Abstract

Here we summarize the results of the research project focused on palaeogeographical and archaeological characteristics of early Neolithic settlement at Moravany (eastern Slovakia). The material culture and radiocarbon dating indicate that the inhabitants of this settlement belonged to the first wave of Neolithic farmers in the Eastern Slovakian Lowland. The settlement lasted for at least 100–200 years, within the period of 5,500–5,200/5,100 cal. BC. Although it was a relatively stable village, no traces of human activities have been found in the sediments of the surrounding areas, similarly to other early Neolithic settlements in the Carpathian Basin. The most plausible cultural hypothesis is that the settlement at Moravany was founded by a population who apparently descended from the tradition of the Körös-Cris culture.

Key words: pottery, lithics, geoarchaeology, palaeogeography, archaeobotany

INTRODUCTION

The earliest Neolithic in the upper Tisza basin is documented by an archaeological phenomenon called either the Eastern Linear Pottery culture or the Alföld Linear Pottery culture (Alföldi Vonaldiszes Kerámia – AVK) (Kalicz and Makkay, 1977; Šiška, 1989; Kozlowski (ed.), 1997) which is slightly similar to the Western Linear Pottery Culture (Linearbandkeramik – LBK). Its beginning is dated to 5,600/5,500 cal. BC. The basic cultural patterns of the AVK societies had their roots in the first Neolithic cultures of the southeastern Europe, defined as the First Temperate Neolithic (FTN), that lasted from ca. 6,300 to 5,300 cal BC. The north-eastern branch of the FTN, the Körös-Cris culture, was the most important in transmitting the Neolithic socio-economic patterns to the north and northeast.
The discovery of a new AVK settlement at Moravany in 1998 provided the opportunity to increase our knowledge concerning the early Neolithic of the upper Tisza basin. The first trial excavations were undertaken in the same year. The results turned out to be very promising and therefore we initiated an interdisciplinary research project. Since 2000 the joint investigations were conducted 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. Together with field campaigns, a number of archaeological, palaeoenvironmental and palaeoeconomic analyses were executed (Kaczanowska et al., 2002, 2003; Kalicki et al., 2004; 2005; Kozłowski et al., 2003; Nowak et al., 2006).

LOCATION AND PRESENT-DAY ENVIRONMENTAL SETTING

The site (N 48°44′15″, E 21°48′06″) is located in the Eastern-Slovakian Lowland (Fig. 1) on the western slope of the tectonic horst known as the Pozdišovský Range testifying to a small scale uplift (Figs 2, 3). This range of N–S direction is an elevation between two depressions: the Ondava Plain on the west and the Laborec Plain on the east. The Sarmatian (Kochanovce formation) and the Lower Pannonian (Sečovce formation) clays built this elevation. The Quaternary cover of slope deposits is irregular and very thin. This is no surprise whereas radiocarbon datings from the alluvial and buried soil indicate that intensive slope movements occurred in the study area during the maximum of last glaciation (Kalicki et al., 2004). The deposits are very homogeneous silts (Mz = 6.3–6.7, badly sorted (ä = 1.6–1.7) (Fig. 4). Only the southern part of the Pozdišovský Range, 5 km southward from the site, is covered with loess. The Quaternary alluvia of the Ondava, Topľa and Laborec rivers fill the depressions (Baňacký et al., 1987).

The site is situated at the altitude of 163 m a.s.l., about 60 m above the Ondava flood plain, and is limited in the south by a small, dry valley of the Šarkan creek (Fig. 2). This is a periglacial valley incised in the local bedrock (Kvitkovič, 1980). Interestingly, the excavated settlement has an atypical topographical position since early Neolithic sites tend to concentrate in the lower part of the local relief (Gillings, 1997; Kosse, 1979; Shiel, 1997; Sümegi, 2004).

