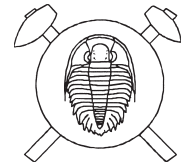


## Silurian Organic-Walled Microfossils in the Prague Basin (Barrandian area): their localities, literature and distribution



### Silurské mikrofosílie s organickou stěnou v pražské pánvi: jejich lokality, rozšíření a literatura

(1 Fig., 8 Tabs)

RADEK MORÁVEK

Institute of Geology and Palaeontology, Charles University, Albertov 6, 128 43, Praha2, Czech Republic. radekmoravek@centrum.cz

A review of the research of Silurian organic-walled microfossils (*Acritarcha*, *Chitinozoa*, *Muellerisphaerida*, *Prasinophyta*, spores) in the Prague Basin is shown in 7 tables. Their distribution and literature are shown in Tables 1 to 3. More than 40 different localities of organic-walled microfossils are included in Tables 4 to 7. Ranges of occurrences are correlated with graptolite biozonation.

**Key words:** Silurian, Czech Republic, Prague Basin, organic-walled microfossils

### Introduction

Organic-walled microfossils (= OWM) have been studied in the Silurian of the Prague Basin since the Eisenack's pioneer work in 1934. A long period with no publications was interrupted by Paris (1981) and Paris – Kříž (1984). More than 15 papers were published by Dufka, Dufka and Fatka or Dufka and Pačtová in the late 1980s and early 1990s. A review of OWM in the Prague Basin was compiled by Dufka (1990c) who dealt with the Silurian period only. Fatka (1999) reviewed OWM generally from the whole stratigraphic range of the Barrandian area.

The stratigraphic range of sampling done by the authors is shown in Tables 1 to 3. Tables 4 to 7 contain data on sampling sites. The absence of OWM in the studied samples is not shown. The depositional environment, lithotype, mode of preservation and method of sampling are not included in the tables. The left columns of all tables are based on Kříž (1991). Insufficient information about the stratigraphic range of sampling is expressed by a question mark. Localities in Tables 4 to 7, which are close to one another (for example, the Lištice locality in Table 5.1), are joined together in order to provide a better orientation in the tables.

