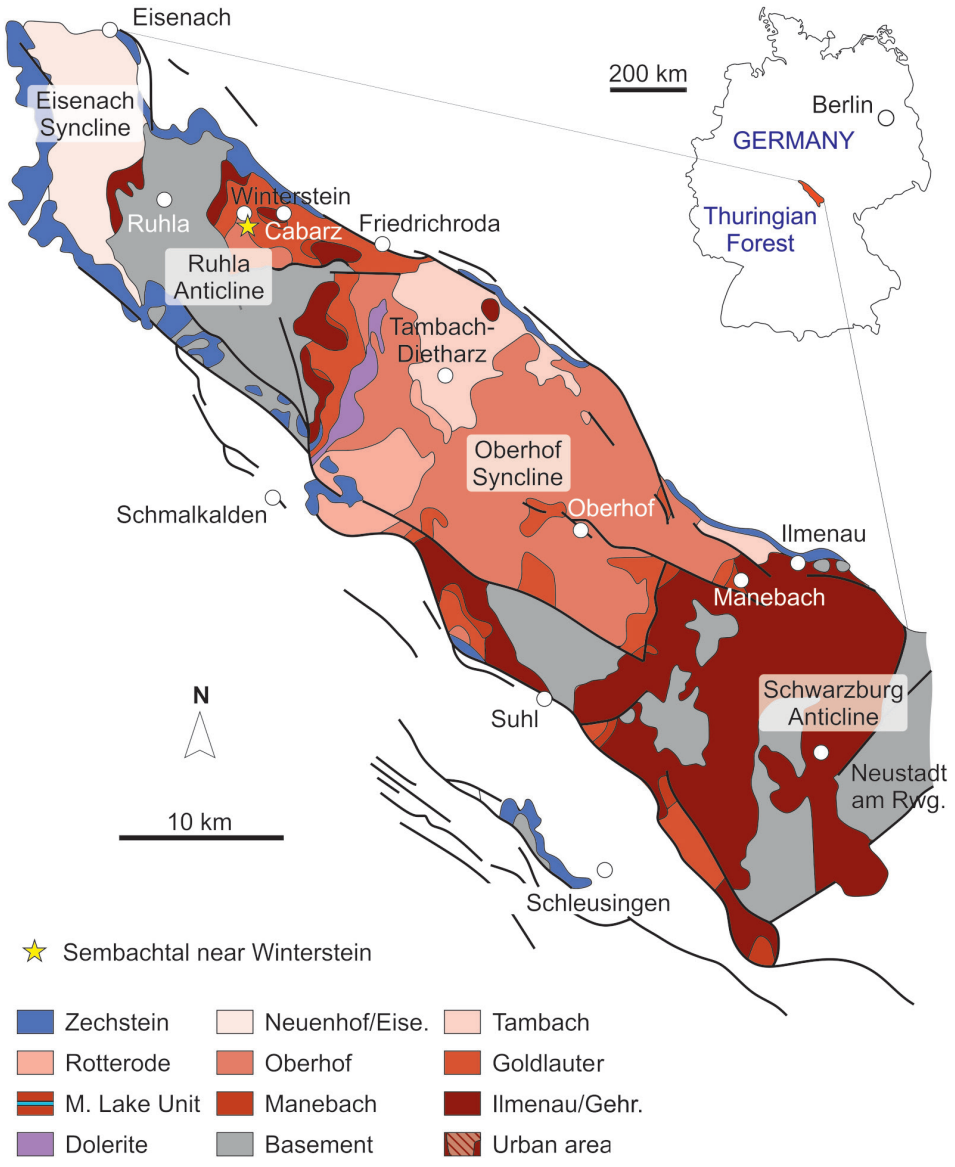


Figure 2. Geological map of the Thuringian Forest, including the positions of the documented localities (numbers) near Manebach and Schmücke. Modified from Lützner *et al*. (2012) and Trümper *et al*. (2023).

part exposed in the horst structure of the Thuringian Forest Mountain (Figs 2, 3). The Basin fill consists of about 4800 m (stacked thickness) volcanites and sediments of exclusively continental origin. They cover the time span from the late Pennsylvanian Gzhelian (Stephanian C) to the early Permian Kungurian–Roadian transition and, above a big hiatus, the late Permian earliest Wuchiapingian with only a decameter thick dry evaporitic red beds (Figs 2, 3). The first description of the Rotliegend plant fossils was published by the coal mine owner Heyn in 1695. The publication of von Schlotheim (1804) on the flora of the "Rothliegend" and the "Steinkohlen-Formation" of the Thuringian Forest Mountain marks the beginning of the scientific paleobotany (*e.g.*, Barthel 1994, 2003; Barthel & Rößler 1995). Since the seventies of the last century, this basin moved again into the focus of paleontological investigations, mainly by studies on the tetrapod tracks, invertebrates (insects) and vertebrates (amphibians) (Haubold 1970, Schneider 1978, Werneburg 1985). This Carboniferous–Permian basin is one of the biostratigraphically best investigated and correlated basin in the Variscan area (*e.g.*, Schneider 1996, 2001; Werneburg & Schneider 2006; Schneider & Werneburg 2006, 2012; Lützner *et al*. 2012; Schneider *et al*. 2021).

