

WHEN MAMMOTHS WERE MIGRATING THROUGH MORAVIA: PALAEOVEGETATION OF WEICHSELIAN PERIOD

**[Když mamuti Moravou táhli ...: paleovegetace poslední doby
ledové]**

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The first, accidentally found sediments, dated later to the Last Glacial Period, were taken during the rescue research in the year 1999 at the site **Šafárka** at Spišská Nová Ves (NE Slovakia). Some time later a similar “natural archive” was obtained from the site **Jablůnka** (E Moravia, Czech Republic). It was found in the wall of the terrace of the river Bečva after the flood in the year 1997. In 2002 a small block of sediment 28 cm thick was withdrawn here. The performed radiocarbon dating placed the deposited material to the Middle Pleniglacial. This was confirmed also by the results of pollen analysis. In 2007 also a sample of peat taken from the probe drilled down to the depth of 15 m at the site **Týn nad Bečvou** (E Moravia, Czech Republic) was dated and processed from pollen-analysis point of view. Radiocarbon dating again documented the origin of the sediment from the Middle Pleniglacial as well as the vegetation situation similar to that at the site Jablůnka.



1 – Šafárka

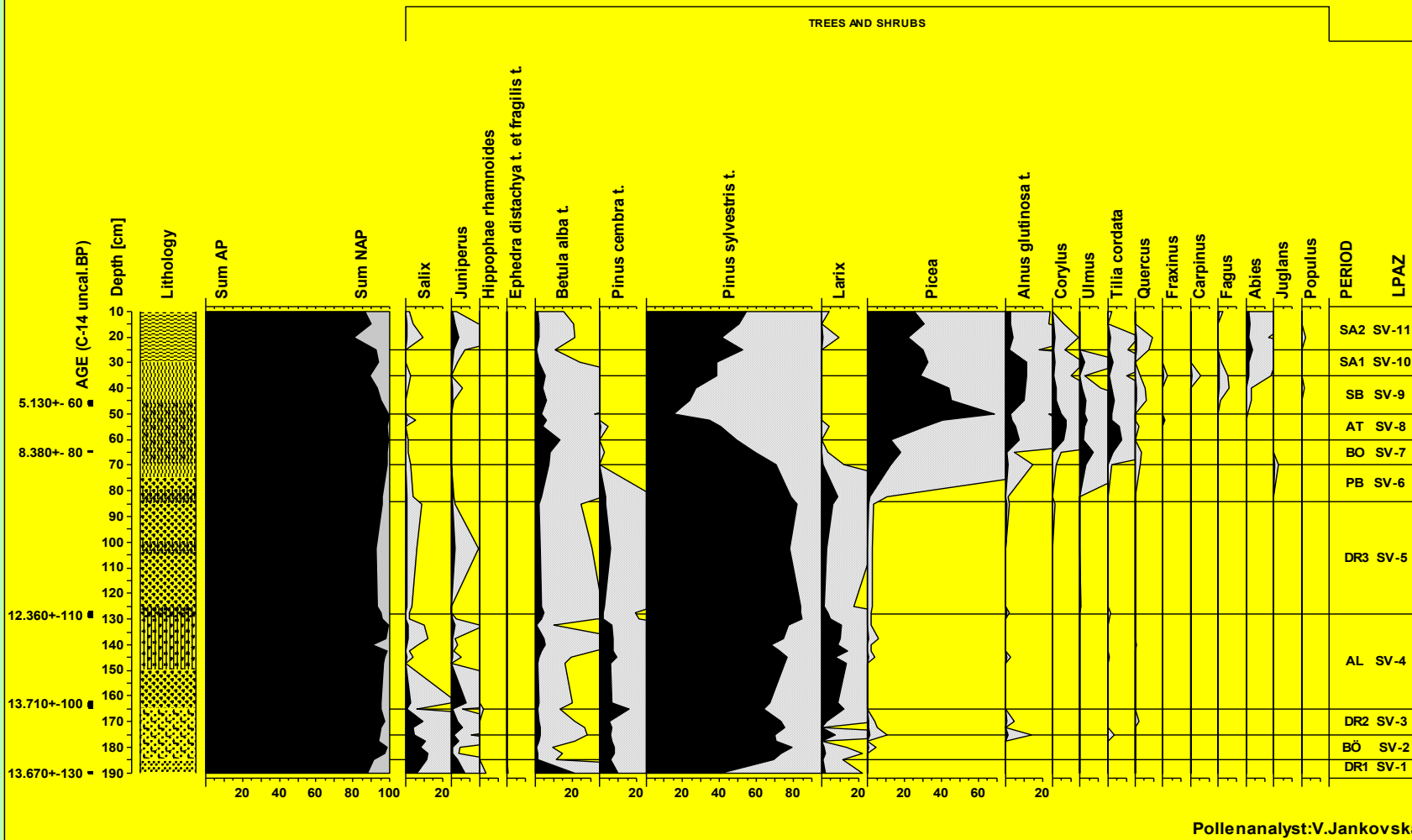
2 – Sivárňa

3 – Jablůnka

4 – Týn n. Bečvou

So the mentioned sediments successfully finished the long-lasting efforts of finding a palaeobotanically positive source of information about vegetation situation in the Last Glacial Period within the area of the former Czechoslovakia. Till that time objective documents for palaeo-reconstruction of vegetation, climate, landscape character, etc. older than those from the Late Glacial were missing. Example of Late Glacial from the locality „Sivárňa“.

