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A settlement of the early Eastern Linear Pottery Culture at Moravany (Eastern Slovakia) – Preliminary report on seasons 2004 and 2006

Introduction

The excavations at the Early Neolithic settlement at Moravany (Figs. 1, 2) have been conducted since 2000 within the framework of the tripartite agreement between the Institute of Archaeology, Jagiellonian University in Kraków, the Institute of Archaeology, Slovakian Academy of Sciences and the Philosophical Faculty of Prešov University (Kaczanowska *et al.* 2002; 2003; Kalicki *et al.* 2004; 2005; Kozłowski *et al.* 2003; Nowak *et al.* 2006). The spatial extent of the excavations during field seasons 2004 and 2006 was relatively moderate when comparing to the previous campaigns (Fig. 3). On the other hand, the main point of research activity at that time was to conduct and finish a number of chronological, palaeoenvironmental and palaeoeconomical analyses.

Archaeological data

In the central part of the settlement a new excavation unit was opened (*sonda* M) (Fig. 4). Three anthropogenic features were identified in this unit: 1/06, 2/06, and 3/06. The first one belongs to the scarcely represented group of the largest pits, like 3/2001 and 10/01 (Nowak *et al.* 2006, 318). Only the western part of the feature 1/06 has been explored to date; the maximal length of the longer axis amounts over 4 m, whereas maximal width amounts ca. 4.2 m. The oval pits 2/06 and 3/06 are much smaller, ca. 60 cm length and 40 cm width. We can hypothesize that they both constitute the lowermost parts of the post-holes. All foregoing features are characterised by the grey-black clayey filling. Pits 2/06 and 3/06 were practically empty as regards archaeological materials whereas in feature 1/06 almost 1000 sherds and *ca.* 200 obsidian artefacts were found, not to mention several hundred daub fragments.

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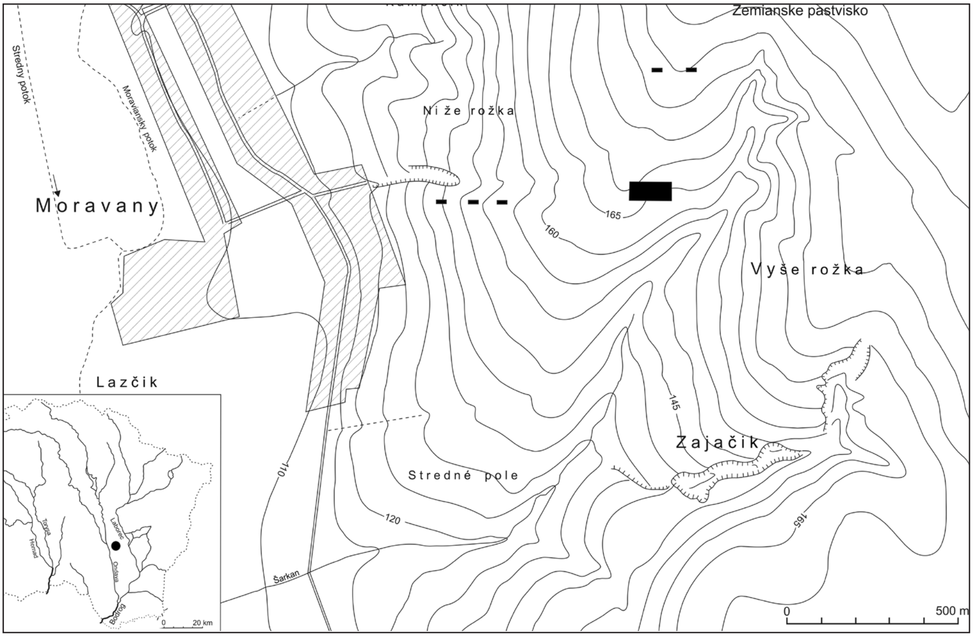


Fig. 1. Location of site at Moravany (black rectangle) and trial trenches (small black rectangles)

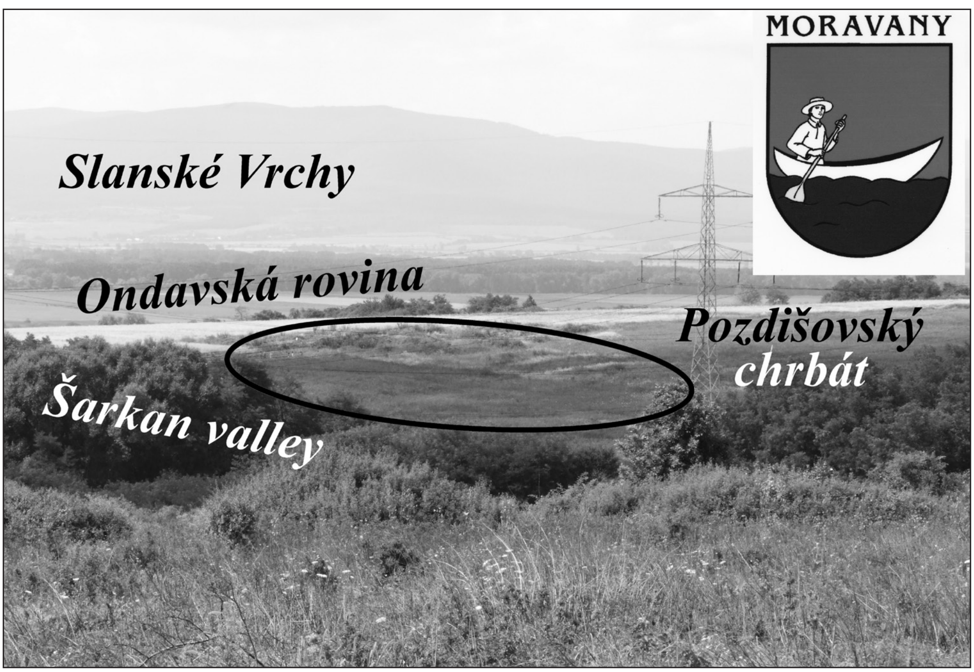


Fig. 2. A view of the site at Moravany from Southeast; black line encircles an approximate extent of the site

Pottery and lithics were of the same type as those discovered in previous seasons (Nowak *et al.* 2006: 319–331).

In the easternmost section of the settlement, next to the feature 1/98, that was extremely rich in archaeological findings, one excavation unit was explored (*sonda* K). Surprisingly enough, it turned out that it contained no anthropogenic structures and almost no archaeological material. The only significant finding was Late Medieval pit, which was full of large fragments of pottery.