The paleontological excavations during the last four decades provide an almost complete picture of the fossil record. The lake horizons were of special interest. The lacustrine black limestones of the uppermost Pennsylvanian Ilmenau Formation are rich on early tetrapods. The fauna of the Sembachtal-locality includes (Werneburg 1989c): about 620 specimens of large growing branchiosaurid *Melanerpeton sembachense*, 12 specimens

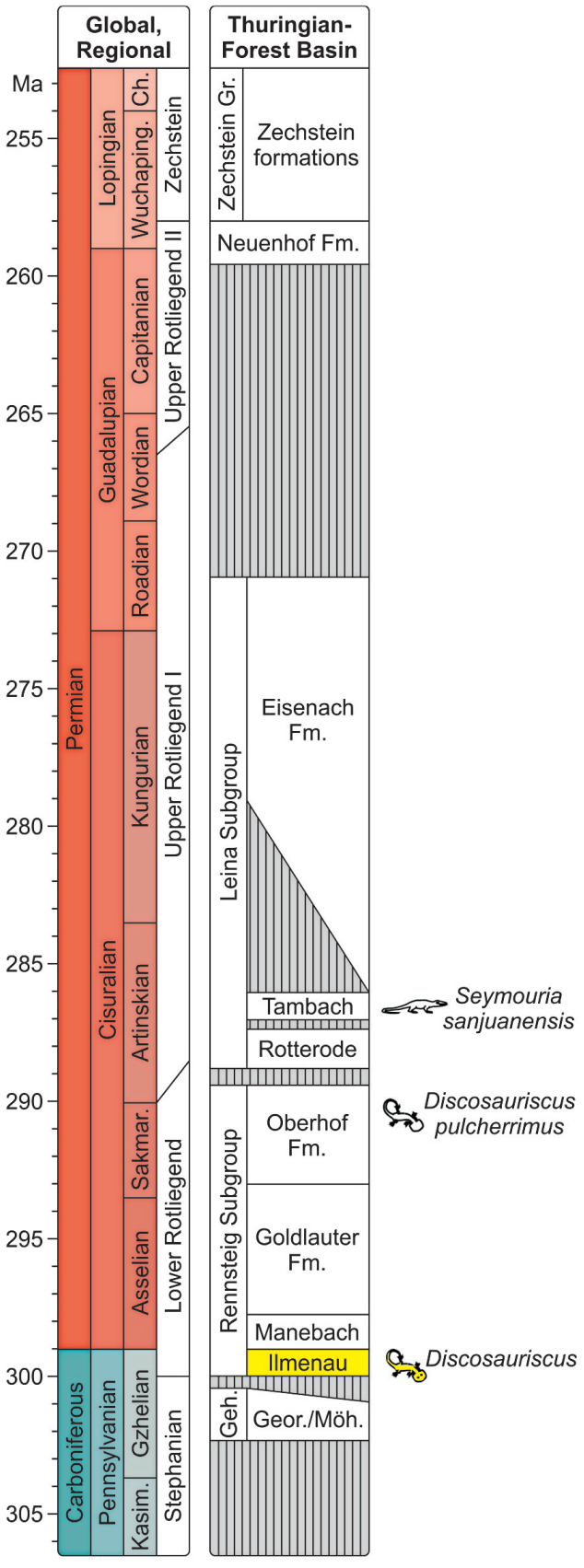


Figure 3. Late Paleozoic lithostratigraphy of the Thuringian-Forest area; modified after Schneider *et al.* (2021) but see Lützner *et al.* (2021) with partially contrasting new radioisotopic ages, and Trümper *et al.* (2023). Abbreviations: Ch. – Changhsingian; Geh. – Gehren Subgroup; Geor. – Georgenthal Formation; Kasim. – Kasimovian; Möh. – Möhrenbach Formation.

of micromelerpetid *Limnogyrinus edani*, 8 specimens of eryopid, *Onchiodon langenhani*, and a unique skeleton of the seymouriamorph *Discosauriscus*. The well-known branchiosaurid *Apateon dracyiensis* (Werneburg 2001) is distributed also in other lakes of the same time level. The actinopterygian fishes (*e.g.*, *Paramblypterus duvernoyi*) occur in the lake beds above the amphibian horizon.

Systematic paleontology

Order Seymouriamorpha Watson, 1917
Family Discosauriscidae Romer, 1947

Genus *Discosauriscus* Kuhn, 1933

***Discosauriscus pulcherrimus* (Fritsch, 1880)**
Figures 4–6

Diagnosis. – *Discosauriscus pulcherrimus* is characterized by three diagnostic features (Klembara 1997): 1) the posterior ramus of the prefrontal and the anterior ramus of the postfrontal meet at about the level of the anterior and middle thirds of the frontal length; 2) the ventrolateral ramus of the postorbital is narrowed and its tip lies slightly anterior to the wedge-shaped dorsomedial ramus of the jugal; and 3) the rows of small densely arranged denticles diverge anteromedially and anterolaterally from the mid-width of the ventral surface of the palatal ramus of the pterygoid.

Material. – Specimen NHMS-WP10870: skull and partial postcranial skeleton deposited in the Naturhistorisches Museum Schloss Bertholdsburg, Schleusingen, Germany.

Description. – The two species of the genus *Discosauriscus*, *D. austriacus* and *D. pulcherrimus*, have been described in detail by Klembara (1997) and Klembara & Bartík (2000). In the following, only the bones and their structures which are crucial for the determination of the studied specimen are described.

