Field Trip E

SILURIAN AND DEVONIAN CONODONT LOCALITIES OF THE BARRANDIAN

By

Ivo CHLUPÁČ, Jiři KŘIŽ & H. P. SCHÖNLAUB

with contributions from

G. KLAPPER & J. ZIKMUNDOVÁ

16 figures and plates 17–25

A contribution to Project „Ecostratigraphy“

Authors addresses:
Dr. I. Chlupáč, Dr. J. Křiž, Dr. J. Zikmundová,
Ústředni Ústav Geologický, Malostranské nám. 19, Praha 1, CSSR;
Doz. Dr. H. P. Schönlaub,
Geologische Bundesanstalt, P. O. Box 154, Rasumofskygasse 23, A-1031 Wien, Austria;
Prof. Dr. G. Klapper,
Department of Geology, The University of Iowa, Trowbridge Hall, Iowa City, Iowa 52242, USA.


PIVO
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UPPER DEVONIAN
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Introduction

by Ivo CHLUPÁČ

The region of non-metamorphic or slightly metamorphic Proterozoic and Palaeozoic (Cambrian to Devonian) in central Bohemia, which lies between the wider surroundings of Prague in the NE and Plzen in the SW, is known as the Barrandian (fig. 1).

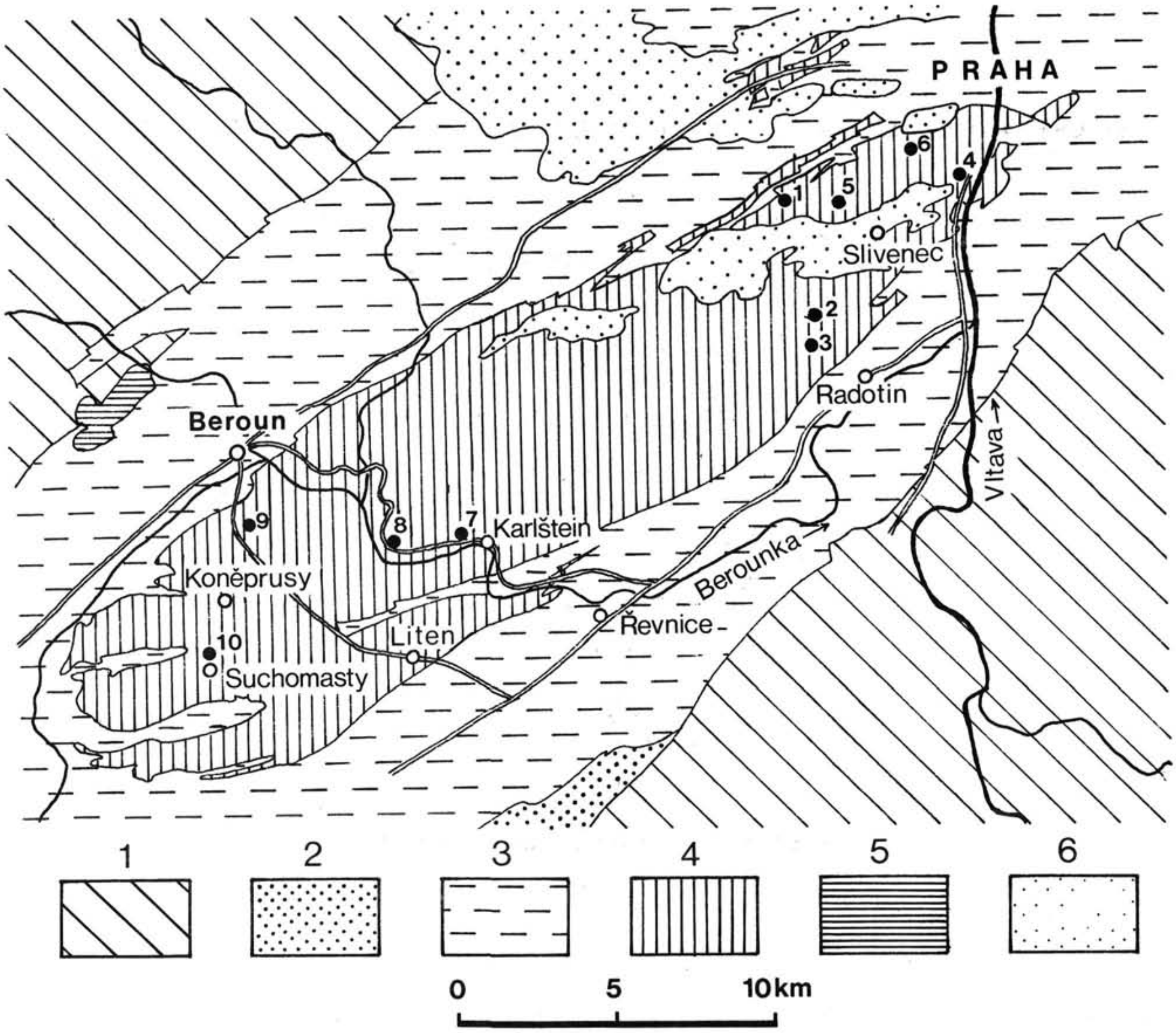


Fig. 1: Location of the visited localities within the central Barrandian.
1 – Proterozoic rocks and Variscan granitoids; 2 – Cambrian; 3 – Ordovician; 4 – Silurian and Devonian; 5 – Carboniferous (limnic); 6 – Cretaceous sediments.

This region, named in honour of the outstanding palaeontologist J. BARRANDE, belongs to classical regions for the Palaeozoic stratigraphy and palaeontology. Many instructive exposures, simple tectonics, unusually rich fossil content and the long tradition of investigation are all features that have made this region known all over the world since the first half of the XIX century, at which time BARRANDE began here his grandiose description of the Palaeozoic rocks and their faunas.

The Proterozoic basement has an eugeosynclinal character; it consists of thick sequences of greywackes, siltstones, conglomerates, shales, chemogenic sediments (lydites), and initial basic and intermediate volcanic rocks (the total thickness of Proterozoic rocks is estimated at 10–15 000 m). The Proterozoic rocks, generally similar to those of the French Brioverian, were folded during the late Cadomian (Assyntian) orogeny.

The transgressive Cambrian is developed only in the W part of the Barrandian. Continental detrital rocks prevail the Lower Cambrian Series; the Middle Cambrian is marine and richly fossiliferous being

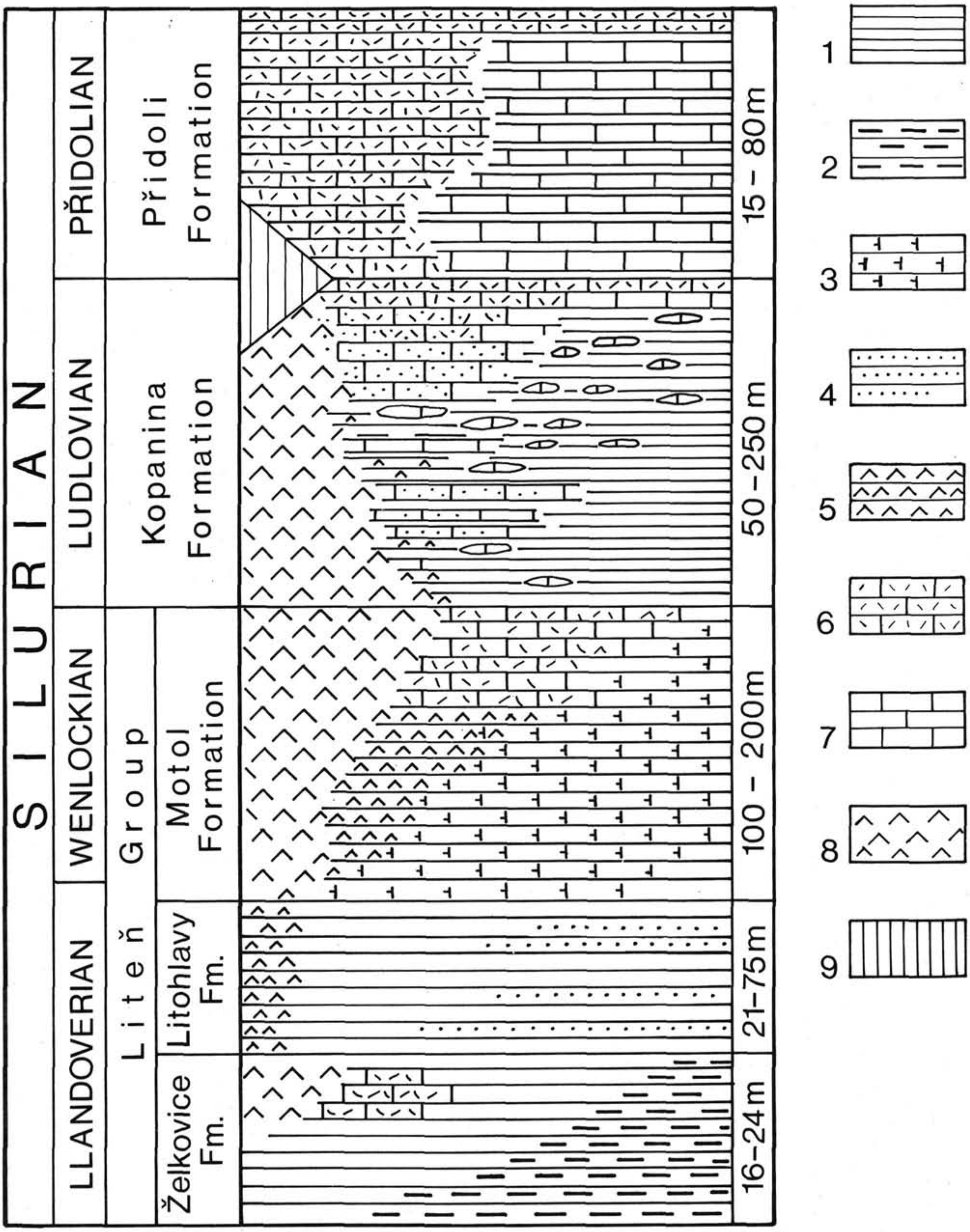
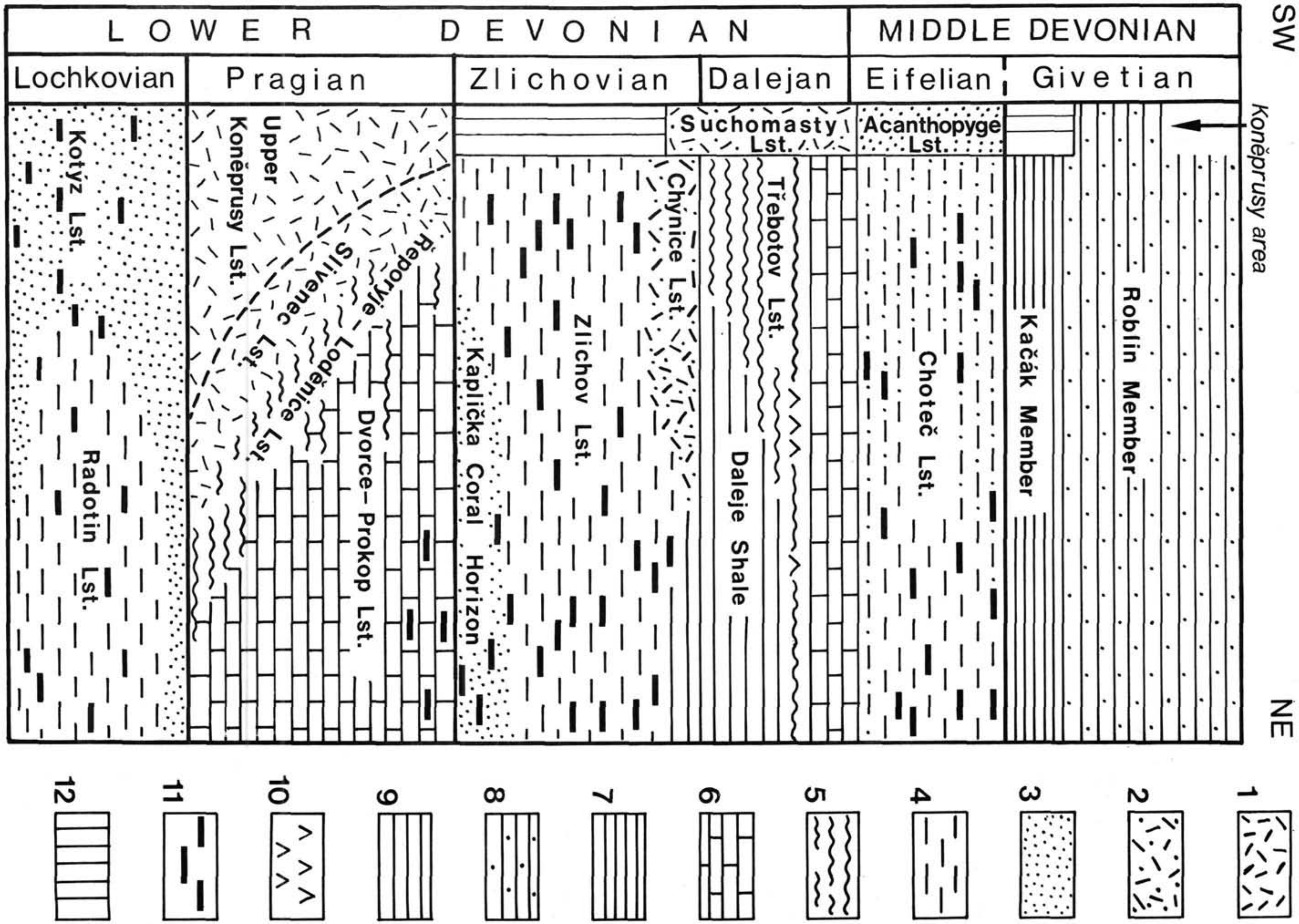


Fig. 2: Stratigraphic scheme of the Silurian in the Barrandian (according to R. HORNÝ 1962, J. KŘIŽ, 1975): 1 – shales; 2 – shales with microcrystalline silicates; 3 – calcareous shales; 4 – alternating black shales and green claystones; 5 – tuffaceous shales; 6 – biosparites, biomicrites; 7 – micrites; 8 – volcanic rocks; 9 – stratigraphic break.


LOWER DEVONIAN
MIDDLE DEVONIAN
SW
Lochkovian
Pragian
Zlichovian
Dalejan
Eifelian
Givetian
Suchomasty Lst.
Acanthopyge Lst.
Koněprusy area
Kotýz Lst.
Upper Koněprusy Lst.
Slivenec Lst.
Reporyje
Loděnice Lst.
Dvorce–Prokop Lst.
Radotín Lst.
Kaplička Coral Horizon
Zlíchov Lst.
Chýnice Lst.
Daleje Shale
Třebotov Lst.
Choteč Lst.
Kačák Member
Roblín Member
NE
12
11
10
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5
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1

famous for its trilobite faunas; the Upper Cambrian is regressive and represented almost exclusively by volcanic rocks.

The Ordovician transgresses on the folded Proterozoic or various Cambrian members. In the Ordovician is a complete succession beginning with the Tremadocian and ending with the upper Ashgillian (Kosovian). Thick sequences of quartzose sandstones, black clay shales, siltstones and greywackes, all accompanied in some places by basic initial volcanics, are the main constituents of the Ordovician. The rich trilobite, brachiopod, and other faunas prove their assignment to the Mediterranean Province.

The Silurian (fig. 2) is built up in its lower part mainly of black graptolite shales (Llandoverian) passing upwards (beginning with the Wenlockian) into calcareous shales and various types of shallow-water limestone facies. The facies development was strongly influenced by an initial basic volcanism (fig. 3) that reached its peak at the beginning of the Ludlovian. The sequence of Silurian strata is usually complete; local breaks occur only near the base and in places with a maximum accumulation of volcanic material. The Silurian limestones, i. e. mostly biogenic facies, contain extremely rich marine faunas consisting of almost all animal groups known from that time. The common graptolites, conodonts and trilobites enable a fine zonation and the interfingering and transitions of different facies give an opportunity to correlate the different kinds of zonation.

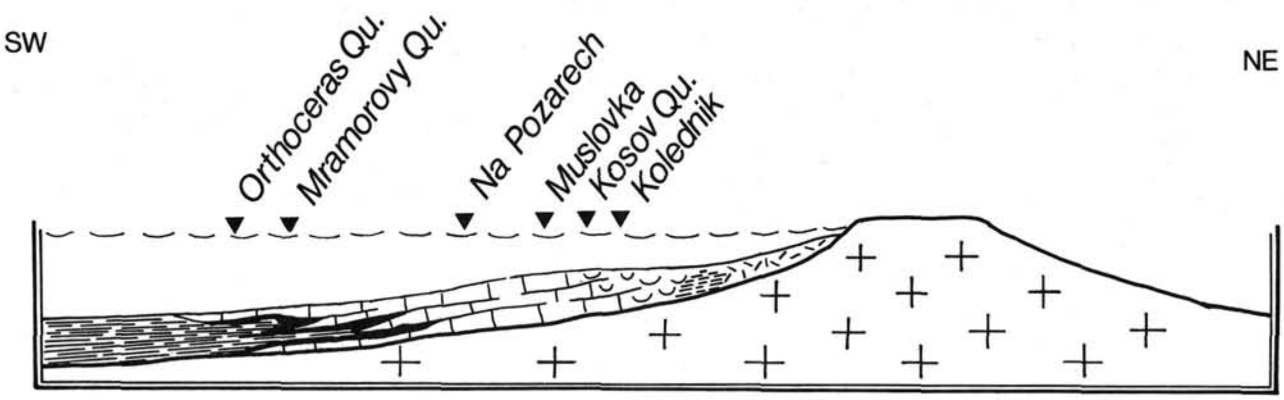


Fig. 3: NE-SW directed facies distribution (simplified) of the Upper Kopanina Formation (according to R. HORNÝ 1962). Note coarse bioclastic limestones on the volcanic slope; they pass into brachiopod limestones, cephalopod limestones and graptolite shales towards southwest.

The topmost Silurian (Přidolian) is purely marine, without any traces of the Late Caledonian orogeny. The carbonate or shale-carbonate sedimentation continues from the Silurian into the Lower Devonian and no impressive breaks in sedimentation or facies changes reflecting a late Silurian regression are developed here. The complete conformity at the Silurian-Devonian boundary and the uninterrupted development of marine faunas show clearly that the Barrandian is an ideal region for the study of the Silurian-Devonian boundary beds and that it rightfully serves as a standard area for the Silurian/Devonian boundary. The standard section (stratotype) at Klonk near Suchomasty and the auxiliary section at Karlštejn will be visited by the ECOS II excursions.

The Devonian (fig. 4) ist predominantly of calcareous development, its fundamental characteristics being combinations of shallow-water current-affected organodetrital, or even reef-facies and of micritic, well bedded and usually nodular limestone facies that were deposited in a substantially calmer and somewhat deeper environment. In places the Devonian strata contain very rich faunal assemblages, e. g., the famous Koněprusy fauna, and the common occurrence of fossils that allow fine zonation, especially tentaculites, conodonts, ammonoids and trilobites, provides the possibility of making wide correlations.

The Barrandian represents a type area of the Bohemian Lower Devonian Stages Lochkovian, Pragian, Zlichovian, Dalejan, the stratotypes of which are defined there. These stages are mostly based on pelagic faunas and have a wide correlative value in regions with purely marine pelagic sedimentation contra-

Fig. 4: Stratigraphic scheme of the Devonian in the Barrandian (according to I. CHLUPÁČ 1967, 1976):
1 – light reef and organodetrital limestones; 2 – reddish organodetrital limestones; 3 – grey organodetrital limestones; 4 – grey finely organodetrital and micritic well bedded limestones; 5 – red micritic and nodular limestones; 6 – grey micritic and nodular limestones (in some places with shale intercalations); 7 – dark calcareous shales; 8 – siltstones and sandstones (flyschoid sediments); 9 – greenish, grey or pink calcareous shales with limestone concretions; 10 – volcanic products; 11 – cherts; 12 – stratigraphic breaks.

sting with the terrigenous-clastic Rhenish development. The Lower and early Middle Devonian is also a type area of tentaculite dacryoconarid zonation and the Barrandian sections play an important role in the current discussion on the Lower–Middle Devonian Series boundary.

The carbonate sedimentation terminates near the Eifelian/Givetian boundary. The late Middle Devonian is characterized by a terrigenous flyschoid sedimentation reflecting the tectonic activity prior to a retreat of the Devonian sea from the Barrandian.

Upper Devonian and Lower Carboniferous sediments are absent in the Barrandian area. In this period the Variscan orogeny took place and affected the Barrandian probably in its initial phases (Bretonian folding). The Variscan folding of the Barrandian is mediotype to germanotype in character: simple, often asymmetrical folds disturbed by less frequent longitudinal reverse and normal faults have been found. The whole structure is cut by abundant younger radial faults trending NW-SE and N-S.

Of younger formations, remnants of Upper Carboniferous (beginning with the Upper Westphalian) limnic sediments have been found preserved locally in depressions of the Variscan-folded Palaeozoic. Later, after a long period of uplift and denudation, the greater part of the Barrandian was covered by marine Upper Cretaceous sediments (Cenomanian to Turonian) which were largely removed after an uplift of the Bohemian Massif in Tertiary time.

For summaries of stratigraphy and tectonics of the Barrandian area see J. SVOBODA et al. (1964). The papers summarizing the stratigraphy of the individual systems are as follows: Cambrian – V. HAVLIČEK (1971), Ordovician – V. HAVLIČEK and J. VANĚK (1966), V. HAVLIČEK and L. MAREK (1973), Silurian – R. HORNÝ (1962), J. KŘIŽ (1975), Devonian – I. CHLUPÁČ (1968, 1976 b).

Previous conodont work in the Barrandian

By Hans P. SCHÖNLAUB

Previous conodont studies in the Barrandian area can be summarized as follows:

The first report on Silurian and lowermost Devonian conodonts can be found in O. H. WALLISER (1964) who studied – beside others – such important sections like Mušlovka, Hvíždalka, Kosov, and Černy Lom. Mušlovka Quarry, for example, is the type locality of *Ozarkodina snajdri*, the Kopaninian near Jinonice is the type locality of *Ozarkodina sagitta bohemica.*

In 1969 G. KLAPPER described and illustrated *Icriodus woschmidti* and *Ozarkodina r. remscheidensis* which came from Lower Lochkovian limestones at Svatý Jan pod Skalou.

Ch. SPASSOV 1971 reported and illustrated an interesting Lochkovian conodont fauna which he isolated from beds with *M. hercynicus* at Podoli Quarry near Prague. The fauna includes such forms as *Pedavis pesavis, Icriodus woschmidti transiens, Ozarkodina r. remscheidensis,* and perhaps *Ozarkodina masara* MURPHY et al. 1980 (see also I. CHLUPÁČ et al. 1972).

In the following year St. G. BARNETT published a biometric trend analysis of *Ozarkodina remscheidensis* based on material from the Přidolian and Lochkovian of section Na Požárech which is located next to our stop 1 at Mušlovka. In a joint paper with Ch. J. MEHRTENS (1976) he continued this work with an evolutionary study of conodont assemblages from the Kopaninian, Přidolian, and Lochkovian of Na Požárech Quarry; in this paper the authors established the multielement *Ozarkodina remscheidensis snajdri*.