Chronology

As to the absolute chronology, we obtained 29 ^{14}C dates from anthropogenic features and organic temper of pottery (Kozłowski *et al.* 2003; Kalicki *et al.* 2004; in print). The simple sum of all dates gives the range of 6000–4600 BC for two sigma probability and of 5650–5050 BC for one sigma probability (Table 1). The first one is totally impossible to acknowledge, both in reference to the beginning and end of the Early Neolithic in Eastern Slovakian Lowland. The second one is more probable, although in our opinion the date of 5650 BC seems to be still too early, especially when compared with the dates from neighbouring regions (Horváth, Hertelendi 1994; Hertelendi *et al.* 1995), pottery stylistics, and characteristics of lithic industry. Another factors like: possible contamination of the dated samples by older charcoal discovered in clayey layers the anthropogenic pits were dug into, as well as "old-wood problem" also contribute to our scepticism as regards such an early dating. In brief, the date of 5500 BC seems to be the most accurate as to the dawn of the Neolithic in the Eastern Slovakian Lowland. The most recent dates (around 5000 BC) seem also to be inappropriate, i.e. they are too late. We think that in such a case we should point at the fact that majority of late dates were obtained from organic temper of the pottery. It is widely known that datings of the kind give usually "broad" results (Gomes, Vega 1999; Stäuble 1995). Thus, it is our belief that the end of the early phase of Eastern Linear Pottery Culture in Eastern Slovakian Lowland and the disappearance

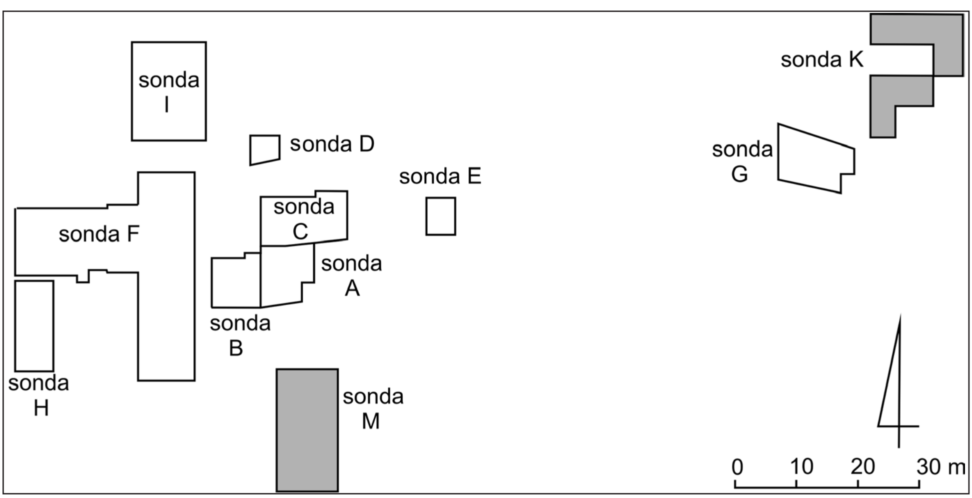


Fig. 3. Moravany. General distribution of excavation blocks within the site. Grey units refer to the blocks excavated in seasons 2004 and 2006

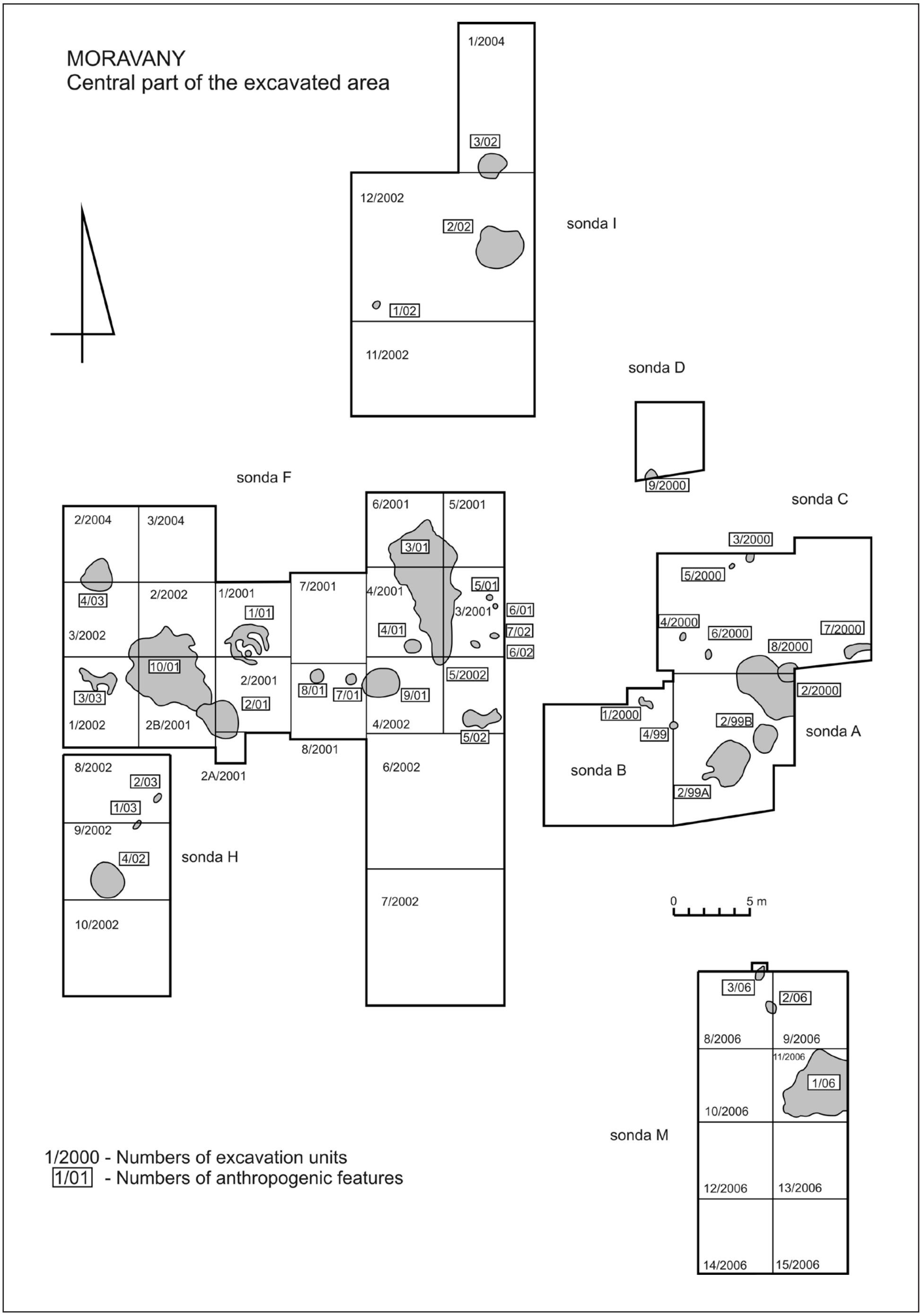


Fig. 4. Moravany. Distribution of excavation units and features in the central part of the site

of the settlement at Moravany should be placed roughly at 5300/5200 BC.