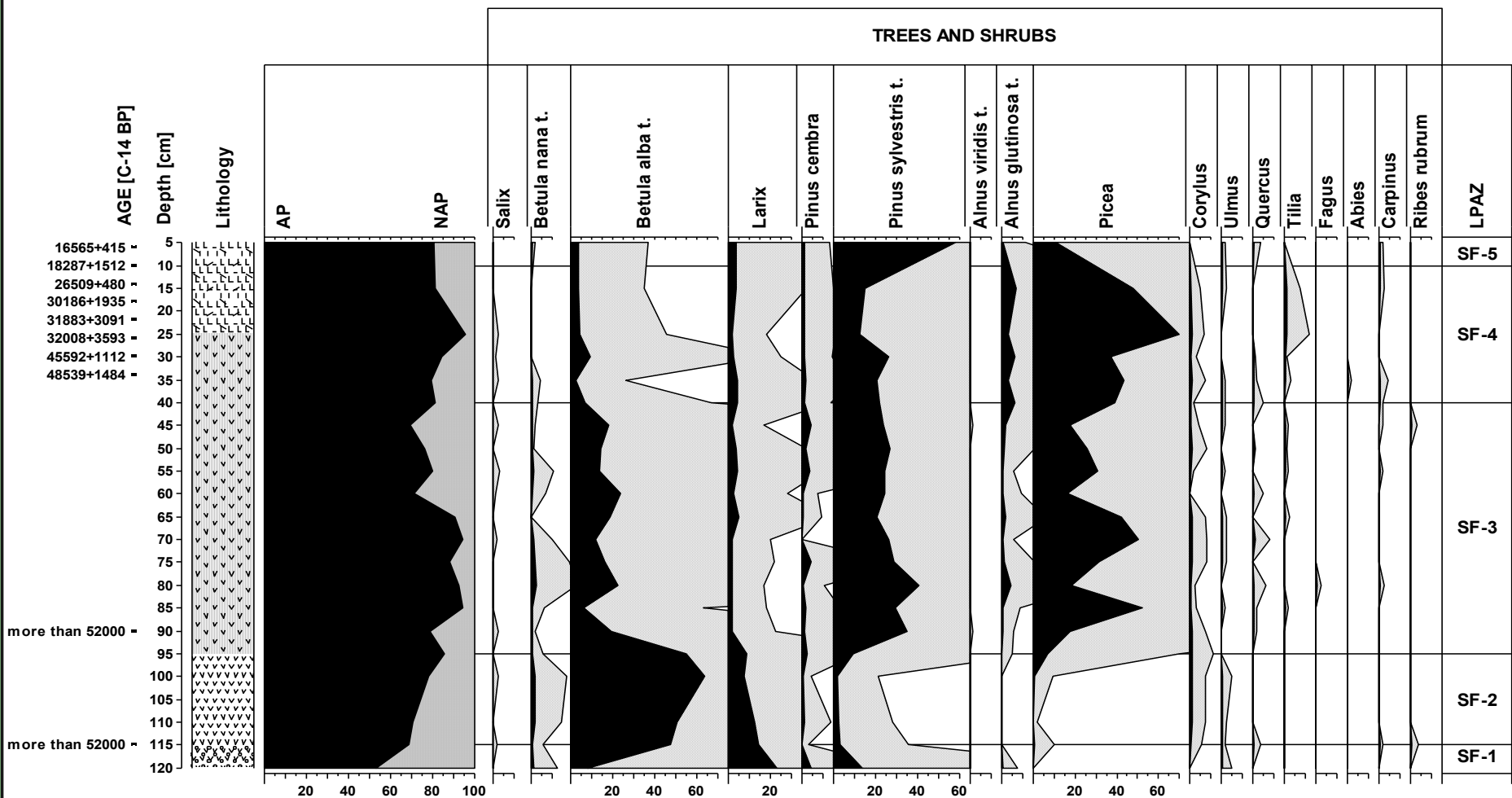
SIVÁRŇA, Profile SK-6-A
 (49°19'N, 20°35' E, 610 m a.s.l.)
 NE SLOVAK REPUBLIC
 1.part



The results of palaeoecological analyses indicate that the presence of forest communities determined the character of Slovak and Moravian Carpathians in the course of the Last Glacial period, i.e. about from the beginning of the Middle Pleniglacial (about 61 000 – 27 000 BP) till to the end of the Upper Pleniglacial (about 27 000 – 13 000 BP).

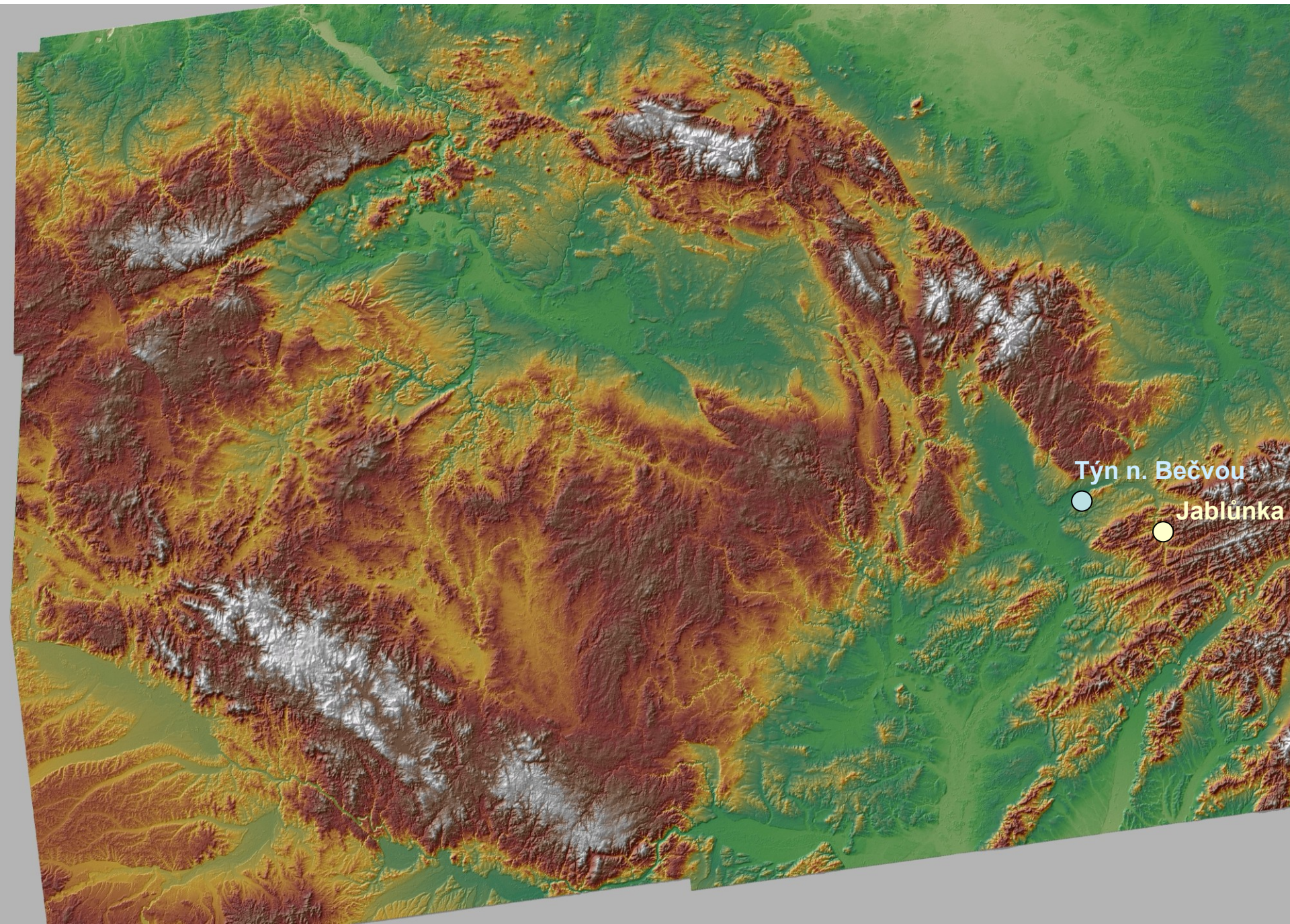
ŠAFÁRKA
 [48°52'55" N, 20°34'30" E, 600 m a.s.l.]
 NE SLOVAK REPUBLIC
 1.part

Example of Middle Pleniglacial vegetation development (reference pollen profile).