The climate of this region is warm (mean temperature of July 8–9 °C; 50 or more days with daily maximum air temperature above 25 °C annually on average), moderately dry (mean annual precipitation about 600 mm) with cool winters (mean temperature of January below 3 °C) (Lapin et al., 2002). The Ondava and Topľa rivers have a rain-snow combined type of run-off regime with flood during March and minimum discharges during September (Šimo and Zatko, 2002).
Early Neolithic in the Upper Tisza Basin

Fig. 2. Location of the early Neolithic site at Moravany (black rectangle) and trial trenches (small black rectangles)

Fig. 3. View of the early Neolithic site at Moravany. Red line encircles an approximate extent of the site. Slanské Vrchy – Slanské Mountains, Ondavská rovina – Ondava plain, Pozdišovský chrbát – Pozdišovský Range
Eutric to dystric planosols and (luvic-, albic-) stagnosols from colluvial deposits with very low content of humus in topsoil occur on the Pozdišovský Range, whereas rich in humus (above 2.3%) eutric fluvisols associated with gleyic and arenic eutric fluvisols from non-carbonate fluvial sediments dominate on the surrounding plains (Bielek, 2002; Šály and Šurina, 2002).
Past-reconstructed vegetation should have in the highest areas of the Pozdišovský Range oak forest cover with *Potentilla alba*, and in the lowest slopes – lowland hygrophilous oak and hornbeam forests. Elm floodplain forests and willow-poplar floodplain forests probably existed along the rivers of Ondava and Topľa (Maglocký, 2002).

**PALAEOGEOGRAPHICAL STUDIES AROUND THE SITE**

Palaeogeographical studies were carried out in the archaeological site as well as in the neighbouring territory (Kalicki *et al.*, 2005, 2010). 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 in reference to the reconstruction of the geomorphological history of the area.

The discovery of black clays in the top layers of Tertiary sediments in the Šarkan valley (Fig. 5) indicates that buried soils were partly preserved on the slopes along the margins of the valley. They were dated at 19,890±120 BP (Poz-6322). The bottom of the valley is filled with silts with numerous charcoal specks and plant macroremnants. Several layers with a sandy-gravel admixture could be distinguished in this 3 metres thick silty member. These deposits, at different levels, reflected the channel changes during the infilling of the valley.

The analysis of floral macroremnants in the fluvial sediments of the Šarkan creek (Kalicki *et al.*, 2010) points to a rather homogeneous and uncharacteristic vegetation. It consisted mainly of herbaceous plants of widespread occurrence. The predominant ones were *Scirpus*, *Urtica*, *Rumex*, *Polygonum*, *Chenopodium*, *Sambucus*, *Scleranthus* and others that testify to a relatively cold cli-
mate in the period of sediment accumulation. There is no significant variety of species in the profile. The number of macroremnants is significantly correlated with the suite of the deposits. In the floor layer of the alluvium that fills the valley (depth 3.08–2.84 m) as well as in the layers of coarse-grained sediments (depth 2.15–1.14 m) the amount of floral detritus is considerably reduced and the number of represented species is twice as lower as in the earlier deposits. This phenomenon is best observed at the depth of 1.68–1.75 m where only three species were discovered represented by only a few specimens. Moreover, these sediments contain the highest number of sharp-edged quartz grains (SiO₂), which are particularly numerous in the floor layer at the depth of 3.08–2.92 m. In addition, also longer (a few millimetres long), prism-like fragments are present. The fossil flora is the most varied at the depth of 3.16–3.08, 2.84–2.15, and 0.75–0.0 m. These levels contain, *inter alia*, Juniperus communis (seeds), fragments of the Pinaceae, *Swida sanquinea*, as well as Ras-nunculus lingua, *R. repens*, Chelidonium majus, *Hypericum perforatum*. In sum, 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 reflecting high number of species.

Radiocarbon dating and archaeobotanical analyses helped us to establish the aftermath of events caused by climatic fluctuations and human impact. Thanks to four AMS dates (Poz-10271: 146.4±0.3 pMC; Poz-10272: 250±35 BP; Poz-10273: 145±35 BP; Poz-10274: 154.2±0.3 pMC – Fig. 5), we know that the alluvia of the valley are much younger than the Neolithic. In other words, there are no traces of the activity of Neolithic people unless these traces were destroyed in the younger periods. Šarkan’s alluvial fan, covering the margin of the Ondava flood plain, is also more recent as indicated by the date of 365±30 BP (Poz-6323) of the lowest sediments on the Tertiary bedrock.

In sum, we 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 Tertiary bedrock.