All these data make it possible to correct the chronological sequence of the Neolithic in the Eastern Slovakian Lowland that was established in the 1980s by the late Stanislav Šiška (1989). According to his work, the Neolithic period began with the so-called Kopčany group; it is part of the Eastern Linear Pottery Culture. As Šiška did not have radiocarbon dates, he could not establish the absolute chronology of this group. He only constructed a scheme of relative chronology, comparing the Kopčany group with an older phase of the Alföld Linear Pottery *(sensu stricto)* in the Great Hungarian Plain *(ibid.)*. Now it is obvious that the beginning of the Kopčany group should

Table 1. Radiocarbon dates from the settlement at Moravany

Sample No.	Age BP	Sample	Feature or excavation unit No.	Depth
Ki-9247	6990±110	charcoal	2/99A	85 cm
Ki-10372	6940±60	charcoal	3/01	75 cm
Ki-10374	6910±60	charcoal	3/01	85 cm
Ki-11152	6580±70	charcoal	10/01	65 cm
Ki-9249	6570±120	charcoal	2/99B	67 cm
Ki-10375	6570±60	charcoal	3/01	85 cm
Ki-11149	6520±80	charcoal	3/01	75 cm
Ki-11733	6520±80	pottery	2/99A	65 cm
Ki-11730	6510±90	pottery	3/01	65 cm
Ki-11782	6460±90	pottery	1/98	65 cm
Poz-12243	6400±40	charcoal	2/01	90 cm
Ki-11732	6360±90	pottery	2/01	75 cm
Ki-10373	6340±60	charcoal	3/01	85 cm
Ki-11148	6310±70	charcoal	3/01	75 cm
Ki-10370	6280±60	charcoal	2/01	55 cm
Ki-11737	6280±100	pottery	3/01	65 cm
Ki-11783	6280±100	pottery	3/01	55 cm
Ki-11150	6270±70	charcoal	3/01	75 cm
Ki-9251	6250±300	charcoal	*sonda* C	60 cm
Ki-10371	6250±60	charcoal	2/01	75 cm
Ki-11731	6230±90	pottery	3/01	55 cm
Ki-11734	6220±100	pottery	2/01	75 cm
Ki-11151	6190±70	charcoal	10/01	65 cm
Poz-12250	6180±40	charcoal	2/01	94 cm
Ki-11736	6140±100	pottery	2/01	65 cm
Ki-11738	5970±90	pottery	1/98	55 cm
Ki-11740	5880±120	pottery	2/01	65 cm
Ki-11739	5430±120	pottery	2/99A	55 cm
Sum (OxCal 3.10) 68.2% probability 5650 BC (68.2%) 5050 BC 95.4% probability 6000 BC (95.4%) 4600 BC				

be placed earlier. In other words, its early stage, the so-called proto-Kopčany group, developed partly alongside the Szatmár group in the Hungarian Plain, at least from 5500 BC.

Archaeobotany

In the last years a number of palaeobotanical samples from the anthropogenic features were examined and among the group of macroremains only charcoal were presented, except of one grain fragment of Cerealia indet. Nevertheless, the agricultural character of the Neolithic settlement was previously confirmed by the presence of cereals: emmer wheat *Triticum dicoccon,* einkorn wheat *Triticum monococcum* and barley *Hordeum vulgare.* Both wheat species were probably cultivated together whereas barley was cultivated separately. Furthermore, it is considered that the fields used for cereal cultivation were probably of small size. Results of geomorphological analyses support this hypothesis because no distinct traces of erosional processes were recorded around the site (Nowak *et al.* 2006).

The charcoals were found dispersed within the pits. A recovery process consisted of a flotation method with the use of 1.2 mm and 0.2 mm meshes. The number of fragments in pits varies and comes from the artificial archaeological layers of 10 cm each. There were samples coming from 3 pits: 1/06, 2/06 and 3/06. Among them, only one feature was characterized by the abundance of charcoal: 1/06 (Table 2). It should be emphasized that the charcoal material is very scarce. As an example can be used the pit 1/06 from which 24 samples of sediments (10 litres each bag) were taken and only 413 small charcoal fragments were found.

The archaeological context has a great importance in the interpretation of charcoal assemblage. The human groups have used the woody species for different purposes (fuelwood, construction, tools, etc.) and for that reason, the charcoal in the excavated area can be found in two distinct forms:

Table 2. Moravany. Absolute frequency of taxa in charcoal assemblage obtained in 2006 season

MORAVANY – 2006	1/06			2/06		3/06		Σ
TAXA	65-55 CM	45-55 CM	35-45 CM	45-55	35-45	45-55	35-45	
ACER SP.	1	1	0	0	0	1	0	**3**
BETULA SP.	0	0	0	3	2	0	0	**5**
CARPINUS BETULUS	2	0	0	0	0	0	0	**2**
CORYLUS AVELLANA	5	0	0	0	0	0	0	**5**
FAGUS SYLVATICA	4	4	0	1	0	0	0	**9**
FRAXINUS EXCELSIOR	67	50	27	0	1	6	5	**156**
QUERCUS SP. DECIDOUOS	66	75	28	5	16	2	4	**196**
ROSACEAE/MALOIDEAE	4	1	0	0	0	0	0	**5**
SAMBUCUS SP.	0	0	0	0	0	0	1	**1**
SALIX SP./*POPULUS* SP.	0	2	0	0	0	0	0	**2**
ULMUS SP.	9	7	1	0	0	0	0	**17**
DICOTYLEDONS	33	21	5	2	6	0	5	**72**
CONIFERS	0	0	0	0	0	1	1	**2**
INDETERMINABLE	0	0	0	0	0	1	0	**1**
CHARCOAL FRAGMENTS Σ	**191**	**161**	**61**	**11**	**25**	**11**	**16**	**476**
MINIMUM NUMBER OF SPECIES	**9**	**7**	**3**	**3**	**3**	**3**	**3**	

associated directly to archaeological structures and scattered in the archaeological layers.

The charcoal related to archaeological structures (posts, graves, funerary fires, hearths, pottery kilns, burnt layers, wooden tools, etc.) gives mainly palaeoethnographic information. This kind of charcoal assemblages usually offers low diversity of species connected with short-term or punctual usage. It is possibly characterized by stronger wood selection (Badal 1990; 1992; Ntinou 2002). The charcoal found as dispersed within archaeological layers can have a palaeoecological meaning because it reflects the remains of different uses of the wood. That kind of dispersed charcoal mostly comes from domestic fuelwood, thus it can provide the specific sample of local woody vegetation. Nevertheless, its environmental interpretation depends only on a long-term usage of woody species. It has been observed that a fuelwood data coming from hearths showed limited amount of taxa due to its punctual usage and the presence of last burnt species. Meanwhile, the dispersed charcoal as a sum of many hearths' remains reflects a long period and its results indicate a diversity of taxa that were presented in the closest area (Smart, Hoffman 1988; Badal 1990; Chabal 1997; Ntinou 2002; Carrión 2005). Some archaeological structures such as pits that lost theirs primary function can have also the same characteristics as charcoal dispersed within the deposits (Badal 1990).

A functional interpretation of the pit 1/06 is not obvious and several possible alternatives have been considered. Independently of the original function of the structures, their filing is characteristic for natural depositional processes. Therefore, the charcoal mostly would have come from a cleaning of domestic fireplace or/and constitutes some remains of burnt constructions. Pits 2/06 and 3/06 probably correspond to the lowermost parts of the post-holes and a scarceness of taxa is documented.