A short note on conodont occurrences in Lower/Middle Devonian boundary beds based on a few samples, was published by P. CARLS et al. 1972.

From various Barrandian sections I. CHLUPÁČ et al. 1972 documented conodonts of the Silurian/Devonian boundary beds; they span the time from the *eosteinhornensis* to the *pesavis*-Zone.

In 1974 V. G. WALMSLEY et al. published a list of conodonts which they found in brachiopod slabs; in the fauna diagnostic elements of the *amorphognathoides-sagitta*-Zones, the *siluricus*-Zone, the *eosteinhornensis*-Zone, and the *woschmidti*-Zone have been recognized.

On the occasion of the SDS-field trip to the Barrandian in the guidebook occurrences of Lower and Upper Devonian conodonts were treated in detail.

Finally, G. KLAPPER et al. (1978) reported on conodont distribution in Lower/Middle Devonian boundary beds and also described and illustrated new taxa; they discussed the correlative potential of five levels which may be chosen for the Lower/Middle Devonian boundary. In the comprehensive study of the whole fauna across the boundary, carried out by I. CHLUPÁČ et al. (1979) the foregoing conodont data have been considered together with additional information from other sections of the Barrandian.

E X C U R S I O N

STOP 1. Daleje Valley, Mušlovka Quarry section
Ludlovian- Přidolian (figs. 5, 6)

By J. KŘÍŽ (geology and paleontology) and H. P SCHÖNLAUB (conodont biostratigraphy)

The section is exposed on the northern slope of the Daleje Valley, south of Velká Ohrada village, between the Arethusina Gorge and Mušlovka Quarry. Since the section is located in the north-western part of the Siluro-Devonian synclinorium the rocks here are dipping to the SE. The sequence includes the Kopanina Formation (Ludlovian) and lower parts of the Přidoli Formation (Přidolian). The section was first studied in detail by B. BOUČEK (1937). Fauna was described in numerous special papers.

On the way from the bus we will cross the junction of the Arethusina Gorge with the Daleje Valley. In the Arethusina Gorge the uppermost Wenlockian rocks (Motol Formation) in volcanic facies are exposed. The sequence of the Kopanina Formation starts on the southern slope of the gorge by the basalts (diabases) of Nová Ves volcanic center which was active during the sedimentation of the *Pristiograptus vulgaris* Biozone (KŘÍŽ, 1962). The volcanites of tephra type are overlain by a sequence of tuffaceous shales (about 40 metres in thickness) with nodules and lenses of grey micrites to biomicrites. Lower parts of the sequence are ill exposed and correspond to the *Neodiversograptus nilssoni* Biozone-*Monograptus scanicus* Biozone. Higher part of the section is exposed in the Mušlovka Quarry. Lowermost rocks cropping out on the northern face of the quarry are represented by tuffaceous and calcareous shales with lenses and nodules of grey biomicrite to biosparite containing rich fauna: *Cromus beaumonti* BARRANDE, *Encrinurus transiens* (BARRANDE), *Diacanthaspis (Acanthalomina) minuta* (BARRANDE), *Eophacops bulliceps bulliceps* (BARRANDE), *Leonaspis minuta* (BARRANDE), *Sphaerexochus paramirus* ŠNAJDR, *Prantlia longula* (H. et C.), *Prionopeltis praecedens* (BOUČEK), *Cheirurus squarrosus* (ZENKER), *Bohemoharpes ungula ovatus* (BOUČEK), *Otarion diffractum* ZENKER, Cephalopoda div. sp. gen., *Cardiola docens* BARRANDE, *Cardiola consanguis* BARRANDE, *Cardiola signata* BARRANDE, *Butovicella migrans* (BARRANDE), *Cyrtia trapezoidalis* (DALMAN), „*Atrypa*" *dormitzeri* BARRANDE, *Shagamella margarita* (BARR.), *Septatrypa sapho* (BARRANDE), *Proreticularia carens* (BARRANDE), *Bohemograptus bohemicus* (BARRANDE), *Monograptus fritschi linearis* BOUČEK a. o.

The measured and sampled section is exposed on eastern and southern faces of the quarry. The bank (sampling sites 1, 2) of grey biosparite (135 cm in thickness) is overlying above described shales with limestone lenses and nodules and contains assemblage of cephalopods yet unrevised together with *Metacalymene baylei* (BARRANDE), *Cromus beaumonti* BARRANDE, *Diacanthaspis (Acanthalomina) minuta* (BARRANDE), *Leonaspis minuta* (BARRANDE), *Prionopeltis praecedens* (BOUČEK), *Metacalymene baylei* (BARRANDE), *Cardiola docens* BARRANDE, *Lunulacardium* div. sp., „*Atrypa*" *dormitzeri* BARRANDE, *Septatrypa sapho* (BARRANDE) a. o.

The bank ist overlain by the level of grey calcareous shales with biomicrite to biosparite nodules (3) containing the assemblage with: *Cromus beaumonti* BARRANDE, *Harpes* sp., Cephalopoda div. sp. div. gen., *Cardiola docens* BARANDE, *Dubaria megaera* (BARRANDE), „*Camarotoechia*" *modica* (BARRANDE), „*Atrypa*" *dormitzeri* BARRANDE, *Bohemograptus bohemicus* (BARRANDE), *Monograptus bohemicus tenuis* BOUČEK, *Monograptus dalejensis* BOUČEK, *Monograptus fritschi linearis* BOUČEK a. o.

The section continues with nine banks (4–12) of grey biosparite with brachiopods (total thickness 372 cm). The assemblage is characterized by the mass occurrence of *Atrypoidea linguata* (BUCH), *Dubaria megaera* (BARRANDE) and „*Camarotoechia*" *modica* (BARRANDE) accompanied by: *Encrinurus transiens* (BARRANDE), *Otarion* cf. *novella* (BARRANDE), Cephalopoda div. sp. div. gen., *Cardiola docens* BARRANDE, „*Camarotoechia*" *famula* (BARRANDE), „*Atrypa*" *dormitzeri* BARRANDE, *Bohemograptus bohemicus* (BARRANDE), *Monograptus longus* BOUČEK a. o.

The next is the bank (13–15) of grey nodular biosparite with abundant cephalopods – thickness 270 cm. Besides cephalopods it contains: *Cardiola alata* BARRANDE, *Spirina patula* (BARRANDE), *Otarion novella* (BARRANDE), *Phaetonides* sp., *Tenka bohemica* BARRANDE, *Spanila aspirans* BARRANDE, *Spanila cuneus* BARRANDE, *Dualina longiuscula* BARRANDE, *Atrypoidea linguata* (BUCH) – at the base only, *Septatrypa sapho* (BARRANDE) a. o.

Overlying layer (16) is a bank of grey biomicrite to biosparite (70 cm in thickness) with: *Dayia navicula minor* BOUČEK, *Septatrypa thisbe* (BARRANDE), *Encrinurus transiens* (BARRANDE), *Triacrinus* sp. a. o.

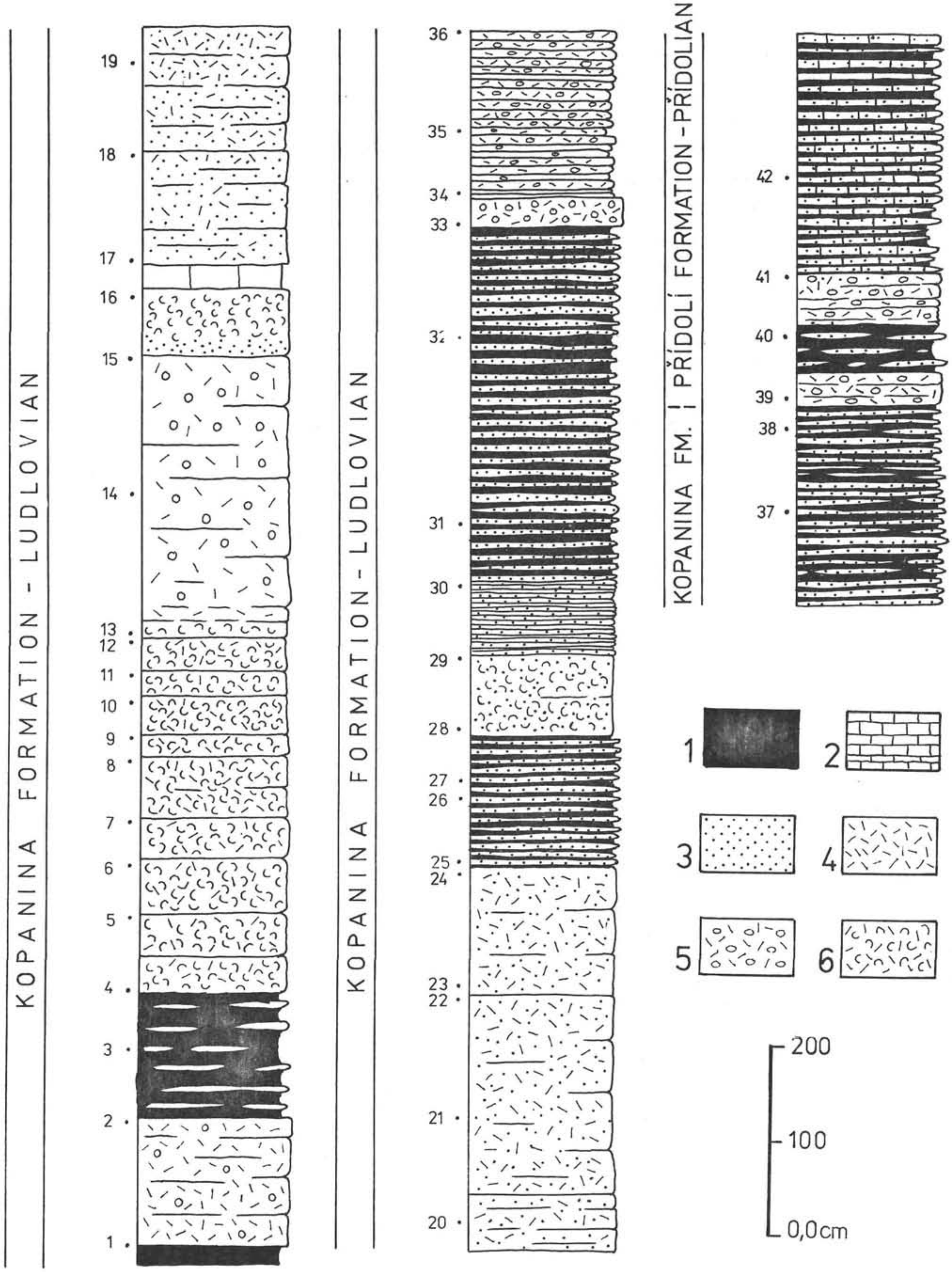


Fig. 5: Stratigraphic scheme of the sequence of Silurian in the Mušlovka quarry at Řeporyje (J. KŘIŽ, orig.): 1 – calcareous shales; 2 – micrites; 3 – biomicrites; 4 – biosparites (mostly crinoidal); 5 – biosparites with cephalopods; 6 – biosparites with brachiopods.

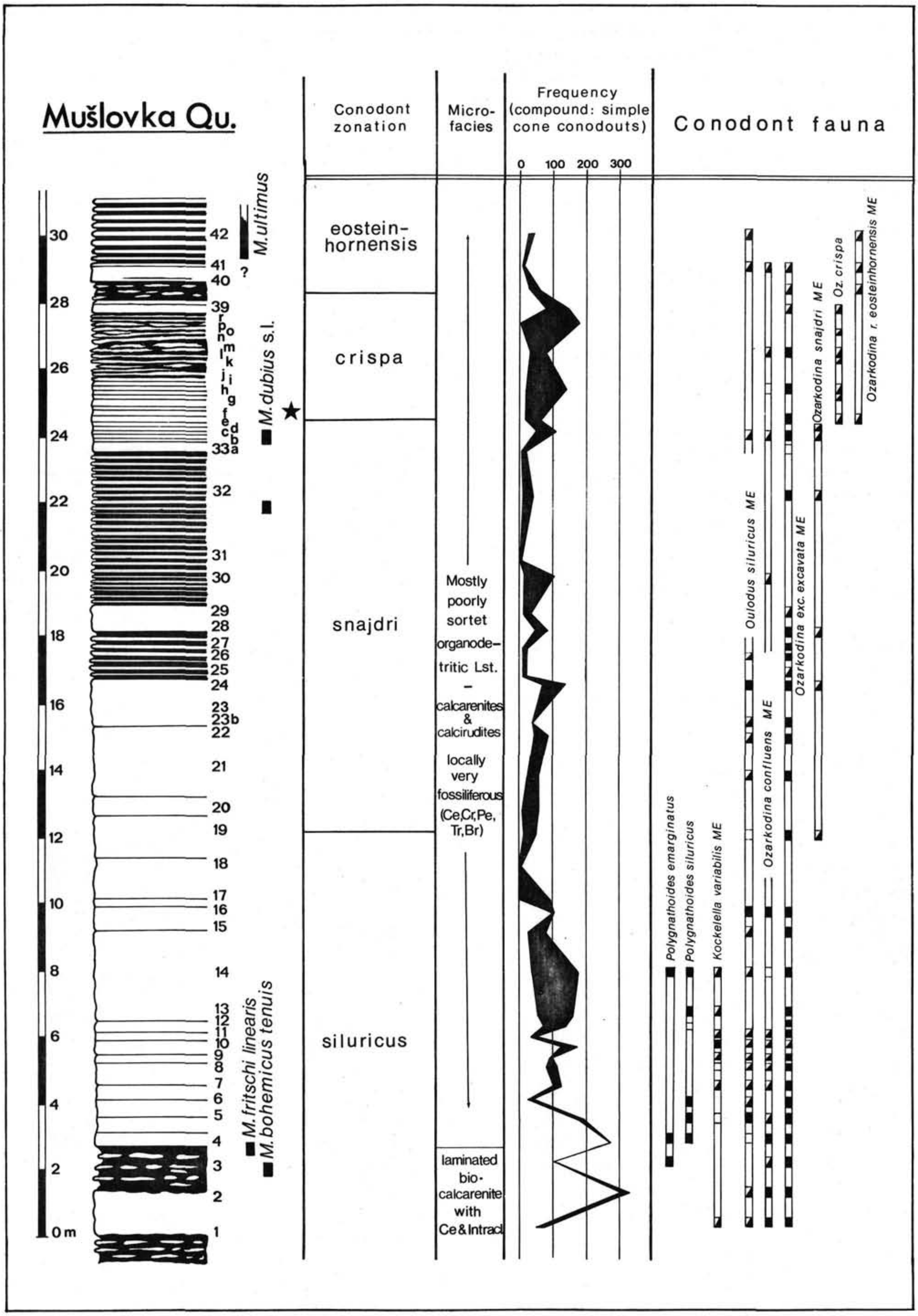


Fig. 6: Conodont stratigraphy of section Mušlovka (H. P. SCHÖNLAUB, based on fig. 5).

It follows a layer of black micrite (25 cm in thickness) and five banks (17–24, 660 cm of total thickness) of grey to pink crinoidal biosparite with characteristic assemblage of the horizon with *Ananaspis fecunda* (BARRANDE): *Otarion diffractum* ZENKER, *Coniproetus (Ryckholtia) ryckholti* (BARRANDE), *Decoroproetus reussi reussi* (H. et C.), *Scharyia micropyga* (H. et C.), *Interproetus intermedins* (BARRANDE), *Interproetus venustus* (BARRANDE), *Decoroscutellum haidingeri* (BARRANDE), *Harpidella novella* (BARRANDE), *Cheirurus bicuspidatus* (BOUČEK), *Kosovopeltis* n. sp., *Bohemoharpes ungula ungula* (STERNBERG), *Ananaspis fecunda* (BARRANDE), *Conocardium* sp., *Cyrtia trapezoidalis* (DALMAN), *Atrypa reticularis* (LINNAEUS), *Dicoelesia* sp., *Atrypina barrandei* (DAVIDSON), *Septatrypa serva* (BARRANDE), „*Atrypa*“ *canaliculata* BARRANDE, *Nymphorhynchia daphne* (BARRANDE) a. o.

Sequence continues by grey crinoidal biosparite with calcareous shale intercalations (25–27) with *Septatrypa serva* (BARRANDE), *Cyrtia trapezoidalis* (DALMAN), „*Atrypa*“ *canaliculata* BARRANDE a. o. It is overlain by a bank of grey biomicrite to biosparite (28, 29) with common „*Atrypa*“ *canaliculata* BARRANDE and *Septatrypa serva* (BARRANDE), *Prionopeltis dracula* ŠNAJDR, *Prionopeltis archiaci* (BARRANDE), *Otarion diffractum* ZENKER. The next in the section is a sequence of thin-bedded grey biomicrite to biosparite with calcareous shale intercalations, total thickness 450 cm (30–32).

Fauna ist mostly fragmental: *Otarion diffractum* ZENKER, *Prionopeltis archiaci* (BARRANDE), *Ceratocephala verneulli* (BARRANDE), *Bohemoharpes ungula ungula* (STERNBERG), *Prionopeltis dracula* ŠNAJDR, *Cheirurus transiens* BOUČEK, *Cardiola conformis* BARRANDE, *Atrypa reticularis* (LINNAEUS), *Decoropugnax berenice* (BARRANDE), *Orbiculoidea* sp., *Monograptus dubius* s. l., abundant crinoids and rugose corals a. o.

Between sampling sites 33–36 the sequence is built up of grey biosparite beds with cephalopods and thin calcareous shale intercalations in total thickness 206 cm with characteristic fauna of the horizon with *Prionopeltis archiaci* BARRANDE: *Scutellum* sp., *Otarion diffractum* ZENKER, *Prionopeltis archiaci* (BARRANDE), *Bohemoharpes ungula ungula* (STERNBERG), *Microcheilinella kolednikensis* BOUČEK, *Alanella decurtata* BOUČEK, *Kosovoceras nodosum* (BARRANDE), abundant unrevised cephalopods, *Spirina patula* (BARRANDE), *Spanila aspirans* BARRANDE, „*Atrypa*“ *canaliculata* BARRANDE, *Septatrypa serva* (BARRANDE), *Monograptus dubius* s. l. a. o.

The cephalopod biosparite is overlain by the thin-bedded biomicrite to biosparite (37–38) with calcareous shale intercalations (total thickness 210 cm) corresponding to the uppermost levels of the Kopanina Formation. Macrofauna is fragmental and ill preserved (crinoids, cephalopods, brachiopods).

Lowermost Přídoli Formation is represented by two levels of grey biosparite with abundant cephalopods (39 and 41) separated by 50 cm of calcareous shale with grey micrite to biosparite nodules (40). The cephalopod biosparite contains assemblage: *Otarion* sp., *Harpes* sp., *Prionopeltis striata* (BARRANDE), cephalopods, *Pristiograptus ultimus* (PERNER). The uppermost part of the sequence exposed in the quarry is formed by thin-bedded dark-grey micrite to biomicrite with dark-grey calcareous shale intercalations. Macrofauna only very fragmentary (trilobites, brachiopods).

Conodont biostratigraphy (fig. 6)

The samples at the base, nos. 1 and 2 are dominated by the apparatuses of *Ozarkodina confluens* (BRANSON & MEHL) – particular in no. 2 – and by *Ozarkodina e. excavata* (BRANSON & MEHL). Other species are *Kockelella variabilis* WALLISER and *Oulodus siluricus* (BRANSON & MEHL).

3: In this sample *Polygnathoides emarginatus* (BRANSON & MEHL) together with *Oz. confluens* and *Oz. e. excavata* occurs;

4, 5: The samples produced excellently preserved conodonts and thus may be recommended for collectors. The fauna is dominated by *Oz. e. excavata* and *Oz. confluens;* less common are *Polygnathoides siluricus* BRANSON & MEHL, *Polygnathoides emarginatus* (BRANSON & MEHL) and *Kockelella variabilis* WALLISER.

5–11: Samples with *Kockelella variabilis* WALLISER (mostly incomplete apparatus except in no. 10 with abundant juvenile P-elements); *Ozarkodina confluens* (BRANSON & MEHL), *Oulodus siluricus* (BRANSON & MEHL), *Ozarkodina e. excavata* (BRANSON & MEHL).

14: This is an excellent sample to obtain a rich fauna composed mainly of *Polygnathoides siluricus* BRANSON & MEHL and *Polygnathoides emarginatus* (BRANSON & MEHL) as well as many single cones; less common are *Oulodus* sp. and *Ozarkodina e. excavata* (BRANSON & MEHL).

16: This sample yielded abundant specimens of *Ozarkodina confluens* (BRANSON & MEHL).

19: At this level the lowest occurrence of *Ozarkodina snajdri* (WALLISER) has been recognized. Hence, the base of the *snajdri*-Zone is drawn at sample no. 19. This species is accompanied by *Ozarkodina e. excavata* (BRANSON & MEHL).

22, 23: In both samples peculiar P-elements occur which previously have been assigned to *Oz. r. eosteinhornensis* (WALLISER). However, they differ from typical P-elements by the small and narrow basal cavity and the fused and slender kind of denticulation. In most details these forms resemble P-elements which have been described and illustrated by L. JEPPSSON 1974 and named *Hindeodella steinhornensis* ssp. 1.

24–33: In this level only few conodonts occur. The diagnostic species *Ozarkodina snajdri* (WALLISER) has been proved in sample nos.24, 28 and 32. Other species are *Oz. e. excavata, Oulodus siluricus,* and *Ozarkodina confluens.*

33 B: *Ozarkodina snajdri* (WALLISER), *Ozarkodina confluens* (BRANSON & MEHL), *Ozarkodina e. excavata* (BRANSON & MEHL).

33 C: Like 33 B.

33 F: In this sample is the first appearance of *Ozarkodina crispa* (WALLISER) together with *Ozarkodina r. eosteinhornensis* (WALLISER). Thus, the base of the *crispa*-Zone is drawn at sample no. 33 F.

33 H, I: Excellent samples to collect a good fauna of the *crispa*-Zone and its name bearer.

33 M, O: *Ozarkodina crispa* (WALLISER); other conodonts in no. 33 M are *Ozarkodina e. excavata* and *Oz. confluens.*

39: Last occurrence of *Ozarkodina crispa* (WALLISER).

40–42: *Ozarkodina r. eosteinhornensis* (WALLISER), in particular in sample no. 42; accompanying fauna *Ozarkodina e. excavata, Oulodus siluricus,* and *Ozarkodina confluens.*

G r a p t o l i t e s : The graptolite information is based on H. JAEGER's studies. According to him *M. fritschi linearis* occurs in strata which produced conodonts of the *siluricus*-Zone (see fig. 5). *M. dubius* s. l. has been found in the upper *snajdri*-Zone; *M. ultimus* occurs near the base of the *eosteinhornensis*-Zone.

S u m m a r y r e m a r k s : Similarily to the section Kolednik-Jarov *Ozarkodina r. eosteinhornensis* (WALLISER) has been found at or near the base of the *crispa*-Zone. Thus, following WALLISER's definition of the *eosteinhornensis*-Zone one must raise the question whether or not the *crispa*-Zone is a valid conodont zone. More frequently, however, *Oz. r. eosteinhornensis* occurs above the last occurrences of *Oz. crispa.*

Hence, we propose to extend the *eosteinhornensis*-Zone to the base of the *crispa*-Zone and to establish the latter as *crispa*-Subzone within the range of the *eosteinhornensis*-Zone.