The skull and anterior postcranial skeleton are exposed in dorsal view (Figs 4, 5). Most of the skull roof bones are articulated, only the left cheek and partially right cheek are more-or-less disarticulated. Both prefrontals and the right postfrontal are well-preserved. Both frontals are also preserved, but there is a big break through both

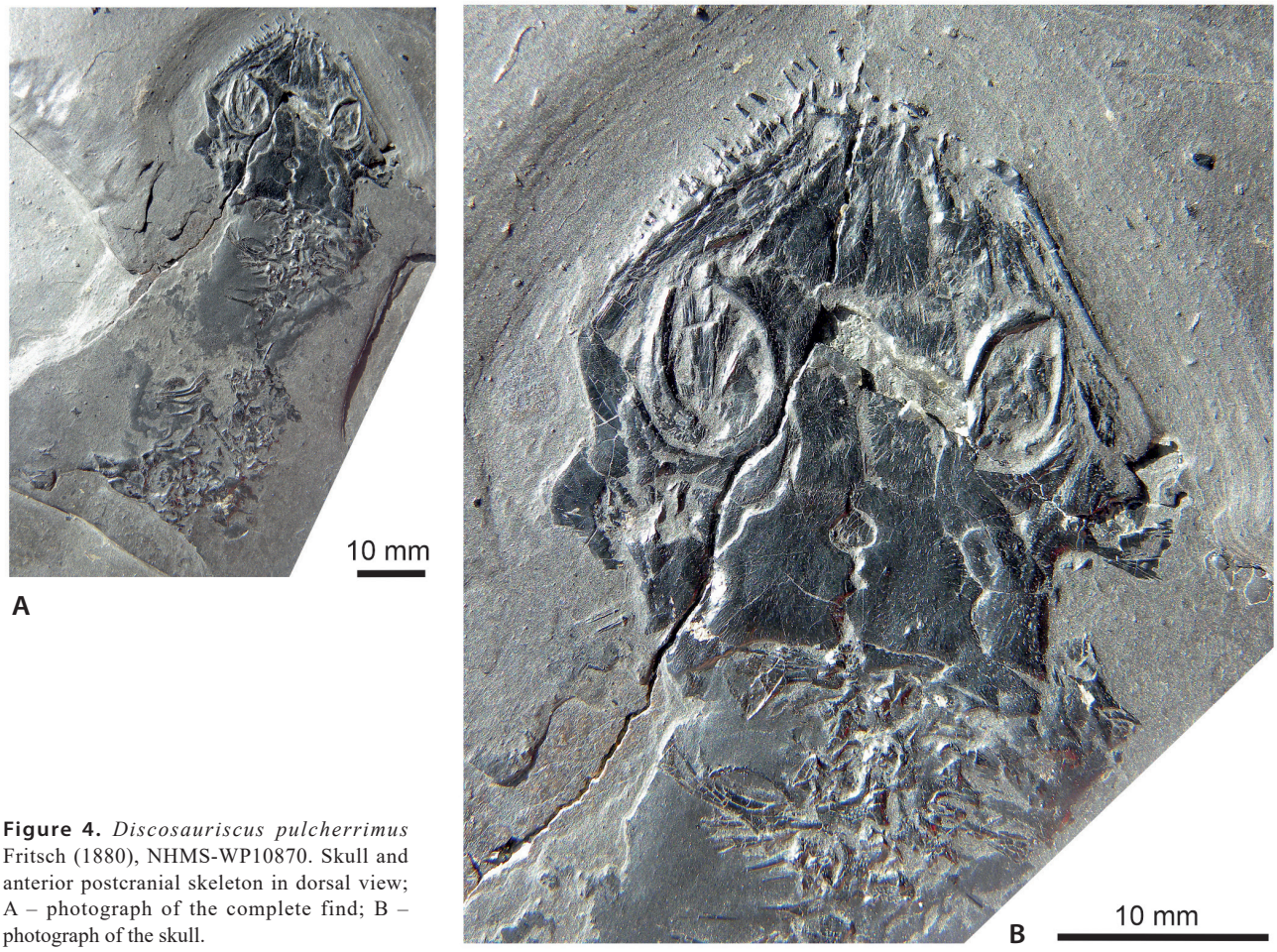


Figure 4. *Discosauriscus pulcherrimus* Fritsch (1880), NHMS-WP10870. Skull and anterior postcranial skeleton in dorsal view; A – photograph of the complete find; B – photograph of the skull.

frontals running in anteromedial-posterolateral direction; the pieces of both frontals are missing here. It may be estimated that the junction of the prefrontal and postfrontal lies slightly anterior to the level of the mid-length of the frontal. This is a typical feature for *Discosauriscus pulcherrimus* (Klembara 1997).

Both postorbitals are present and well-preserved (Figs 4, 5). The postorbital is of triangular shape. Its orbital margin is smooth and slightly extends dorsally. The dorsomedial portion of the postorbital is of triangular shape. The posterior portion of the postorbital is of triangular shape and its posterior extension fitted between the intertemporal medially and squamosal laterally. The lateroventral portion of the postorbital is anteroposteriorly broad and extends anterolaterally into a short and pointed process. This process slightly overlaps the dorsal, pointed process of the jugal in the articulated skull.