The charcoal fragments were examined in the laboratory for the botanical determinations. Each fragment is the observation unit (Badal 1990; 1992; Chabal 1990; 1997) and it is usually broken manually along the three wood anatomical sections (transversal, longitudinal tangential and longitudinal radial). The fragments were then observed microscopically using a reflected light microscope with light and dark fields. Detailed information was supported by observing some samples by Scanning Electron Microscope Hitachi S-4100. Microphotographs were taken using the EMIP 3.0 (Electron Microscope Image Processing) software. Identifications were made by comparison with anatomical atlases (Greguss 1955; 1959; Jacquiot 1955; Jacquiot *et al.* 1973; Schweingruber 1982, 1990) and specimens coming from a modern reference collection.

The charcoals from Moravany are generally badly preserved because the anatomical structure is incrusted with sediments' particles and the cellular walls are melted. The preservation state together with small size of the charcoal caused the presence of indeterminable fragments and a great amount of fragments belonging to dicotyledonous group. Among the latter group also many fragments of curl wood are encountered that show very irregular anatomical structure (Schweingruber 1982).

The palaeoflora documented in 476 charcoal fragments presents 11 taxa. A list of the taxa from the charcoal assemblages is presented in Table 2. The identified taxa both represent conifers and dicotyledonous group, but among the conifers there are only two fragments. Among dicotyledons, one taxon is identified to subfamily (Maloideae), six to genus: *Acer* sp. (Fig. 5:1–2), *Betula* sp., *Quercus* sp. deciduous (Fig. 6:4), *Sambucus* sp., *Salix* sp. vel *Populus* sp. and *Ulmus* sp. (Fig. 6:5–6) and four to species: *Carpinus betulus* (Fig. 5:3–4), *Corylus avellana* (Fig. 5:5–6), *Fagus sylvatica* (Fig. 6:1–2) and *Fraxinus excelsior* (Fig. 6:3). Absolute number of fragments was applied as a quantification method (Badal 1992; Chabal 1990; 1997; Ntinou 2002; Lityńska-Zając, Wasylikowa 2005).

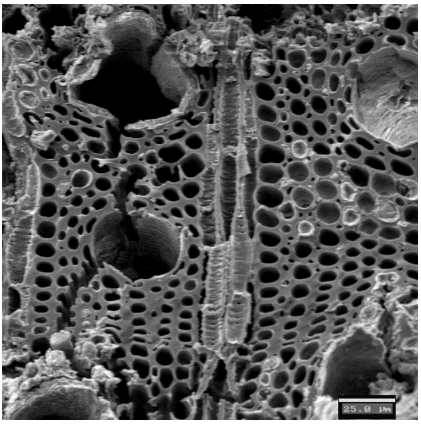
It is noticed that the diversity of taxa is directly related to the number of fragments examined, and thus is why the more reliable and representative results comes from the feature 1/06. First of all, it can be seen that along this features' depth in general there are no qualitative differences. In the pit 1/06 prevail oak and ash accompanied by elm. Other taxa as Rosaceae, beech, birch, hazel, hornbeam, poplar and/or willow, are represented only by single specimens (Table 2). The rest of the features are characterized by the presence of four identified taxa: in the pit 2/06 there are oak, birch, beech and ash, whereas in the pit 3/06 oak and ash are accompanied by maple and Prunoideae. The most frequent taxa presented in the charcoal assemblages usually indicate their real abundance in the site's proximity because the most frequent categories are found easier in the archaeological assemblage (Smart, Hoffman 1988; Ntinou 2002).

In previous seasons the charcoal also were analyzed. It can be observed (Table 3) that the same taxa as oak, ash and elm are predominant. Moreover, in the charcoal assemblages three new taxa that complete the image of a local vegetation were found: *Carpinus betulus, Corylus avellana* and *Salix* sp. vel *Populus* sp. Furthermore, the pit 1/06 is the most differentiated one according to the minimum number of species (comp. Tables 2 and 3).

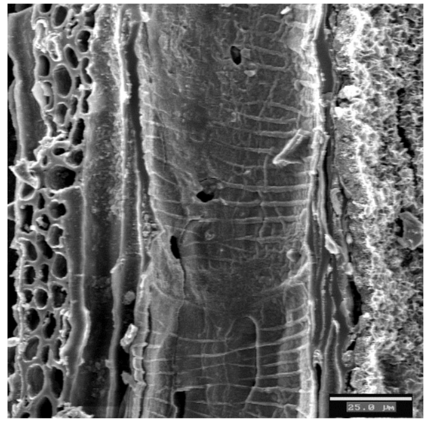
Moravany site is located in the proximity of the Ondava Plain at an altitude of 170 m a.s.l., in the edge of the western slope of Pozdišovský Ridge (max. 228 m a.s.l.) (Kozłowski *et al.* 2003). Thus the site is in the colline belt that is characterized by the presence of deciduous or mixed deciduous woodland. The charcoal assemblage from Moravany seems to correspond to the vegetation connected with mixed deciduous forest. The ecological requirements of all taxa indicate an average annual precipitation of minimum 500 mm without any drought season. In rich soils thoroughout the entire colline area, that constitutes the site's proximity, in deciduous forest could have predominated different oaks species accompanied by elm, ashe, beech, maple and hornbeam, whereas poplar and/or willow could have been found rather in the riverine areas. *Corylus avellana* could have form part of the understorey of deciduous and mixed deciduous forests. Ubiquitous and light-demanding species of *Betula* could have also appeared within these formations. This taxon is also a pioneer tree.

The Eastern Slovakian Lowlands now are characterized by subcontinental climate, with an average annual temperature of 8–9ºC and average precipitation from 600 mm. The natural potential vegetation in Moravany region is characterized by the development of elm floodplain forests *(Ulmenion)* composed mostly of elms and oaks. In the proximity of the rivers appears the community of the willow-poplar floodplain forest *(Salicion albae)*, while in the hilly areas there are other plant communities such as lowland hygrophilous oak-hornbeam forest *(Querco robori-Carpinetum)* and others oak or oak-hornbeam forest *(Potentillo albae-Quercion, Carici pilosae-Carpinetum)* (Maglocký 2002).

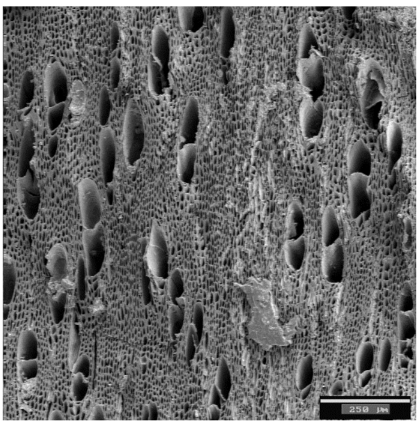
The Ondava Plain region unfortunately lacks of any published palynological data as well as no charcoal analysis is known (Rybníčková, Rybníček 1996). The closest contemporaneous charcoal assemblage (the