STOP 2: Radotin valley, U topolů

Silurian/Devonian boundary beds (fig. 7)

By I. CHLUPÁČ (stratigraphy) & H. P. SCHÖNLAUB (conodonts)

The section is located at the northern slope of the Radotin valley, between the Lochkov cement factory and the farm Cikánka. A sequence of the uppermost Silurian (Přidolian) and lowermost Devonian (Lochkovian) is exposed in a disused railway cut.

The Přidolian sequence consists of dark grey platy bituminous limestones alternating with grey and brown weathering calcareous shales. In some layers the limestone intercalations are reduced to limestone concretions. The fauna has an obvious Přidolian character, including *Pterygotus (Acutiramus) bohemicus* BARR., *Ceratiocaris bohemica* BARR., *Platyceras (Orthonychia) elegans* (PERNER), *Spirina patula* PERNER, *Panenka* sp., *Dualina* sp., *Dayia bohemica* BOUČ., *Scyphocrinites excavatus* (SCHLOTH.), common orthoconic nautiloids, and (in some layers) the very common bivalve *Pterochaenia (Joachimia) falcata* (BARR.). The index upper Přidolian graptolite *Monograptus transgrediens* PERNER was found 130 cm below the first appearance of the index lower Devonian graptolite *Monograptus uniformis angustidens,* which occurs in bed 11, 20–25 cm below the thick *Scyphocrinites* bank. *Ozarkodina remscheidensis remscheidensis* ZIEGLER was found also in this layer.

The index lower Lochkovian trilobite *Warburgella rugulosa rugosa* (BOUČ.) occurs in bed 12, immediately below a thick bank.

The following bed is the 1,8 m thick *Scyphocrinites* bank (No. 13) composed of coarse Crinoid detritus with abundant loboliths. The lower Lochkovian fauna including *Monograptus uniformis angustidens* PŘIBYL has been found here.

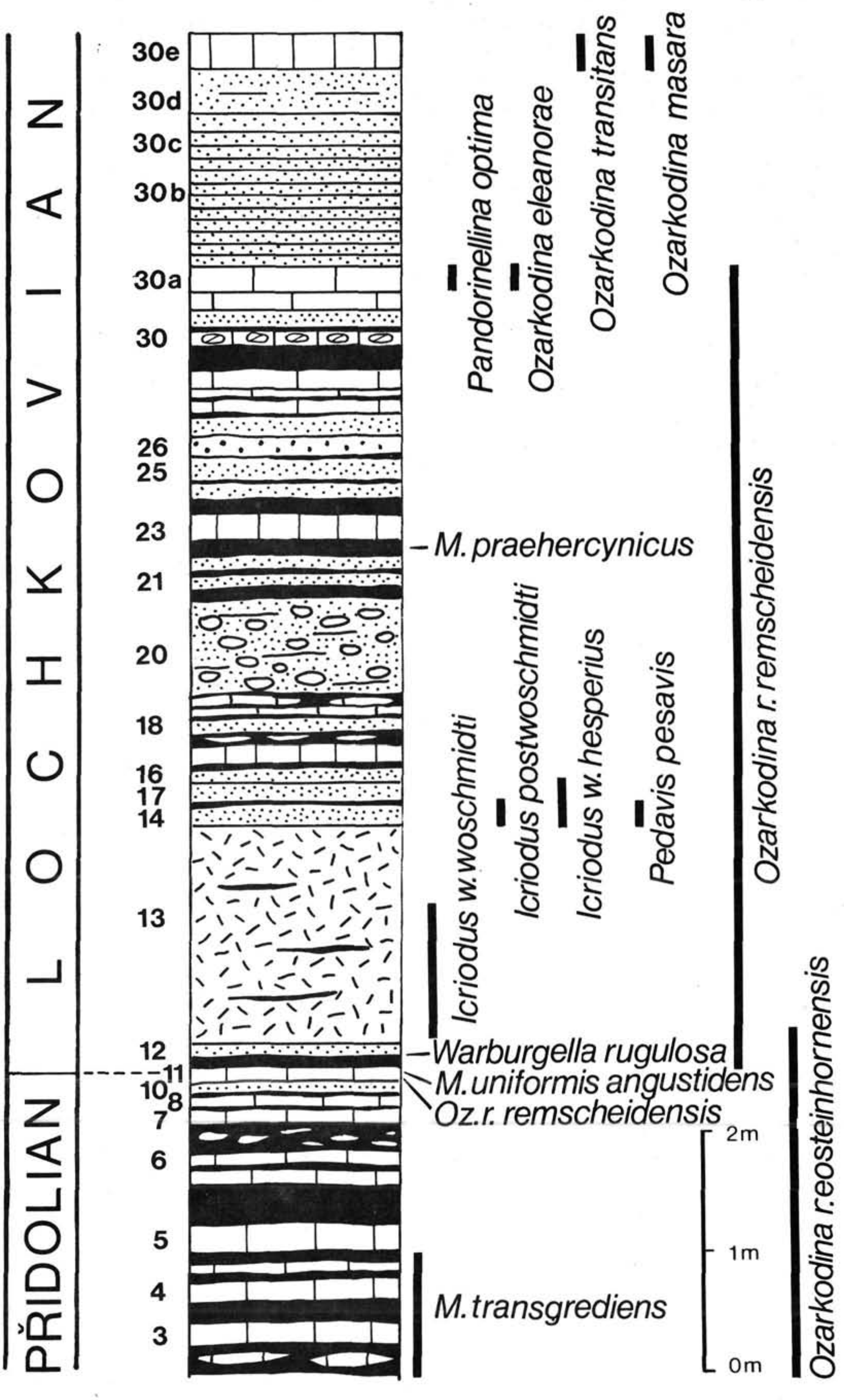


Fig. 7: Radotin Valley, „U topolů", diagrammatic section of the Silurian-Devonian boundary interval (according to I. CHLUPÁČ et al. 1972, occurrence of conodonts after H. P. SCHÖNLAUB).

The *Scyphocrinites* bank is overlain by fine grained grey detrital limestones, often with graded bedding, interbedded with very fine grained limestone, shale intercalations and subordinate layers of sedimentary breccias. Some beds, e. g., nos. 15, 26 yielded fossils, such as *Leonaspis lochkovensis* (PRANTL et PŘIBYL), *Otarion (O.) novaki* BOUČ., *Lepidoproetus lepidus* (BARR.), *Kielania* sp., *Plectodonta mimica* (BARR.), *Glossoleptaena emarginata* (BARR.), *Eoglossinotoechia mystica* HAVL., *E. cacuminata* HAVL., *Spurispirifer fuscus* HAVL. etc. No pronouncedly lower Lochkovian elements have been found here and *Monograptus praehercynicus* occurs in shales 1,5 to 1,65 m above the top of the *Scyphocrinites* bank, i. e. within interbeds 22/23 (coll. et det. H. JAEGER). *Monograptus hercynicus* has not been found in this section but by correlating the nearby Hvižďalka section, situated on the opposite side of the Radotin valley (see R. HORNÝ, 1962), with the U topolů section, it may be concluded that the *hercynicus*-Zone may begin 4–5 m above the top of the *Scyphocrinites* bank, i. e., above sample 30 A. The condensed sequence of the lower Lochkovian is analogous here to other localities in the vicinity.

C o n o d o n t s : Conodonts are fairly abundant, in particular in the organo-detrital crinoid beds. Important taxa in the succeeding order are as follows (H. P. SCHÖNLAUB):

No. 13 (base):	*Icriodus woschmidti* ZIEGLER,
	Ozarkodina remscheidensis eosteinhornensis (WALLISER)
	Ozarkodina remscheidensis remscheidensis (ZIEGLER)
13 (middle):	*Pandorinellina* cf. *praeoptima* (MASHKOVA)
14:	*Icriodus w. hesperius* KLAPPER & MURPHY
	Icriodus postwoschmidti MASHKOVA
15:	*Icriodus w. hesperius* KLAPPER & MURPHY, *Pand.* cf. *praeoptima* (MASHKOVA)
	Ozarkodina i. wurmi (BISCHOFF & SANNEMANN)
18:	*Ozarkodina i. wurmi* (BISCHOFF & SANNEMANN)
30 a	(0,40 m above top of 30):
	Pandorinellina optima (MOSKALENKO)
	Ozarkodina r. remscheidensis (ZIEGLER) – the last occurrence in this section
	Ozarkodina eleanorae LANE & ORMISTON Pb-element
30 e	(2,60–2,70 m above top of 30):
	Ozarkodina transitans (BISCHOFF & SANNEMANN)
	Ozarkodina masara SCHÖNLAUB n. sp.:

D i a g n o s i s : A spathognathodiform element with a large asymmetrical and deeply excavated basal cavity which extends to the posterior end. In adult specimens on the outer half of the basal cavity two to three laterally compressed denticles are developed. The posterior part of the blade is distinctly bent inward. In lateral view the denticles of the blade are highest near the anterior end and form a depression in middle part. They decrease gradually towards the posterior end.

H o l o t y p e : Plate 20, figs. 15–16, Section U topolů, bed no. 30e, *hercynicus*-Zone.

C o m p a r i s o n: *Ozarkodina masara* is well known from the *Monograptus hercynicus*-Zone in the Barrandian area, e.g., Praha-Podoli Quarry (see Ch. SPASSOV 1971, pl. 1, figs. 11, 12), and occurs also in the Carnic Alps (section Oberbuchach 2, H. JAEGER & H. P. SCHÖNLAUB, in press and this guidebook respectively).

A d d i t i o n a l r e m a r k s : As far as graptolite/conodont correlation is concerned some interesting aspects have to be noted:

(1) In a sample collected by Prof. W. ZIEGLER from bed 14, *Pedavis pesavis* has been found. Such a low occurrence in the presumed *uniformis*-Zone has thus far only been reported in the Carnic Alps (this guidebook, section Oberbuchach 2);

(2) Conodonts of the *hercynicus*-Zone are *Oz. transitans, Oz. eleanorae, Ozarkodina masara* and *Pandorinellina optima;*

(3) The last occurrence of *Oz. r. remscheidensis* is in sample no. 30 a; this level may correspond with the beginning of the *hercynicus*-Zone;

(4) The easily recognizable *Ozarkodina masara* SCHÖNLAUB occurs in the Carnic Alps together with graptolites of the *hercynicus*-Zone. Hence, there is a good correlation with the occurrence in the Barrandian!

STOP 3. Kosoř – Černá rokle

Lower Devonian; Lochkovian/Pragian boundary stratotype (fig. 8).

By I. CHLUPÁČ (stratigraphy) and H. P. SCHÖNLAUB (Pragian conodonts).

The outcrops in the abandoned quarries of the Černá rokle gorge near the village Kosoř on the SE flank of the Barrandian belong to classic localities. The well exposed and richly fossiliferous upper Lochkovian and Pragian sequence includes the Lochkovian/Pragian boundary stratotype established here in 1958.

(a) The quarries first expose gently NW-dipping black-grey platy limestones with intercalations of calcareous shales. They belong to the upper Lochkovian Radotin Limestone of the Lochkov Formation and contain rich faunas. The most abundant are: the trilobites *Spiniscutellum umbelliferum* (BEYR.), *Leonaspis lochkovensis* (PTL. & PŘIB.), *Lepidoproetus lepidus* (BARR.); the phyllocarids *Ceratiocaris cornwallisensis damesi* CHL.; the gastropods *Raphistomina tarda* (PER.), *Loxonema solvens* PER., *Praenatica proeva* PER.; the bivalves *Hercynella bohemica* PER., *Neklania insignis* (BARR.), *Panenka* div. sp.; the brachiopods *Howellella inchoans* (BARR.), *H. digitatoides* HAVL., *Plectodonta mimica* (BARR.), *Areostrophia interjecta* (BARR.), *Orbiculoidea intermedia* (BARR.); very common orthocone nautiloids etc. *Monograptus hercynicus* PER. is very abundant in some shale intercalations, the youngest found 4 m below the base of Pragian. Some beds have abundance of the index tentaculites *Paranowakia intermedia* (BARR.). This locality has also yielded marine fish fauna *(Radotina, Kosoraspis, Machaeracanthus)* and remains of large eurypterids, esp. *Pterygotus*. The total number of species described from this locality exceeds 100.

(b) The sequence of Pragian strata – with its lower boundary designated on the wall 60 cm below a thicker nodular layer – consists of grey, nodular, dense, mostly micritic Dvorce-Prokop Limestone of a total thickness of 150–180 m. The fauna is less abundant here than in the underlying Lochkovian. The index dacryoconarid tentaculites *Nowakia acuaria* (RICHT.) are very common. The trilobites are represented esp. by *Odontochile rugosa* H. et C., *O. hausmanni* (BRONGN.), *Reedops cephalotes* (H. et C.), *R. prospicens* CHL., *Phacops (Prokops) hoeninghausi* (BARR.), etc.; rather common are small brachiopods *(Chonetes, Dalejodiscus)*, orthocone nautiloids and thin-shelled bivalves *(Kralovna, Panenka)*. The trace fossils *Chondrites* are very common throughout the Pragian sequence.

C o n o d o n t s : The section Kosoř–Černá rokle has been sampled for conodonts at relatively small intervals. For biostratigraphic reasons main emphasis has been placed on the upper part of the Lochkovian and the base of the Pragian. However, conodont frequency is very low throughout the section, as they are generally scarce in dark-coloured platy limestones with shale intercalations.

Samples from the top of the upper Lochkovian no. 9 – Kosor limestone facies of the Lochkov Formation within the *Monograptus hercynicus*-Zone – have yielded *Ozarkodina excavata excavata* (BRANSON et MEHL) and *Icriodus* sp.; the latter most probably belongs to the range of variability of *Icriodus rectangularis* CARLS et GANDL s. l. and is analogous to the early phylogenetic specimens known from the upper Gedinnian.

The following specimens were recorded from the Pragian limestone (H. P. SCHÖNLAUB):

No. 19: *Icriodus* sp., an incomplete specimen resembling *I. steinachensis* AL-RAWI
21, 24: *Pelekysgnathus s. serratus* JENTZSCH
25: *Pedavis* cf. *mariannae* LANE et ORMISTON
50: *Icriodus bilatericrescens* ZIEGLER

The accompanying microfauna consists of spicules, acrotretacean brachiopods, dacryoconarids, ostracods and radiolaria.

The fauna characterizes an association of calmer and deeper surroundings in a muddy environment; it contrasts with the contemporaneous shallow-water Koněprusy reef fauna.

For description of the section see I. CHLUPÁČ (1953, 1957, 1969), fauna described in separate paleontological monographs.

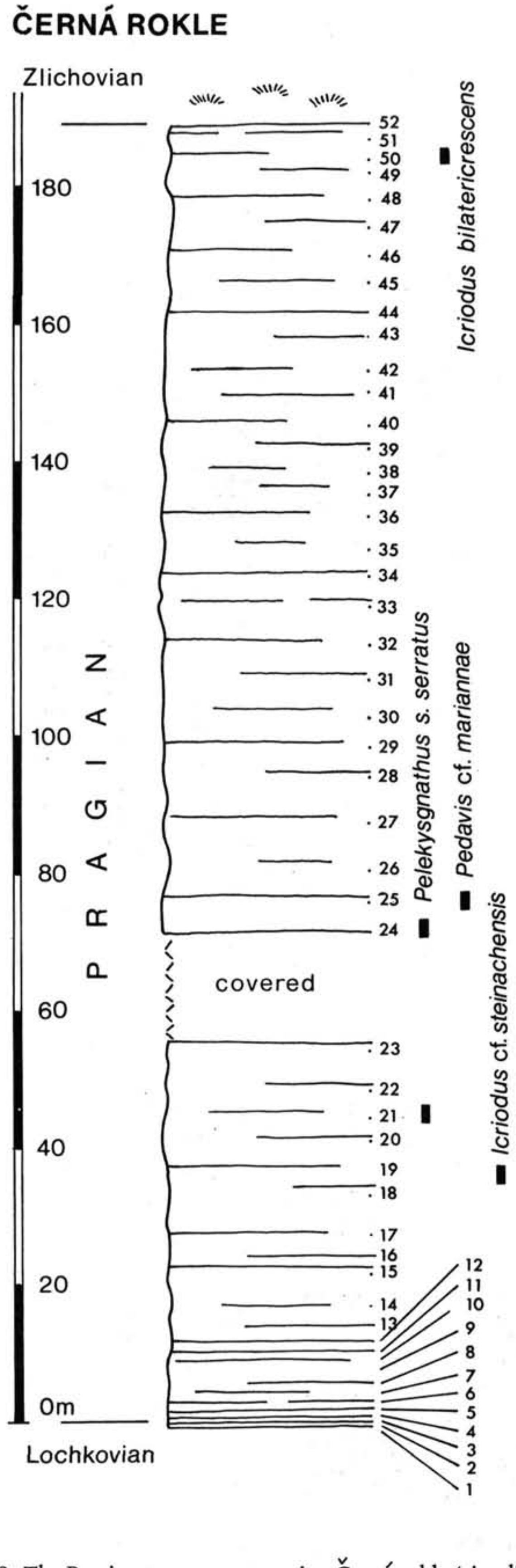
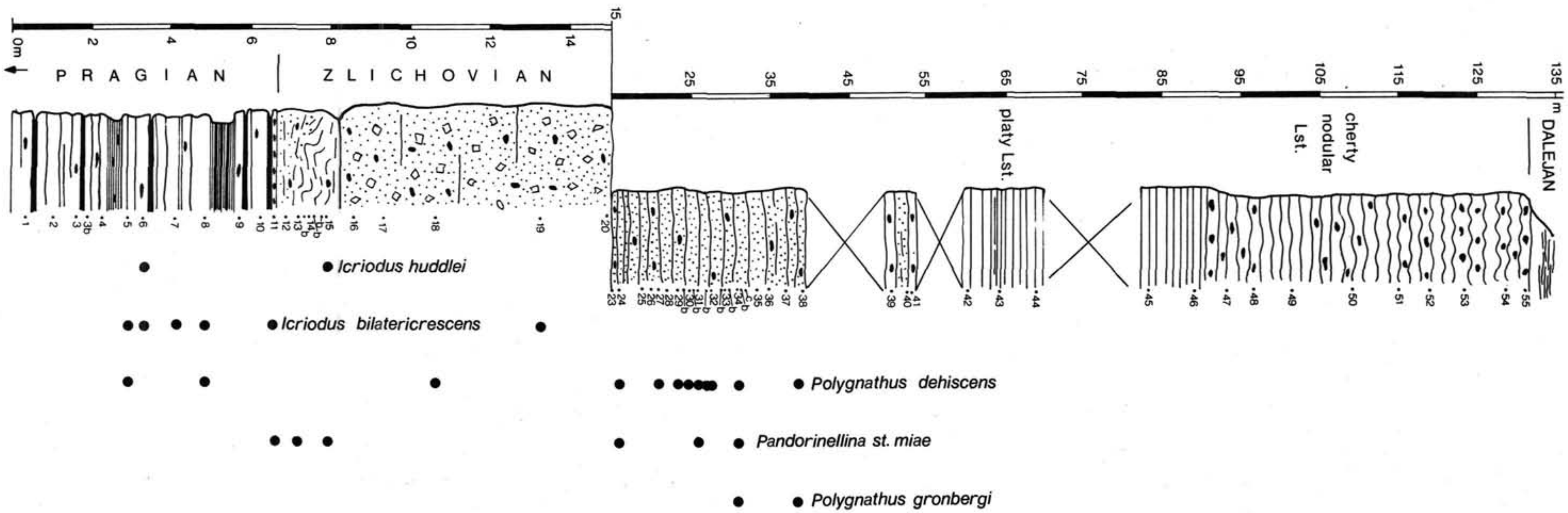


Fig. 8: The Pragian sequence at section Černá rokle (simplified).



0m
PRAGIAN
ZLICHOVIAN
DALEJAN
platy Lst.
cherty nodular Lst.
Icriodus huddlei
Icriodus bilatericrescens
Polygnathus dehiscens
Pandorinellina st. miae
Polygnathus gronbergi

STOP 4. U Kaplički Quarry and its vicinity

Lower Devonian, Pragian/Zlichovian boundary stratotype (fig. 9).

By I. CHLUPÁČ (stratigraphy) and H. P. SCHÖNLAUB (conodonts)

The locality belongs to the extensive outcrops on the left bank of the river Vltava below Barrandov in the southern part of Prague. In the roadcut N of the old quarry „U Kapličky" (Chapel Quarry) the Pragian/Zlichovian boundary is well exposed (= the stratotype established here in 1958).

(a) Most of the Pragian succession is developed in facies of the Dvorce-Prokop Limestone: grey nodular or platy micritic limestones with *Chondrites* prevail (the total thickness exceeds 160 m). The uppermost part of the Pragian sequence outcropping in the roadcut consists of grey micritic platy limestones with cherts and calcareous shale intercalations. Macrofauna is rather rare but there is the index tentaculite *Guerichina strangulata* BOUČ. & PTL. The spores from the level 1 m below the Pragian/Zlichovian boundary are represented by *Emphanisporites decoratus* ALLEN, *E. micrornatus* RICHARDSON & LISTER, *E. rotatus* McGREGOR, *Apiculiretusispora* sp. ?, *Dibolisporites wetteldorfensis* ALLEN, *Dictyitriletes* sp., *Retusotriletes actinomorphus* CHIBRIKOVA a. o. (McGREGOR, 1978).

(b) The Dvorce-Prokop Limestones are sharply overlain by dark-grey platy or thick-bedded organodetrital limestones that contain layers of sedimentary breccias with an abundance of fragmented corals, crinoids, bryozoans and brachiopods. This is the so-called Kaplička (= Chapel) Coral Horizon that characterizes the base of the Zlichovian in the nearest vicinity of Prague.

The breccias developed in thick banks contain chaotically arranged fragments of detrital and dense limestones embedded in the organodetrital matrix. Slip deformations are well visible in the lowermost patches of the Zlichovian in the road cut. In the „U Kapličky" (Chapel) Quarry the organodetrital beds are locally deeply weathered and have yielded a very rich coral, crinoid, bryozoan and especially brachiopod fauna, e. g., more than 150 brachiopod species have been described from the quarry by V. HAVLIČEK (1956–1978). The characteristic lower Zlichovian dacryoconarid tentaculites *Nowakia zlichovensis* BOUČ. were found in fine organodetrital beds.

The higher beds of the Zlichovian sequence are exposed above the houses N of the roadcut. There are dark grey, well bedded, mostly fine-grained, micritic and biosparitic limestones with black cherts. The total thickness of the Zlichovian amounts to about 120–130 m.

C o n o d o n t s : This famous section has been studied in great detail. 65 samples were collected from the uppermost Pragian to the top of the Zlichovian.

Polygnathus dehiscens PHILIP et JACKSON first occurs 3,80 m below the Pragian/Zlichovian boundary in sample no. 5. From here onwards it is associated with *I. bilatericrescens* ZIEGLER (nos. 5, 6, 7, 8, 11).

The crinoidal and platy, in part cherty limestone above the intraformational breccia has been sampled from nos. 23 to 55. With the exception of the lower part, conodonts are very rare. Nevertheless, the transition from *Polygnathus dehiscens* PHILIP et JACKSON to *Polygnathus gronbergi* KLAPPER et JOHNSON is traceable.