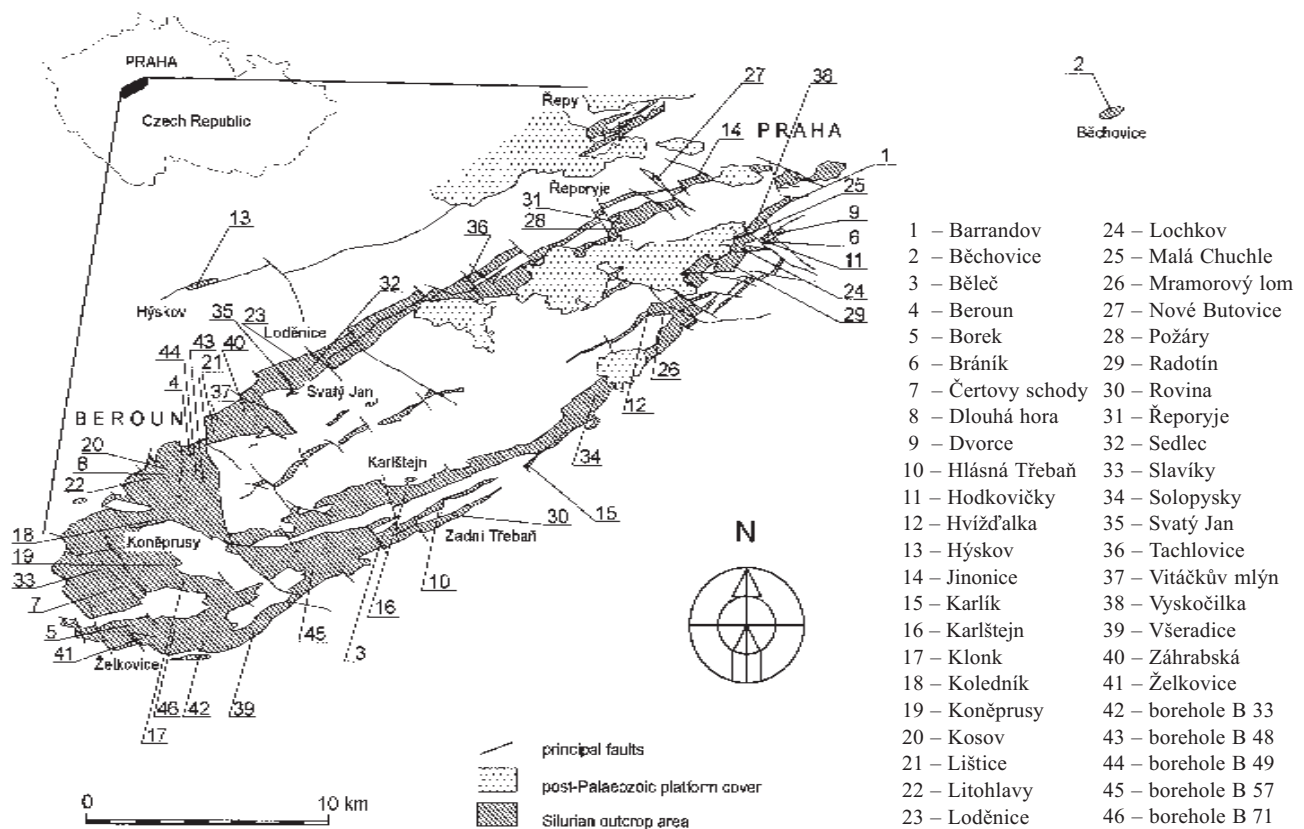


Fig. 1. Silurian outcrop area in Prague Basin (Barrandian area; Czech Republic) with localities referred in text. Map after Štorch (1994).



Table 2. Summary of Silurian research of Chitinozoa in the Prague Basin (the Barrandian area, Czech Republic) according different authors (see explanations and references). Stratigraphy based on Kriz 1991.

CHITINOZOAN STRATIGRAPHY	CHITINOZOAN STRATIGRAPHY																						EXPLANATIONS	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
CIRKOVNÍ STRATIGRAFIE	<p style="text-align: center;"><b>S I L U R I A N</b></p> <p style="text-align: center;">LUDLOW      WENLOCK      ILIANDOVĚKÝ</p> <p style="text-align: center;">LUDLOWIAN      SILURIAN      ILLYRIAN</p>																							
BASTIŘANŮVSKÝ LITHOSTRATIGRAFIE	<p><i>M. transsylvanica</i></p> <p><i>M. aemata</i></p> <p><i>Isabel with M. beatus</i></p> <p><i>M. sordid</i></p> <p><i>M. beuvenensis</i></p> <p><i>Isabel with M. cocleensis</i></p> <p><i>M. jilivus</i></p> <p><i>M. parvulus</i></p> <p><i>M. fragnealis</i></p> <p><i>D. soergelensis</i></p> <p><i>M. fischeri linearis</i></p> <p><i>L. scaberris</i></p> <p><i>L. fischeri</i></p> <p><i>L. rissoni</i></p> <p><i>P. laevigata</i></p> <p><i>Isabel with C. praesa</i></p> <p><i>T. testis</i></p> <p><i>C. facialis</i></p> <p><i>C. fischeri</i></p> <p><i>C. laevigata</i></p> <p><i>M. testis</i></p> <p><i>C. rignoli</i></p> <p><i>Isabel with P. cultratus</i></p> <p><i>M. decalopora</i></p> <p><i>C. rignoli</i></p> <p><i>C. gastrifagus</i></p> <p><i>C. thermis</i></p> <p><i>S. spiralis</i></p> <p><i>O. spiralis</i></p> <p><i>M. chertuliza</i></p> <p><i>M. gabelkoviensis</i></p> <p><i>P. chertulizi</i></p> <p><i>S. laticostatus</i></p> <p><i>H. longus</i></p> <p><i>M. soergelensis</i></p> <p><i>E. ovalis</i></p> <p><i>E. fischeri</i></p> <p><i>T. pedicularis</i></p> <p><i>C. laticostatus</i></p> <p><i>C. capinus</i></p> <p><i>C. vasicalbeus</i></p> <p><i>P. acuminatus</i></p> <p><i>A. beuvenensis</i></p>																						<p>Požár</p> <p>Forman</p> <p>Kopetiv</p> <p>Forman</p> <p>Mož</p> <p>Forman</p> <p>Forman</p> <p>Zakáze</p> <p>Forman</p>	<p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p> <p>?</p>
																						1. Frenkel, 1954		
																						2. Puri, 1981		
																						3. Puri & al., 1981		
																						4. Puri - 1981		
																						5. Puri, 1983		
																						6. Puri - 1981		
																						7. Puri in Kriz & al., 1992		
																						8. Dufek - Fackert, 1964		
																						9. Dufek, 1989		
																						10. Dufek, 1993		
																						11. Dufek, 1987		
																						12. Dufek, 1993		
																						13. Dufek, Fackert, 1964		
																						14. Dufek, 1988		
																						15. Dufek, 1993		
																						16. J. Hříst, 1987		
																						17. Dufek - 1992		
																						18. Dufek, Fackert, 1965		
																						19. Dufek & al., 1995		
																						20. Dufek, 1993		
																						21. Dufek, 1993		
																						22. Kriz & al., 1991		