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

3) The filling processes began during 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 was 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 this was caused by the collectivization following the Second World War, when previously divided fields were joined and the bulks between them disappeared. The final stage of the development is a dry valley with a braided alluvial plain and ephemeral creek.

The recent Ondava river course is very young and was established as a 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, there was no single course, and the Ondava was an anastomosing river, divided into at least several meandering branches, as can be seen in historical records (Koźlowski and Nowak, 2007). Besides, almost every spring the whole plain was flooded to a significant degree. This is also evident based on historical data; for example on Moravany’s eighteenth-century coat-of-arms (see Fig. 3). The same phenomena took place in prehistoric periods. Sections and borings across the flood plain, both older ones and those made during our research, show meandering belts, located much closer to the eastern slope of the valley. Besides, the profiles with buried soils, black oaks, animal bones and prehistoric pottery occur in the valley bottom near the study area.

In the literature the middle fossil soils were dated in the Topľa valley to 4,720±300 BP (Božice – 4 km to NE) and in the Ondava valley at 4,200±900 BP (Kladzany – 15 km to N) whereas the lower and upper ones were combined with the Preboreal and the Subboreal, respec-
tively (Baňacký et al., 1987). Doubts in the chronology are raised given the new research reported here.

Studies of the middle Ondava river were done near Kladzany (N 48°52’56”, E 21°44’23”) in 2006–2008. The area is located about 16.5 km north of Moravany (Kalicki et al., 2005). The river flows along a bottom of a depression characteristic of a graben, limited from west and east by Quaternary faults (Baňacký et al., 1987). The borders of the valley are created by slopes declining from troughs built of Baden rocks in the west (Vranovska Pahorkatina), and of Kladzany layers in the east (Karpatian). The Tertiary rocks were affected by a network of pre-Quaternary faults oriented SW–NE and SE–NW. The thickness of the Quaternary sediments in the valley bottom does not exceed a dozen or so meters (10.7 m in the drilling HO-27). These sediments constitute of two series: the Vistulian gravels with sands are affected by a network of pre-Quaternary faults.

In the proﬁle ‘Kladzany 2007A’ (Fig. 6) the overall thickness exceeds 6 m. In the lower part (depth 4.35–6.1 m) channel sediments appear – gravels of the diameter 4–6 cm with sands. In their bottom part (5.2–5.4 m) irregular fragments (porvak) of organic silts and clay balls were recorded. The organic silts from such clay ball were dated at 9940±50 BP (Poz-22257). In the sandy layer (4.7–4.95 m) numerous pieces of wood and detritus appear. Channel alluvia are covered by thick series of fine clastic, overbank deposits with buried soils. In this series one can distinguish several members. The lower one (depth 3.05–4.35 m) is built of silts with distinct remains of gley processes. Above, a thick layer of buried soil (depth 1.85–3.05 m) occurs, well developed, with prismatic structures. That testifies for a longer period of time of soil and depositional processes worked here simultaneously and stayed in the relative equilibrium. Grey brown silty groundmass occurs in all the thin sections. The coarse material consists of rough quartz grains; with very rare feldspars, micas and glaukonites. In humic horizon well decomposed, amorphous humus is dominant in groundmass and plant fragments with well preserved tissue structure occur. Diagenetic processes are indicated by typical iron nodules visible in thin sections. Clay coatings in channels are well preserved but in the bottom clay movement is weakly developed. On the basis of micromorphological data we conclude that brown soil forming with lessive processes took place here (Fig. 7: 1).