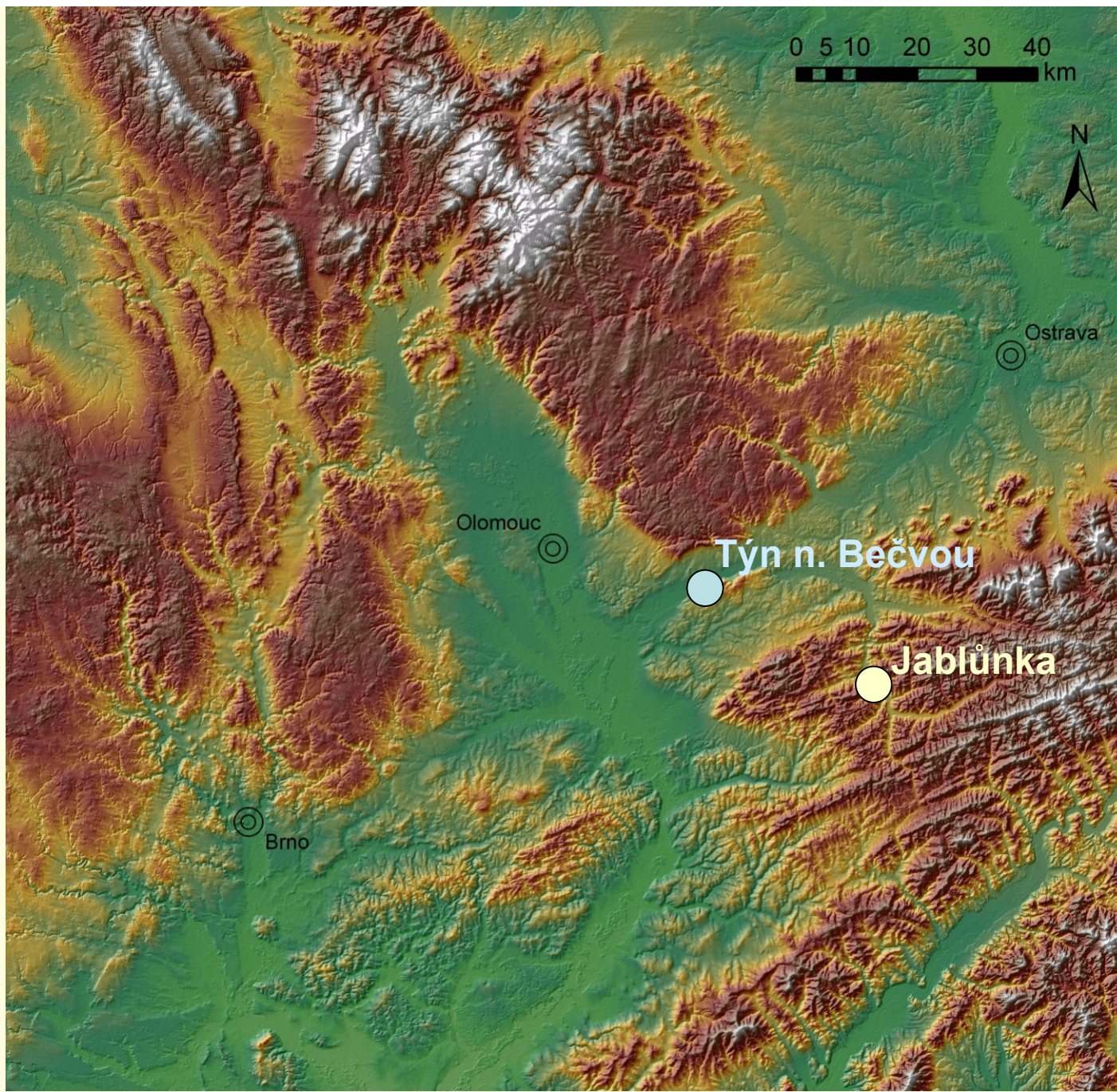


Pollenanalyst: V. Jankovská

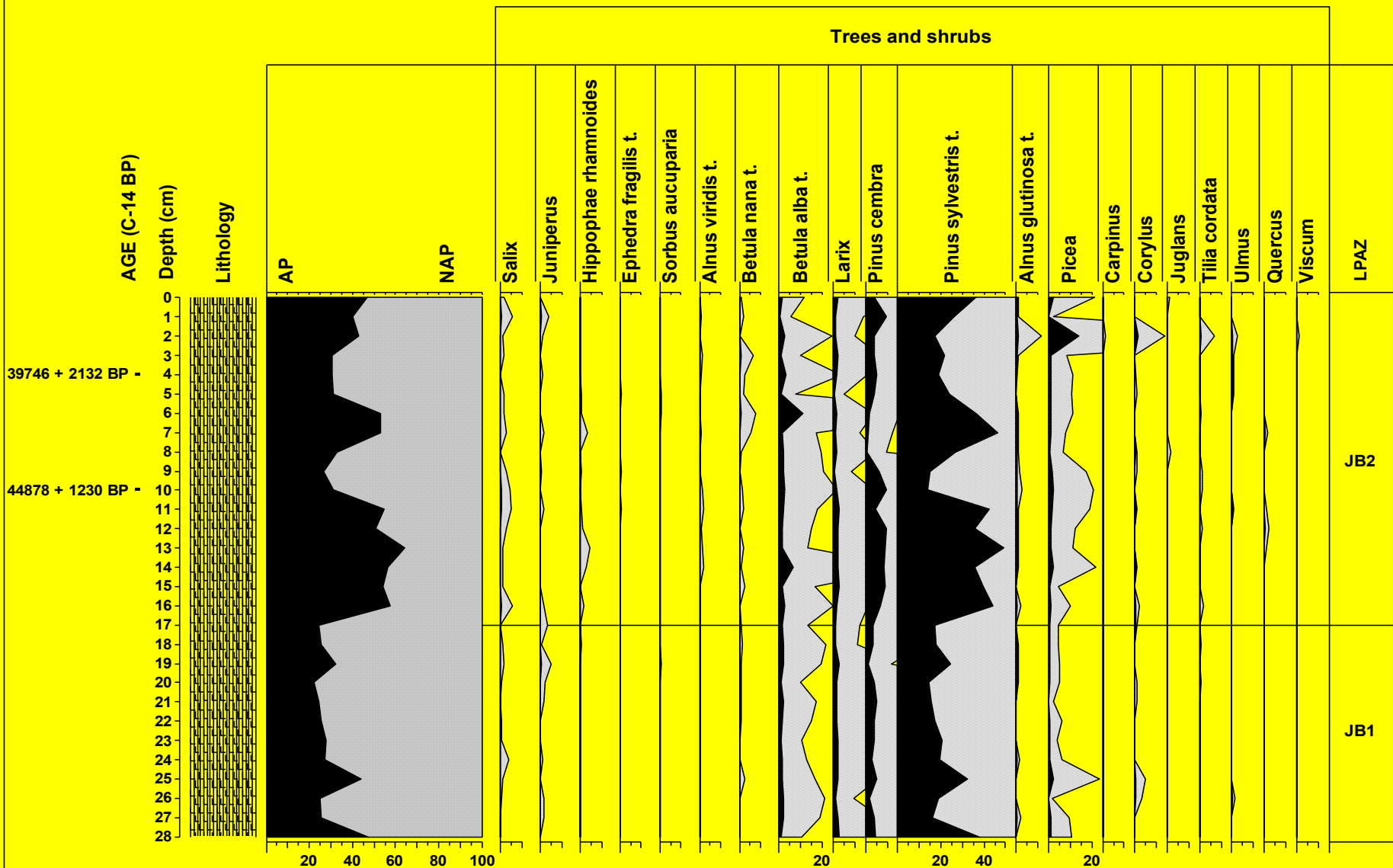
Localization of the two localities in this study on the map of the Czech Republic