The horizons promising for sampling and important faunal units are:

24: *Pandorinellina st. miae* (BULTYNCK), *Polygnathus dehiscens* PHILIP et JACKSON, *Belodella* sp.; good for reference material!

27: In this level the first polygnathids occur which have flat but not inverted posterior portions of the basal cavity.

29 b, 30 b: *Polygnathus dehiscens* PHILIP et JACKSON.

31: *Pandorinellina st. miae* (BULTYNCK), *Polygnathus dehiscens* PHILIP et JACKSON, *Ozarkodina e. excavata* (BRANSON et MEHL), Icriodids.

31 b, 32: Apparently the best horizon to collect abundant *P. dehiscens!*

34 b: First *P. gronbergi* KLAPPER et JOHNSON together with *P. st. miae* and *P. dehiscens*.

38: *P. dehiscens* is still present in this sample. Its association with *P. gronbergi* suggests an Y-branched evolutionary lineage as already has been proposed by G. KLAPPER et D. B. JOHNSON, 1975.

Samples above no. 38 have only produced simple cones (*Bellodella* type) and few ramiform elements. The accompanying microfauna comprises ostracods, spicules, tentaculites, fish teeth and acrotretacean brachiopods.

Fig. 9: Praha–Hlubočepy, roadcut at the „U Kapličky" Quarry. Diagrammatic section starting at the Pragian-Zlichovian boundary interval and ending close to the top of the Zlichovian (conodont distribution after H. P. SCHÖNLAUB, orig.).

In summary, the transition from *Polygnathus dehiscens* PHILIP et JACKSON to *Polygnathus gronbergi* KLAPPER et JOHNSON takes place approx. 25 m above the base of the Zlichov Limestone.

For description of the section see: I. CHLUPÁČ (1957), I. CHLUPÁČ et al. (1977); macrofauna described in special palaeontological monographs (references in I. CHLUPÁČ 1976, 1977, V. HAVLIČEK 1977, M. ŠNAJDR 1980).

STOP 5. Holyně–Prastav Quarry

Lower/Middle Devonian boundary beds (fig. 10).

By I. CHLUPÁČ (stratigraphy) and G. KLAPPER (conodonts)

The upper part of the Třebotov Limestone and the basal part of the Choteč Limestone are well exposed in the former Prastav Quarry NE of the village Holyně, SW of Prague, see fig. 10. This is one of the most instructive sections of the Lower-Middle Devonian boundary beds in the Barrandian where the levels of all most important variants of the Lower/Middle Devonian boundary are traceable.

(a) The upper part of the Třebotov Limestone constituting the left side and the majority of the quarry faces is developed as mostly light grey, micritic, nodular limestones belonging to the tentaculite *Nowakia richteri* and *N. holynensis*-Zones. These beds yielded a rich fauna represented by the trilobites *Phacops (Ph.) superstes superior* CHL., *Ph. (Ph.) insequens* CHL., *Macroblepharum tumidum* ŠNAJDR, *Tafilaltaspis* div. sp., the goniatites *Mimagoniatites bohemicus* (BARR.), *Paraphyllites tabuloides* (BARR.), *Gyroceratites gracilis* BRONN , *Anarcestes plebeius* (BARR.), *A. simulans* (BARR.), *A. applanatus* FRECH, the nautiloids *Hercoceras mirum* BARR., large thin-shelled bivalves *(Panenka, Pantata* etc.), brachiopods, rugose and tabulate corals, and very abundant tentaculites. The conodonts belong to the *Polygnathus serotinus, P. costatus patulus* and *P. costatus partitus*-Zones (see G. KLAPPER et al. 1978, I. CHLUPÁČ et al. 1977, 1979).

(b) The basal part of the Choteč Limestones, beginning at the base of no. 11 consists of well bedded, grey and dark grey micritic and biosparitic limestones – often showing graded bedding – and thin intercalations of dark calcareous shales. These beds form the right side of the face and most of the right side of the quarry. Similar to the sequence observed at Hlubočepy, the index goniatites *Pinacites jugleri* (ROEM.) and *Agoniatites occultus* (BARR.) appear here and also other fauna differing from that of the Třebotov Limestones has been collected: the trilobites *Cyphaspides holynensis* RŮŽ., *Aulacopleura (Paraulacopleura) bohemica* PŘIB., *Struveaspis fugitiva* (BARR.), *Thysanopeltis speciosa* H. et C., proetids of the genera *Proetopeltis, Koneprusites, Cyrtosymboloides* and *Piriproetus,* strophomenid and chonetid brachiopods, thin shelled bivalves and the index tentaculite *Nowakia sulcata* (ROEM.). *Pinacites jugleri* and *Foordites occultus* have been found, e. g., 170 cm above the Třebotov/Choteč Lst. boundary. The conodonts belong to the zones with *Polygnathus costatus partitus* and *P. costatus costatus* (see G. KLAPPER et al. 1978, I. CHLUPÁČ et al. 1977, 1979).

The importance of the Holyně-Prastav section is clearly reflected in the presence of all principal animal groups enabling a fine zonation (conodonts, tentaculites, ammonoids) together with other groups in the same sequence of purely marine sediments withouth any marked breaks or strong facies changes.

For these reasons, the Holyně section has been proposed as a candidate section for the Lower/Middle Devonian boundary stratotype.

C o n o d o n t s (G. KLAPPER): (Bed numbers refer to those of CHLUPÁČ et al., 1979, fig. 8)

Třebotov Limestone

Bed 1 (0–0,27 m above base of bed): lower *serotinus*-Zone:

Polygnathus cracens KLAPPER, ZIEGLER & MASHKOVA, 1978
P. serotinus TELFORD, 1975
P. linguiformis bultyncki WEDDIGE, 1977
Icriodus beckmanni sinuatus KLAPPER, ZIEGLER & MASHKOVA, 1978
Ozarkodina carinthiaca (SCHULZE, 1968)

Bed 1 (1,20 m above base of bed):

P. cracens
P. serotinus
P. linguiformis bultyncki
I. beckmanni sinuatus
Pandorinellina steinhornensis steinhornensis (ZIEGLER, 1956)

Bed 2 (0,27–0,37 m above base of bed):
P. cracens
P. serotinus
P. linguiformis bultyncki?
Bed 3 (1,28–1,38 m above base of bed):
P. serotinus
P. linguiformis bultyncki
I. beckmanni sinuatus
Bed 4 (1,00–1,12 m above base of bed): lower *serotinus*-Zone:
P. serotinus
P. linguiformis bultyncki
I. beckmanni sinuatus
O. carinthiaca
Bed 5 (0–0,10 m below top of bed): upper *serotinus*-Zone:
P. quadratus KLAPPER, ZIEGLER & MASHKOVA, 1978
P. l. bultyncki
Bed 6 (0,64–0,70 m below top of bed): upper *serotinus*-Zone:
P. quadratus
P. l. bultyncki
P. cooperi cooperi KLAPPER, 1971
P. cooperi secus KLAPPER, ZIEGLER & MASHKOVA, 1978
O. carinthiaca
Bed 6 (top of bed, 1,20–1,25 m above base): lower *patulus*-Zone:
P. costatus patulus KLAPPER, 1971
P. serotinus
P. l. bultyncki
P. cooperi secus
O. carinthiaca
Bed 7 (0–0,17 m above base of bed):
P. costatus patulus
P. serotinus
O. carinthiaca
Bed 7 (0–0,20 m below top of bed):
P. costatus patulus
P. l. bultyncki
P. serotinus
P. cooperi secus
O. carinthiaca
Bed 8 (0,10–0,20 m below top of bed):
P. costatus patulus
P. serotinus
P. l. bultyncki
O. carinthiaca
Bed 9 (0,20–0,40 m above base of bed): lower *patulus*-Zone:
P. costatus patulus
P. serotinus
P. l. bultyncki
P. cooperi secus
Bed 9 (0,75–0,85 m above base of bed): lower *patulus*-Zone:
P. costatus patulus
P. serotinus
P. l. bultyncki
Bed 9 (0,14–0,34 m below top of bed): upper *patulus*-Zone:
P. costatus partitus KLAPPER, ZIEGLER & MASHKOVA, 1978
P. serotinus
P. l. bultyncki

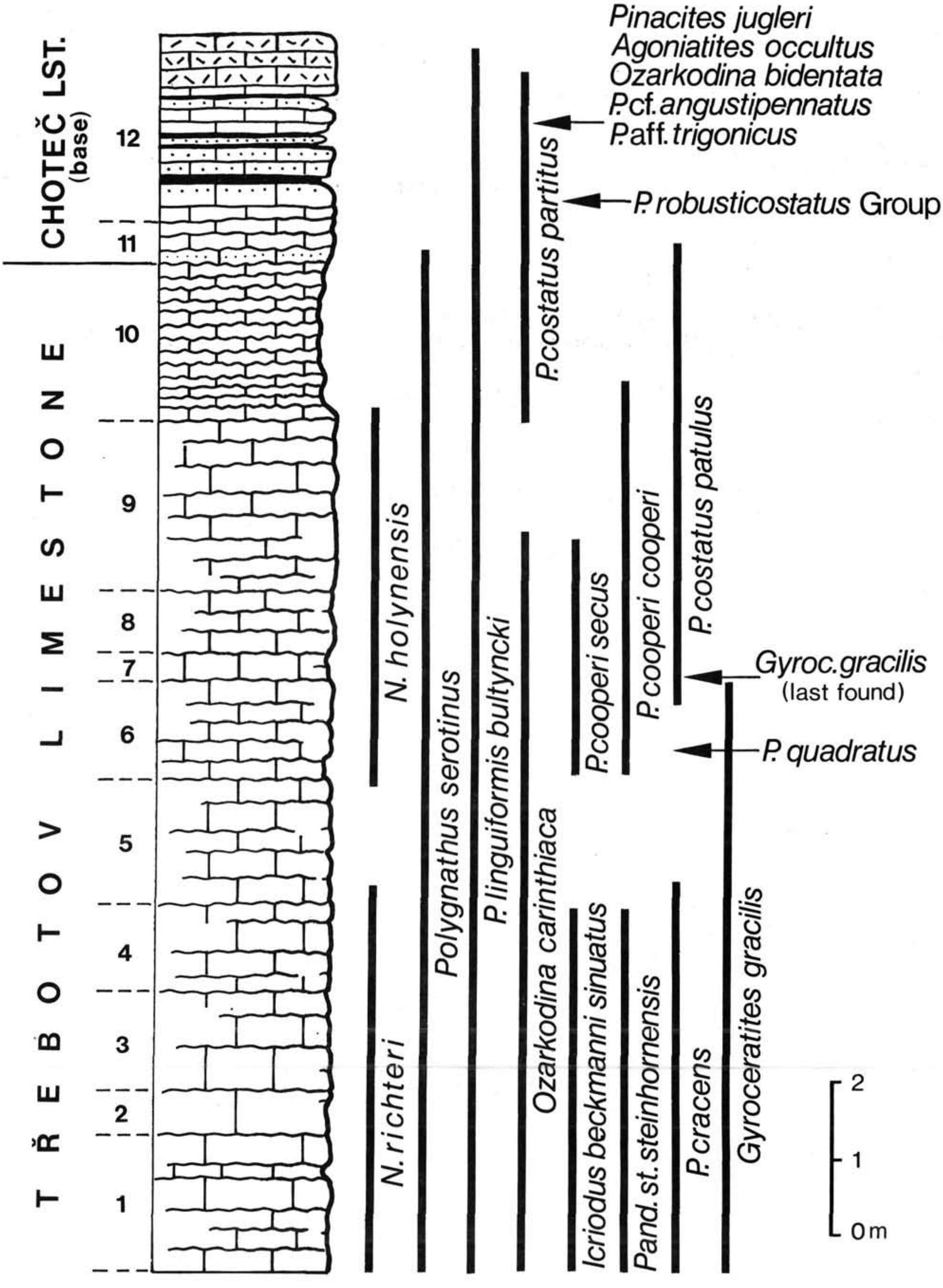


Fig. 10: Holyně–Prastav Quarry. Diagrammatic section of the Lower/Middle Devonian boundary interval (according to I. CHLUPÁČ et al., 1979, conodonts after G. KLAPPER et al. 1978, J. ZIKMUNDOVÁ in I. CHLUPÁČ et al. 1977, 1979).

Bed 10 (0–0,15 m above base of bed):
P. costatus patulus
P. serotinus
P. cooperi cooperi
Bed 10 (0,80 m above base of bed):
P. costatus partitus
P. costatus patulus
P. serotinus
Bed 10 (1,00–1,10 m above base of bed):
P. costatus partitus
P. costatus patulus
P. serotinus
P. l. bultyncki

Choteč Limestone

Bed 11 (0,25 m above base of bed): upper *patulus*-Zone:
P. costatus partitus
P. l. bultyncki
Bed 12 (1,30–1,35 m above base of bed): *costatus costatus*-Zone:
P. sp. aff. *P. trigonicus* BISCHOFF & ZIEGLER, 1957
P. costatus partitus
P. l. bultyncki
P. l. pinguis WEDDIGE, 1977
P. cf. *P. angustipennatus* BISCHOFF & ZIEGLER, 1957
Bed 12 (1,55 m above base of bed):
P. costatus partitus
P. cf. *P. angustipennatus*
O. bidentata (BISCHOFF & ZIEGLER, 1957)

Description of the section see: I. CHLUPÁČ (1959), I. CHLUPÁČ, P. LUKEŠ & J. ZIKMUNDOVÁ (1977, 1979); fauna described in special papers (for reference see I. CHLUPÁČ 1977); conodonts reported by G. KLAPPER (1977), G. KLAPPER, W. ZIEGLER & T. V. MASHKOVA (1978) and J. ZIKMUNDOVÁ in I. CHLUPÁČ et al. (1977, 1979).

STOP 6. Praha – Hlubočepy
Lower to early Middle Devonian (fig. 11)

By I. CHLUPÁČ (stratigraphy) and G. KLAPPER (conodonts)

The old quarries situated on the northern slope of the Prokopské údoli valley at Praha–Hlubočepy represent instructive outcrops of the latest Lower Devonian (late Dalejan) and early Middle Devonian (Eifelian) beds. The following sequence could be observed in the outcrops, see fig. 11:

1. Ligth green and grey-green weathered calcareous shales in the uppermost right part of the old quarry belong to the uppermost Daleje Shale (no. 1 in fig. 11) and still contain the typical Daleje Shale fauna; the index tentaculite, however, is already *Nowakia richteri* BOUČ. et PTL.

2. Predominantly red, in some layers also greenish, calcareous shales with abundant intercalations and irregular nodules of red or greenish-grey micritic limestones (shales predominate, lowest part of the Třebotov Limestone, thickness 9–10 m, no. 2 in fig. 11).

These beds yielded, apart from the index *Nowakia richteri* BOUČ. et PTL., the first anarcestids associated with *Gyroceratites gracilis* BRONN etc. *Icriodus* cf. *corniger* WITTEKINDT occurs among the conodonts.

3. Predominantly red nodular micritic limestones with subordinate red-exclusively greenish-shale intercalations (limestones predominate, thickness c. 8 m, no. 3 in fig. 11). Apart from tentaculites (including also *N. richteri)*, the anarcestids, *Gyroceratites gracilis* BRONN and the trilobites *Phacops superstes superior* CHL. and *Struveaspis micromma* (ROEM.) occur here. Conodonts are rather rare *(Icriodus* sp., *Polygnathus* sp. etc.).

4. Well bedded grey and grey-green nodular limestones with abundant intercalations of greenish and grey calcareous shales (thickness c. 6 m, no. 4 in fig. 11). The macrofauna is identical with that found

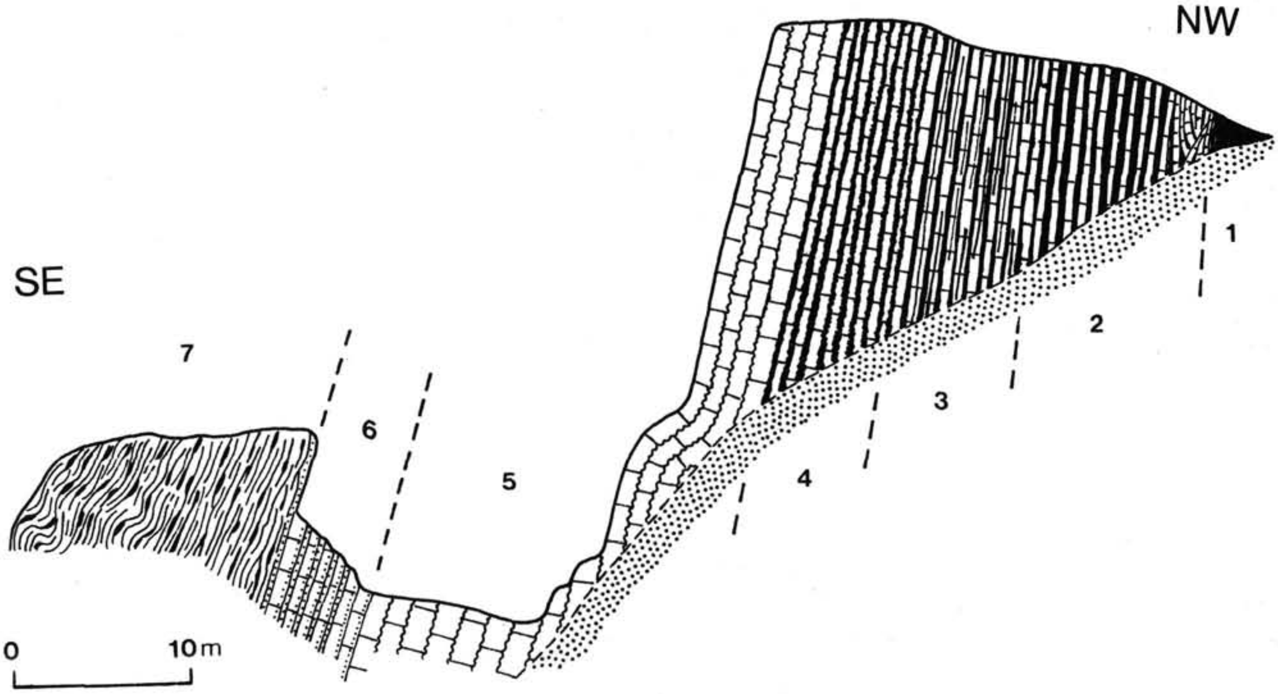


Fig. 11: Praha–Hlubočepy, section exposed in the „Nad trati" quarry. For units 1–7 see text (after I. CHLUPÁČ et al. 1979).

in the underlying red limestones and shales; *Nowakia richteri* BOUČ. et PTL. is locally common.

5. Light grey, more coarsely bedded micritic limestones with nodular surface of the bedding planes, but without marked shale intercalations (total thickness c. 18–19 m, no. 5 in fig. 11). These limestones represent the upper part of the Třebotov Limestone and form the steep rock walls; they were quarried and their higher parts mostly dug out. From these layers most of BARRANDE's type of cephalopods and bivalves of his „bande G_3" derive, e. g., *Hercoceras mirum* BARR., *Mimagoniatites bohemicus* (BARR.), *Paraphyllites tabuloides* (BARR.), *Anarcestes plebeius* (BARR.), *Latanarcestes neglectus* (BARR.), *Nothoceras bohemicum* BARR., *Adelphoceras bohemicum* BARR., many species of the bivalves *Kralovna, Panenka, Sestra, Pantata* etc. The main part of this sequence still belongs to the tentaculite Zone with *Nowakia richteri (N. richteri* found still 7 m below the top of these limestones); *Nowakia holynensis* BOUČ. has been discovered at the level of 2–4 m below top.

Conodonts of Unit 5 (upper part of Třebotov Limestone)
By G. KLAPPER

13,5–13,6 m below top: lower *serotinus*-Zone:
P. cracens
P. l. bultyncki

6,25–6,35 m below top: upper *serotinus*-Zone:
P. quadratus (holotype !)
P. l. bultyncki

4,95–5,05 m below top [composite of several samples]: lower *patulus*-Zone:
P. costatus patulus
P. cooperi cooperi
P. serotinus
P. l. bultyncki

4,85–4,95 m below top: lower *patulus*-Zone:
P. costatus patulus
P. serotinus
P. l. bultyncki

1,80 m below top of Třebotov – 0,06 m above base Choteč Limestone [composite of several samples]: upper *patulus*-Zone:
P. costatus partitus
P. robusticostatus Group
P. costatus patulus
P. cooperi cooperi
P. serotinus
P. l. bultyncki

1,20–1,40 m below top of Třebotov: upper *patulus*-Zone:
P. costatus partitus
P. costatus patulus
P. serotinus
P. l. bultyncki

6. The base of the Choteč Limesteone consists of platy limestones of somewhat darker grey colour and with a larger proportion of biosparitic limestones concentrated in some graded beds (total thickness c. 6 m, no. 6 in fig. 11). These beds contain, apart from common anarcestids, the indexgoniatites *Pinacites jugleri* (ROEM.) and *Foordites occultus* (BARR.). Some other species continue across the Třebotov/Choteč boundary, for example *Phacops* (PH.) *insequens* CHL.

Conodonts of Unit 6:

0,20–0,30 m above base: *costatus costatus*-Zone:
P. costatus costatus KLAPPER, 1971
P. costatus partitus (holotype !)
P. l. bultyncki

1,50–1,60 m above base: *costatus costatus*-Zone:
P. costatus costatus
P. l. bultyncki

7. The youngest beds exposed in the southern part of the quarries are thinner bedded, dark grey, im-

pure limestones with cherts (radiolarites) and thin intercalations of dark calcareous shales (total thickness approx. 30–40 m, in quarries only the lower part exposed, no. 7 in fig. 11). The fauna is not abundant. The trilobite *Phacops (Chotecops) auspex* CHL. is locally common only near the base, being associated with other elements of the Choteč Limestone fauna.

Conodonts of Unit 7:

6,50–7,00 m above base: *australis*-Zone:
Tortodus kockelianus australis (JACKSON, 1970)
P. pseudofoliatus WITTEKINDT, 1966

STOP 7. Budňany Rock near Karlštejn
Silurian/Devonian boundary (fig. 12).

By I. CHLUPÁČ

The disharmonically folded sequence of the Přidoli and Lochkov Formations of the south-eastern flank of the Barrandian is exposed on the left bank of the Berounka river in the village Karlštejn.

The well exposed upper part of the Přidoli Formation consists mainly of dark platy bituminous limestones with intercalations of calcareous shales, but in the uppermost part of the Přidoli sequence thicker banks of „Orthoceras" limestone also occur (beds 40–41). The limestones and shales of the Přidolian contain a characteristic fauna with abundant *Scyphocrinites, Ceratiocaris bohemica* BARR., *Cycloceras bohemicum* (BARR.) and numerous other nautiloids, gastropods (esp. *Platyceras),* lamellibranchs *(Lunulacardium, Pterochaenia, Pygolfia, Snoopyia, Leiopteria, Praecardium* a. o.), dendroids and common graptolites, esp. the index *Monograptus transgrediens* PER. (last found c. 35 cm below the upper bedding plane of bed 41).