Table 4. Distribution of Acritarcha on Silurian localities of the Prague Basin (the Barrandian area, Czech Republic). Stratigraphy based on Kříž 1991. The numbers represents papers of the next authors: 1. Dufka – Pacltová, 1988; 2. Dufka, 1990a; 3. Dufka, 1990b; 4. Dufka, 1990c; 5. Dufka, 1991a; 6. Dufka – Fatka, 1991; 7. Dufka – Fatka, 1992c; 8. Dufka – Fatka, 1993; 9. Dufka, 1995b.

LOCALITIES	STRATIGRAPHIC RANGE OF OCCURENCE																																											
Běchovice	2, 4 ■																																											
Beroun	4 ■																																											
Borek	4 ■																																											
Hlásná Třebaň	2, 4, 6, 8 ■																																											
Hodkovičky	4 ■																																											
Hýskov	2, 3 ■																																											
Jinonice	4 ■																																											
Karlik	2, 4, 6, 8 ■																																											
Karlštejn	1, 2, 4 ■																																											
Kosov	4, 5 ■																																											
Lištica (4 localities)	4 ■																																											
Litohlavy	4 ■																																											
Loděnice	4 ■																																											
Nové Butovice	2, 4 ■																																											
Radotín	4 ■																																											
Rovina	4 ■																																											
Řeporyje	4 ■																																											
Sedlec	4 ■																																											
Solopyský	4 ■																																											
Svatý Jan	4, 5, 9 ■																																											
Tachlovice	4 ■																																											
Vitáčkův mlýn	5 ? ■ ?																																											
Vyskočilka	4 ■																																											
Záhřabská	4 ■																																											
Želkovice	2, 4, 7 ■																																											
BIOSTRATI - GRAPHY	Indurane	M. bartoloni	Leve with M. barto-	M. boeck	M. bockovensis	Leve with M. prodenis	M. latus	M. parafinis	M. fragmentalis	Inezone	B. tcherkouszovi	M. h. bartoloni	L. scanicus	L. pragensis	K. rikszovi	P. indanus	Leve with G. naase	T. bealle	C. radians	C. dentifer	C. globosus	M. flexilis	C. ligulus	Leve with P. ciliata	M. ruzickensis	C. murchisoni	C. oertrugi	C. reesii	S. grandis	C. salata	M. crenulata	M. pulcherrima	P. crispus	S. tricoloratus	R. inaequalis	M. sedgwicki	D. conularis	D. orbili	D. pedicularis	D. triangularis	C. cyathus	C. weakleyi	P. acuminatus	A. asperus
CHRONO - STRATIGRAPHY	LUDLOWIAN			DOUGLASSIAN			WENLOCKIAN		GILLYWOODIAN					TILYCHIAN			ATTORIAN			HOLLANDIAN																								
	PRIDOLI			LUDLOW			WENLOCK					LANDOVERY																																
	S I L U R I A N																																											