Localization of Jablůnka and Týn n. Bečvou



JABLUNKA
 (49°23' N, 17°57' E, 350 m a.s.l.)
 NE MORAVIA, CZECH REPUBLIC
 1.part



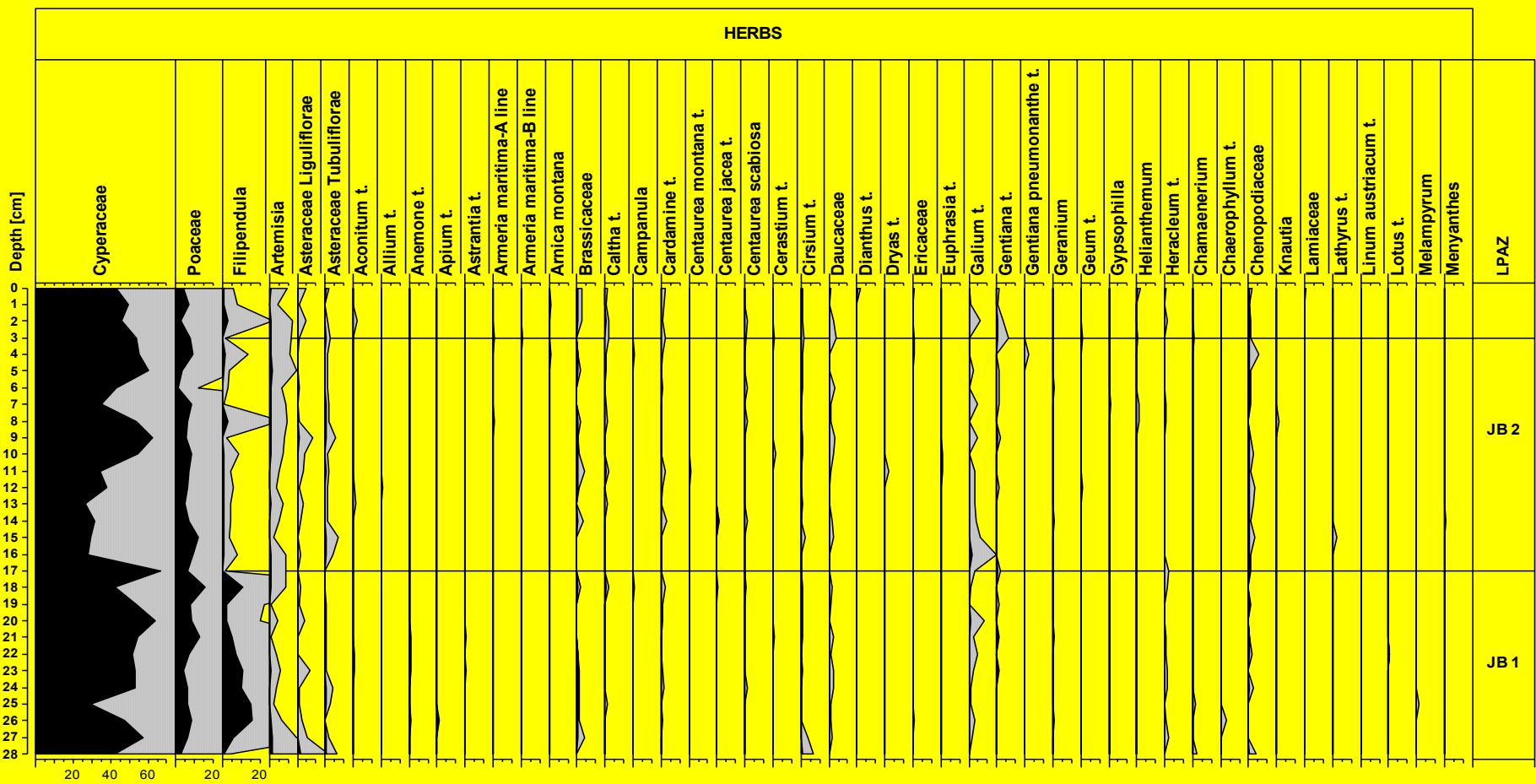
Pollenanalyst: V.Jankovská

JABLUNKA

(49°23' N, 17°57' E, 350 m a.s.l.)