The chitinozoans are represented by common *Desmochitina urna* EISENACK, *Sphaerochitina sphaerocephala* (EISENACK), *Ancyrochitina* ex. gr. *ancyrea* forma B and *Margachitina* sp. (see F. PARIS et S. LAUFELD, 1979).

The first representatives of the Lochkovian graptolite *Monograptus uniformis* PŘIB. have been found in the thin shale interbed 41/42 which forms the first bed of the Lochkovian. The Silurian/Devonian boundary is thus defined at the upper bedding plane of bed 41.

The Lochkovian sequence consists in its lowest part of thick banks of massive *Scyphocrinites*-limestones and, higher up, of light grey platy fine grained and organoclastic limestones with subordinate shale intercalations. The characteristic fauna consists of the trilobites *Warburgella rugulosa* (BOUČ.), first found 30 cm above the 41/42 boundary interbed, *Otarion novaki* BOUČ., *Tropidocare index* CHL. a. o., the brachiopods *Hebetoechia hebe* (BARR.), *H. ornatrix* HAVL., *Linguopugnoides carens* (BARR.) *Spurispirifer fucus* HAVL., *Plectodonta mimica* (BARR.) a. o., numerous ostracods of the *Acanthoscapha bohemica* horizon described by B. BOUČEK, 1936 etc.

Among chitinozoans *Desmochitina urna* EISENACK, *Sphaerochitina sphaerocephala* (EIS.) and *Angochitina chlupaci* PARIS et LAUFELD were recognized (see F. PARIS et S. LAUFELD, 1979).

The index graptolite *Monograptus uniformis uniformis* PŘIB. is common in some shale intercalations.

C o n o d o n t s : The index conodont species *Icriodus woschmidti* ZIEGLER and *Ozarkodina remscheidensis remscheidensis* (ZIEGLER) have been found for the first time 40 cm above the base of the Lochkovian together with *Ozarkodina remscheidensis eosteinhornensis* (WALLISER), the latter representing the last known occurrence of this specimen in the Barrandian area (J. ZIKMUNDOVÁ).

The Budňany Rock is a well-known palaeontological locality reported already since BARRANDE's time. Many of BARRANDE's originals of cephalopods, bivalves and gastropods come from this place, and this locality is celebrated especially for the large crowns of *Scyphocrinites* showing good preservation.

The Budňany rock is also of special stratigraphic importance because the Přidolian and Lochkovian contain rich faunas, the interval between the last known occurrence of *Monograptus transgrediens* and the first appearance of *M. uniformis* is the smallest in the whole Barrandian (30–35 cm) and the sequence is well exposed. This outcrop has thus been accepted in 1972 by the International Commission on Stratigraphy (1972) as an auxiliary type section of the Silurian/Devonian boundary.

For a description of the outcrop see R. HORNÝ (1955), I. CHLUPÁČ, H. JAEGER & J. ZIKMUNDOVÁ (1972, p. 118–122). Fauna was described in many special papers.

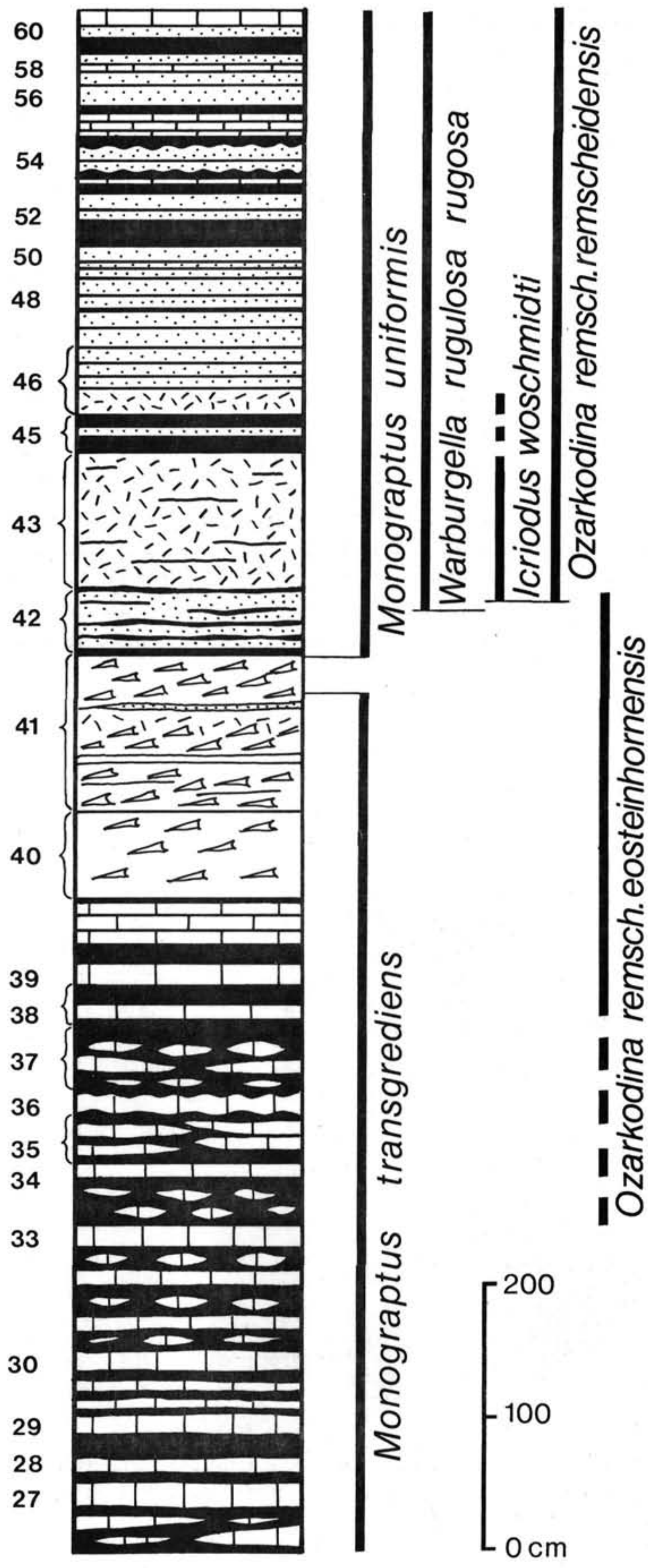


Fig. 12: Karlštejn, Budňany Rock. Diagrammatic section of the Silurian/Devonian boundary interval (after I. CHLUPÁČ et al. 1972, conodonts after J. ZIKMUNDOVÁ).

STOP 8. Srbsko – roadcut

Upper Lochkovian, Pragian, Zlichovian (fig. 13, 14)

By I. CHLUPÁČ (stratigraphy) and H. P. SCHÖNLAUB (conodonts)

On the north-western flank of a local anticline in the central part of the Barrandian synclinorium, a roadside exposure on the left bank of the river Berounka to the S of the village Srbsko displays a Lower Devonian section. The beds dip to the NW, so that ever younger beds can be observed from S to N.

(a) The oldest member forming a core of the anticline is the light grey biosparitic, well bedded Kotýs Limestone (Lochkovian) with abundant, often light coloured cherts.

(b) the Pragian sequence starts with the whitish, massive crinoidal Koněprusy Limestone (10–12 m thick) passing gradually upwards into the pink crinoidal Slivenec Limestone (c. 10 m thick). There follows a transitional member – mostly reddish, well-bedded biosparitic and micritic limestones with an admixture of organic detritus representing the Loděnice Limestone exposed in the roadside quarry, thickness c. 15 m. These limestones pass gradually into the red nodular micritic Řeporyje Limestone forming picturesque rocks at the roadside (thickness c. 20 m, *Nowakia acuaria* very common in some layers); The latter are more massive in the lower part, strikingly nodular upwards and pass into an 8–12 m thick sequence of the grey, nodular, micritic Dvorce–Prokop Limestone which terminates the Pragian sequence. *Guerichina strangulata* BOUČ. appears in the uppermost few meters.

By comparing the section at Srbsko with the Pragian development in the proper vicinity of Prague, e. g., Černá rokle at Kosoř, it is evident that the former sequence is more varied in facies and facies changes took place vertically. On a larger scale, these facies pass both laterally and diagonally into one another. The facies variability is connected with a transition of the monotonous micritic limestone facies

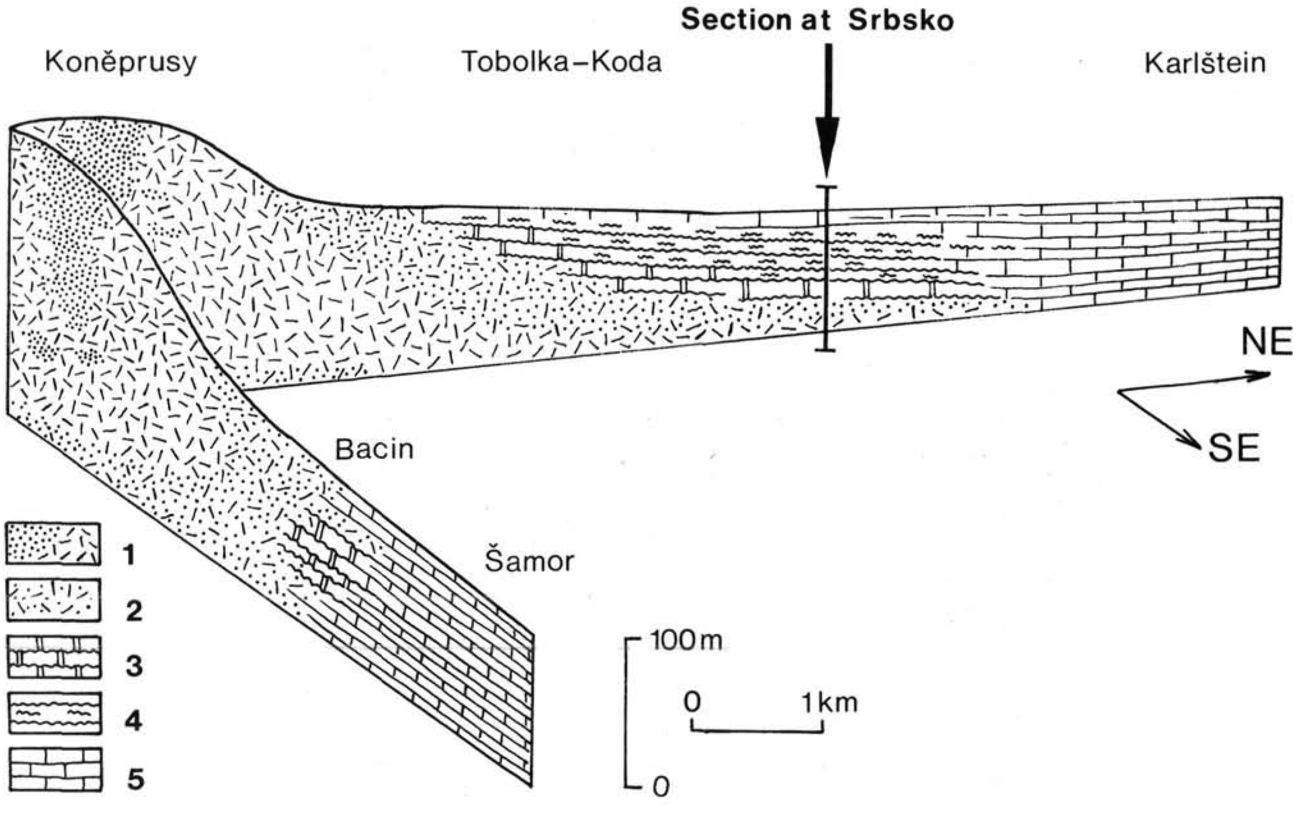


Fig. 13: Scheme of the facies development of the Pragian in the SW part of the Barrandian: transition from the reef and organodetrital development into the micritic limestone („cephalopod") facies (after I. CHLUPÁČ 1969). 1 – light reef and coarsely organoclastic limestones (Koněprusy Lst.), 2 – reddish organoclastic Slivenec and Vinařice Limestones, 3 – variegated platy Loděnice Lst., 4 – grey micritic Dvorce-Prokop Lst.

in the NE into the bioclastic or even reef facies in the SW. This section represents one of the links between the two extremes (see fig. 13).

(c) The Zlichovian sequence – well exposed near the first house – begins with platy, well bedded, grey limestones with dark cherts; an alternation of dense micritic limestones, coarser crinoidal, biosparitic limestones, and subordinate intercalations of dark shales is well traceable. These beds contain a characteristic Zlichovian fauna, e. g., the trilobites *Reedops decorus* (H. et C.), *Odontochile spinifera* (BARR.), *O. auriculata* (DALM.), the brachiopods *Dalejodiscus subcomitans* (HAVL.), *Chonetes novellus* BARR. a. o. The index lower Zlichovian tentaculite *Nowakia zlichovensis* BOUČ. is also present here, being concentrated in detrital layers. The shales and micritic limestones are rich in the trace fossil *Chondrites tschernyschewi* KATZER.

The higher part of the Zlichov Limestone, outcropping on the slope above the first houses of the village of Srbsko, are represented by thinner bedded, dark grey, micritic and biosparitic limestones with abundant black cherts. The total thickness of the Zlichovian amounts to about 90–100 m. The rocks further northwards (in the village Srbsko) belong already to the Třebotov and Choteč Limestones.

C o n o d o n t s (H. P. SCHÖNLAUB): The following numbered beds are important for conodont biostratigraphy:

11, 13, 14 (top of Slivenec Lst. and Loděnice Lst.): *Pelekysgnathus s. serratus* JENTZSCH
11, 19: *Icriodus* cf. *steinachensis* AL-RAWI
21: (Řeporyje Lst.): *Pelekysgnathus* n. sp.
23: *Icriodus huddlei* KLAPPER et ZIEGLER
25, 29, 30 (Dvorce Prokop Lst.): *Icriodus bilatericrescens* ZIEGLER, *Icriodus* cf. *huddlei* KLAPPER et ZIEGLER, *Pandorinellina st. miae* (BULTYNCK).

The accompanying microfauna of the Pragian limestones comprises dacryoconarids, gastropods, brachiopods, bivalves, echinoderms, fish teeth *(„Oneotodus")* and chitinozoans.

The boundary between the Pragian and the Zlichovian is drawn at the base of sample no. 31. Important conodonts in the Zlichovian part of the section are:

31, 33, 39: *Icriodus bilatericrescens* ZIEGLER (it is possible to obtain good specimens particularly from no. 33).
40 – 0,3 m, 43, 45: Icriodids together with *P. st. miae* (BULTYNCK)
42: *Icriodus bilatericrescens* ZIEGLER (excellently preserved)
47: (7,2 m above the base of the Zlichovian): the first *Polygnathus dehiscens* PHILIP et JACKSON with mostly juvenile icriodids.
48, 49: *Icriodus bilatericrescens* ZIEGLER
50, 51: *Icriodus beckmanni* ZIEGLER, *Pandorinellina st. miae* (BULTYNCK)
52: *Polygnathus dehiscens* PHILIP et JACKSON
53, 55: *Pandorinellina st. miae* (BULTYNCK) and *Polygnathus dehiscens* PHILIP et JACKSON
58: *Icriodus sigmoidalis* CARLS et GANDL, *P. dehiscens* and *Pand. st. miae* (BULTYNCK)
64: *Icriodus* cf. *beckmanni* ZIEGLER
65, 66: *Icriodus* cf. *latus* AL-RAWI
69: *Icriodus bilatericrescens* ZIEGLER
70 (41 m above the base of Zlichovian Lst.): *Icriodus bilatericrescens* ZIEGLER, *Pand. st. miae* (BULTYNCK), *Polygnathus gronbergi* KLAPPER et JOHNSON (a fairly rich fauna!)
74: *Polygnathus gronbergi* KLAPPER et JOHNSON, *Icriodus bilatericrescens* ZIEGLER, *Pandorinellina st. miae* (BULTYNCK)
75, 77: *Icriodus bilatericrescens* ZIEGLER
78: *Icriodus bilatericrescens* ZIEGLER and *Icriodus latus* AL-RAWI
80: *Pandorinellina st. steinhornensis* (ZIEGLER)
81: *Icriodus* cf. *beckmanni sinuatus* KLAPPER et al.
82: *Polygnathus* cf. *gronbergi* KLAPPER et JOHNSON, *Pandorinellina st. steinhornensis* (ZIEGLER)

The microfauna in the upper part of the Srbsko section (Zlichovian) consists of spicules, fish teeth and other vertebrate remains, acrotretacean brachiopods, dacryoconarids and echinoderms.

For description of the section see I. CHLUPÁČ (1957), I. CHLUPÁČ et al. (1967, 1977).

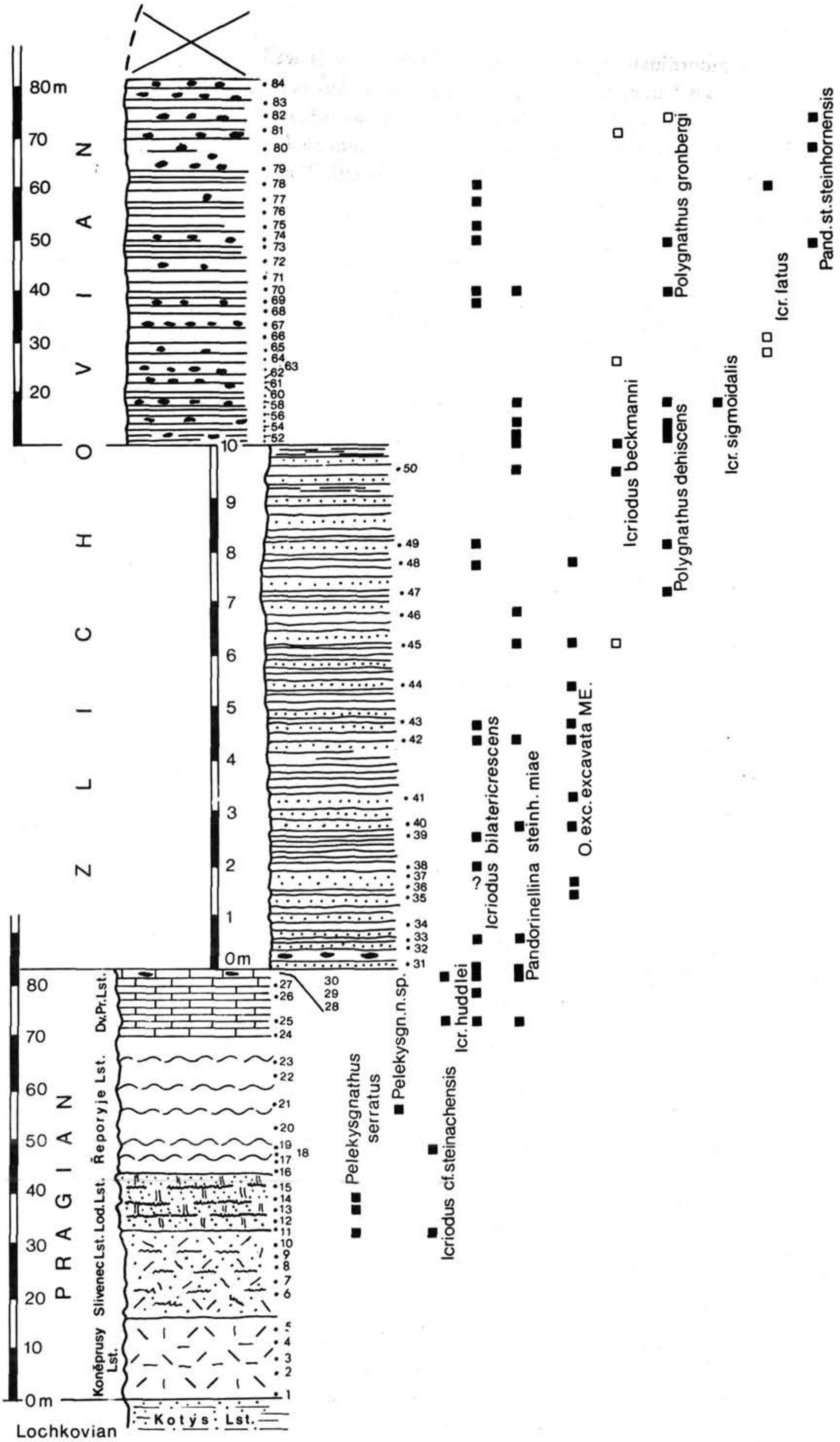


Fig. 14: Srbsko, outcrops S of the village on the left bank of the Berounka River. Diagrammatic section of the exposed topmost Lochkovian, Pragian and Zlichovian sequence (after I. CHLUPÁČ 1957, *conodonts* after H. P. SCHÖNLAUB).

STOP 9. Koledník (Jarov) Quarry

Ludlovian, Přidolian (fig. 15)

By J. KŘÍŽ (stratigraphy) and H. P. SCHÖNLAUB (conodonts)

The section is exposed in an abandoned quarry on the eastern slope of a valley between Koledník and Jarov villages, south of Beroun. Upper parts of the Kopanina Formation (Ludlovian) and lowermost Přídolí Formation (Přídolian) rocks are dipping to the SE.

The northern face and lower to middle parts of the eastern face of the quarry are formed by thin to thick-bedded grey to brownish-grey micrite to biomicrite or biosparite alternating with thin layers of calcareous shale. This part of the sequence contains rich fauna characteristic for the horizon with *Ananaspis fecunda* (BARRANDE): *Otarion diffractum* ZENKER, *Coniproetus (Ryckholtia) ryckholti* (BARRANDE), *Scharyia micropyga* (H. et C.), *Interproetus intermedins* (BARRANDE), *Interproetus venustus* (BARRANDE), *Decoroscutellum Haidingeri* (BARRANDE), *Harpidella novella* (BARRANDE), *Bohemoharpes ungula ungula* (STERNBERG), *Eremiproetus senex senex* G. ALBERTI, *Kosovopeltis partschi* (BARRANDE), *Ananaspis fecunda* (BARRANDE), *Microcheilinella kolednikensis* BOUČEK-PŘIBYL, *Bythocypris berounensis* BOUČEK-PŘIBYL, *Alanella decurtata* BOUČEK, *Macrocypris? novaki* BOUČEK-PŘIBYL, *Aparchites* sp., *Conocardium* div. sp., *Atrypoidea linguata* (BARRANDE), *Cyrtia trapezoidalis* (DALMAN), *Leptaena vellerosa* (HAVLÍČEK), *Orthostrophella mulus* (BARRANDE), *Nymphorhynchia daphne* (BARRANDE), *Havlicekia togata* (BARRANDE), *Diabolirhynchia* sp.

The sampled and measured section starts in uppermost parts of the sequence described above. Fauna is characterized here by abundant *Atrypoidea linguata* (BARRANDE).

Uppermost part of the Kopanina Formation (bed below conodont sample 3 to top of no. 6 – total thickness 626 cm) is formed by grey to brownish grey biosparite with abundant trilobites and other fossils characteristic for the horizon with *Prionopeltis archiaci* (BARRANDE): *Otarion diffractum* ZENKER, *Prionopeltis dracula* ŠNAJDR, *P. archiaci* (BARRANDE), *Bohemoharpes ungula ungula* (STERNBERG), *Eremiproetus senex senex* G. ALBERTI, *Ananaspis calvescens* CHLUPÁČ, large cephalopods, *Spurispirifer spurius* (BARRANDE), *Decoropugnax berenice* (BARRANDE), *Cardiola signata* BARRANDE.