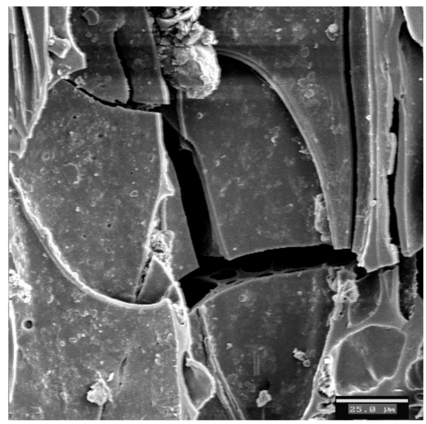
1. *Acer* sp. Transversal section



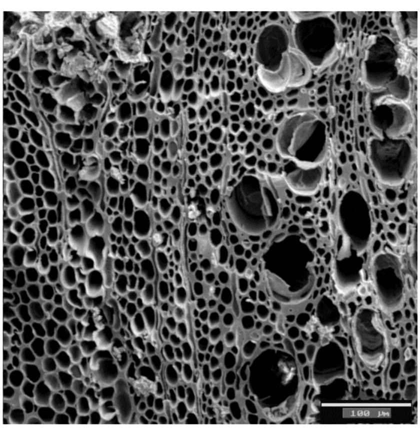
2. *Acer* sp. Longitudinal radial section



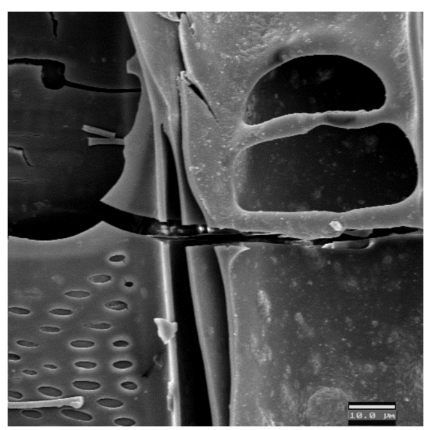
3. *Carpinus betulus* Transversal section



4. *C. betulus* Longitudinal radial section

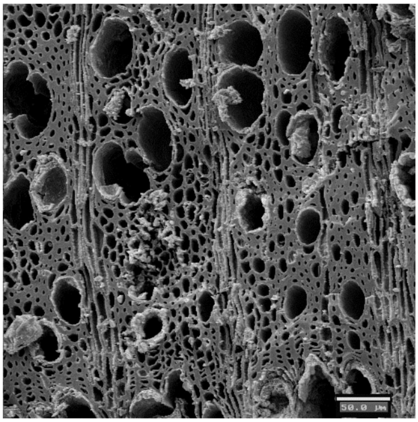


5. *Corylus avellana* Transversal section

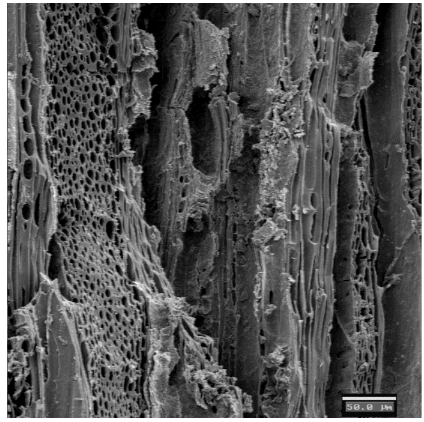


6. *C. avellana* Longitudinal radial section

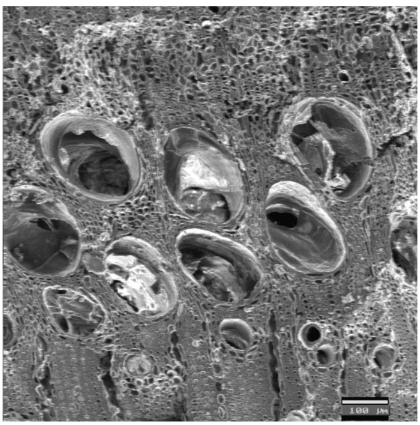
Fig. 5. Moravany. SEM micrographs of taxa documented in charcoal assemblage



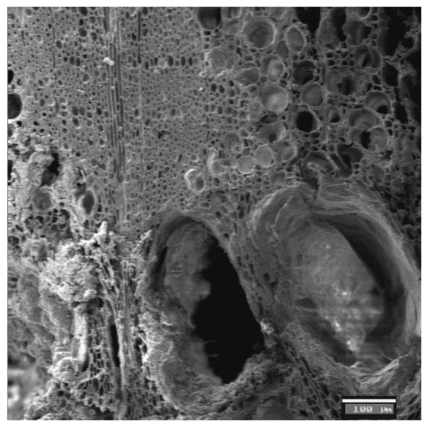
1. *Fagus sylvatica* Transversal section



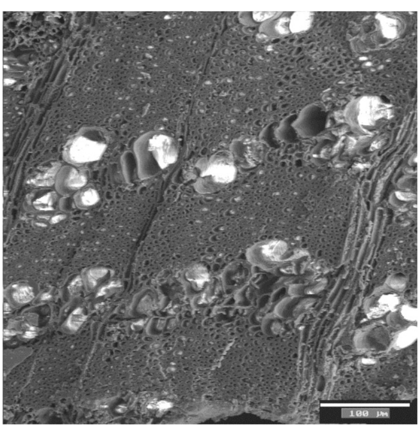
2. *F. sylvatica* Longitudinal tangential section



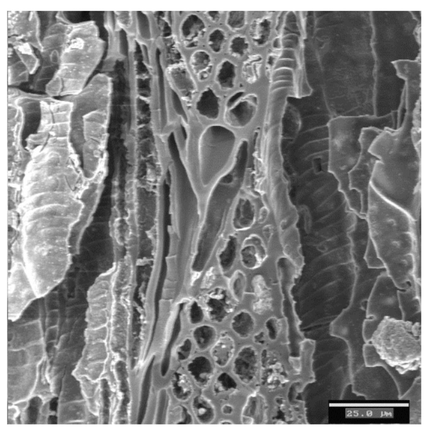
3. *Fraxinus excelsior* Transversal section



4. *Quercus* sp. deciduous Transversal section



5. *Ulmus* sp. Transversal section



6. *Ulmus* sp. Longitudinal radial section

Fig. 6. Moravany. SEM micrographs of taxa documented in charcoal assemblage

older phase of Linear Pottery Culture) were found in south-western Slovakia (Blatné and Štrky). Among the taxa *Quercus* sp., *Fraxinus* sp. and *Acer* sp. were found (Hajnalová, Hajnalová 2005).