Table 5.1. Distribution of Chitinozoa on Silurian localities of the Prague Basin (the Barrandian area, Czech Republic). Stratigraphy based on Kříž 1991. The numbers represent papers of the next authors: 1. Eisenack, 1934; 2. Paris, 1981; 3. Paris – Kříž, 1981; 4. Paris – Laufeld – Chlupáč, 1981; 5. Paris, 1983; 6. Paris – Kříž, 1984; 7. Paris in Kříž et al., 1986; 8. Dufka – Pacltová, 1988; 9. Dufka, 1990a; 10. Dufka, 1990b; 11. Dufka, 1990c; 12. Dufka – Fatka, 1991; 13. Dufka, 1992a; 14. Dufka, 1992b; 15. Le Herisse, 1992; 16. Dufka – Fatka, 1993; 17. Dufka in Kříž et al., 1993; 18. Dufka, 1995a.

LOKALITICS	STRATIGRAPHIC RANGE OF OCCURENCE																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Barrandov			13	?														?
Běchovice																	9, 11	
Beroun																	11	
Bráňník					5, 7, 17													
Čertovy schody					5, 7													
Dlouhá Hora	1	?																?
Dvorce	1	?																?
Hlásná Třebaň																		
Hodkovičky																		
Hviždalka	10, 11, 13																	
Hýskov																		
Jinonice																		
Karlík																		
Karlštejn																		
Klonk																		
Koledník																		
Koněprusy																		
Kosov																		
Kozol	?																	
Lišnice (9 lokalities)																		
Litohlavy																		
Loděnice	?																	
Lochkov																		
Malá Chuchle																		
Mramorový lom																		
Nové Butovice																		
CHRONO- STRATIGRAPHY	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis
	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis	M. senecensis
LITOSTRATI- GRAPHY	PRIDOLI				LUDLOW				WENLOCK				LLANDOVERY					
	S I L U R I A N																	

Table 5.2. Distribution of Chitinozoa at Silurian localities of the Prague Basin (the Barrandian area, Czech Republic). Stratigraphy based on Kříž (1991). The numbers represent papers of the following authors: 1 – Paris–Kříž (1981); 2 – Paris (1983); 3 – Paris–Kříž (1984); 4 – Paris in Kříž et al. (1986); 5 – Dufka (1990c); 6 – Dufka (1992a); 7 – Dufka in Kříž et al. (1993); 8 – Dufka et al. (1995); 9 – Verniers et al. (1995).

LOCALITIES	STRATIGRAPHIC RANGE OF OCCURRENCE																																											
Požáry	1, 2, 3, 4, 9																																											
Rovina	5																																											
Řeporyje	5, 6, 7 ?																																											
Sedlec	5																																											
Solopysky	5, 6																																											
Tachlovice	5																																											
Všeradice	7																																											
borehole B 33	8																																											
borehole B 48	8																																											
borehole B 49	8																																											
borehole B 57	8																																											
borehole B 71	8																																											
BIOSTRATI- GRAPHY	M. transgibbatus	M. perneri	level with M. beatus	M. boučeki	M. lachkovensis	level with M. pridolensis	M. ultimus	M. parulimus	M. fragmularis	interzone	B. bohemicus s. l.	M. fritschii linearis	I. scabricus	L. projectilii	N. nielsenii	P. ludensis	level with G. nassa	I. testis	C. raptans	C. perneri	C. ramosus	M. flexilis	C. rigidus	level with P. dubius	M. riccartonensis	C. murchisoni	C. oenofugus	C. insectus	S. grandis	O. spiralis	M. crenulata	M. griffithsiensis	P. crispus	S. turniculus	R. linnaei	M. sedgwickii	D. convolutus	D. pribylii	D. pedimatus	D. triangulatus	C. cyphus	C. vesiculatus	P. acuminatus	A. ascensis
CHRONO- STRATIGRAPHY	LUDLOWIAN										DEVONIAN					SHELVODIAN				TRIFURCATE				ACROAN				RHIBANIAN																
	PŘÍDOLÍ					LUDLOW					WENLOCK					LLANCOVERY																												
	S I L U R I A N																																											