Both jugals are preserved, however, their posteroventral portions are overlapped by the postorbitals (Figs 4, 5). The dorsal portions of the jugals are anteroposteriorly narrow and form almost pointed processes. Such narrowed or almost pointed processes of the jugal and postorbital are typically present in *Discosauriscus pulcherrimus* (Klembara 1997, Klembara & Mikudíková 2019 and see above). This is in contrast to *D. austriacus*, in which the lateroventral process of postorbital and dorsal portion of the jugal are anteroposteriorly broad and meet in a direct, anteroposterior suture (Klembara 1997).

The pterygoid is not visible on the fossil, however, the roots of small denticles and pits for the denticles are detectable in the space of the fracture in the skull roof (Fig. 6A, B). Besides this, the high-resolution X-ray microcomputed tomography revealed both pterygoids in ventral view (Fig. 6C). Although the distinct rows of small denticles typical for *Discosauriscus pulcherrimus* are not clearly recognizable, the scattered denticles and pits for the missing denticles are clearly recognizable (Fig. 6C).

The presence of all three diagnostic features in NHMS-WP10870 shows that it represents the species *Discosauriscus pulcherrimus*.

Occurrence. – Krkonoše Piedmont Basin (Czech Republic), Rudník Horizon of the Vrchlabí Formation,

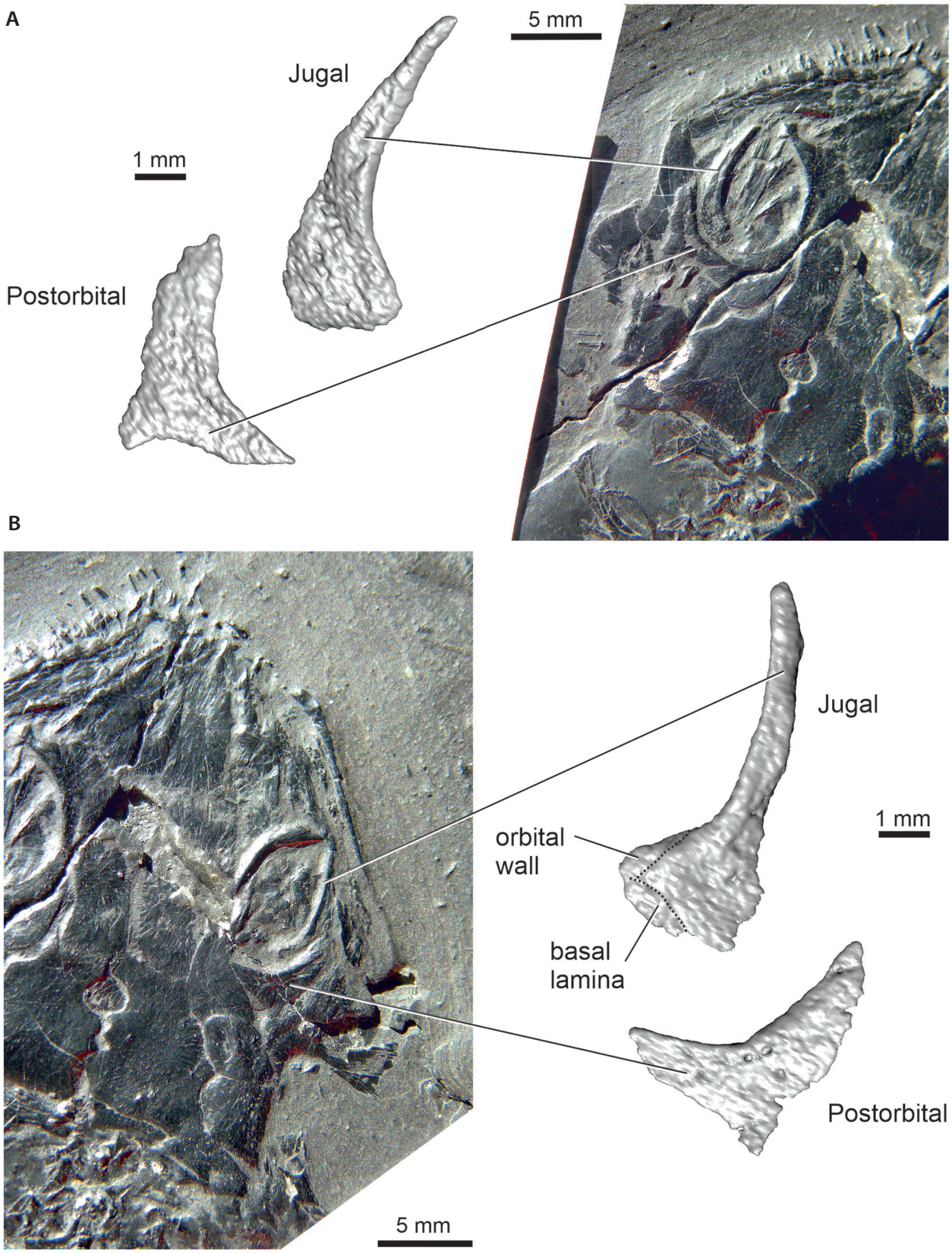


Figure 5. *Discosauriscus pulcherrimus* Fritsch (1880), NHMS-WP10870. A, B – photographs of the skull in dorsal view and the virtual 3D models of the left and right postorbitals and jugals.