All of the taxa documented in Moravany were well settled already in the Atlantic period (Huntley, Birks 1983; Bennett *et al.* 1991; Willis *et al.* 2000; Ralska-Jasiewiczowa *et al.* 2004). The most interesting

Table 3. Moravany. Absolute frequency of taxa in charcoal assemblage obtained before 2006 season

Taxa/Pits	2/99 A	2/99 B	4/99	2/00	3/00	9/00	1/01	2/01	3/01	7/01	9/01	10/01	2/02	3/02	4/02	Σ
Picea/ Larix									1					2		**3**
Pinus sylvestris		7				1		1								**9**
Coniferous		16				4								3		**23**
Acer sp.								4	8							**12**
Alnus sp.							4									**4**
Betula sp.		8				1	1									**10**
Fagus sylvatica		1										17				**18**
cf. *Fagus sylvatica*												3				**3**
Fraxinus excelsior					2		2	269	128							**401**
cf. *Fraxinus excelsior*								10	2							**12**
Quercus sp. *deciduous*			4		4		11	105	309	10	4	157			1	**605**
cf. *Quercus*								6	12	2	1					**21**
Sambucus sp.									3			10				**13**
cf. Prunoideae									20							**20**
Ulmus sp.				41			1	12	49							**103**
cf. *Ulmus*								12	17							**29**
Dicotyledons							23	68	94	5	2	10				**202**
Indeterminable	5	2			12	1	4	45	41	41	1	1	1			**154**
Charcoal fragments Σ	**5**	**34**	**4**	**41**	**18**	**7**	**46**	**532**	**684**	**58**	**8**	**198**	**1**	**5**	**1**	**1662**
Minimum Number of Species		**3**	**1**	**1**	**2**	**2**	**4**	**5**	**7**	**1**	**1**	**3**		**1**	**1**	

finding from Moravany is the early presence of the charcoals of *Fagus sylvatica* and *Carpinus betulus*, nevertheless ultimately due to new data their early spread along the Holocene not only in the Central Europe but also in the Mediterranean region is indicated (Svobodová *et al.* 2001; Ralska-Jasiewiczowa *et al.* 2004; Delhon, Thiébault 2005). In north-eastern Hungary in the palynological data, *Fagus* and *Carpinus* were also detected in the Atlantic period. Moreover, *Fagus* was also detected in early Holocene stage or even in the final period of the late Glacial and *Carpinus betulus* was recorded in the full Glacial in the Great Hungarian Plain (Gardner 2002; 2005; Willis *et al.* 1995; Willis *et al.* 2000). From the Atlantic period in the south-western part of Slovakia some charcoal fragments of *Fagus sylvatica* (Borovce and Šturovo) were also found in the sites of the younger phase of Linear Pottery culture (Hajnalová, Hajnalová 2005). In the interpretation of palynological data there is always the possibility of long-distance pollen transport; nevertheless the finding *in situ* of charcoal fragments can prove the presence of these taxa in the region. Certainly AMS dating is needed[7].

In the Atlantic period in south-western Slovakia and north-eastern Hungary also the great development of mixed deciduous forest dominated by oaks was documented (Krippel 1971; Willis *et al.* 1998; 2000; Gardner 2002; 2005; Hajnalová, Hajnalová 2005). The closest analogy of vegetation of Moravany can be found in the eastern part of Slovakia (Vihorlat Mountains). E. Krippel (1971) analyzed a few sites which showed the history of the vegetation since Late Pleistocene. Nevertheless, only two of them present the results of the Atlantic period (Vinné I, II and Hypkaňa). In the Late Pleistocene there were mostly *Pinus, Betula* and *Salix* documented, but since the beginning of the Holocene various deciduous taxa were presented: *Ulmus, Quercus, Tilia, Alnus, Acer, Fraxinus* and *Corylus.* In the Atlantic period, also appeared *Carpinus,* while *Fagus* was detected since the second phase of that period.

The analogy can be found in the results from the Bátorliget marsch that is situated in the Nyírseg depression and the Sirok-Nyírseg-tó pit bog located in the Mátra uplands. The pollen data from the Bátorliget marsch indicate that in the postglacial period the mixed deciduous woodland start to replace the mainly coniferous forest and between ca. 8500 and ca. 6050 cal BP the dominant tree became *Quercus* accompanied by *Tilia, Ulmus, Alnus, Betula, Carpinus orientalis, Corylus* and *Fagus.* Some coniferous trees such as *Pinus, Abies,* and *Picea* still existed. In the early Atlantic period, traces of the first anthropogenic activity were detected (Willis *et al.* 1995). According to the results related to the Atlantic period from the Sirok-Nyírseg-tó pit bog (2 zones dated between 8300-5200 cal BP) the initial dominance of mixed deciduous forest and later of deciduous one can be observed. The most important components belonged to *Quercus, Corylus, C. betulus, Ulmus* and *Tilia* (Gardner 2002; 2005).

Palaeogeographical research

Many kinds of environmental research were carried out at the site of Moravany as well as around the site in the seasons 2004 and 2006 (Kalicki *et al.* 2005; 2007). Data obtained in borings and outcrops situated across the Šarkan valley, in its alluvial fan and in the Ondava flood plain are of the utmost importance with reference to the reconstruction of the geomorphological history of the area.

[7] AMS datings of beech and hornbeam charcoals, made after 2006, indicated much younger age than Neolithic (Lityńska-Zając *et al.* 2008).

As to the Šarkan valley (Fig. 7), the discovery of black clays in the top layers of Tertiary sediments is one of the most important ones. They are probably buried soils, only partly preserved at the margin of the valley, on its slopes. They were dated at 19,890±120 BP (Poz-6322). The bottom of the valley is filled with silts with numerous charcoals and vegetational macroremnants. Some layers with a sandy-gravel admixture could be distinguished inside this silty member, 3 metres thick. These deposits, on different levels, reflected the channel changes during the filling of the valley.

The analysis of floral macroremnants in the fluvial sediments of the Šarkan creek points to a rather homogeneous and uncharacteristic vegetation. It consisted mainly of herbaceous plants of widespread occurrence (Table 4). The predominant ones were *Scirpus, Urtica, Rumex, Polygonum, Chenopodium, Sambucus, Scleranthus* and other that testify to a relatively cold climate in the period of sediment accumulation. There is no significant variety of species of palaeobotanical macroremnants in the profile. Only its upper part contains a clearly larger number of seeds of *Scirpus sylvaticus* and *Urtica dioica,* with the maximum of several hundreds of specimens.

The number of macroremnants is significantly correlated with the suite of sediments. In the floor layer of the alluvium that fills the valley (depth 3.08 – 2.84 m, samples no. 31–29) as well as in the layers of coarse-grained sediments (depth 2.15 – 1.14 m, samples no. 20 – 9) the amount of floral detritus is considerably reduced and the number of represented species is twice lower. This phenomenon can be observed best at the depth of 1.68 – 1.75 m (sample no. 15), where only three species were discovered and where they are represented only by a few specimens. These sediments, moreover, contain the highest number of sharp-edged quartz grains (SiO_2), which are particularly numerous in the floor layer at the depth of 2.92 – 3.08 m. Apart from them, also longer (a few millimetres long), prism-like fragments are present. The phases of rapid accumulation of coarse river-bed sediments were interspersed with phases of stability and steady sedimentation of fine-grained sediments that included a large amount of floral detritus containing remnants of the highest number of species.

The fossil flora is the most varied at the depth of 3.16 – 3.08 (sample no. 32), 2.84 – 2.15 (samples no. 28 – 21) and 0.75 – 0.00 m (samples no. 8 – 1). At these levels, it contains almost twice as many species, with fragments and macroremnants of some species of trees and bushes such as *Juniperus communis* (seeds), fragments of the Pinaceae, *Swida sanquinea,* as well as *Ranunculus linqua, R. repens, Chelidonium majus, Hypericum perforatum.* Also, more fruits and seeds of other species can be found there.