In the lower part of this layer (depth 2.95 m) bones, daub, Neolithic pottery and charcoal were found in situ. Charcoals were dated at 6,130±40 BP (Poz-22366). This soil developed during the mid-Holocene as a typical fluvisol, to at least 5,830±40 BP (Poz-22256). This date marks the top level. However, this date is possibly slightly older when compared to the real age of the layer,
Fig. 6. Kladzany 2007A profile and grain size composition with Falk-Ward parameter distribution of sediments. Sediments: A – gravels and sands, B – gravels and sands with silty admixture, C – silty sands, D – silts; E – clayey silts, F – buried soils; Fractions: 1 – coarse gravel, 2 – middle and fine gravel, 3 – coarse sand, 4 – middle sand, 5 – fine sand (2 to 4\(\phi\)), 6 – coarse and medium silt (4 to 6\(\phi\)), 7 – fine silt (6 to 8\(\phi\)), 8 – clay (above 8\(\phi\)); Folk-Ward distribution parameters: Mz – mean size diameter, \(\delta_1\) – standard deviation, Sk\(_1\) – skewness, K\(_G\) – kurtosis
Fig. 7. Kladzany. Thin sections of the sediments from the Ondava river valley. 1. Brown soil with lessive processes; pll – plane polarized light, xpl – cross polarized light, c – clay coatings, ch – channel, i – iron impregnation of groundmass. 2. Buried soil. Grey-orange groundmass with weakly developer lessive processes; pll – plane polarized light, xpl – cross polarized light, m – groundmass, o – organic matter in channel, n – amiboidal iron nodules. 3. Soil horizon from the depth of 0.5–0.8 m; pll – plane polarized light, xpl – cross polarized light, m – groundmass, n – typic iron nodules, c – clay coatings
as the soil fossilization should be dated to the decline of Atlantic period. This soil was covered with thick (depth 0.8–1.85 m) overbank deposits. In thin section from the buried soil, the grey-orange groundmass consists of unsorted quartz grains and silty undifferentiated material. There are well preserved pedo- and diagenetic processes, represented by typical, amboidal and digitate iron nodules, iron hypocoatings in channel and orange groundmass saturated by iron hydroxides. Clay movements in thin section are poorly developed. In groundmass traces of fresh biological activity occur like earthworms filling in channel or fresh organic matter (Fig. 7: 2).

In the upper part of this member a soil with prismatic structure was recorded (depth 0.5–0.8 m), however it is more weakly developed than the mid-Holocene soil. In the thin section from this depth the groundmass is similar to the above. Diagenetic processes commonly occur. There are typical iron nodules, iron and clay hypocoatings in channels and rarely on mineral grains. Appearing clay coatings are deformed or destroyed (Fig. 7: 3). The top of this soil was dated at 3,140±35 BP (Poz-22254) and it became fossilized by the silty overbank deposits (depth 0.0–0.5 m). In the top of this member an A horizon of present-day soil is weakly readable.

The lower morphological terrace is cut and filled within the older and younger portions of the higher terrace, as recorded in the main outcrop in Kladzany (‘Kladzany 2007B’). Alluvia of this terrace are only partly deposited within the remains of the higher terrace. The erosive base rock is built of channel gravels (depth 4.15–4.6 m) and above the remnants of the sediments filled in the Late Glacial palaeochannel (depth 3.8–4.15 m), dated to 10,940±50 BP (Poz-22367). The upper part of this palaeochannel fill is probably the origin of irregular clay fragments and clay balls found in the profile ‘Kladzany 2007A’, because this base deposit is eroded by the series of younger gravelly-sandy channel alluvia (depth 0.7–3.8 m). In their precints appear small interbeddings (10–35 cm) of silts or sandy silts. The topmost profile is silty overbank series (depth 0.0–0.7 m). The youngest accumulation within this morphological terrace constitute channel alluvia with numerous subfossil trees in the lowest part and with bones in the upper part, located on the border between channel and overbank sediments (‘Kladzany I’).

The general structure of the river valley near Kladzany (Fig. 8) records the erosional phase of the end of the Pleistocene, which eroded the Tertiary base rock and cut the eastern part of the valley forming a deep depression (palaeochannel dated at 10,940±50 BP). In the Early Holocene the Ondava river cut off during lateral migration the upper part of palaeochannel fill, and as a result clay balls (9,940±50 BP) became included in the younger channel alluvia.

At the beginning of the Neolithic the level of the floodplain was lower by about 3 m comparing to the present-day bottom of the valley. This plain was probably already exploited by humans in that period, judged on the basis of several archaeological sites linked to the early AVK, located on the middle Ondava river (Šiska, 1989). Direct confirmations of human presence are provided by ceramics found in situ in the lower part of fossil soil dated at 6,130±40 BP.