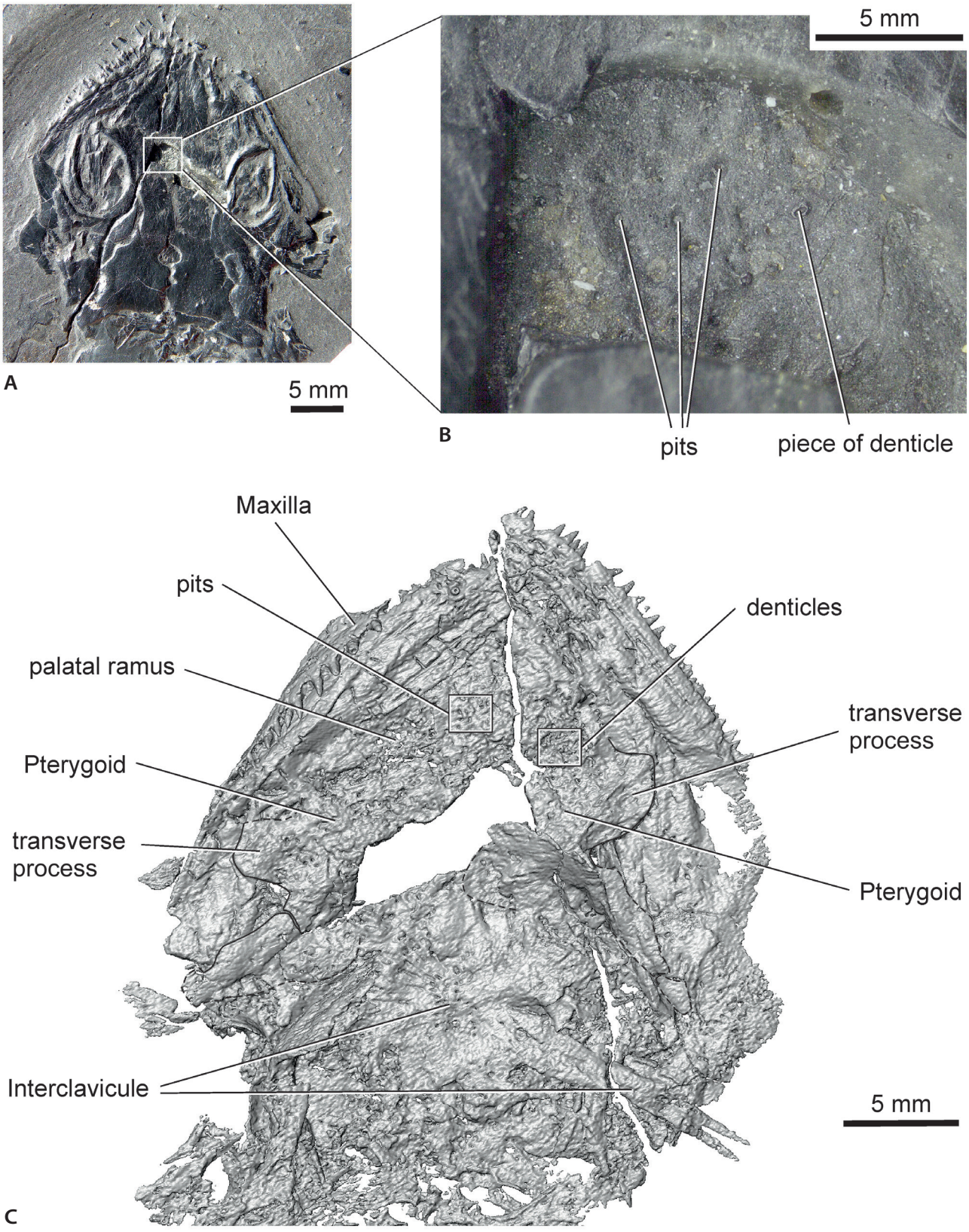


Figure 6. *Discosauriscus pulcherrimus* Fritsch (1880), NHMS-WP10870; A – photograph of the skull in dorsal view; B – detail of the small remnant of the denticle and pits for the denticles in the region of the ventral surface of the pterygoid; C – virtual 3D model of the skull in ventral view.

Asselian, early Permian; locality Semily "Left bank of Jizera River" (Štamberg & Zajíc 2008) (coordinates 50° 35′ 44.112″ N, 15° 20′ 31.353″ E).

Genus *Discosauriscus* Kuhn, 1933

Discosauriscus* cf. *pulcherrimus
Figure 7

Material. – Specimen NHMS-WP12069, postcranial skeleton deposited in the Naturhistorisches Museum Schloss Bertholdsburg, Schleusingen, Germany.

Description. – The specimen includes only the postcranial elements (Fig. 7). The grade of ossification of the vertebral column, girdles and limb elements shows that it represents an immature individual (*cf*. Klembara & Bartík 2000).

The interclavicle is preserved in dorsal (internal) view and consists of almost completely preserved anterior plate and posterior stem (Fig. 7). The anterior plate is approximately equally wide as long. The posterior stem is the widest anteriorly and gradually narrows posteriorly. The anterior plate is of about rhomboidal shape. The anterior fringe of the anterior plate bears radially diverging bony strips. In the region between the strips and the anterior portion of the stem the interclavicle bears a net of cracks in the form of about the radially running narrow grooves and ridges (Fig. 7B). This is, however, only the matter of preservation. It is the place where the dorsal compact layer of the bone is absent, and the "grooves" and "ridges" represent the internal bony structure (Fig. 7).