NE MORAVIA, CZECH REPUBLIC

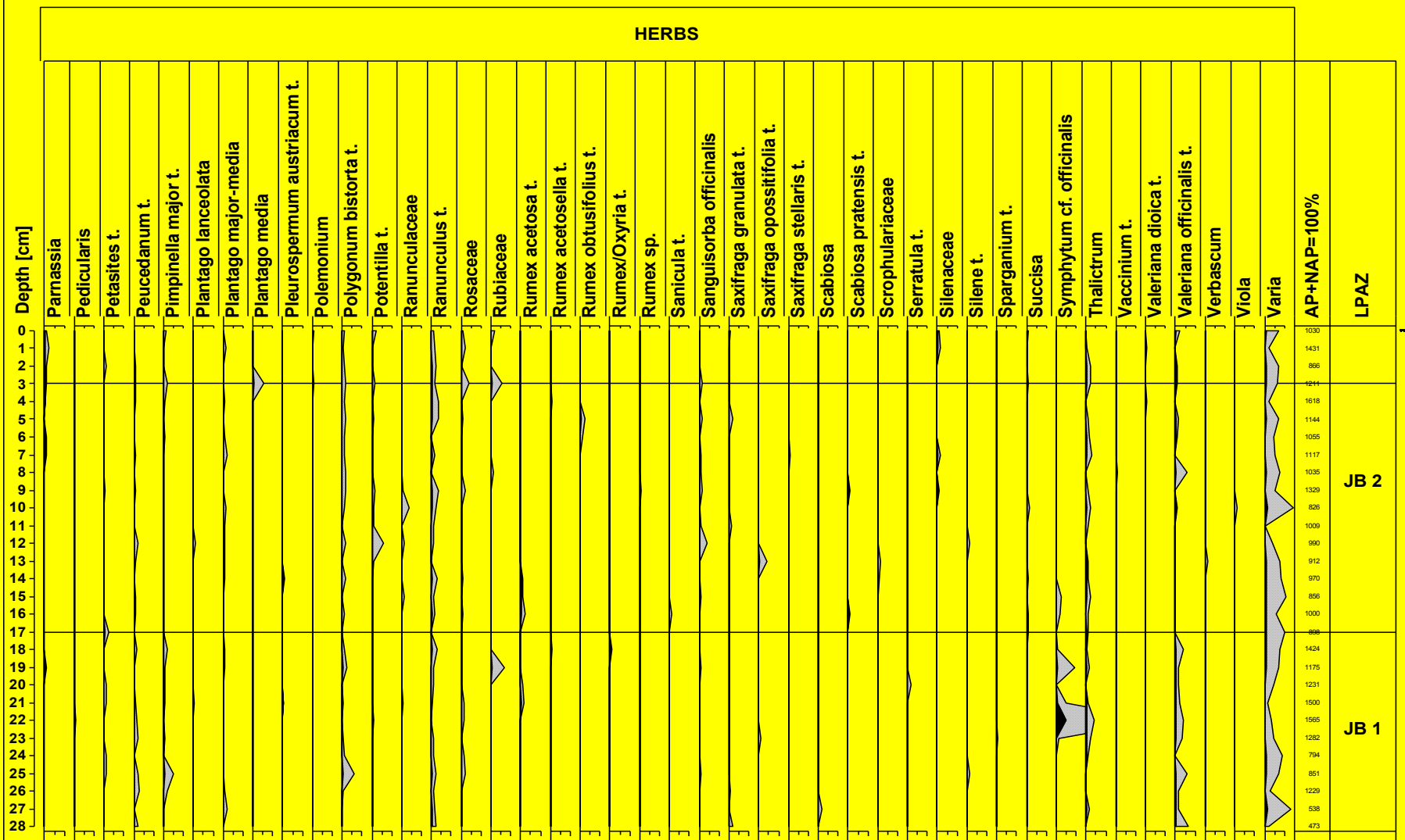
2.part



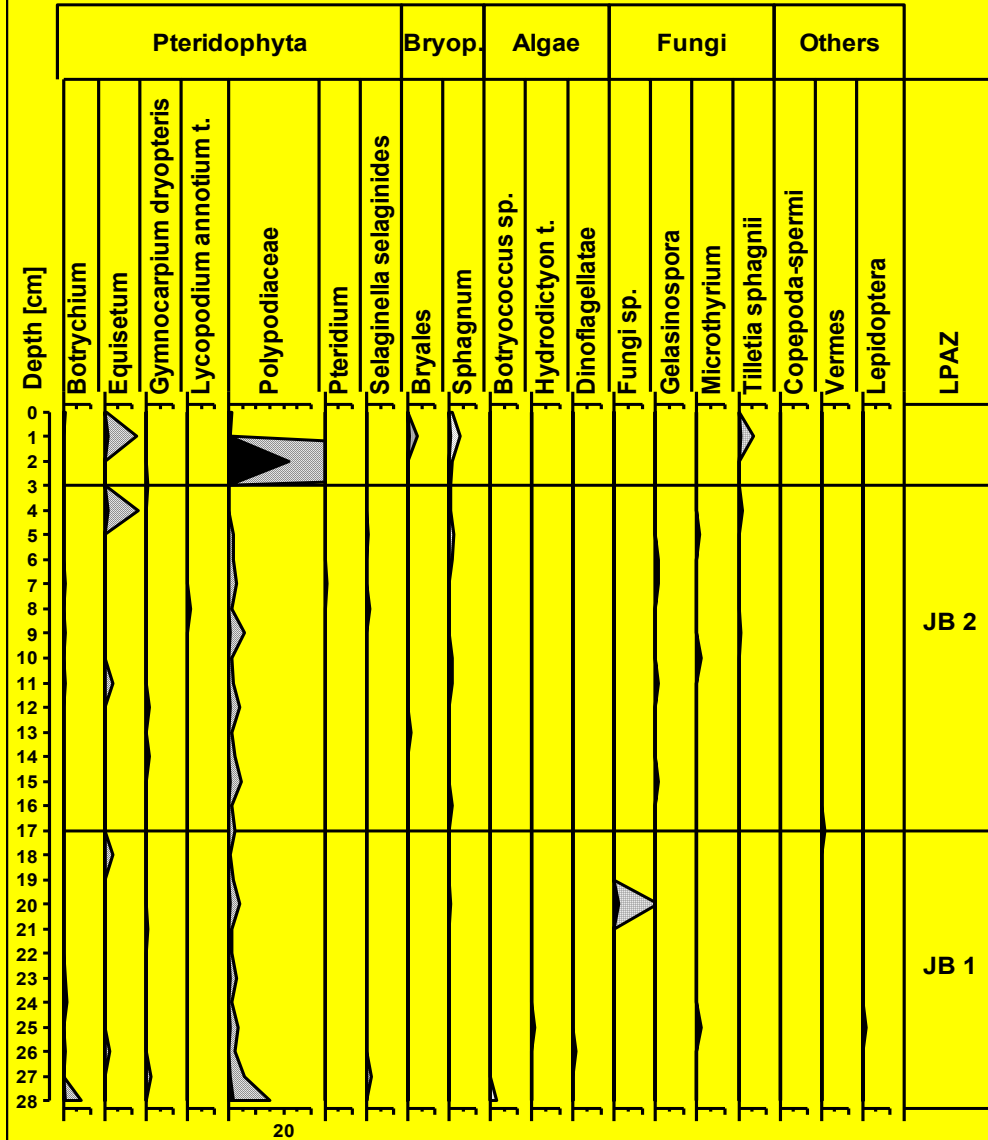
Pollenanalyst: V. Jankovská

JABLUNKA

(49°23' N, 17°57' E, 350 m asl.)

NE MORAVIA, CZECH REPUBLIC**3.part**

JABLUNKA
 (49°23' N, 17°57' E, 350 m asl.)
 NE MORAVIA, CZECH REPUBLIC
 4.part



Pollenanalyst: V. Jankovská

JABLŮNKA (49°23'N; 17°57'E; 350 m asl.), NE Moravia, Czech Republic

Taxon / depth (cm)	1	2	3	4	Taxon / depth (cm)	1	2	3	4
AP					Filipendula	7	15	13	5
Abies	0	1	0	0	Galium type	8	13	15	7
Alnus glutinosa type	6	10	2	0	Glyceria type	15	5	2	2
Alnus viridis type	1	0	3	0	Gentiana	1	1	0	0
Betula alba type	14	42	15	20	Heracleum type	1	0	0	0
Betula nana type	2	2	0	0	Chenopodiaceae	2	1	2	1
Carpinus	2	3	1	0	Lamiaceae	1	0	0	0
Corylus	3	6	2	1	Lychnis type	0	1	1	0
Ephedra fragilis type	0	1	0	0	Melampyrum	0	2	0	0
Fagus	1	1	1	0	Petasites type	0	0	1	0
Fraxinus	1	2	0	0	Plantago major-media	0	1	1	0
Hippophae	0	1	3	0	Plantago lanceolata	0	2	0	0
Juniperus	1	2	0	0	Poaceae	41	76	80	46
Juglans	0	1	0	0	Polygonum bistorta type	1	1	1	2
Larix	7	9	18	2	Polygonum persicaria type	0	0	1	0
Picea	9	26	16	8	Potentilla type	5	1	2	0
Pinus sylvestris type	66	248	33	250	Pulsatilla type	0	0	1	0
Pinus cembra type	15	22	305	86	Ranunculus type	1	0	5	0
Populus	0	1	1	0	Rosaceae	1	9	2	0
Ribes rubrum type	0	0	1	0	Rumex sp.	1	1	0	0
Salix	0	5	2	0	Sanguisorba officinalis	0	1	1	0
Tilia cordata type	1	1	1	0	Symphytum type	1	1	0	0
Ulmus	2	1	1	0	Thalictrum	1	2	1	0
Quercus	1	3	0	0	Urtica	0	15	2	0
Σ AP	132	388	405	367	Valeriana officinalis type	1	2	1	1
AP (Tertiary)					Veratrum type	2	9	1	0
Lygodium	1	0	0	0	Varia	7	15	13	4
					Σ NAP	511	751	740	431
NAP					Σ AP + NAP = 100%	643	1139	1145	798
Ambrosia type	1	2	0	0	Pteridophyta				
Artemisia	4	16	3	4	Equisetum	1	1	1	0
Asteraceae tubuliflorae	6	5	1	1	Gymnocarpium dryopteris	0	2	0	0
Asteraceae liguliflorae	1	4	2	0	Lycopodium annotinum type	0	0	1	0
Brassicaceae	1	1	1	1	Polypodiaceae	2	2	2	0
Caltha type	1	0	0	0	Pteridium	0	0	0	1
Campanula type	1	0	0	1	Selaginella selaginoides	0	1	0	0
Cirsium type	0	0	1	1	Fungi				
Cyperaceae	370	464	540	341	Fungi sp.div.	48	0	10	0
Daucaceae	1	1	1	0	Microthyrium sp.	1	0	0	0