During the Neolithic we note a slow process of aggradation (1.2 m of sediment) since soil-forming “kept up” with the sedimentation. A change in the rhythm of overbank deposition occurred after 5,830±40 BP, which led to the fossilization of the soil by over 1 m thick layer of silts. It is difficult to determine whether it is related to human activity, but it is worth noting that the above date sets roughly the beginning of the Eneolithic. In the Eastern Slovakian Lowland, in contrast to other regions of eastern Slovakia, this period (represented by Tiszapolgár, Bodrogkere-sztúr, and especially Baden culture) is not associated with demonstrable decrease of human settlement (Pavúk, 2004). However, a distinct intensification of human presence is visible only in the Bronze Age (especially the Otomani, Suciu de Sus, and Gava cultures) (Gašaj, 2004). What is more important, the location of profiles in Kladzany basically records the situation in areas north of the Eastern Slovakian Lowland where archaeological remains of Eneolithic settlement are scanty (till the period covered by Eastern Slovakian Barrows culture, i.e. the very end of the Eneolithic).

The next phase of stabilization dated to the later Subboreal period is documented by the upper soil that was fossilized during the phase of
floods (3,140±35 BP), well recorded in numerous valleys of Central Europe (Kalicki, 2006). This soil resulted from brown soil formation with traces of lessivé processes in wet conditions, as evidenced by well-developed precipitation of iron oxides. In the Late Holocene a series of alluvia building a lower morphological terrace appeared.

The type of the sediments, dominated by channel and over overbank facies confirm a greater flow within the river channel, which has been narrowed and stabilized by resistant to side erosion fine clastic series.

In sum, we would like to emphasize that the study area was a mosaic landscape consisting of
the upper parts of Pozdišovsky Ridge environment, the environment of its lower slope parts and finally a very dynamic alluvial environment. We estimate that during the Atlantic period such an ecological mosaic was more distinct for human perception than the central and southern parts of the Great Hungarian.

ANTHROPOGENIC FEATURES

Over 2000 sq m of the site area have been excavated (Figs 9, 10). Moreover, in the vicinity of the site a dozen of trial trenches were made in order to obtain geological and geomorphological data.

In the archaeologically investigated section of the settlement almost 40 anthropogenic features sunk into the ground were identified. Generally, they are characterized by the presence of grey-black clayey filling. In some of the pits the lower part had a more intensive sooty color. The features could be seen at the level of 30–40 cm; they were sunk to maximum 110–120 cm from the ground surface.

In terms of shape and dimensions, four distinct types of features can be distinguished:

1. The relatively large (about 1.5–5 m in diameter) and medium-size (up to 1.5 m in diameter) trough-like features, circular or oval in outline (2/99A, 2/99B, 2/2000, 8/2000, 2/01, 4/01, 8/01, 9/01, 2/02, 3/02, 4/02, 4/03). An exceptional structure in this category is feature 1/01 because its formation is clearly multiphase, while its filling contained almost no material finds. Possibly, this part of the site was intentionally protected from dumping or leaving rubbish.

2. The small features (4/99, 1/2000, 7/01) with a large number of daub pieces and distinct traces of fire (reddish color of the filling, charcoals and ashes). It seems that feature 1/2000 can be interpreted as the remains of an oval, trough-shaped hearth which was accompanied by a structure made of clay or lined with clay. Such an interpretation is further supported by the presence of a very hard, burnt layer of clay in the floor of the pit, which – in addition – was paved with sherds. However, it is difficult to explain the situation found in features 4/99 and 7/01. The layout of lumps of daub and the presence of undamaged and unburnt obsidian artefacts do not allow us to interpret the features as remains of hearths. Hypothetically, these might be remains of a construc-
Fig. 10. Distribution of excavation units and anthropogenic features in the central part of the site
tion (a wall, a fence, the roof of a dome oven?) faced with clay that slid or fell into the small pits.

