Ber. Inst. Erdwiss. K.-F.-Univ. Graz	ISSN 1608-8166	Band 23	Valencia 2017
International Conodont Symposium 4	Valencia, 25-30th June 2017		

Summary of conodont data from the GSSP of the Silurian-Devonian boundary at Klonk near Suchomasty

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Locality *- The GSSP section is situated NE of the village Suchomasty in the south-western limb of the flat syncline of the Silurian and Devonian strata. (Fig. 1) (GPS positioning of the middle parts of natural escarpment: N 49°54'02''; E 014°03'44'').*
Lithostratigraphic units *- Kopanina Fm., Požáry Fm. and Lochkov Fm.*
Age *- The upper Ludlow, Přídolí and Lochkovian. The conodont zones are problematic and thus can be only estimated:* eosteinhornensis *s.s. (in the sense of Carls et al. 2007) and* hesperius-optima *(in the sense of Slavík et al., 2012).*
What to see *- The first GSSP between two geological systems that has been established.*

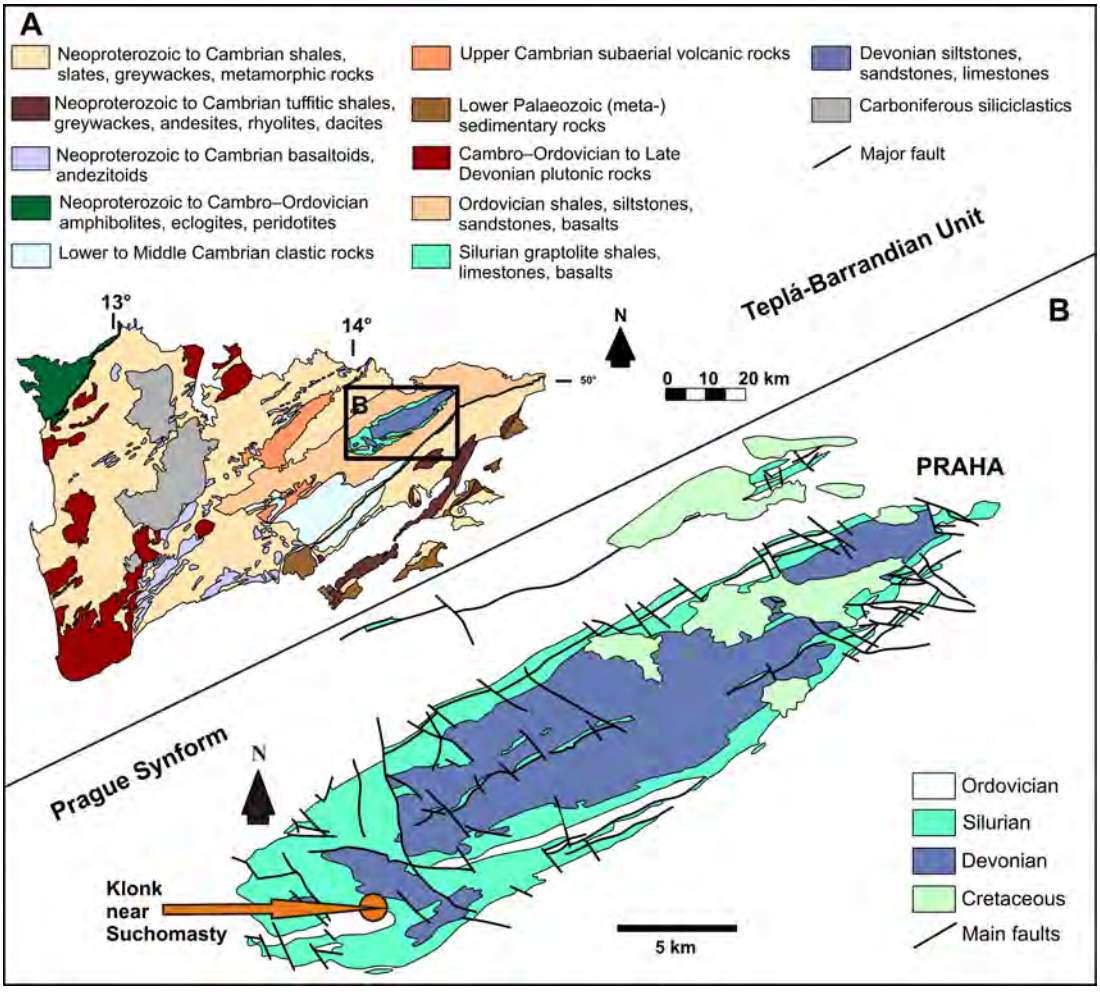

Figure 1. A location of the GSSP of the Silurian-Devonian boundary at Klonk in the Prague Synform (i.e a part of the Teplá-Barrandian Unit).

How to get there
The best view of the entire GSSP section is from the place near the geological monument at the northern border of the village of Suchomasty in the southwestern part of the Prague Synform (Fig. 2).