**Acritarcha**

Tables 1 and 4

*Acritarcha* are organic-walled microfossils of uncertain systematic position. *Acritarcha* consist of an organic wall surrounding a central cavity. The organic wall is composed of a variable number of layers. For the definition and examples, see Evitt (1963a, b), Servais et al. (1996) and Strother (1996).

*Acritarcha* from the Prague Basin were described by Dufka – Pacltová (1988), Dufka (1990a, b, c, 1991a, 1992c, 1995b) and by Dufka – Fatka (1991, 1993).

**Chitinozoa**

Tables 2, 5.1, 5.2

*Chitinozoa* are microfossils with an organic wall delimiting a cavity. The cavity is sealed by a plug. The indi-

viduals normally display radial symmetry. For details, see Paris et al. (1999), a.o.

In the Prague Basin, *Chitinozoa* were first described by Eisenack in 1934. However, the locations of the studied samples are not clear. Abbreviations used by Eisenack (1934) do not match with those of the cited author – Heritsch (1928).

Laufeld (1977) mentioned the importance of a detailed research of the Silurian/Devonian boundary interval in the Barrandian (Czech Republic) and Podolia (Ukraine). In this respect, *Chitinozoa* assemblages of the Silurian/Devonian boundary interval were studied by Paris. The results were published in two papers (Paris 1981 and Paris et al. 1981). The establishment of the fourth series of the Silurian – Přídolí – led to the study of *Chitinozoa* of this series and its limits by Paris – Kříž (1981, 1984), Paris (1983) and Paris in Kříž et al. (1986). Papers dealing with Silurian *Chitinozoa* include the following: Dufka – Pacltová (1988), Duf-

Table 6. Distribution of *Muellerisphaerida* (A) and spores (B) on Silurian localities of the Prague Basin (the Barrandian area, Czech Republic). Stratigraphy based on Kříž 1991. The numbers represent papers of the next authors: 1. Eisenack, 1934; 2. Dufka – Pacltová, 1988; 3. Dufka, 1990a; 4. Dufka, 1990c; 5. Dufka, 1991b; 6. Dufka, 1991c; 7. Dufka, 1992c; 8. Dufka – Kříž, 1992a; 9. Dufka – Kříž, 1992b; 10. Le Herisse, 1992; 11. Dufka in Kříž et al., 1993; 12. Dufka, 1995a; 13. Dufka, 1995b.

## A

LOCALITIES	STRATIGRAPHIC RANGE OF OCCURENCE
Dlouhá hora	1 ■■■■■
Kosov	7, 12 ■■■■■
Lištice	4, 6, 7 ■■■
Loděnice	7 ■
Mramorový lom	■■■■■ 10
Řeporyje	7 ■
Želkovice	■■■■■ 3, 4, 5, 6