3. Pits are spots where wooden posts were sunk (post-holes). The most evident examples are features 3/2000, 9/2000, 1/03, 2/03, 2/06 and 3/06, possibly also 1/02, 2/07, 3/07. They are either round or oval in the horizontal and conical in the vertical cross-section. They were sunk to a depth of up to about 90–100 cm from today’s ground surface, and measure about 50–60 cm in diameter. No finds were discovered in their filling. Micromorphological analyses carried out by K. Fechner from Université Libre de Bruxelles showed that the edges of the pits had been rammed down. This confirms the hypothesis that the features are post-holes and their edges were beaten when the wooden posts were being driven into the ground. Small, circular, grayish areas, whose thickness is not very large (10–15 cm) registered in trench C (features 4, 5 and 6/2000) and in section 3/2001 in trench F (features 5/01, 6/01, 5/02, 6/02) could also constitute remains of wooden posts sunk into shallow holes. Even if the latter structures are taken into account, the lay-out of all the post-holes does not form any regular pattern.

4. In respect to size exceptional structures are 1/98 (within trench G), 3/01, 10/01, and 1/06. In the horizontal outline their shape approach an irregular, elongated trapezium or oval. The filling was uniform, grey-black, with numerous sherds, obsidian finds, lumps of daub and charcoals. A functional interpretation of a feature of this type encounters obvious difficulties. Due to the considerable size, a tentative explanation is plausible, namely that they were the remains of semi-dugout dwellings. Similar, large, trough-like features in the settlements of the AVK are interpreted in precisely this way (e.g. Makkay, 1982; Šiška, 1989). The supposition that the feature described above might be a habitation structure seems to be confirmed by the presence of protrusions spaced out regularly along the outline of feature 3/01. They can be viewed as post-holes arranged along the edges of the feature. On the other hand, these post-holes could constitute the remains of a dwelling (hut) situated next to the pit under discussion. A large number of daub pieces found in these features, especially in 1/98, which could have been a remains of either plastered, clayey floor or a structure that had stand at the edge of a pit and collapsed inwards may also point at dwelling function of such features. On the other hand, the narrowing of the some features in their southern parts does not quite point to a habitation structure; the features seem to be too narrow for a house in this part. For these reasons we suggest that features of the sort are the remains of a clay extraction pits, i.e. long, irregular pits for the extraction of clay which was used, first of all, for facing walls of post-houses. After the extraction they could have been used as rubbish-pits. Pits of such type, located along longer walls of such houses occur frequently in the settlements of the LBK (e.g. Lenneis, 2001); recently such features have also been discovered in the Eastern Linear context (Domboróczki, 2001). Although at Moravany we did not discover any evident traces of post-houses on either side of the aforementioned features, yet this does not totally disqualify the interpretation offered above; remains of such houses may have been completely removed by erosional processes.

It should be emphasized that stratigraphical relations between the features are rare. There are only two situation of the kind, i.e. between features 2/2000 and 8/2000 and between features 2/01 and 10/01. On the whole, this might suggest that the site at Moravany is a single-phase settlement.

POTTERY

As erosional processes removed the culture layer associated with the Neolithic settlement, finds were preserved only in the filling of the pits and in other depressions in the ground surface of the site.

The group of ceramics obtained so far in the excavations comprises nearly 8,000 potsherds and several dozen of miscellaneous clay finds. The majority of potsherds (ca. 75%) come from only five features (1/98, 2/99A, 3/01, 2/01, 4/01, 1/06). The remaining features yielded only small quantities of ceramic fragments (from several to several dozen of items). Although not a single vessel has been wholly preserved, yet the degree of fragmentation is not considerable. Consequently, the index of diagnostic features of clay vessels should be estimated as relatively high.
**Pottery technology**

The mineralogical and technological analyses were carried out on the Neolithic pottery sherds from Moravany and on the clay samples collected on the site. They included: 1) measurements of wated absorption, 2) determinations of expansion and shrinkage (dilatometry), 3) determinations of phase composition using X-ray diffraction analysis (XRD), scanning electron microscopy (SEM), the latter supported by spot chemical analysis and thermal analysis (DTA), 4) chemical determinations using inductively coupled plasma – atomic emission spectroscopy (ICP-AES). None of these methods is universal but each of them helps find an answer to some of the questions posed.

The water absorption of the pottery samples is 22–34% and testifies to their high porosity. It means that a degree of firing of the clay out of which the pottery had been made was low, and – consequently – the temperature of firing was not too high. The water absorption of the fired clays collected on the site is much lower (12–13%). It may be explained by much better homogenization of the ceramic body in the laboratory experiments. Therefore, if we assume that the Neolithic pottery was manufactured from local raw materials, the clays for making vessels must have been deliberately prepared.