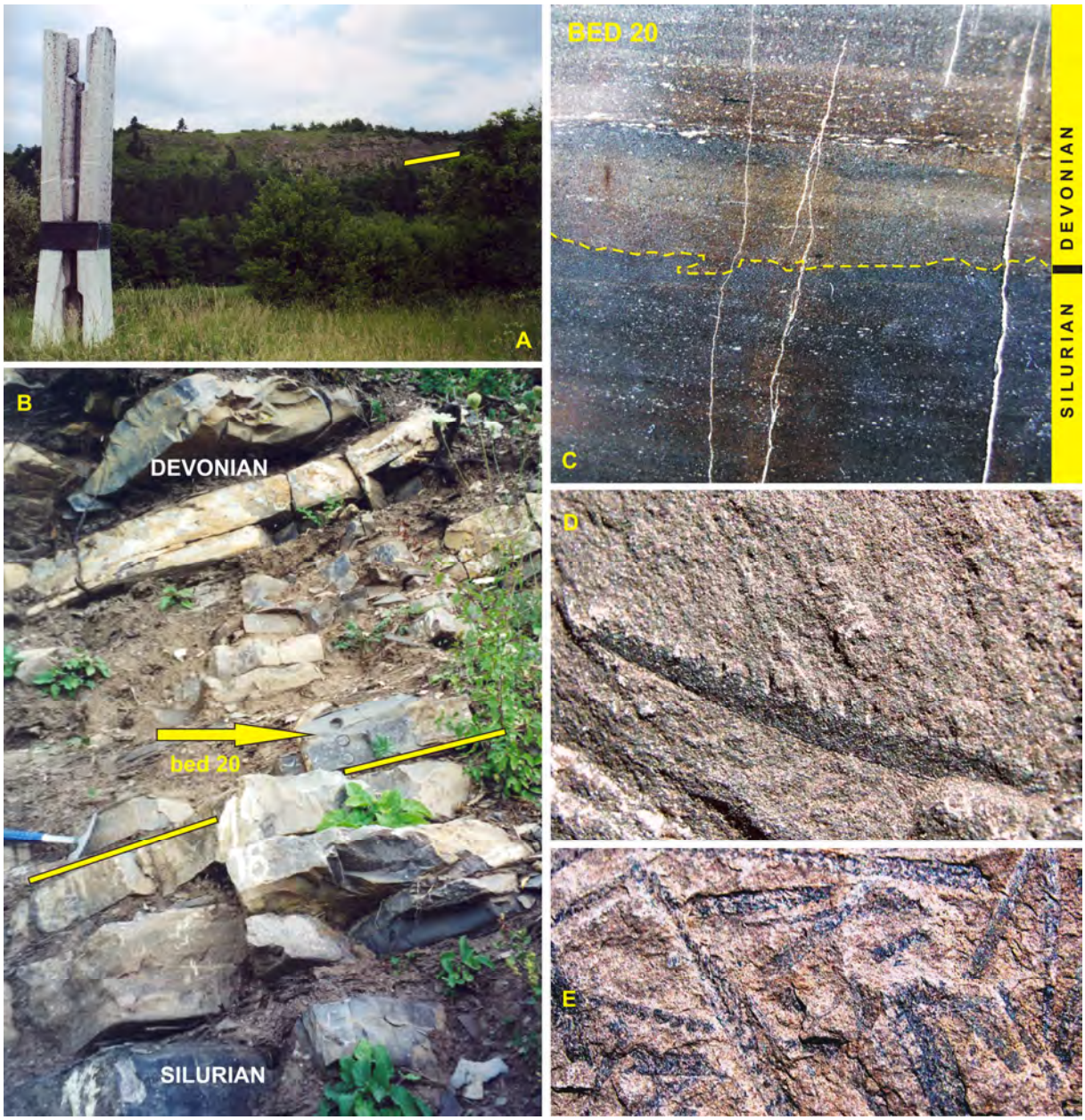

Figure 2. A. The view on the Klonk near Suchomasty and the geological monument. The bar marks the S-D boundary. **B.** Detail of the Silurian/Devonian boundary interval. Devonian starts in upper part of the bed 20. **C.** Detail of the bed 20; the index graptolites (*Monograptus uniformis uniformis* and *Monograptus uniformis angustidens*) occur above yellow dashed line). **D.** *Monograptus uniformis uniformis* – a detail of the GSSP-defining taxon, bed 20, section at Klonk. E. Assemblages of *Monograptus uniformis uniformis* and *Monograptus uniformis angustidens* from bed 20, section at Klonk.

Historical outline