## B

LOCALITIES	STRATIGRAPHIC RANGE OF OCCURENCE																								
Karlštejn	2, 4 ■																								
Lištice (8 localities)	4, 8, 9, 11 ■■■■■ ■■■																								
Loděnice	4 ■■■																								
Nové Butovice	4 ■																								
Řeporyje	4 ■																								
Svatý Jan (2 localities)	11, 13 ■■■■■																								
Tachlovice	4 ■																								
BIOSTRATI- GRAPHY	<i>interzooie</i> <i>M. tsarskiensis</i> <i>M. perneri</i> <i>leve</i> with <i>l. oectus</i> <i>M. brucei</i> <i>M. tschekowensis</i> <i>level with M. erubescens</i> <i>M. ullius</i> <i>M. parulimus</i> <i>M. tschekowensis</i> <i>interzooie</i> <i>B. bohemicus</i> s. l. <i>M. trisechi</i> near s. <i>I. scanicus</i> <i>I. progerator</i> <i>N. misoni</i> <i>P. ludaralis</i> <i>level with G. massu</i> <i>I. testis</i> <i>C. radialis</i> <i>C. oernei</i> <i>C. temoaus</i> <i>M. flexilis</i> <i>C. r. c. us</i> <i>level with P. dubius</i> <i>M. tschekowensis</i> <i>C. murci soti</i> <i>C. centrigus</i> <i>C. insectus</i> <i>S. grandis</i> <i>O. solis</i> s. <i>M. granulata</i> <i>M. g. estoniensis</i> s. <i>P. gissovus</i> <i>S. L. "oullius"</i> <i>R. linnæi</i> <i>M. saegwicii</i> <i>D. convolutus</i> <i>D. p. hyl</i> <i>D. pedimatus</i> <i>D. triangularis</i> <i>C. cyrtus</i> <i>C. vesiculatus</i> <i>P. acuratus</i> <i>A. saegwicii</i>																								
CHRONO- STRATIGRAPHY	<table border="1"> <tr> <td></td> <td>LODDEGAN</td> <td>GIBBERIN</td> <td>DOYLEINA</td> <td>SELESDOVAN</td> <td>TRICHAN</td> <td>ALBUKIAN</td> <td>REHDDAN</td> </tr> <tr> <td>FRIDOLI</td> <td>LUDLOW</td> <td colspan="2">WENLOCK</td> <td colspan="4">LLANDOVERY</td> </tr> <tr> <td colspan="8" style="text-align: center;">S I L U R I A N</td> </tr> </table>		LODDEGAN	GIBBERIN	DOYLEINA	SELESDOVAN	TRICHAN	ALBUKIAN	REHDDAN	FRIDOLI	LUDLOW	WENLOCK		LLANDOVERY				S I L U R I A N							
	LODDEGAN	GIBBERIN	DOYLEINA	SELESDOVAN	TRICHAN	ALBUKIAN	REHDDAN																		
FRIDOLI	LUDLOW	WENLOCK		LLANDOVERY																					
S I L U R I A N																									

ka (1989, 1990a, b, c, 1992a, b, 1995a, b), Dufka in Kříž et al. (1993). The paper of Dufka – Fatka (1991, 1993) deals with *Chitinozoa* near the Ordovician/Silurian boundary.

Dufka et al. (1995) processed samples from boreholes drilled in the course of uranium exploration.

The global *Chitinozoa* biozonation for the Silurian was established by Verniers et al. (1995). The distribution of selected index species, characteristic and accompanying species of *Chitinozoa* in the Prague Basin is mentioned in this paper.



Table 7. Distribution of Prasinophyta on Silurian localities of the Prague Basin (the Barrandian area, Czech Republic). Stratigraphy based on Kříž 1991. The numbers represent papers of the next authors: 1. Dufka, 1990a; 2. Dufka, 1990b; 3. Dufka, 1990c; 4. Dufka, 1992c; 5. Dufka, 1995a.

LOCALITIES	STRATIGRAPHIC RANGE OF OCCURENCE																																															
Rěchovice																		1, 3	■	■																												
Běleč																			3	■																												
Beroun																			3	■																												
Borek																		3	■	■																												
Hlásná Těbaň																			1, 3	■																												
Hodkovičky																			3	■																												
Hýskov																			2, 3	■																												
Jinonice																			3	■																												
Karlík																				1, 3																												
Karlštejn																			1, 3	■																												
Kosov																			3, 5	■																												
Lištice																			3	■																												
Litohlav																			3	■																												
Loděnice																			3	■																												
Malá Chuchle																			1, 3	■																												
Nové Butovice																			1, 3	■																												
Radotín																			3	■																												
Rovina																			3	■																												
Řeporyje																			3	■																												
Sedlec																			3	■																												
Slavíky																			3	■																												
Solopyský																			3	■																												
Svalý Ján																			3	■																												
Tachlovice																			3	■																												
Záhabská																			3	■																												
Želkovice																			1, 3, 4	■																												
BIOSTRATI GRAPHY	Mazonia	V. tenuigranulata	M. parvifera	Kevlertina	M. beakensis	M. beakii	K. beakiformis	Levlertina	M. pilsbachiensis	V. ulmifera	M. parvifera	V. flagellatella	marzoni	B. beakensis I.	M. lincolnensis	L. scaberrima	L. pilsbachi	M. masoni	P. Lincolnensis	Levlertina	G. beakii	T. beakii	C. beakensis	G. beakii	C. beakensis	K. beakensis	G. beakensis	Levlertina	P. beakensis	M. beakensis	C. beakensis	D. beakensis	C. beakensis	S. beakensis	S. beakensis	C. beakensis	M. beakensis	F. beakensis	S. beakensis	R. beakensis	K. beakensis	D. beakensis	D. beakensis	D. beakensis	C. beakensis	C. beakensis	F. beakensis	A. beakensis
CHRONO- STRATIGRAPHY	PRIDOLI		LUDLOW				WENLOCK				ILIANDOVERY																																					
	S I L U R I A N																																															