Pollenanalyst: V. Jankovská

Jablůnka sample: 1) twig, C-14 (43.000 ± 2.000 uncal BP [Poz-33846])

2) compact peat, C-14 (35.300 ± 1.800 uncal BP [Poz-33664])

3) peat

4) peat

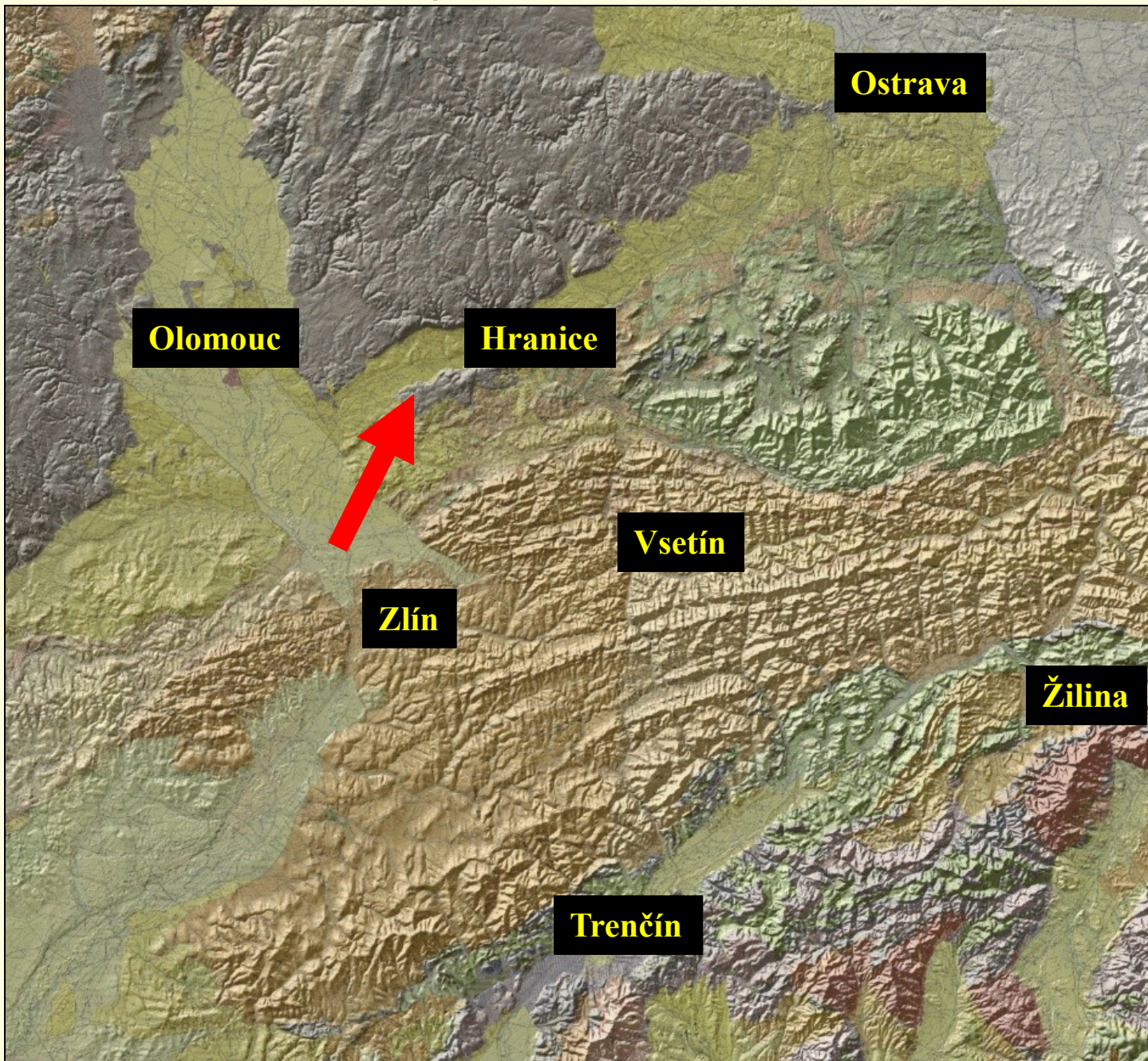
JABLŮNKA (E Moravia, Czech Republic)

[49 23'N; 17 57'E; 350 m a.s.l.]

stratigraphic

<u>Sample</u>	<u>uncalibrated</u>	<u>position</u>	<u>calibrated BP</u>	<u>calibrated BC</u>	<u>Laboratory</u>
peat	39 746 ± 2 132	depth 4 cm	43 830 ± 1 590	41 880 ± 1 590	Erl-5837
peat	44 872 ± 1 230	depth 10 cm	48 090 ± 1 620	46 140 ± 1 620	Erl-4531
compact peat	35 300 ± 1 800	unknown	39 460 ± 2 010	37 510 ± 2 010	Poz-33664
twig	43 000 ± 2 000	unknown	46 510 ± 2 010	44 560 ± 2 040	Poz-33846

Týn nad Bečvou



Palaeoreconstruction of the land slides situation at Týn n. Bečvou (view from SW)



holocén

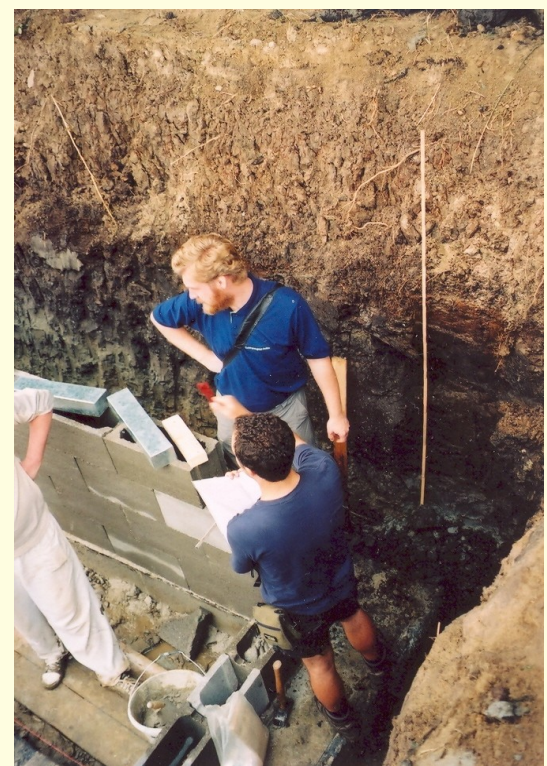
**47460 ± 1720 cal. yr
BP**

- *hluboký polycyklický rotační kerný sesuv;*
- *vznik týlní deprese za rotovanou krou;*
- *dvě odlišitelné fáze pohybu tělesa sesuvu (2 generace týlních depresí);*
- *mezi nimi fáze geliflukce a mělkých sesuvů a ploužení vyplňujících původní deprese klastickými svahovinami*

Orig.: I. Baroň

Týn n. Bečvou [49 30'36,95"N; 17 36'57"E; 370 m a.s.l. NE Moravia – Czech Republic]. Peat sample from the depth of 15 m under soil surface was obtained by the boring of the water well. The rich pollen spectrum with lot of pollen grains of *Pinus cembra* and *Larix* was found. Age of this stone pine-larch taiga was: 44.200 ± 1.400 uncal. BP = 47.460 ± 1.720 cal. BP .