The section at Klonk near Suchomasty has major significance for the development of global stratigraphy as the first boundary stratotype between two geological systems. It was selected following international discussion and based on multiproxy data.

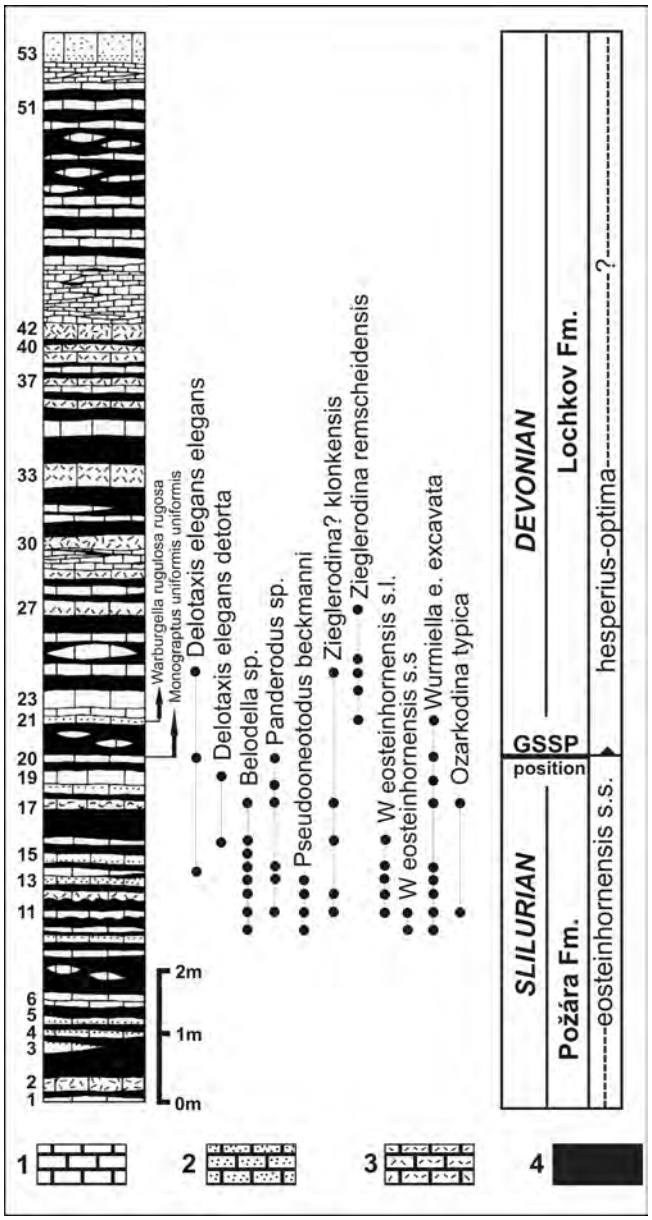

Figure 3. Conodont data from the Silurian-Devonian interval showing the position of the first occurrences of stratigraphically relevant taxa in relation to the GSSP. (Data from Jeppsson, 1988; 1989; and this paper). Lithology (after Chlupáč, 1993): 1. Micritic and very fine-grained bioclastic limestones. 2. Medium-grained bioclastic limestones. 3. Coarse-grained, mostly crinoidal bioclastic limestones. 4. Calcareous mudstones up to shaly micrites.