## Muellerisphaerida

Tables 1 and 6

*Muellerisphaerida* are spherical phosphatic microfossils with spines. They represent a group of uncertain systematic position. The body is 100–400 nm in size (including spines). For further information, see Aldridge–Armstrong (1981) and Kozur (1999), a.o.

Silurian *Muellerisphaerida* from the Prague Basin were first depicted by Eisenack (1934). The locations and detailed stratigraphic positions of samples are uncertain. Aldridge – Armstrong (1981), who established the informal group of “mazuelloids”, listed “Czechoslovakia” among their localities. Nevertheless, no precise location is given in their paper.

Additional information concerning the Prague Basin is connected with the research conducted by Dufka (1990a, 1992c, 1995a). The paper of 1991 dealt exclusively with this group. The last contribution was published by Le Herisse (1992).

## Prasinophyta

Tables 3 and 7

No accurate definition of the *Prasinophyta* exists. In general, this term is applied to cysts belonging among primitive green algae (Guy – Ohlson 1996).

No author dealt with *Prasinophyta* only. Information about this group is presented in papers dealing with other groups of OWM: Dufka (1990a, b, c, 1992c, 1995a, b).

## Spores

Tables 3 and 6

The spores from the Prague Basin were described by Dufka – Pacltová (1988) and Dufka (1990c, 1995b). The presence of abundant spores in the upper Wenlock of the Prague Basin was taken as one piece of evidence for the emergence of the Svatý Jan Volcanic Centre by Dufka – Kříž (1992a, b).

## Conclusion

*Acritarcha* were studied from 28 localities in the Llandovery and Wenlock. *Chitinozoa* from the Prague Basin were studied from all four Silurian series. However, only one paper concerns the Wenlock/Ludlow boundary, and no overlap exists between this study and the other studies in the overlying formations. *Chitinozoa* have been found in 38 localities and 5 boreholes. Only one paper dealt with *Muellerisphaerida* as a main subject with specific results. *Muellerisphaerida* were often treated as a by-product of studies primarily focused on other groups of OWM. They come from 7 localities. *Prasinophyta* have been found at 26 localities as a by-product of studies in the Llandovery, Wenlock, in one graptolite biozone in the Ludlow and Přídolí. Spores have been determined from 15 localities in the Llandovery and Wenlock.

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### Silurské mikrofosílie s organickou stěnou v pražské pánvi: jejich lokality, rozšíření a literatura

V sedmi tabulkách je uveden přehled rozšíření mikrofosilií s organickou stěnou (Acritarcha, Chitinozoa, Muellerisphaerida, Prasinophyta, spóry) v pražské pánvi. Jejich rozšíření a literatura je zpracována do tabulek 1 až 3. V tabulkách 4 až 7 jsou vyneseny rozsahy výskytů mikrofosilií na jednotlivých lokalitách. V příspěvku je uvedeno více než 40 lokalit. Rozsahy výskytů u všech tabulek jsou korelovány s graptolitovou biozonací. Jednotlivé tabulky jsou opatřeny slovním doprovodem.