The abrupt change in sedimentation characterizes the boundary with the Přídolí Formation *(Pristiograptus ultimus* Biozone). The latter is represented by layers, lenses and nodules of grey to dark grey micrite to biomicrite, and biosparite. The sequence contains distinct assemblages of ostracodes, brachiopods, trilobites, scolecodonts and graptolites: *Microchilina jarovensis* BOUČEK, *Parahippa rediviva* (BARRANDE), *Aechimina cuspidata* BOUČEK, *Laccoprimitia subcentralis* BOUČEK, *Craspedobolbina bohemica* BOUČEK, *Alanella bohemica* BOUČEK, *Radiaspis nauseola* KŘÍŽ, *Prionopeltis striata* (BARRANDE), *Prionopeltis unica unica* ŠNAJDR., *Scharyia nympha* CHLUPÁČ, *Kettnerites kosoviensis* ŽEBERA, *Dubaria megaera* (BARRANDE), *Hebetoechia hebe* (BARRANDE), *Pristiograptus ultimus* (PERNER), *Pristiograptus kolednikensis* PŘIBYL, *Spirograptus? formosus* (BOUČEK) a. o.

The section was studied by B. BOUČEK and A. PŘIBYL (1955) and R. HORNÝ (1955). The locality was visited by the Excursion 11 AC of XXIII IGC 1968 (I. CHLUPÁČ 1967). Fauna from the area was described in numerous special papers.

C o n o d o n t s (H. P. SCHÖNLAUB): There is no direct proof of conodonts belonging to the *siluricus*-Zone. However, the first occurrences of *Ozarkodina snajdri* in sample no. 2 suggest that the *siluricus*-Zone may be represented below that level. Sample no. 0, 1 and 1 b are derived from this basal part of the section. As shown in the chart only *Oulodus* sp. and *Ozarkodina excavata excavata* (BRANSON & MEHL) have been found there.

In sample no. 2 there are elements which may belong to the apparatus of *Ozarkodina confluens* (BRANSON & MEHL) and *Ozarkodina e. excavata* (BRANSON & MEHL). However, not all elements are present and this is indicated by open squares. Full squares on the other side mean that the complete apparatus has been found.

The name bearer of the *snajdri*-Zone, *Ozarkodina snajdri* (WALLISER) starts in sample 2. In this sample there is no association with any other except the ones mentioned.

2 b: *Pedavis latialata* (WALLISER), *Ozarkodina snajdri* (WALLISER) and *Oz. e. excavata* (BRANSON & MEHL).

The common occurence of *P. latialata* and *Oz. snajdri* does not agree with the concept of WALLISER 1964. In the Koledník-Jarov section there is a clear restriction of *P. latialata* at the basal

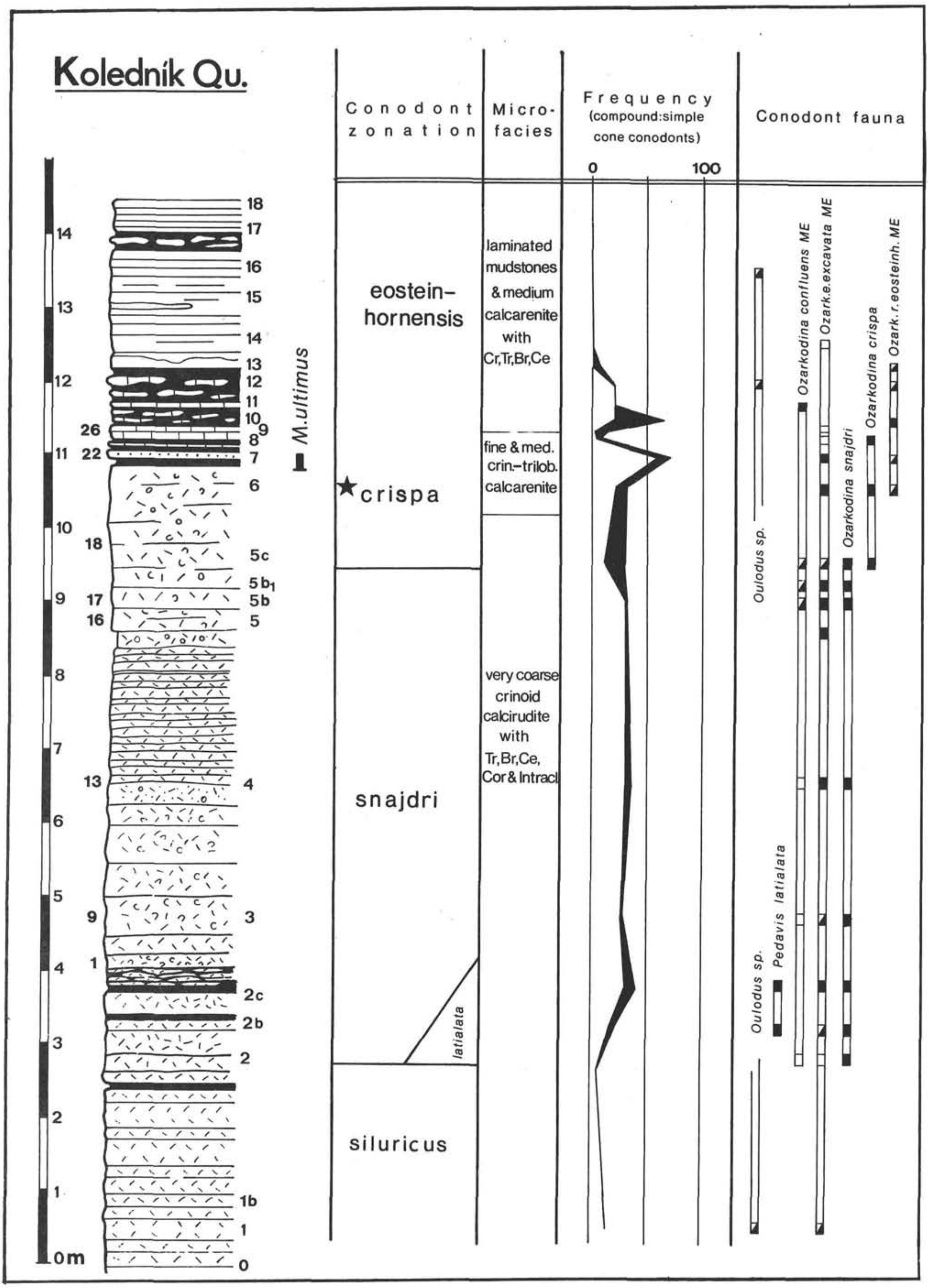


Fig. 15: Jarov Quarry near Koledník. Diagrammatic section of the Kopanina-Přídolí boundary interval (after J. KŘÍŽ and H. P. SCHÖNLAUB). For explanation of rock types see fig. 5.

part of the *snajdri*-horizon (or better *snajdri*-Zone) suggesting that the establishment of the *latialata*-Zone is invalid; it may better be named *latialata*-Subzone!

2 c: In this sample the same conodonts occur as in no. 2 b.

3, 4: There is some indication of the presence of *Oz. confluens* (BRANSON & MEHL); the apparatus of *Oz. e. excavata* (BRANSON & MEHL) is almost complete, and *Ozarkodina snajdri* (WALLISER) is present.

5 b, 5 b 1: *Oz. snajdri* (WALLISER) and other elements listed in the chart. In particular, sample no. 5 b 1 is an excellent horizon to collect rich faunas.

5 c: marks the beginning of the *crispa*-Zone. In this sample the name bearer of that zone, *Ozarkodina crispa* (WALLISER) occurs together with *Oz. e. excavata* and *Oz. confluens. Ozarkodina snajdri* (WALLISER) has also been found in this sample.

6: *Ozarkodina crispa* (WALLISER), *Ozarkodina remscheidensis eosteinhornensis* (WALLISER). Following the zonal concept of WALLISER 1964 the beginning of the *eosteinhornensis*-Zone has to be drawn at sample no. 6. However, the range of *Oz. crispa* overlaps with *Oz. r. eosteinhornensis* as the former is also present in sample no. 8. More diagnostic representatives of the *eosteinhornensis*-Zone occur in sample no. 12 suggesting that the base of the *eosteinhornensis*-Zone should be placed higher in the section.

10 and 11 yielded *Ozarkodina confluens* (BRANSON & MEHL) but no elements belonging to *Oz. r. eosteinhornensis.*

12, 13: *Ozarkodina remscheidensis eosteinhornensis* (WALLISER)

Samples 14 – 18 did not produce any diagnostic conodont faunas.

STOP 10. Klonk at Suchomasty

Stratotype of the Silurian/Devonian boundary (fig. 16)

By I. CHLUPÁČ

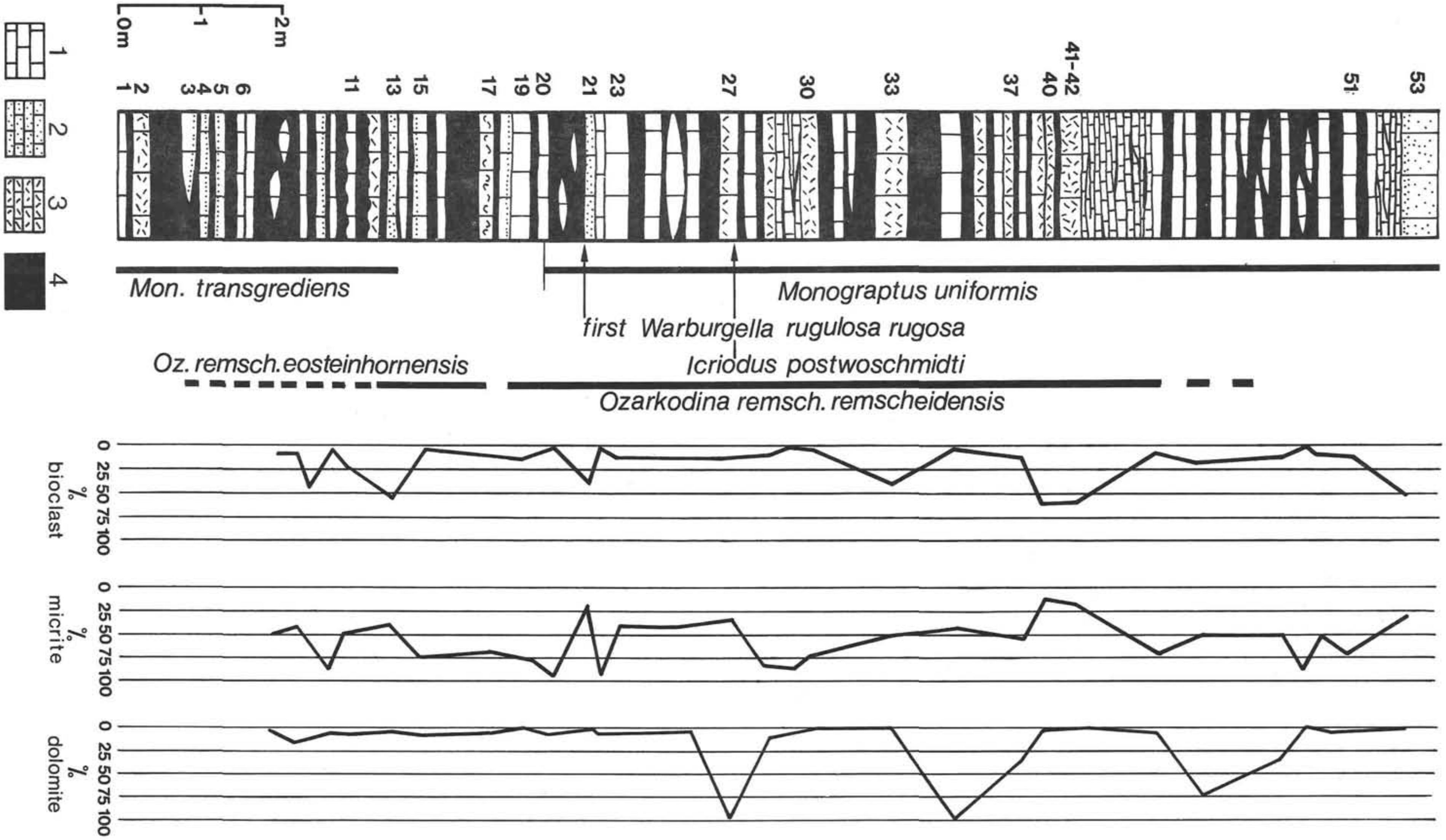
The Klonk section is situated in the south-western part of the Silurian-Devonian region of the Central Barrandian, about 8 km S of the town Beroun.

The southern part of the rocky hillside at Klonk consists of the Upper Silurian (Ludlovian) Kopanina Formation developed here as tuffaceous shales with limestone intercalations. The northern part comprises the uppermost Silurian (Přidolian) Přidoli Formation and the lowest Devonian Lochkov Formation. The Přidoli and Lochkov Formations consist of greyish-black platy, mostly fine-grained bituminous limestones alternating with calcareous shale and clayey limestone interbeds. At the Silurian/Devonian boundary no facies change occurs and the boundary proper is precisely recognizable only in the palaeontological content.

The upper part of the Přidolian contains a characteristic fauna of this age: abundant graptolites *Monograptus transgrediens* PERNER, eurypterids *Pterygotus (Acutiramus) bohemicus* BARR., phyllocarids *Ceratiocaris bohemica* BARR., trilobites *Otarion (Otarion) novaki* BOUČ., *Prionopeltis* div. sp., ostracodes *Boucia ornatissima* (BOUČ.), nautiloids, bivalves *Pterinopecten (P.) cybele* (BARR.), *Pterochaenia (P.) impatiens* (BARR.), *P. (Joachimia) falcata* (BARR.), *Lunulacardium (Patrocardium) evolvens* (BARR.), *Snoopyia insolita* (BARR.), gastropods *Platyceras (Orthonychia) elegans* PERNER, brachiopods *Dayia bohemica* BOUČ. etc. The remains of pelagic crinoid *Scyphocrinites* are fairly common. Microfossils are represented by conodonts and common chitinozoans. Ostracods are represented by common *Mirochilina jonesiana* BOUČEK and *Craspedobolbina ? bohemica* (BOUČEK); *Clintiella* cf. *hirsiana* MARTINSSON; less common are „*Hippa*" *rediviva* BARRANDE a. o. (F. KRŮTA, in press).

The chitinozoans are represented by *Ancyrochitina* ex gr. *ancyrea* forma A, *A.* ex gr. *ancyrea* forma B, *Desmochitina urna* EISENACK, *D. ? suchomastyensis* PARIS et LAUFELD, *Eisenackitina krizi* PARIS et LAUFELD, *E.* sp. aff. *lagenomorpha* (EISENACK), *Linochitina klonkensis* PARIS et LAUFELD, *L.* aff. *ervensis* PARIS, *Linochitina* sp., *Margachitina ?* sp., *Sphaerochitina sphaerocephala*(EISENACK).

The first index lower Lochkovian graptolites *Monograptus uniformis uniformis* PŘIBYL and *M. uniformis angustidens* PŘIBYL appear in the upper part of bed no. 20 where the Silurian/Devonian boundary is drawn. The characteristic fauna of the lower Lochkovian at Klonk is otherwise represented by *Monograptus microdon microdon* RICHTER, *M. aequabilis aequabilis* PŘIB., *Linograptus posthumus posthumus* (RICHTER), *Acanthograptus leiskoviensis* BOUČ., *Palaeodictyota undulatum* (POČTA), *Coremagraptus corniculatus* BOUČ., *Thallograptus* div. sp., phyllocarids *Ceratiocaris cornwallisensis da-*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Mon. transgrediens
Monographus uniformis
first Warburgella rugulosa rugosa
Icriodus postwoschmidti
Oz. remsch.eosteinhornensis
Ozarkodina remsch. remscheidensis
% bioclast
% micrite
% dolomite
0 25 50 75 100

mesi CHLUPÁČ, *Aristozoe radvani* CHL., *A. virga* CHL., trilobites *Warburgella rugulosa rugosa* BOUČ., *Ceratocephala lochkoviana* CHL., *Tropidocare index* CHL., *Otarion (Otarion) novaki* BOUČ., bivalves *Pterochaenia* sp., *Lunulacardium (Patrocardium) evolvens* (BARR.), *Leptodesma carens* (BARR.), *Panenka* sp., brachiopods *Hebetoechia hebe* (BARR.), *Plectodonta mimica* (BARR.), *Leptagonia relicta* HAVL., *Eoglossinotoechia mystica* HAVL., *Lingula nigricans* BARR. a. o. The crinoid *Scyphocrinites* surpasses the Silurian-Devonian boundary and occurs within the lowest 8 m of the Lochkovian sequence.

C o n o d o n t s : Conodonts are rather scarce in the Klonk section. The index lower Lochkovian subspecies *Ozarkodina remscheidensis remscheidensis* (ZIEGLER) first appears in this section in bed no. 18, i. e., 0,40–0,50 m below the level with the first index lower Lochkovian graptolites *Monograptus uniformis uniformis* and *Monograptus uniformis angustidens.* No specimens of *Icriodus woschmidti* ZIEGLER were found here. *Icriodus* cf. *postwoschmidti* MASHKOVA occurs in bed no. 27 only.

The chitinozoans studied by F. PARIS et S. LAUFELD (1979) are represented by the index *Angochitina chlupaci* PARIS et LAUFELD accompanied by *Ancyrochitina ancyrea* forma B., *A. ancyrea* forma C., *Gotlandochitina* sp., *Margachitina* ? sp., *Sphaerochitina sphaerocephala* (EISENACK).

The Silurian-Devonian boundary beds at Klonk were subjected to a detailed „bed-by-bed" study and more than 123 individual beds were distinguished here.

The Klonk section fulfills all the main requirements for a stratotype of chronostratigraphic units of a higher rank as are expressed in the guidelines of the International Subcommission for Stratigraphic Classification and contained in the International Stratigraphic Guide (1976). Klonk was selected as standard section (stratotype) of the Silurian/Devonian boundary by the International Committee on the Silurian/Devonian boundary and approved by the International Stratigraphic Commission at the session of the XXIV. Intern. Geol. Congress in Montreal (1972). The monument below Klonk was established in 1977 (made by the Czech sculptor Jiří NOVOTNÝ from the Lower Devonian Zbuzany Marble). Klonk is the first stratotype of a system boundary established as a result of the world-wide international discussion according to the modern stratigraphical principles.

For description of the section see: R. HORNÝ (1955), I. CHLUPÁČ et al. (1972), I. CHLUPÁČ et Z. KUKAL (1977); R. D. DAVIES et R. W. MacQUEEN (1977 – sedimentology of the boundary bed); description of megafaunas in some special papers; description of chitinozoans in F. PARIS et S. LAUFELD (1979); ostracods in F. KRŮTA (1980 in press); conodonts J. ZIKMUNDOVÁ.

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Fig. 16: Klonk at Suchomasty. Diagrammatic section of the Silurian-Devonian boundary interval (after I. CHLUPÁČ and Z. KUKAL, 1977; conodonts after J. ZIKMUNDOVÁ).
1 – dark micritic and detrital micritic limestones; 2 – medium grained micritic detrital and detrital limestones; 3 – coarse grained biodetrital limestones; 4 – dark calcareous shales and clayey limestones.

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Plate 17

Mušlovka Quarry section, Ludlovian and Přidolian Kopanina and Přidoli Fm. (Stop 1)

Figs. 1–2: *Kockelella variabilis* WALLISER. P-element *(„Ozarkodina fundamentata")* from sample no. 10, lateral and upper views. 0,612 mm.

Figs. 3, 21: *Ozarkodina confluens* (BRANSON & MEHL).
Fig. 3: Lateral view of Pb-element from sample no. 10 (in form-taxonomy: *„Spathognathodus primus"); fig.* 21: complete apparatus, sample no. 10.
Fig. 3: 0,654 mm; fig. 21: approx. x 30.

Fig. 4: *Polygnathoides siluricus* BRANSON & MEHL. Oblique view from sample no. 14, *siluricus*-Zone. 1,115 mm.

Fig. 5: *Polygnathoides emarginatus* (BRANSON & MEHL). Lateral view from sample no. 14, *siluricus*-Zone. 0,764 mm.

Figs. 6, 7–8: *Ozarkodina* n. sp.
Fig. 6: Lateral view of a specimen from sample no. 23; figs. 7–8: Upper and lateral views of a specimen from sample no. 22; both *snajdri*-Zone.
Fig. 6: 0,717 mm, fig. 7: 0,69 mm.

Figs. 9, 10, 13: *Ozarkodina snajdri* (WALLISER). Upper view of 3 specimens from sample no. 28 (fig. 9), no. 33 b (fig. 10) and no. 33 i (fig. 13); *snajdri*-Zone.
Fig. 9: 0,7 mm, fig. 10: 1,15 mm, fig. 13: 0,87 mm.

Figs. 11–12, 14–15: *Ozarkodina crispa* (WALLISER). Upper and lateral views of 2 specimens from sample no. 33 f (figs. 11–12) and no. 33 i (figs. 14–15); *crispa*-Subzone.
Fig. 11: 1,155 mm, fig. 14: 0,94 mm.

Figs. 16, 17, 18, 19: *Ozarkodina r. eosteinhornensis* (WALLISER). Lateral and upper views of 4 specimens from sample no. 42; *eosteinhornensis*-Zone, Přidolian.
Fig. 16: 0,683 mm, fig. 17: 0,632 mm, fig. 18: 0,716 mm, fig. 19: 0,746 mm.

Fig. 20: *Oulodus siluricus* (BRANSON & MEHL). An incomplete apparatus (Pa-element is missing) from sample no. 16 consisting of Pb-elements *(„Lonchodina walliseri"),* one Sa-element *(„Trichonodella inconstans"),* one Sb-element *(„Lonchodina greilingi"),* an incomplete Sc-element *(„Ligonodina silurica")* and two figured M-elements *(„Neoprioniodus multiformis"); siluricus*-Zone.
Magnification approx. x 30.