Radiocarbon dating and archaeobotanical analyses helped us to establish the aftermath of events caused by climatic fluctuations and human impact (Fig. 7). Thanks to four AMS-radiocarbon datings (Poz-10271: 146.4±-0.3 pMC; Poz-10272: 250±35 BP; Poz-10273: 145±35 BP; Poz-10274: 154.2±-0.3 pMC), we know that the alluvia of the valley are much younger than Neolithic. In other words, there are no traces of the activity of Neolithic people or these traces were destroyed in the younger periods. The rate of accumulation was different. There were two phases of quick accumulation. Šarkan's alluvial fan, covering the margin of the Ondava flood plain, is also very young because charcoals from the limit between its sediments and the Tertiary bedrock were dated at 365±30 BP (1450-1630 cal AD for two sigma probability) (Poz-6323).

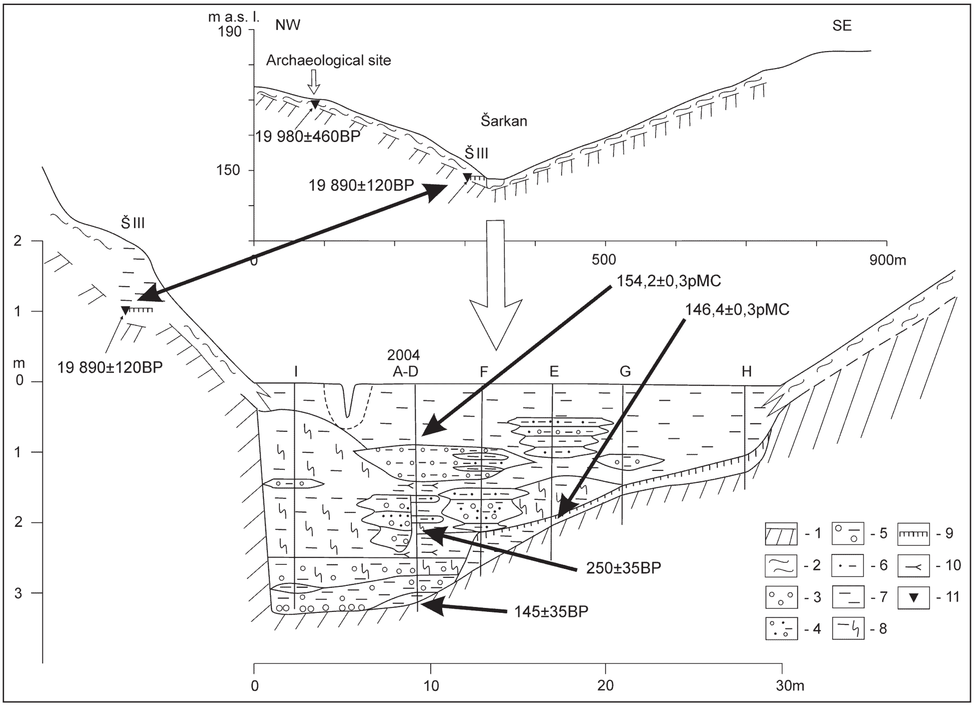


Fig. 7. Moravany. Section across the Šarkan valley.

1 – Tertiary clays, 2 – slope deposits (deluvia), 3 – gravels, 4 – sandy gravels with silts, 5 – silty gravels, 6 – sandy silts, 7 – silts, 8 – organic silts, 9 – buried soils, 10 – detritus, 11 – radiocarbon datings

To sum up, we can distinguish five main stages of the development of the valley during which the perennial creek turned into an episodic creek:

1) In the Last Pleniglacial it was a periglacial valley deeply incised in the basement.

2) For most of the Holocene it was also a deep valley with a perennial creek (this inference resolves the problem of water supply for the Neolithic settlement).

3) The filling processes began in the Little Ice Age. Originally, deposits were transported to the alluvial fan, as suggested by the date pointing to the fifteenth-seventeenth century AD.

4) The accumulation of alluvial filling of the valley itself (ca. 1 m thick), which at times went at an extremely high rate, started after the Maunder minimum (1675–1715 AD).

5) Two present-day dates, the low number of plant taxa as well as the small amount of detritus at the depth of 2.15–1.14 m indicate extremely strong slope erosion caused by human activity in the last decades and further flash flood infilling of the valley; most probably it was caused by the collectivization following the Second World War, when the previously separate fields were joined and the balks between them disappeared. The final stage of the development is a dry valley with a braided alluvial plain and episodic creek.

As to the research within the Ondava flood plain, it must be emphasized from the very start that the recent Ondava river course is very young and was established in consequence of the regulation and channelization of the river bed in the nineteenth and twentieth century. Before the nineteenth century the course of the Ondava was extremely unstable. In fact, usually there was no single course; the Ondava was an anastomosing river, divided into at least several meandering branches, as can be seen in historical records. Besides, almost every spring the whole plain was flooded to a significant degree. This is also evident based on historical data; for example on the original name of Moravany (Murva – which refers to wet or boggy place) and on Moravany's eighteenth-century coat-of-arms (Fig. 2). The same phenomena took place in prehistoric periods. For instance, sections and borings across the flood plain, made during our research, show an older meandering belt, much closer to the eastern slope of the valley. It could be active during the Early Neolithic. Besides, the profiles with buried soils occur in the valley bottom near the study area as well as those with black oaks and animal bones. Radiocarbon dating of all these elements will hopefully decipher its precise chronological setting.

Conclusions

Research and analyses carried out in period 2004–2006 have provided further data that contribute to a better understanding of life of the Early Neolithic community inhabiting the settlement at Moravany. In particular, they allow a more precise estimate of the chronological position of the settlement, the natural context, as well as the ways of utilizing the environment.

All obtained absolute dates, along with the typological premises give rise to a lifetime of the settlement between ca. 5500 and 5300/5200 BC. Therefore, it turns out that the beginnings of the Neolithic Age in the Eastern Slovakian Lowland were about 100/200 years earlier than previously thought. Anthracological data indicate that the natural habitat of the village were deciduous or mixed deciduous woodlands, just as in the neighboring territories. However, the issue of the age of beech and hornbeam charcoals found in anthropogenic features remains to be explained (through AMS dating). Palaeogeographical studies led to detailed reconstruction of the history of the small stream Šarkan valley, adjacent to the archaeological site. Interestingly enough, it did not record traces of Early Neolithic human impact on the environment, which probably reflects the real situation. This is in line with the results of other studies which also suggest low level of environmental transformation caused by the first Neolithic groups in the Balkan Peninsula and in the Carpathian Basin. The question for further research is to reconstruct a detailed chronology of the Ondava river valley adjacent to the settlement, including exact age of palaeochannels and fossil soils discovered in the course of the project.