As summarized in Chlupáč (1993), the problem of definition of the Silurian-Devonian boundary arose during the 1850s, and became an issue of vigorous international discussion. When E. Kayser 1877 clearly formulated the view that the youngest "etages" of the Barrande's "Silurian System" in Bohemia correspond to the Devonian System of the Harz and other regions, this question of the boundary became most actual. Many of the outstanding geologists and palaeontologists of the 19th century were involved in the subsequent, rapidly evolving dispute known in the literature as the "Hercynian Question". A general consensus was that the extinction of graptolites (characteristic Silurian fossils) should delimit the Silurian-Devonian boundary in marine sections. A new reason for reopening the boundary question was given by finds of "Silurian" graptolites together with "Devonian" fossils in the Barrandian (1952). This association was subsequently observed in Podolia, North Africa, Arctic Canada, and other regions. Based on the recommend-dations of two international conferences (Prague 1958, Bonn-Bruxelles 1960) the International Committee on the Silurian-Devonian Boundary was created. This Committee, after several international meetings and inspections of the most promising sections throughout the world, decided to select the global boundary stratotype at Klonk. This judgement was officially accepted at the 24th International Geological Congress in Montreal 1972. The Barrandian was also approved as the type area of the boundary and the Budňany Rock at Karlštejn as the auxiliary type section. The monument below Klonk is the work of the Czech sculptor Jiří Novotný. It is made of the Bohemian Devonian "Zbuzany Marble" (Pragian age, Dvorce-Prokop Limestone), and was erected in 1977.

Lithology, sedimentology and paleoenvironment

The whole sequence of boundary beds consists of rhythmical alteration of limestone beds and calcareous shales, where the first rock types correspond mostly to distal calciturbidite and current-related drifted sediment and the latter have a significant proportion of pelagic material that was dissolved and condensed in early stages of lithification (several meters of burial depth, not-dissolved relicts are preserved in thick nodules with lamination). Sedimentological studies suggest that this mixture of pelagic, turbidite and drift sediments, with numerous but short episodes of non-

sedimentation, formed in depths of at least several hundreds of meters, on slightly inclined seafloor (Hladil, 1991; 1992; Hladil & Beroušek, 1992). The average rate of sedimentation in the boundary succession of beds is about 20 m/Ma. The S/D boundary level in the upper part of the bed 20 corresponds to change of the direction of sea currents (Hladil, 1992). In millimetre scale, there are two firmgrounds, and the sediment above the lower one differs in structures as well as fine chemical and isotopic features (Hladíková et al., 1997; Frýda et al., 2002). This change also well corresponds to the most detailed position of the first *M. u. uniformis* thecas, i.e. 1 or 2 cm lower than usually referred to (Chlupáč & Hladil, 2000; Chlupáč & Vacek, 2003). Stratigraphic variations of magnetic susceptibility were recently reinvestigated, and they were correlated with the Klonk-1 borehole and parts of other sections in the world (Crick et al., 2001). Similarly, the stratigraphic variation of organic matter contents and related mineralogical and geochemical indicators is also involved in Herten (2000) and Kranendonck (2000) – Klonk-1 borehole and outcrop with this GSSP itself.