<u>Týn nad Bečvou</u>					
<u>AP</u>		Cyperaceae	357	Succisa	1
<i>Alnus glutinosa</i> t.	2	Daucaceae	1	Symphytum	1
<i>Betula alba</i> t.	47	Ericaceae	2	Thalictrum	3
<i>Ephedra fragilis</i> t.	2	Filipendula	14	Valeriana officinalis	1
		Gentiana t.	1	Vicia t.	1
<i>Picea</i>	7	Geum t.	2	Varia	3
		Heracleum t.	2	Σ IAP	51
<i>Pinus sylvestris</i> t.	452	Chenopodiaceae	1	AP+IAP=100%	800
<i>Tsuga</i> t.	1	Petasites t.	1	<u>Pteridophyta</u>	
Σ AP	749	<i>Pimpinella major</i>	2	Equisetum	7
<u>IAP</u>		<i>Plantago major-media</i> t.	8	<i>Gymnocarpium dryopteris</i>	1
<i>Aconitum</i> t.	4	<i>Pleurospermum austriacum</i>	2	Polypodiaceae	2
<i>Artemisia</i>	26	Poaceae	150	<u>Bryophyta</u>	
Asteraceae liguliflorae	3	<i>Polygonum aviculare</i>	1	Encalypta	2
Asteraceae tubuliflorae	13	<i>Polygonum bistorta</i> t.	4	Sphagnum	7
Brassicaceae	1	<i>Ranunculus</i> t.	4	<u>Fungi</u>	
<i>Campanula</i>	2	Rosaceae	2	Gelasinospora	3
Cardamine t.	1	Rubiaceae	9	<i>Tilletia sphagnii</i>	17
<i>Cirsium</i> t.	1	<i>Sanguisorba officinalis</i>	2		



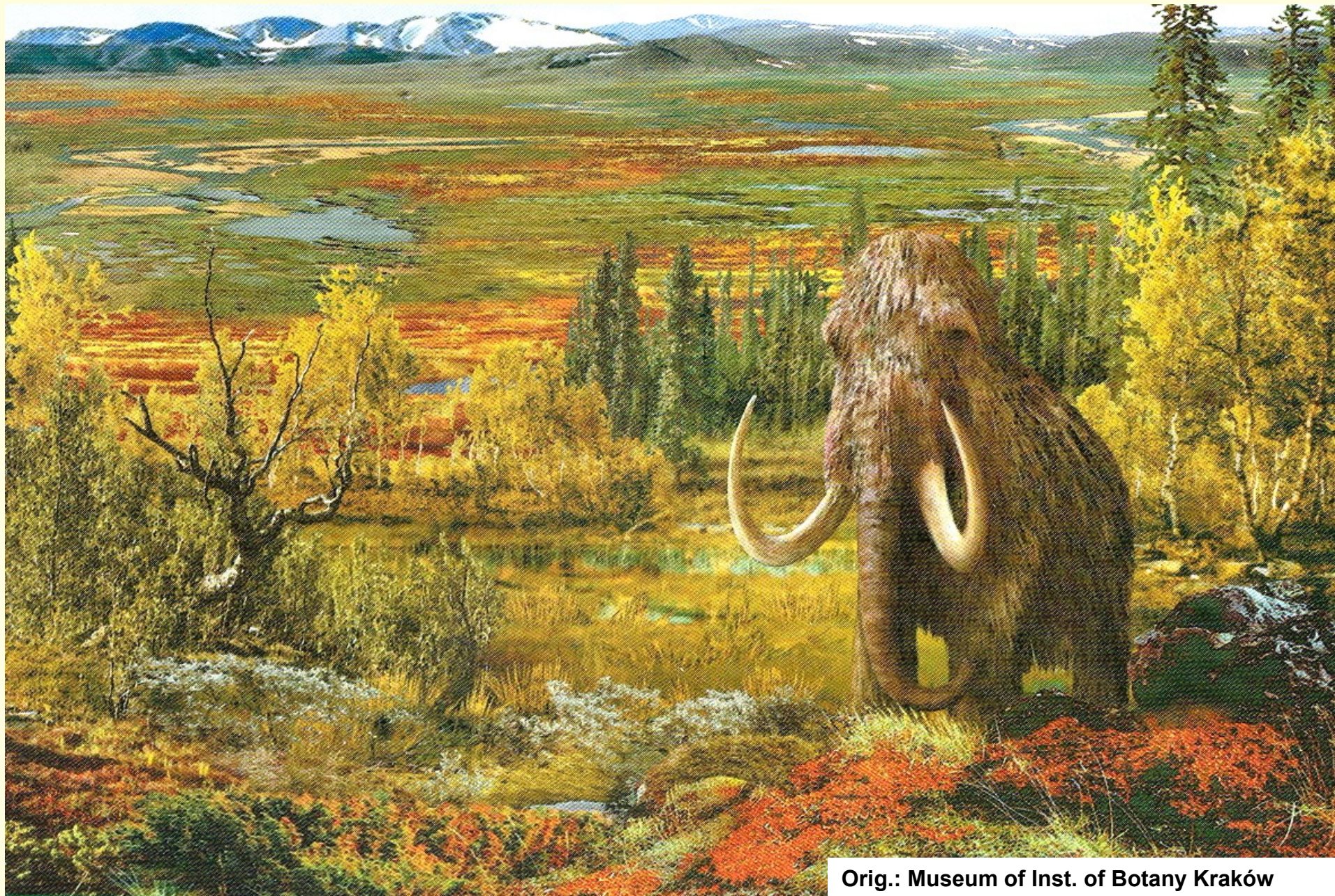
**Týn n. Bečvou – Late
Glacial and Holocene**



Photo: V. Jankovská

Palaeoreconstruction of landscape character during the Middle Pleniglacial.

Transect: Maleník-Moravská brána Gate – Jeseníky Mts.



Orig.: Museum of Inst. of Botany Kraków

TÝN NAD BEČVOU (E Moravia, Czech Republic)

[49 30'36,95"N; 17 36'57"E; 370 m a.s.l.]

Sample	uncalibrated	stratigraphic position	calibrated BP	calibrated BC	Laboratory
		the depth 15 m			
peat	44 200 ± 1 400	under soil surface	47 460 ± 1 720	45 510 ± 1 720	Poz-18738

The age of the sediments from the mentioned Moravian sites goes back mainly to OIS 3 (MIS 3). The climate is characterized as transitory, mildly warm with fluctuations of cold periods of various extent (Musil 2005).

From the archaeological point of view the mentioned character of vegetation occurred in the Moravian territory – the Carpathians, Moravian gate, the Jeseníky mountains – since the beginning to the Middle up to the Upper Palaeolithic. This was the period when human societies of *Homo neanderthalensis* and *Homo sapiens* were meeting in the Central Europe. Both big and minute glacial forest and non - forest fauna was numerous in those times.

For example:

Mammuthus primigenius

Ursus spaeleus

Canis lupus

Coelodonta antiquitatis

Ursus arctos

Gulo gulo

Equus germanicus

Megaloceros

Felix sylvestris

Crocuta spaelea

Bos primigenius

Lepus timidus

Panthera leospaelea

Bison bonasus

Microtus sp. div.

Panthera pardo

Lynx lynx

Lemus sp.div.