The scapula is crescent-shaped and has a strongly concave posterior margin.

The vertebral column of the trunk is almost completely preserved. The neural arches are swollen and not fused dorsally. Several intercentra are determinable. Their lateral portions are slightly dorsally curved. The pleurocentra are not present. The thoracic ribs consist of slender rods and separated capitulum and tuberculum. The sacral rib has a much robustly constructed rod and a broadened proximal portion.

The humerus is robustly constructed and is slightly shorter than the radius and ulna. Its shaft and especially the unfinished proximal and distal ends are wide. The right humerus has preserved the wide entepicondyle which seems to be slightly notched (a future entepicondylar foramen). As for the radius and ulna, it is not possible to distinguish which of these two bones is radius and which is ulna.

The pelvic girdle is incompletely ossified. The ilium has widened dorsal and ventral ends. The ischium is of about crescent shape.

The femur is longer and slender than the humerus, but the tibia is about of the same length as the radius.

A few thin and tiny scales are preserved. Their diameter is of about 1 mm and their ornamentation consists of concentric rings.

Remarks. – The interclavicle is the only bone that supports attributing the Sembachtal specimen to the genus *Discosauriscus* (Špinar 1952, Werneburg 1985, Klembara 1997, Klembara & Bartík 2000). The study of the extensive number of specimens of both species of *Discosauriscus*, *D. austriacus* and *D. pulcherrimus*, showed that the morphology of the interclavicle of both species may overlap. This regards especially the width of the anterior plate and morphology and width of the anterior portion of the posterior stem. For example, the interclavicle of *D. austriacus* has typically wide anterior plate and anterior portion of the posterior stem; the stem may have two more or less distinct constrictions (Klembara & Bartík 2000: fig. 17a). However, the specimens of *D. austriacus* may possess the interclavicle with also relatively narrower anterior plate and the stem without the widening of its anterior portion and both constrictions (Klembara & Bartík 2000: fig. 19a, c). The same is true for the interclavicles of *D. pulcherrimus* (*e.g*., Werneburg 1985: fig. 8a–e and our personal observations). Thus, the skull with the preserved distinctive features for the given species of *Discosauriscus* must be present for the secure attribution of the interclavicle to the given species of the genus *Discosauriscus*.

The skull of the Sembachtal specimen is not preserved. However, the specimen SCD-253 from Niederhäslich in Germany (Werneburg 1985) has well preserved skull and shoulder girdle (Fig. 8). The skull has two features typical for *Discosauriscus pulcherrimus* (see also above): 1) the prefrontal-postfrontal suture lies in the anterior half of the frontal length; and 2) the ventrolateral ramus of the postorbital and dorsomedial ramus of the jugal are narrowed, wedge-shaped. The interclavicle of this specimen is extremely similar to that of the Sembachtal specimen (Fig. 7). The anterior plate of SCD-253 specimen is slightly wider than that in the Sembachtal specimen, but the shape of the posterior stem of the Sembachtal and SCD-253 specimens is extremely similar. Thus, it is highly probable that the Sembachtal specimen represents *D. pulcherrimus*, however, because we do not have its skull, we prefer to determine it as *Discosauriscus* cf. *pulcherrimus.*

Occurrence. – Thuringian Forest Basin (Germany), Sembachtal horizon of the Ilmenau Formation, latest Upper Carboniferous; valley Sembachtal near village Winterstein (13 km southeast of the town Eisenach).