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Table 4. Moravany. Flora macroremnants in the Šarkan profile (sample nos. – see text); om – very numerous remains, above 100 pieces

№	Flora	Sample number											
		32	31	30	29	28	27	26	25	24	23	22	21
1	Pinaceae gen.										+		
2	*Juniperus communis* L.					1		1					
3	*Scirpus sylvaticus* L.	1	2	4	5	4				3			
4	*Carex* subg. *Vignea*	6		1									
5	*Carex* subg. *Carex*	2											
6	*Urtica dioica* L.				3	12	1			12	3		
7	*Rumex acetosella* L.							2	1			1	52
8	*Rumex* sp. 1	2				5	3	6	7	11	7	5	1
9	*Rumex* sp. 2					3		1					
10	*Polygonum* sp.						+			+	2		
11	*Chenopodium album* L.				+		1	3		3	2		
12	*Moehringia trinervia* (L.) Clairv.		1					2	1			1	
13	Caryophyllaceae gen. 1	6	3	2	6	6	8	10	4	9	11	10	
14	Caryophyllaceae gen. 2	2	1	2	1								
15	*Ranunculus linqua* L.	1									1		
16	*R. repens* L.	1						2	1		1		
17	*Chelidonium majus* L.										2	+	
18	*Rubus* spp.							1	+	+	+		
19	*Potentilla* sp.	1											
20	*Prunus spinosa* L.												
21	Fabaceae gen.							1	2		1	1	
22	*Hypericum perforatum* L.									1	1		
23	*Viola* sp.			2	1				1	2			
24	*Swida sanquinea* (L.) Opiz							3				+	
25	*Stachys* sp.							2					
26	*Lycopus europaeus* L.								1				
27	Lamiaceae gen.												
28	*Sambucus racemosa* L.					1	1	3	5	6	3	1	2
29	*Cirsium palustre* L.					+							
30	*Sclerantus annuus* L.	+	+	+	1	10	2	11	11	9	2	+	2
31	*Geum* cf. *rivale* L.					22					1		
32	Bidens tripartitus L.												

Table 4. Continuation

	Sample number																			
№	**20**	**19**	**18**	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1																				
2																				
3	1	4	9		7	1	4	6	22	31	3		1	om	om	om	om	67	om	31
4				+						1			2							
5			+																	
6			1		1		1		2	1			1	78	om	65	13	3	23	14
7								1												
8		2		1	4	1			6	3	1		1	2		1				
9		1																		
10										2										
11			1				1	1	4	1		2	6		2				2	+
12		1	1											1						
13	1	+	3	+	7		2	3	2	8	2			39	3			1	+	2
14																				
15																				
16																				
17										2										
18							1									1				
19																				
20										1					1					
21													3	1						
22	1										1									
23										+										
24																				
25														1						
26								1	1											
27																				1
28		1			3	+	2		4	3	1	1	2					6	2	
29							1	1												
30			1		2		+	3	+	1				1			1		+	1
31																				
32			1																	

Osada wczesnej fazy kultury wschodniej ceramiki linearnej w Moravanach (wschodnia Słowacja) – wstępny raport z badań w sezonach 2004 i 2006

W sezonach 2004 i 2006 kontynuowano badania na osadzie wczesnej fazy kultury wschodniej ceramiki linearnej w miejscowości Moravany (okres Michalovce). Wykopaliska archeologiczne miały ograniczony wymiar przestrzenny w porównaniu z poprzednimi sezonami (ryc. 3, 4), ponieważ pierwszoplanowe znaczenie w latach 2004 – 2006 miało zrealizowanie programu analiz paleoekonomicznych, paleośrodowiskowych i chronologicznych.

Analizom archeobotanicznym poddano przede wszystkim liczne szczątki węgli drzewnych, pozyskane w wypełnisku kilku obiektów (tabela 2). Pozwoliły one zidentyfikować 11 taksonów. Są wśród nich zarówno drzewa iglaste, jak i liściaste. Wśród tych ostatnich dwa taksony oznaczone zostały do poziomu podrodziny (*Maloideae,* cf. *Prunoideae*), pięć do rodzaju (*Acer* sp. – ryc. 5:1 – 2; *Betula* sp.; *Quercus* sp.; *Salix* sp. vel *Populus* sp.; *Ulmus* sp. – ryc. 6:5 – 6) i cztery do gatunku (*Carpinus betulus* – ryc. 5:3 – 4; *Corylus avellana* – ryc. 5:5 – 6; *Fagus sylvatica* – ryc. 6:1 – 2; *Fraxinus excelsior* – ryc. 6:3). Stwierdzone relacje pomiędzy taksonami odpowiadają w przybliżeniu danym archeobotanicznym i – przede wszystkim – palinologicznym uzyskanym dotąd dla okresu atlantyckiego w północno-wschodniej części Kotliny Karpackiej.

W zakresie badań geologicznych i geomorfologicznych szczególne znaczenie przypisać należy kolejnym danym pochodzącym z dolinki niewielkiego cieku Šarkan. Wiemy obecnie, iż u schyłku plejstocenu zmiany klimatyczne spowodowały transformację procesów morfogenetycznych, co doprowadziło do pogłębienia doliny o ok. 4 m i wykształcenia V-kształtnej dolinki erozyjnej. Później w jej dnie zostały złożone osady o miąższości rzędu 3 m, wskutek czego zmienił się jej profil poprzeczny i współcześnie jest to dolinka płaskodenna bez stałego cieku, który ginie w aluwiach. Dzięki czterem datom AMS (Poz-10271: 146.4±-0.3 pMC; Poz-10272: 250±35 BP; Poz-10273: 145±35 BP; Poz-10274: 154.2±-0.3 pMC) wiemy, że aluwia w dnie doliny są w całości młodsze od neolitu, co dobrze koreluje z wiekiem stożka napływowego potoku Šarkan, złożonego na skraju równiny zalewowej Ondavy (Poz-6323: 365±30 BP). Można zatem wyróżnić 5 zasadniczych etapów rozwoju dolinki potoku Šarkan: 1) silne przemodelowywanie zboczy dolinki peryglacjalnej, prawdopodobnie suchej, w zimnym klimacie maksimum ostatniego zlodowacenia, 2) głębokie rozcięcie dna dolinki peryglacjalnej przez stały ciek i powstanie V-kształtnego wciosu, 3) holoceński etap funkcjonowania głębokiej doliny ze stałym ciekiem wodnym (co rozwiązywało problem zaopatrzenia w wodę osady wczesnoneolitycznej), 4) etap powolnej akumulacji aluwiów, początkowo na stożku napływowym, a później także w dnie doliny (formowanie stożka rozpoczęło się w okresie tzw. małej epoki lodowej, natomiast akumulacja aluwialnego wypełnienia samej dolinki, momentami bardzo gwałtowna, rozpoczęła się po tzw. minimum Maundnera – 1675 – 1715 AD – i do ok. połowy XX wieku osiągnęła ona miąższość rzędu 1 m), 5) etap wyjątkowo silnej erozji i dostawy ze stoków, wywołany ludzką działalnością w ostatnich dziesięcioleciach, co spowodowało wypełnienie dolinki osadami o miąższości ok. 2 m.

W latach 2004 – 2006 uzyskano 14 kolejnych dat radiowęglowych. W połączeniu z datami absolutnymi uzyskanymi uprzednio oraz z przesłankami typologicznymi daje to podstawy do wydatowania osady na okres pomiędzy ok. 5500 a 5300/5200 BC.

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