The results of the pollen analyses reveal that coniferous taiga was predominant within the region of the Moravian, same as in larger Slovakian Carpathians. It had mostly the aspect of light larch taiga with copiously represented stone pine. Correct evaluation of the occurrence of Scotch pine (*Pinus sylvestris*) is problematic. Its relatively high pollen finds could be influenced also by the fall-out of pollen grains of the dwarf pine (*Pinus mugo*). The different composition of the forest growths in relation with the altitude gradient shall be taken in consideration. In lower altitudes, namely around 350 m a.s.l., both stone pine and Scotch pine were frequent in the larch growths. Also spruce (*Picea*) occurred as an admixture there. Higher altitudes of the Carpathians (and evidently also in the Jeseníky Mts.) could be covered with larch forest-tundra, and also with mountainous tundra on the highest ranges. As a whole, during the Middle Pleniglacial, the Carpathian forests were of the character of the present-day continental Siberian taiga.

Difference was, however, in the probable but very limited occurrence of some climatically more demanding broad-leaved trees (*Tilia* - lime, *Quercus* - oak, *Ulmus* - elm, *Acer* - hornbeam, *Corylus* - hazel) in refugia. Limestone territories could be friendly to them from pedological and geomorphological points of view.

Some photo examples from W Siberia



Polar Ural Mts.- Perevalnoye Lake
Alpine tree limit with *Larix sibirica*

NW Siberia (Noyabrsk):
Northern taiga at polar
circle with *Larix sibirica*,
Pinus sibirica and *Alnus
viridis*



NW Siberia: Polar tree limit in the
forest tundra of the Jamal peninsula
with *Larix sibirica*



NW Siberia-Noyabrsk
region:
Pinus sibirica grows on
permafrost of high
palsas



Photo:V.Jankovská

Examples of present-day *Larix* – *Pinus cembra* stands from Central Europe



Photo: V.Jankovská

Larix at the Rhône Glacier (Switzerland)



Photo: V.Jankovská

„Aletsch Forest“ with *Larix decidua* and *Pinus cembra* at the Aletsch Glacier (Switzerland).

Taiga - forest with the dominate *Pinus sibirica* (*P.cembra*) in the wallely of the Terekhyul riwer (W Siberia)

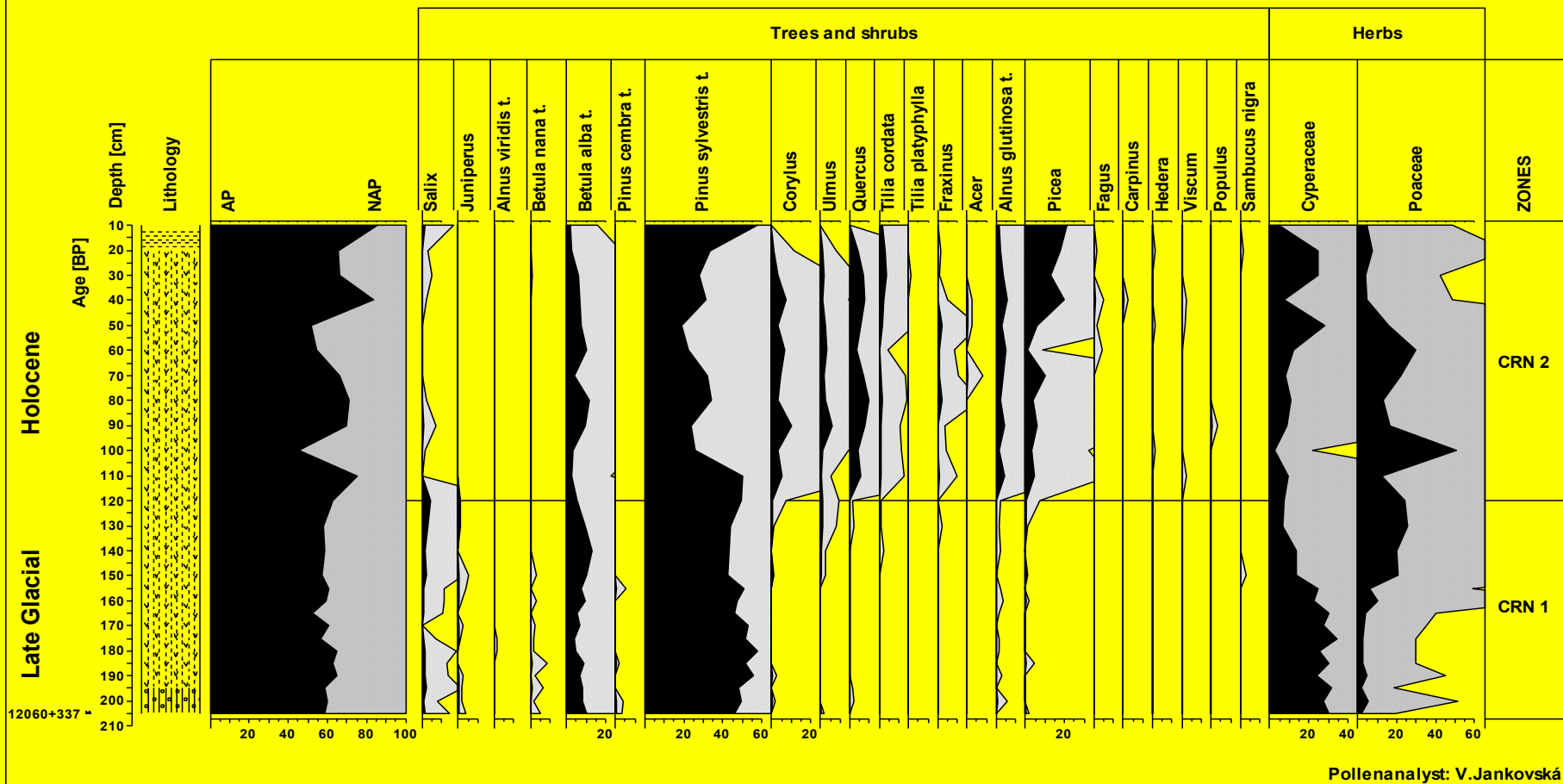


Photo: S.Burkanov

Example of the Late Glacial from Central Moravia (ČERNOVÍR at Olomouc)

Sample	uncalibrated	stratigraphic position	calibrated BP	calibrated BC	Laboratory
<i>Pinus-wood</i>	12 060 ± 337	205 cm	14 240 ± 520	12 290 ± 520	CU-

Černovír (49°37'26" N; 17°16'31" E; 220 m a.s.l.)
Central Moravia, Czech Republic
1.part



Conclusions

In the Last Glacial period – in Middle Pleniglacial of Moravian W Carpathians – prevailed in the study territory coniferous taiga of the different types. During cool phases dominated *Larix*, *Betula*, partly *Pinus cembra* and maybe *Pinus mugo*. In climatically more favourable phases (higher temperature and humidity) there was here a higher presence of *Pinus sylvestris*, *Pinus cembra*, *Picea* and *Alnus*. It isn't excluded very sporadic presence of climatically more demanding deciduous trees, surviving in refuges too.

Prevailing forest communities of different taiga types were passing in to larch – forest tundra with higher altitudes. Mountain tundra was covering, the summit parts of mountain ranges. Along the rivers and brooks were wet meadows and shrubwoods with *Salix*, *Betula*, maybe also with *Hippophaë*, etc.

Thank you for your attention