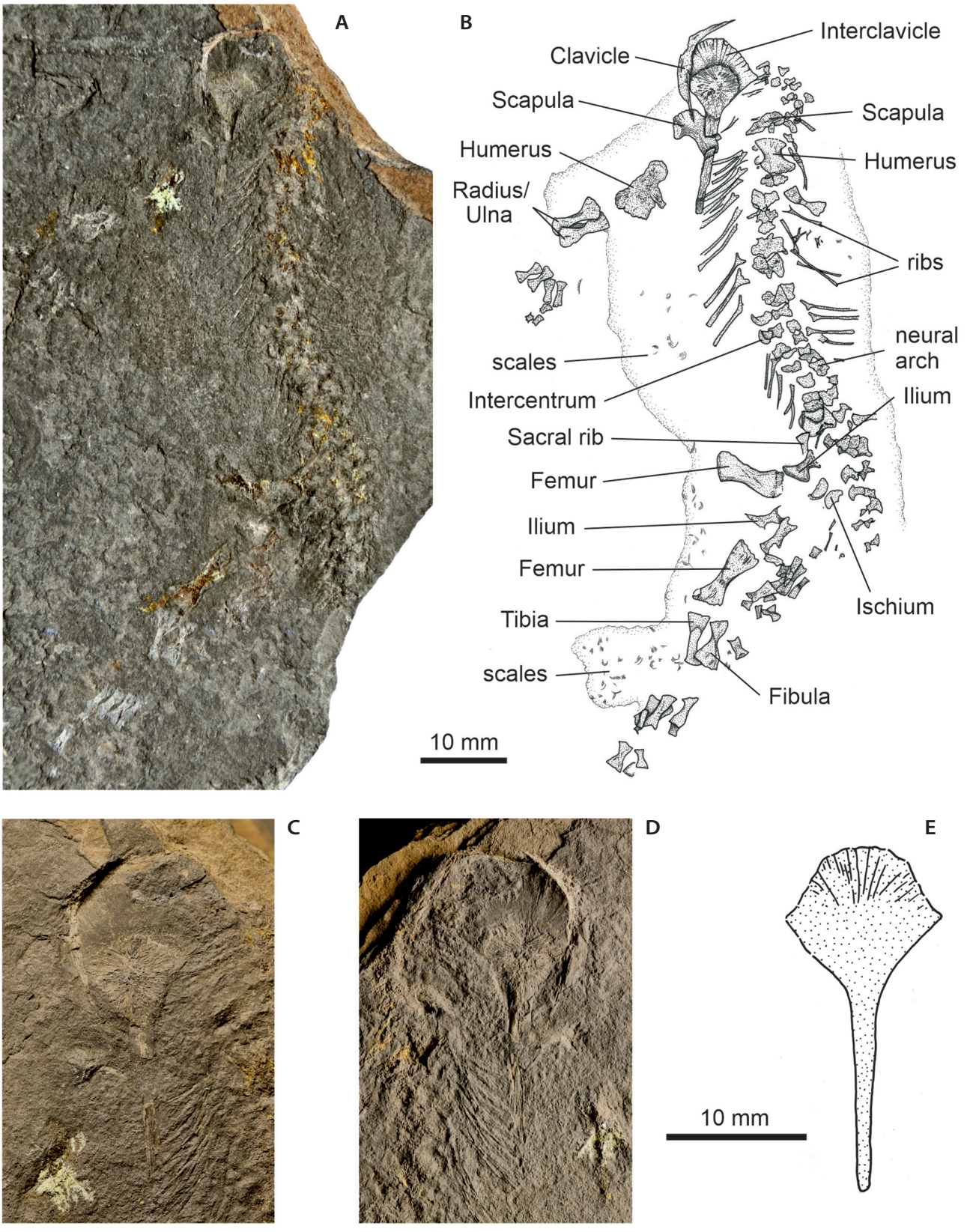


Figure 7. *Discosauriscus* cf. *pulcherrimus*, NHMS-WP12069a; A – photograph and B – drawing of the specimen; C – interclavicle (part) in dorsal view and its counterpart (D); E – reconstruction of the interclavicle of NHMS-WP12069a in dorsal view.

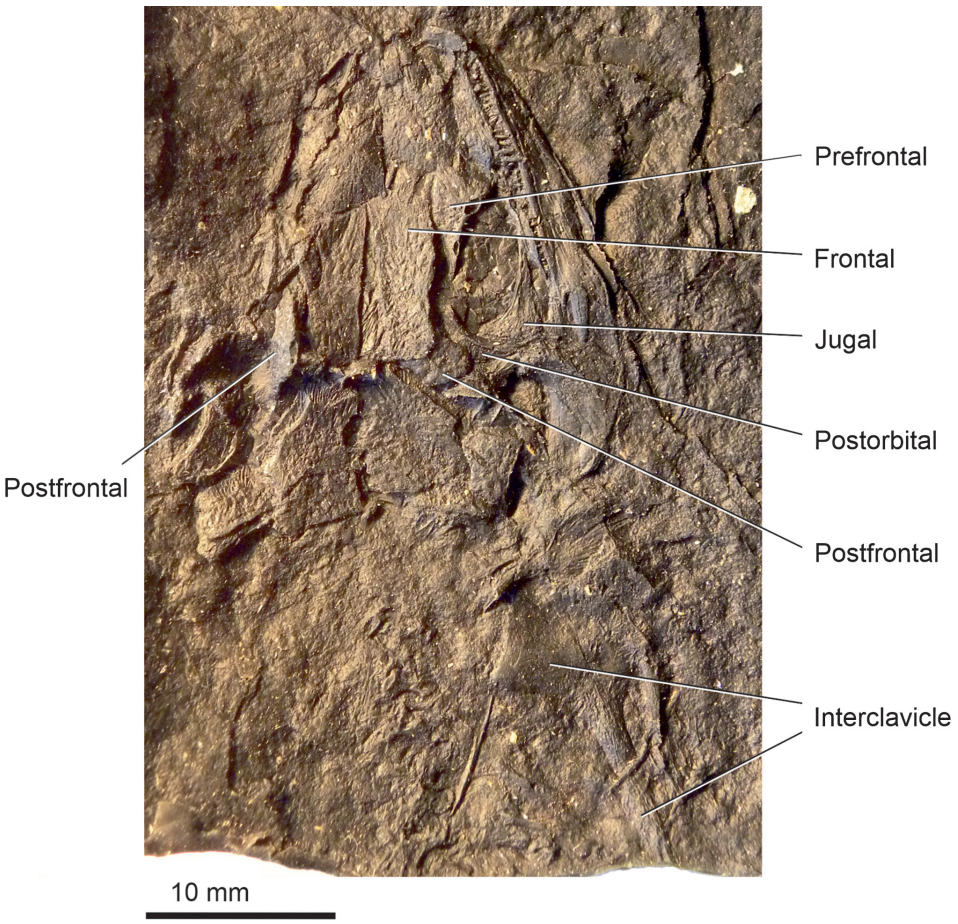


Figure 8. *Discosauriscus pulcherrimus*, SCD-253. Latex cast of the skull and shoulder girdle in dorsal view; locality: Niederhäslich-Schweinsdorf Formation of Niederhäslich, Döhlen Basin, Germany.