Comments on conodont distribution

Conodont faunas from Klonk were first studied by Jeppsson (1988, 1989). He established conodont zonation including *eosteinhornensis* s.s., *elegans* and *detorta* Zones at Klonk. The *detorta* Zone was long time believed to be an important biostratigraphical marker characterizing the uppermost Přídolí. It has been almost globally accepted and it is still being used in recent papers (e.g., Melchin et al., 2012). Taxon *Delotaxis detorta* was found in the Požáry section, where the strata of the Přídolí are about 40 m thick, from 7 m above the GSSP base of the Přídolí onwards; that is 10.5 m below the entry of genus *W eosteinhornensis* s.s. (Carls et al., 2007). This shows that the *detorta* Zone starts much lower than was formerly thought, well below the beginning of the *eosteinhornensis* Zone. This zone delimited by Jeppsson (1989) has no particular biostratigraphical meaning in the section of Klonk or wherever. The beginning of the Lochkovian can be confirmed by means of typical Lochkovian conodont taxa as *Zieglerodina remscheidensis* (Fig. 3 and 4). Former identifications of the typical early Lochkovian taxon "*remscheidensis*" in the uppermost Přídolí were erroneous. One of the most conspicuous morphologies among spathognathodontids is *Zieglerodina? klonkensis* Carls et al. (= *Ozarkodina s. remscheidensis* in Jeppsson, 1989, Pl.2, figs 8, 9).

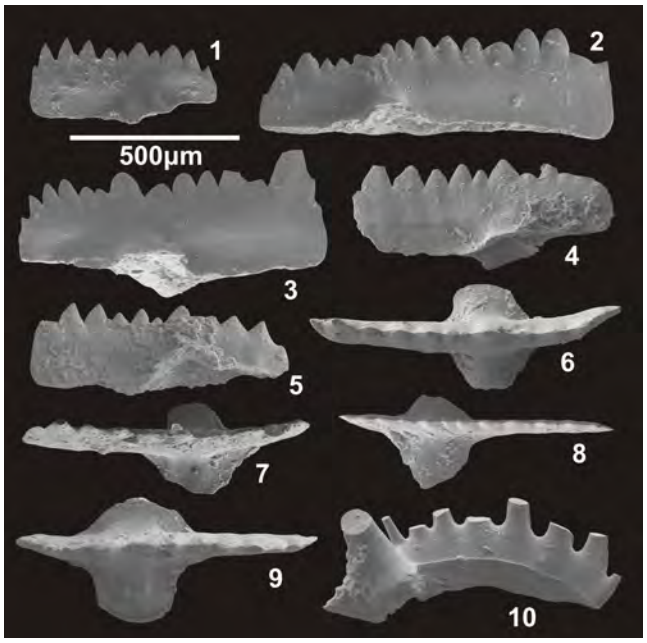

Figure 4. Selected conodont specimens from Devonian of the Klonk section.
1. *Zieglerodina remscheidensis* (Ziegler), lateral view of Pa element, SpNo. 201KL, Klonk section, bed No. 24. **2.** *Zieglerodina? klonkensis* Carls et al., lateral view of Pa element, SpNo. 204KL, Klonk section, bed No. 24. **3-9.** *Zieglerodina* cf. *remscheidensis* (Ziegler), **3-5.** lateral view of Pa elements, SpNo. 206KL, SpNo. 208KL, SpNo. 207KL, Klonk section, bed No. 40; **6-9.** upper view of Pa elements, SpNo. 209KL, SpNo. 212KL, SpNo. 210KL, Klonk section, bed No. 23. **10.** *Delotaxis elegans elegans* (Walliser), lateral view of Sc? element, SpNo202KL, Klonk section, bed No. 24.

Other biostratigraphic markers

Graptolites: The Lower Lochkovian index graptolites *Monograptus uniformis uniformis* and *Monograptus uniformis angustidens* appear suddenly and in great number in the upper part of Bed 20. The last occurrence of typically Přídolian *Monograptus transgrediens* is within interbed 13/14, about 160-170 cm below the bed 20. For further details about biostratigraphy, biofacies and paleontology of this GSSP see Chlupáč & Hladil (2000) and papers referred to.

Trilobites: The occurrence of *Warburgella*

rugulosa rugosa is another biostratigraphical marker of practical significance. This trilobite is relatively abundant in the bed 21.
The chitinozoa and organic-walled microfossils in general are very abundant and yileds a great material for fine-scale stratigraphic, biofacies and taphonomic studies (Paris et al., 1981; Fatka et al., 2003 and Brocke et al., 2006).

Acknowledgements
It was supported by the research plan RVO67985831 of the Institute of Geology of the CAS, v.v.i. and the final stages of the conodont research were supported by the by the Czech Science Foundation (GA17-06700S).

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