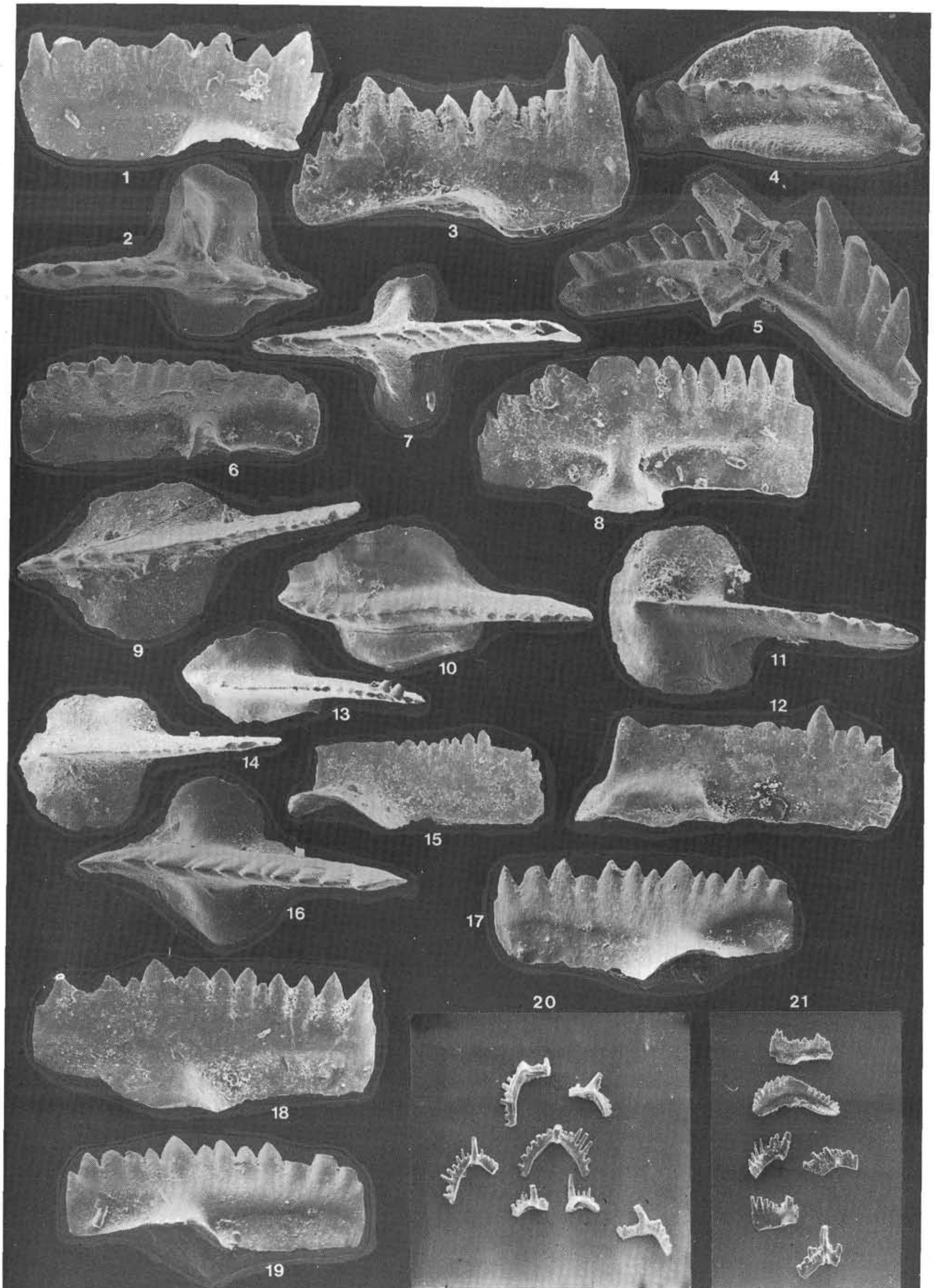
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Plate 18

Section Černá Rokle, Section U topolů

Figs. 1–4: Dvorce Prokop Lst. (Pragian), Černá Rokle (Stop 3)

Fig. 1: *Pelekysgnathus s. serratus* JENTZSCH. Lateral view from sample no. 24 + 0,4 m, lower Pragian. 0,924 mm.

Fig. 2: *Pelekysgnathus s. serratus* JENTZSCH. Incomplete specimen from sample no. 21, lower Pragian. 0,577 mm.

Fig. 3: *Pedavis mariannae* LANE & ORMISTON. Incomplete specimen from sample no. 25, lower Pragian. 0,955 mm.

Fig. 4: *Icriodus bilatericrescens* ZIEGLER. Upper view from sample no. 50, upper Pragian. 1,258 mm.

Figs. 5–28: Basal Lochkovian at section U topolů (Stop 2)

Figs. 5, 6: *Icriodus woschmidti* ssp. Incomplete specimens from the middle part of the *Scyphocrinites* bed (sample no. 13 b), lower Lochkovian, *uniformis*-Zone. Fig. 5: 0,85 mm, fig. 6: 0,7 mm.

Fig. 9–10: *Ozarkodina r. eosteinhornensis* (WALLISER). Lateral and upper views from the base of the *Scyphocrinites* bed (sample no. 13 a), lower Lochkovian, *uniformis*-Zone. 0,61 mm.

Fig. 11: *Ozarkodina r. remscheidensis* (ZIEGLER). Lateral view from the base of the *Scyphocrinites* bed (sample no. 13 a), lower Lochkovian, *uniformis*-Zone. 0,825 mm.

Figs. 12–13: *Ozarkodina r. eosteinhornensis* (WALLISER). Lateral and upper views from the middle part of the *Scyphocrinites* bed (sample no. 13 b), lower Lochkovian, *uniformis*-Zone. 0,66 mm.

Figs. 14–23: *Ozarkodina r. remscheidensis* (ZIEGLER). Lateral and upper views of 3 specimens from the middle part of the *Scyphocrinites* bed (sample no. 13 b), lower Lochkovian, *uniformis*-Zone. Fig. 14: 0,96 mm, fig. 16: 0,88 mm, fig. 18: 0,61 mm, fig. 20: 1 mm, fig. 22: 0,92 mm.

Figs. 24–26: *Ozarkodina r. remscheidensis* (ZIEGLER). Lateral view of 3 specimens from the upper part of the *Scyphocrinites* bed (sample no. 13 c), lower Lochkovian, *uniformis*-Zone. Fig. 24: 0,93 mm, fig. 25: 0,64 mm, fig. 26: 0,74 mm.

Figs. 27–28: *Ozarkodina r. eosteinhornensis* (WALLISER). Lateral and upper views from the upper part of the *Scyphocrinites* bed (sample no. 13 c), lower Lochkovian, *uniformis*-Zone. 0,81 mm.

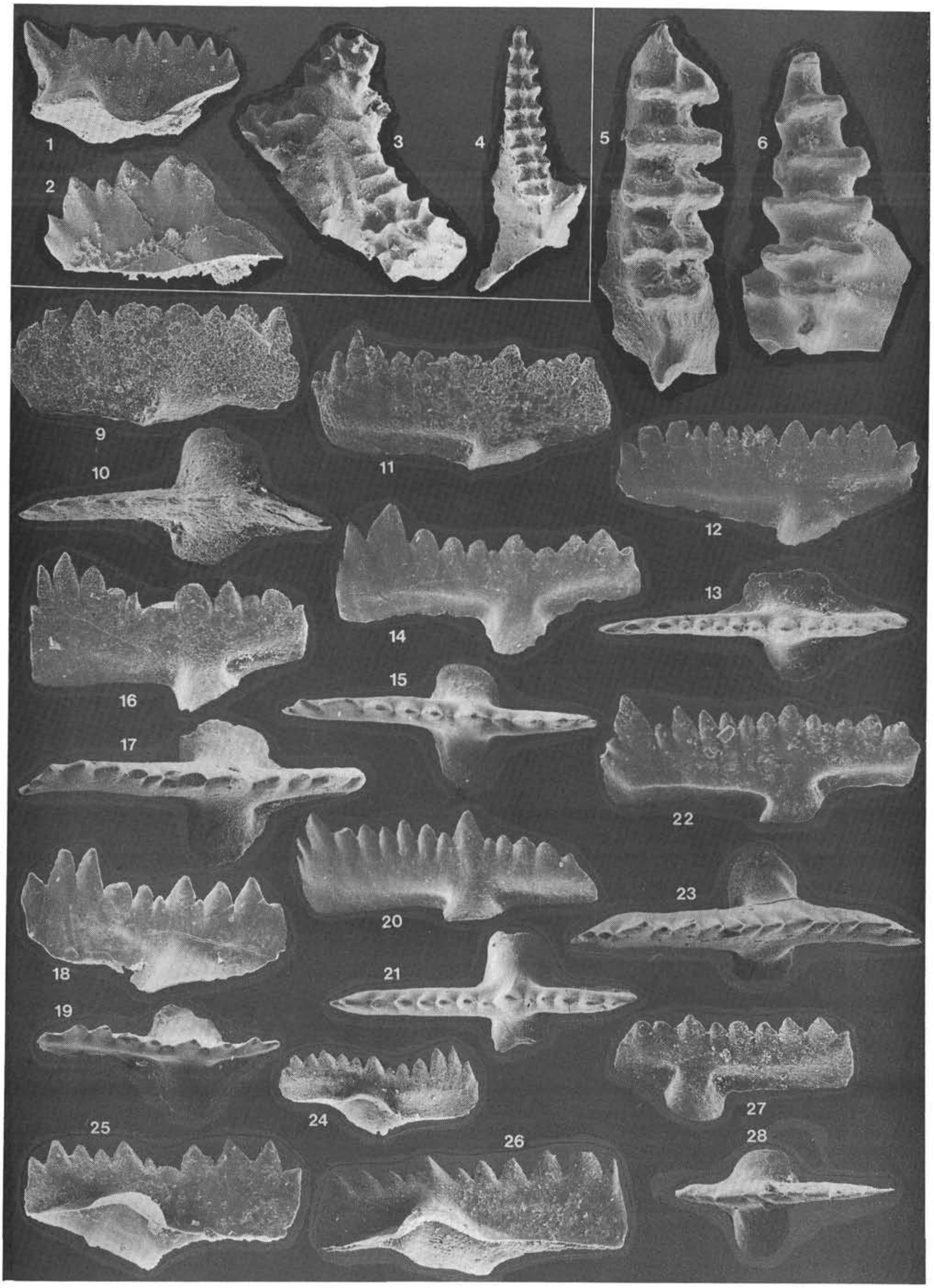
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Plate 19

Section U topolů, bed 14–18 (Stop 2 cont'd)

Fig. 1: *Icriodus woschmidti hesperius* KLAPPER & MURPHY. Sample no. 14, lower Lochkovian, *uniformis*-Zone. 0,99 mm.

Figs. 2, 3: *Icriodus postwoschmidti* MASHKOVA. Upper view of 2 specimens from sample no. 14, lower Lochkovian, *uniformis*-Zone.
Fig. 2: 0,869 mm, fig. 3: 0,79 mm.

Figs. 4–5: *Pedavis* sp. Incomplete I-element and M_2-element from sample no. 14, lower Lochkovian, *uniformis*-Zone.
Fig. 4: 1,28 mm, fig. 5: 0,549 mm.

Figs. 6, 8, 9, 10, 15–16: *Pandorinellina* cf. *praeoptima* (MASHKOVA). Lateral and upper views of 5 specimens from sample nos. 14 (figs. 6, 8, 9, 10) and 15 (figs. 15–16), lower Lochkovian, *uniformis*-Zone.
Fig. 6: 1,31 mm, fig. 8: 1,35 mm, fig. 9: 1,056 mm, fig. 10: 1,15 mm, fig. 15: 1,06 mm.

Fig. 7: *Ozarkodina r. remscheidensis* (ZIEGLER). Lateral view from sample no. 14, lower Lochkovian, *uniformis*-Zone. 0,68 mm.

Fig. 11: *Pedavis* sp. Incomplete specimen (anterior part of the main process) from sample no. 15, lower Lochkovian, *uniformis*-Zone. 0,85 mm.

Fig. 12: *Icriodus woschmidti hesperius* KLAPPER & MURPHY. Sample no. 15, lower Lochkovian, *uniformis*-Zone. 1,01 mm.

Figs. 13–14: *Ozarkodina r. remscheidensis* (ZIEGLER). Lateral and upper views from sample no. 15, lower Lochkovian, *uniformis*-Zone. 0,97 mm.

Fig. 17: *Ozarkodina wurmi* (BISCHOFF & SANNEMANN). Lateral view from sample no. 15, lower Lochkovian, *uniformis*-Zone. 1,8 mm.

Figs. 18–19, 20, 21: *Ozarkodina r. remscheidensis* (ZIEGLER). Lateral and upper views of 3 specimens from sample no. 18, lower Lochkovian.
Fig. 18: 0,81 mm, fig. 20: 0,83 mm, fig. 21: 0,85 mm.

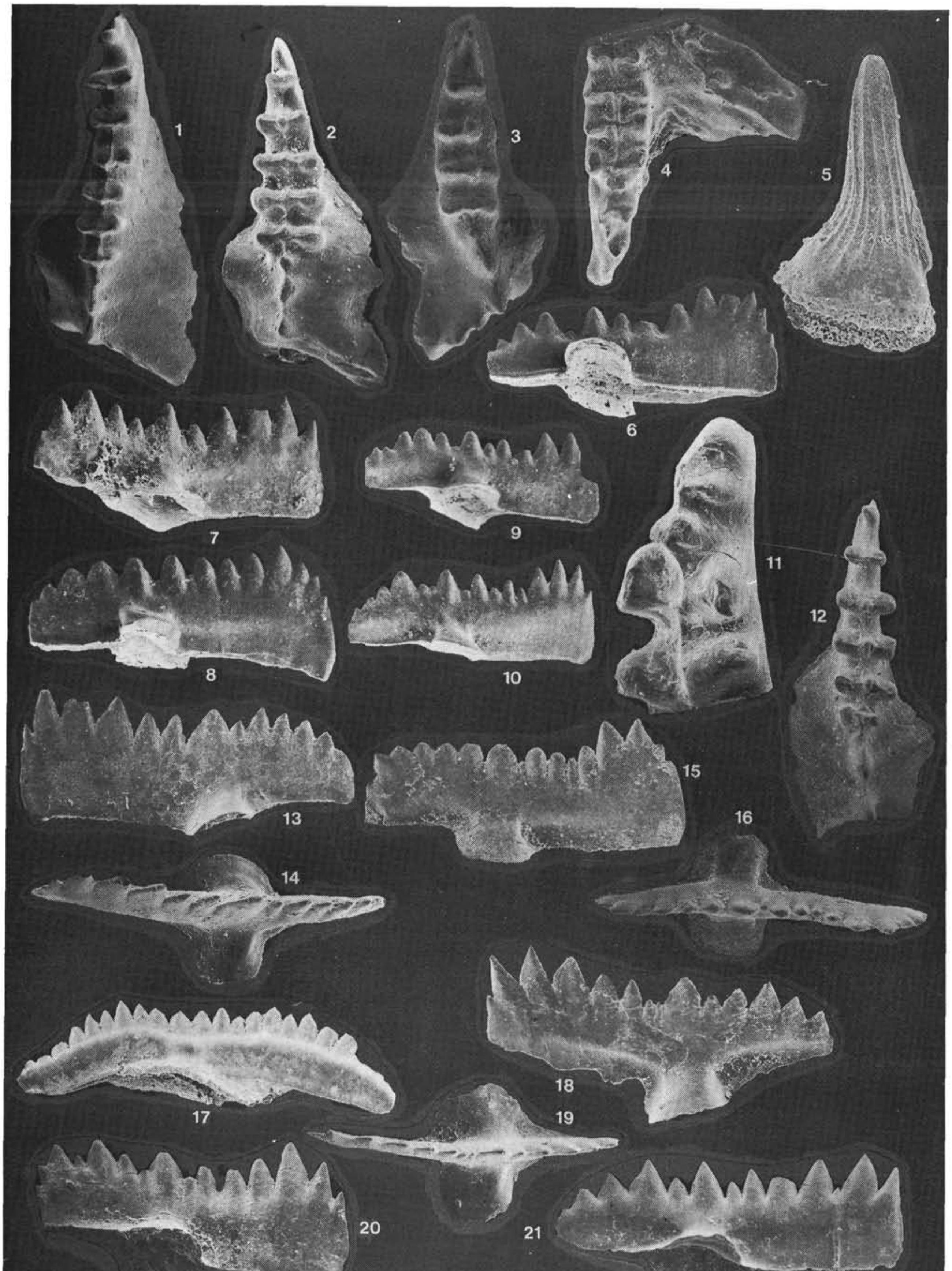
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Plate 20

Section U topolů, bed 27–30 e (Stop 2 cont'd)

Figs. 1, 2–3: *Ozarkodina r. remscheidensis* (ZIEGLER). Lateral and upper views of 2 specimens from sample no. 27, middle (?) Lochkovian, *praehercynicus*-Zone (?).
Fig. 1: 0,44 mm, fig. 2: 0,63 mm.

Fig. 4: *Ozarkodina* cf. *eleanorae* LANE & ORMISTON. Lateral view from sample no. 30 a, upper Lochkovian, *hercynicus*-Zone (?). 1,39 mm.

Figs. 5–6, 7–8, 9–10, 11–12, 13–14: *Pandorinellina* cf. *optima* (MOSKALENKO). Lateral and upper views of 5 specimens from sample no. 30 a, upper Lochkovian, *hercynicus*-Zone (?).
Fig. 5: 0,71 mm, fig. 7: 1,1 mm, fig. 9: 0,93 mm, fig. 11: 1,04 mm, fig. 13: 1,34 mm.

Figs. 15–16, 17–18, 19–20: *Ozarkodina masara* SCHÖNLAUB n. sp. Lateral and upper views of 3 specimens from sample no. 30e, upper Lochkovian *hercynicus*-Zone. Fig. 15: Holotype.
Fig. 15: 0,89 mm, fig. 17: 0,77 mm, fig. 19: 0,72 mm.

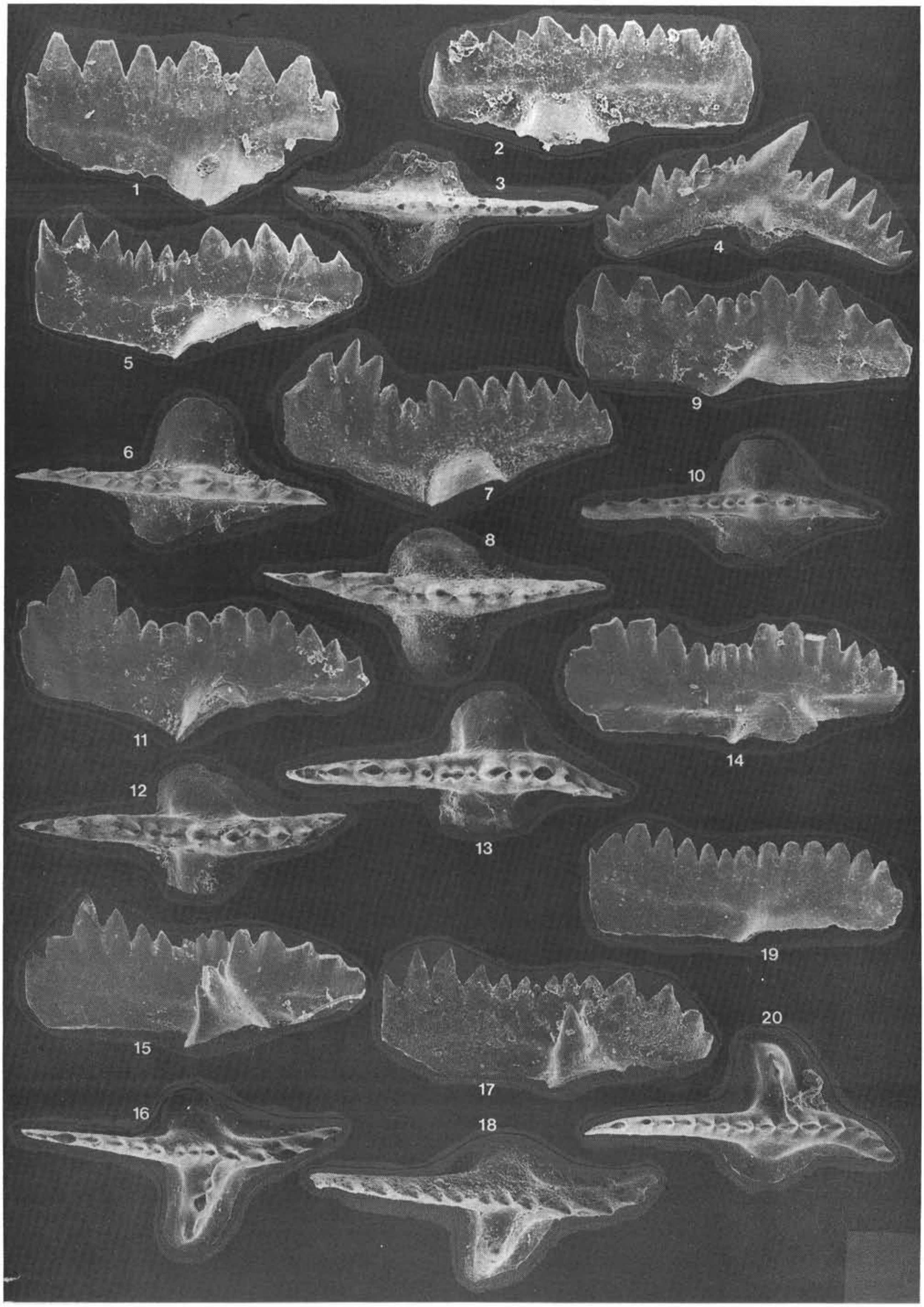
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Plate 21

U Kaplička Quarry section, uppermost Pragian-Zlichovian (Stop 4)

Fig. 1: *Icriodus bilatericrescens* ZIEGLER. Upper view from sample no. 5, uppermost Pragian, Dvorce Prokop Lst. 0,95 mm.

Figs. 2–3, 4: *Polygnathus dehiscens* PHILIP & JACKSON. Lateral, lower and upper views of 2 specimens from sample no. 5, uppermost Pragian, Dvorce Prokop Lst.
Fig. 2: 0,84 mm, fig. 4: 0,81 mm.

Fig. 5: *Icriodus beckmanni* ssp. Upper view from sample no. 15, lower Zlichovian. 0,82 mm.

Figs. 6, 8, 9, 10–11, 12, 13, 14, 15, 16, 17: *Polygnathus dehiscens* PHILIP & JACKSON. Upper and lower views of 10 specimens from sample nos. 24 (fig. 6), 27 (figs. 8, 9), 29 b (figs. 10–11), 30 (fig. 12), 31 (fig. 13), 31 b (fig. 14), 32 (figs. 16, 17), lower to middle Zlichovian.
Note flat or shallow basal cavity at posterior end in figs. 8, 9, 14, 15, 16.
Fig. 6: 0,56 mm, fig. 8: 0,64 mm, fig. 9: 0,55 mm, fig. 10: 0,91 mm, fig. 12: 0,87 mm, fig. 13: 0,88 mm, fig. 14: 0,88 mm, fig. 15: 0,86 mm, fig. 16: 0,77 mm, fig. 17: 0,55 mm.

Figs. 7, 19, 20, 22: *Pandorinellina st. miae* (BULTYNCK). Upper and lateral views of 4 specimens from lower to middle Zlichov Lst. sample nos. 24 (fig. 7), 32 (fig. 20), 34 c (fig. 19), 38 (fig. 22).
Fig. 7: 0,75 mm, fig. 19: 0,77 mm, fig. 20: 0,57 mm, fig. 22: 0,74 mm.

Figs. 18, 21: *Polygnathus gronbergi* KLAPPER & JOHNSON. Lower view of 2 specimens from sample nos. 34 b (fig. 18) and 34 c (fig. 21); middle Zlichovian.
Fig. 18: 0,69 mm, fig. 21: 0,7 mm.