Discussion and conclusions

The genus *Discosauriscus* is present in the Boskovice Basin, Intra-Sudetic Basin and Krkonoše Piedmont Basin in the Czech Republic, Bourbon-l'Archambault Basin in France, Saar-Nahe Basin, Thuringian Basin and Döhlen Basin in Germany, and Polish portion of the Intra-Sudetic Basin.

Discosauriscus pulcherrimus was described by Fritsch (1880) from the Olivětín Member of the Intra-Sudetic Basin, and the same species is known from the upper Kalná Horizon of the Prosečné Formation of the Krkonoše Piedmont Basin (Klembara *et al.* 2020). The most frequent occurrence of the genus *Discosauriscus*, namely *D. pulcherrimus* and *D. austriacus*, is found in the Upper Letovice Member of the Boskovice Basin (Klembara 1997, Klembara & Mikudíková 2019).

Discosauriscus pulcherrimus is found in the Polish part of the Intra-Sudetic Basin, namely in the Walchia shales of the Słupiec Formation (Werneburg & Kiersnowski 1996). From France, representatives of the genus *Discosauriscus* are known from the Bourbon- l'Archambault Basin from where *D. sacheti* (Saint-Seine, 1949) was described (Heyler 1969). This species, according to Werneburg (1989a), probably represents *Discosauriscus pulcherrimus*.

The original material of Saint-Seine (1949) is not traceable and is probably lost (written information of D. Heyler to RW, March 1997). The well-preserved skull assigned to *Discosauriscus sacheti* (Heyler 1969: fig. 163, pl. l, fig. 3) belongs probably to *D. austriacus* because of the wide ventrolateral process of the postorbital (RW 1997). But other specimens from the same horizons belong to *D. pulcherrimus*; they exhibit radiating denticle rows on the ventral surface of the pterygoid and have narrow ventrolateral process of the postorbital. Nevertheless, the revision of these specimens is necessary. From the same basin, namely from the Reniére Formation, Steyer *et al.* (2012) described numerous occurrences of *D. austriacus*. *Discosauriscus* is also known from the Usclas Formation of the Lodève Basin in southern France. This Formation is of a late Asselian age (Michel *et al*. 2015, Schneider *et al*. 2021).

From the basins in Germany, *Discosauriscus pulcherrimus* is known from the upper *Protriton* Horizon of the Oberhof Formation (Werneburg 1989b, 2001) and from the Niederhäslich-Schweinsdorf Formation of Döhlen Basin (Werneburg 1989b). Another member of

the genus *Discosauriscus* without species determination is given by Boy (2007) from the Humberg-See-Horizon of the upper part of the Meisenheim Formation in the Saar-Nahe Basin, as well as the disarticulated remains of *Discosauriscus* from the Sobernheim-Horizon of the Nahe subgroup of the Saar-Nahe Basin.

Schneider & Werneburg (2012) considered, with use of the insect and amphibian biostratigraphy, the localities of the Upper Oberhof Formation of the Thuringian Forest Basin, Upper Niederhäslich Formation of the Döhlen Basin, Humberg Horizon of the Upper Meisenheim Formation of the Saar-Nahe Basin, Upper Buxières Formation of the Bourbon-l'Archambault Basin, Olivětín Member of the Broumov Formation of the Intra-Sudetic Basin and the Upper Słupiec Formation of the Polish part of the Intra-Sudetic Basin to represent the Sakmarian. The localities Obora, Drválovice, Kochov and Bačov of the Boskovice Basin with discosauriscids belong approximately to the borderline Sakmarian–Artiniskian (after Schneider & Werneburg 2012 and Schneider *et al*. 2020). Lützner *et al*. (2012) confirm with the use of radiomertric data (287 ± 2 Ma) the Sakmarian age for Oberhof Formation. The age Sakmarian is also proposed (Steyer *et al*. 2012) for the locality Franchesse in Bourbon-l'Archambault Basin which belongs to the Renière Formation and is stratigraphically younger than Upper Buxières Formation.

The age of the Olivětín Member and thus the age of the Ruprechtice and Otovice horizons can be accurately derived from age determination of the Nowa Ruda Member based on a new radioisotope study of the volcanic rock (Opluštil *et al*. 2016). The age of the volcanic complex in the upper part of the Nowa Ruda Member was confirmed at 297.11 ± 0.04 Ma and in combination with the thickness of the layers suggests it is the top of the Broumov Formation (around 295 Ma) at approximately the Asselian–Sakmarian boundary or slightly above (Opluštil *et al*. 2016). It follows that the Olivětín Member, as well as the Ruprechtice and Otovice horizons, may belong to the Asselian. Similarly, on the basis of the radiometric data of Opluštil *et al*. (2016) can be supposed the Asselian age for Upper Kalná Horizon of the Krkonoše Piedmont Basin (Klembara *et al*. 2020).

On the other hand, the Vrchlabí Formation of the Krkonoše Piedmont Basin with the Rudnik Horizon, to which the locality Semily "Left bank of Jizera River" belongs (with the specimen of *Discosauriscus pulcherrimus* described here) is placed at the base of the Asselian (Opluštil *et al*. 2016, Schneider *et al*. 2020). From the above results that the newly found *Discosauriscus* cf. *pulcherrimus* from the Sembachtal is stratigraphically the oldest record of the genus *Discosauriscus* and probably the oldest stratigraphically confirmed seymouriamorph tetrapod so far.

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