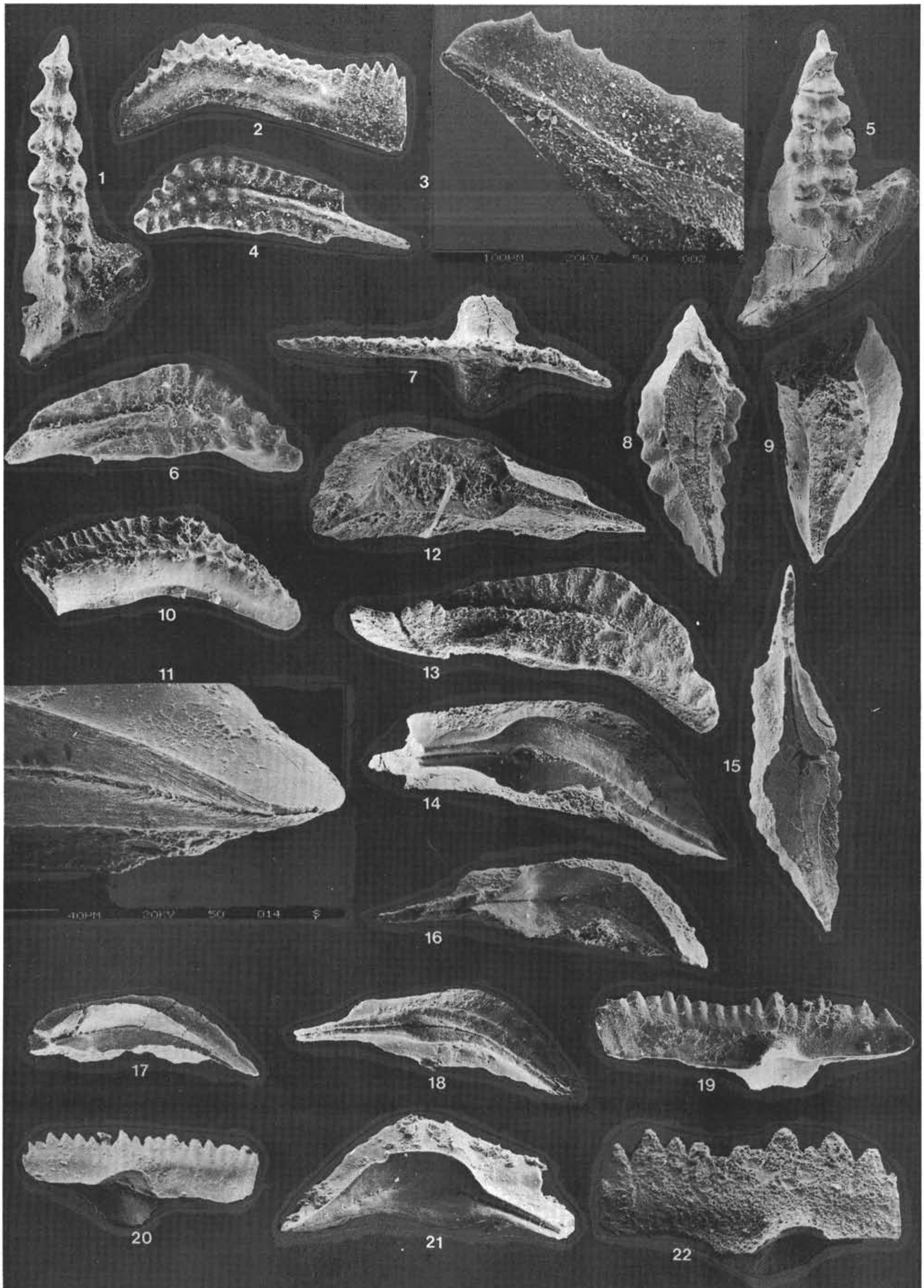
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Plate 22

All specimens were previously illustrated in KLAPPER, ZIEGLER & MASHKOVA (1978); all magnifications are x 40.

Hlubočepy (Stop 6)

Třebotov Limestone:

Figs. 10, 14: *Polygnathus quadratus* KLAPPER, ZIEGLER & MASHKOVA Upper and lower views of SUI holotype 44950, 6,25–6,35 m below top of Třebotov, upper *serotinus*-Zone.

Choteč Limestone:

Figs. 1–5: *Polygnathus costatus partitus* KLAPPER, ZIEGLER & MASHKOVA, 1, 2, lower and upper views of SUI paratype 44963; 3, upper view of SUI holotype 44964, 4, 5, lower and upper views of SUI paratype 44962; all from 0,20–0,30 m above base of Choteč, *costatus costatus*-Zone.

Figs. 11, 12: *Polygnathus costatus costatus* KLAPPER. Upper and lower views of SUI 44968, 0,20–0,30 m above base of Choteč, *costatus costatus*-Zone.

Holyně – Prastav Quarry (Stop 5)

Třebotov Limestone:

Fig. 13: *Polygnathus cooperi secus* KLAPPER, ZIEGLER & MASHKOVA. Upper view of SUI paratype 44973, Bed 6, top of bed, 1,20–1,23 m above base of bed, lower *patulus*-Zone.

Choteč Limestone:

Figs. 6, 7: *Polygnathus* cf. *P. angustipennatus* BISCHOFF & ZIEGLER. Upper and lateral views of SUI 44951, Bed 12, 1,30–1,35 m above base of bed, *costatus costatus*-Zone. Specimen differs from those of *P. angustipennatus* in the greater posterior arching and the platform outline.

Figs. 15, 16: *Polygnathus* sp. aff. *P. trigonicus* BISCHOFF & ZIEGLER. Lower and upper views of SUI 44981, Bed 12, 1,30–1,35 m above base of bed, *costatus costatus*-Zone.

Fig. 17: *Polygnathus linguiformis pinguis* WEDDIGE. Upper view of SUI 44982, Bed 12, 1,30–1,35 m above base of bed, *costatus costatus*-Zone.

Chýnice – Jelínkův Mlýn

Třebotov Limestone:

Figs. 8, 9: *Polygnathus costatus patulus* KLAPPER. Upper views of SUI 44966–44967, 0,25–0,40 m below top of Třebotov, upper *patulus*-Zone.

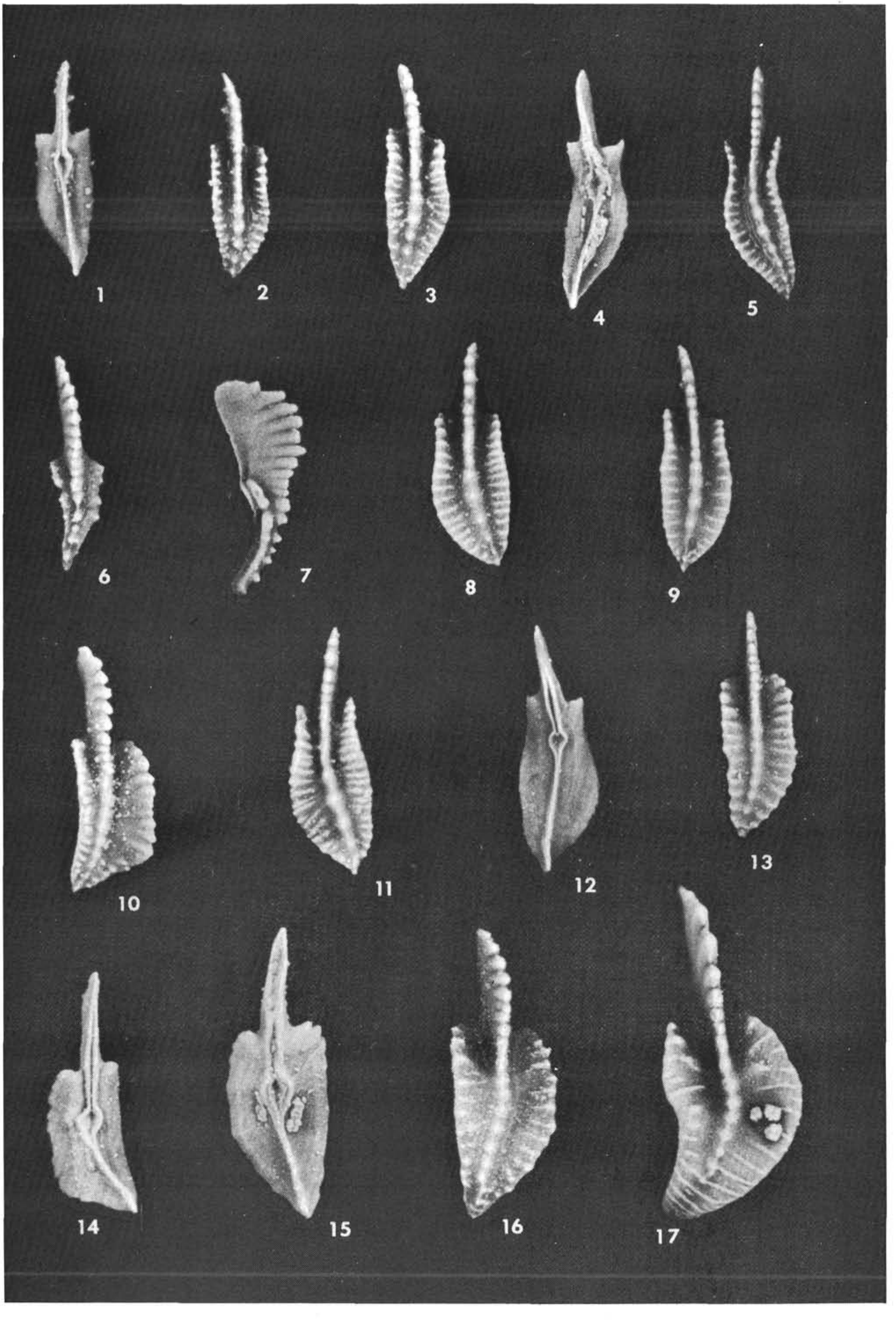
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Plate 23

Srbsko roadcut section, lower Pragian to lower Zlichovian (Stop 8)

Fig. 1: *Icriodus* cf. *steinachensis* AL-RAWI. Incomplete specimen from the Slivenec Lst., sample no. 75/11, lower Pragian. 0,6 mm.

Fig. 2: *Pelekysgnathus s. serratus* JENTZSCH. Lateral view of an incrusted specimen from sample no. 13, (transition Slivenec–Loděnice Lst.), lower Pragian. 0,63 mm.

Figs. 3, 4: *Pelekysgnathus* n. sp. Lateral view of 2 specimens from sample no. 21, Řeporyje Lst., middle Pragian.
Fig. 3: 0,74 mm, fig. 4: 0,5 mm.

Figs. 5, 6, 7, 8, 9, 13: *Icriodus bilatericrescens* ZIEGLER. Upper view of 6 specimens from the Dvorce Prokop Lst. (sample no. 25 = fig. 5) and the basal Zlichovian (fig. 6 = sample no. 33, fig. 7 = no. 39, figs. 8, 9 = no. 42, fig. 13 = no. 51).
Fig. 5: 0,86 mm, fig. 6: 1,29 mm, fig. 7: 0,87 mm, fig. 8: 1,17 mm, fig. 9: 1,04 mm, fig. 13: 0,95 mm.

Figs. 10, 14, 15: *Polygnathus dehiscens* PHILIP & JACKSON. Upper and lower views of 3 specimens from the lower Zlichov Lst. (fig. 10 = sample no. 49, fig. 15 = no. 52, fig. 14 = 53).
Fig. 10: 0,88 mm, fig. 14: 0,86 mm, fig. 15: 1,02 mm.

Figs. 11, 12: *Pandorinellina st. miae* (BULTYNCK). Lateral view of 2 specimens from the lower Zlichovian, sample no. 50.
Fig. 11: 0,66 mm, fig. 12: 0,76 mm.

Figs. 16, 17, 18, 19: *Icriodus sigmoidalis* CARLS & GANDL. Upper view of 4 specimens from the lower Zlichov Lst., sample 58.
Fig. 16: 0,91 mm, fig. 17: 0,98 mm, fig. 18: 0,94 mm, fig. 19: 1,15 mm.

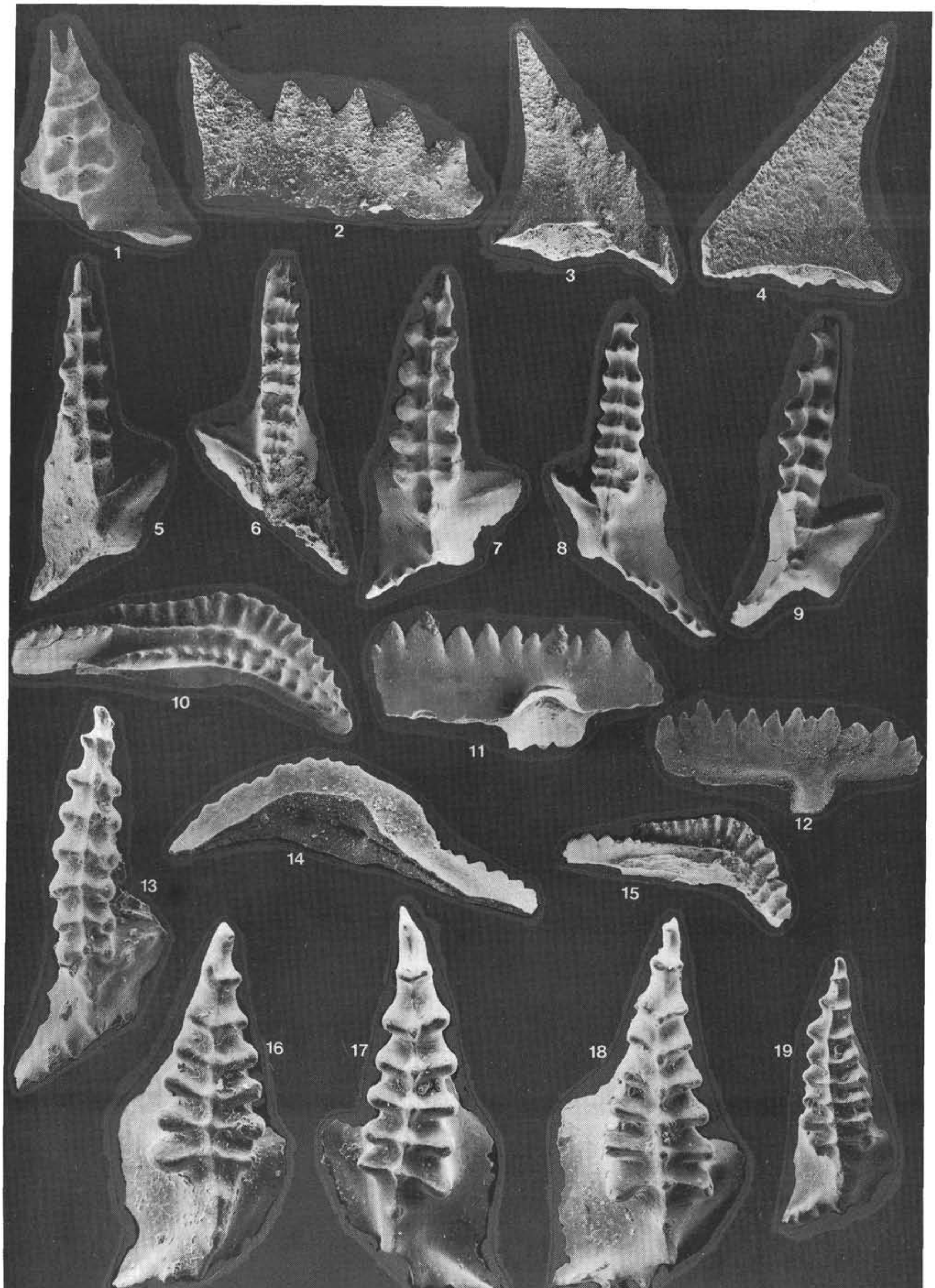
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Plate 24

Srbsko roadcut section, middle to upper Zlichovian (Stop 8, cont'd)

Figs. 1, 2, 3, 19: *Icriodus latus* AL-RAWI. Upper view of 4 specimens from the middle and upper Zlichov Lst.
Fig. 1 = sample no. 64, figs. 2, 4 = no. 66, fig. 19 = no. 78.
Fig. 1: 0,92 mm, fig. 2: 1,02 mm, fig. 3: 0,79 mm, fig. 19: 1,01 mm.

Figs. 4, 13, 16: *Pandorinellina st. miae* (BULTYNCK). Lateral and upper views of 3 specimens from the middle to upper Zlichov Lst.
Fig. 4 = sample no. 66, fig. 13 = no. 75, fig. 16 = no. 74.
Fig. 4: 0,44 mm, fig. 13: 0,58 mm, fig. 16: 0,66 mm.

Figs. 5, 15: *Polygnathus gronbergi* KLAPPER & JOHNSON. Lateral view of 2 specimens from the middle part of the Zlichov Lst.
Fig. 5 = sample no. 70, fig. 15 = no. 74. Note inverted posterior part of the basal cavity in fig. 5.
Fig. 5: 0,95 mm, fig. 15: 0,93 mm.

Figs. 6, 7, 8, 9, 10, 11: *Icriodus bilatericrescens* ZIEGLER. Upper view of 6 specimens from the middle to upper part of the Zlichov Lst.
Fig. 6 = sample no. 69, figs. 7, 8, 9 = no. 70, figs. 10, 11 = no. 74.
Fig. 6: 1,28 mm, fig. 7: 1,07 mm, fig. 8: 1,09 mm, fig. 9: 1,13 mm, fig. 10: 1,15 mm, fig. 11: 1,23 mm.

Fig. 12: *Icriodus beckmanni beckmanni* ZIEGLER. Upper view from sample no. 78, upper Zlichov Lst. 0,73 mm.

Fig. 14: *Icriodus* sp. An undescribed *Icriodus* from the upper Zlichov Lst., sample no. 78. 0,69 mm.

Figs. 17–18: *Pandorinellina st. steinhornensis* (ZIEGLER). Lateral and upper views from the Upper Zlichovian, sample no. 80. 0,63 mm.

Fig. 20: *Icriodus* cf. *beckmanni sinuatus* KLAPPER et al. Upper view of a specimen from the uppermost Zlichov Lst., sample no. 81. 1,35 mm.

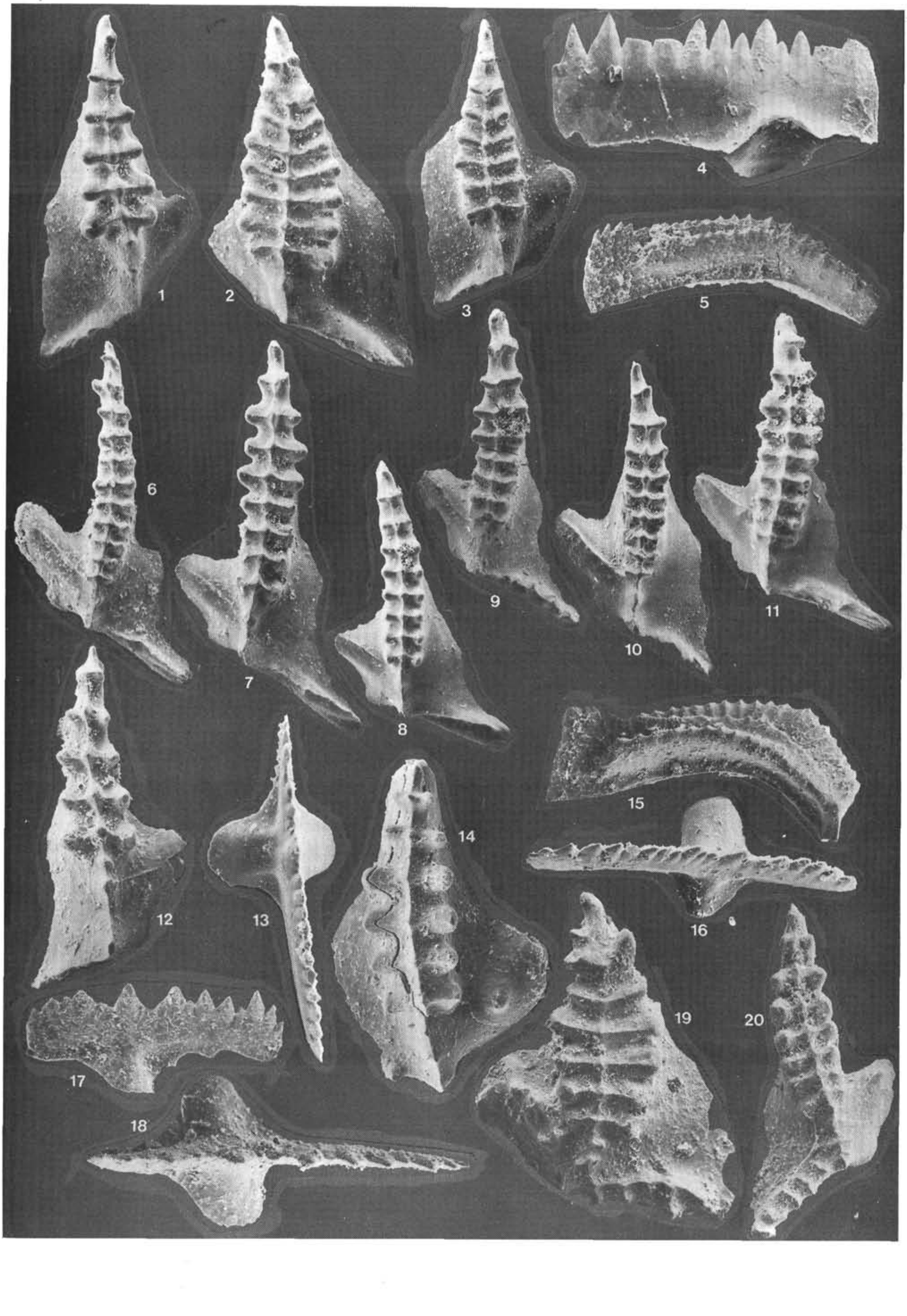
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Plate 25

Kolednik (Jarov) Quarry section, Ludlovian, Kopanina Fm. (Stop 9)

Figs. 1, 4–5, 6–7, 8–9, 10–11: *Ozarkodina snajdri* (WALLISER).
Fig. 1: Upper view of a specimen from sample no. 2 c (incomplete); figs. 4–9: Upper and lateral views of 3 specimens from sample no. 5 b 1; figs. 10–11: Upper and lateral views of a specimen from sample no. 5 c; *snajdri*-Zone.
Fig. 1: 0,61 mm, fig. 4: 1,22 mm, fig. 6: 1,4 mm, fig. 8: 1,43 mm, fig. 10: 0,91 mm.

Figs 2, 3: *Pedavis latialata* (WALLISER). Upper view of 2 specimens (fig. 3 incomplete) from sample no. 2 c; *latialata*-Subzone
Fig. 2: 0,82 mm, fig. 3: 0,59 mm.

Figs. 12–13, 14–15: *Ozarkodina crispa* (WALLISER). Figs. 12–13: Upper and lateral views of an incomplete specimen from sample no. 5 c; figs. 14–15: Upper and lateral views from sample no. 6; *crispa*-Subzone.
Fig. 12: 0,55 mm (max. width of basal cavity), fig. 14: 0,97 mm.

Figs. 16–17, 18: *Ozarkodina r. eosteinhornensis* (WALLISER). Figs. 16–17: Upper and lateral views from sample no. 6; fig. 12: lateral view from sample 12; *eosteinhornensis*-Zone.
Fig. 16: 0,68 mm, fig. 18: 0,94 mm.

Fig. 19: *Ozarkodina confluens* (BRANSON & MEHL). An incomplete apparatus from sample 11 in which the Sb-element *(„Plectosphathodus flexuosus")* is missing. Magnification approx. x 30.

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