The phase composition of the Neolithic sherds is similar in all the cases (Fig. 11). The mass for firing vessels was composed of clay minerals (mainly of illite) with an admixture of quartz and minor feldspars and ferrous oxides, the same minerals that have been found in the local clays. It suggests that these clays could have been used to manufacture the Moravany ceramic vessels.

The concentration of $P_2O_5$ in the sherds is significantly higher than that in the clays (1.14–6.38 and 0.31%, respectively), as results from both bulk chemical analyses and the SEM/EDS spot analyses of the Neolithic sherds. Higher contents of phosphorus have been found particularly in the sherds that reveal the presence of highly porous, sponge-like, most probably organic fragments (Fig. 12). Their pores are arranged in the form of parallel tubes with oval cross-sections that resemble the pores occurring in bone tissue (Baslé et al. 1998; Pawlikowski and Niedźwiedzki, 2002). Such a thesis would require further, more detailed analysis on more abundant research material collected from other archeological sites. These organic structures may just as well represent the fragments of organic temper that was purposely added to the clay mass and which can be observed with the naked eye in some sherds. Another explanation is based on the ethnographically confirmed (Holubowicz, 1950) habit of mixing clay with organic substances, such as excrements.

Regardless of the organic temper, the early Neolithic pottery from Moravany reveals a unique technological feature: adding of crushed, often coarse-grained rock fragments into the ceramic mass as a temper. Among them, fragments of quartzite, Ondava hornstone and, possibly, obsidian have been identified. These rocks were also used by the inhabitants of the settlement to make chipped tools. Such a mineral temper has been recorded in all the sherds found on the site, both in thin- and in thick-walled fragments. Besides the crushed rocks, some pottery fragments contain an admixture of broken sherds.

The dilatometric curves of the analyzed sherds (Figs 13; 14A) clearly demonstrate that the nature of the changes on heating, i.e. expansion/shrinkage, is similar. Approximate firing temperatures of the Moravany vessels, determining according to Wirska-Parachoniak (1980), range between 800 and 900°C. However, analyzing the dilatometric curves of the clay samples 11, 12, 13 and 14 fired at 600, 700, 800 and 900°C, respectively, it is seen that three of them break almost at the same temperature, i.e., around 850°C, and the fourth (sample 14) at around 900°C. It means that there is no dependance between the firing temperature and the temperature at which dilatometric curves break, which challenges the method of temperature estimation used by Wirska-Parachoniak (1980). Considering this discrepancy, establishing the exact temperatures of the pottery manufacturing by the Moravany population remains an open question.

**Pottery morphology and ornamentation**

The pottery obtained so far from the site falls into seven basic morphological types (Kaczanowska et al., 2002; 2003; Šiška, 1989).

1. **Hollow-pedestalled bowls**

The evidence of the presence of such bowls is
**Fig. 11.** X-ray powder diffraction patterns of a clay sample from the site (A) and the pottery samples 2 and 4 (B and C respectively)

*S* - smectite; *S/I* - smectite/illite
Fig. 12. A. An SEM image of the pottery sample 1. A highly porous, sponge-like, most probably organic fragment with tubular, parallel arranged pores occupies the central and right sides of the micrograph (around point 1). B. Elemental composition of the fragment in question; the place of the EDS analysis marked with a circle.
Fig. 13. Dilatometric curves of samples of thick-walled pottery (A – samples 1–5) and medium-walled pottery (B – samples 6–8). Abbreviation: pr. – sample
Fig. 14. Dilatometric curves of thin-walled pottery (A – samples 9, 10) and the clay samples from the Moravany (B – samples 11–14, fired at 600, 700, 800, and 900 °C respectively). Abbreviation: pr. – sample
Fig. 15. Selected pottery. Scale: a – 1–3, 6, 7, 9; b – 4, 5; c – 8
thin-walled sherds of the part between the hollow pedestal and the bowl proper. The diameter of these parts of bowls is from 5 to 8 cm (Fig. 16: 6; 18: 7, 9). Although the specimens under description have been preserved only as fragments, we can identify vessels with conical and slightly bell-shaped pedestals. The bowls are, mainly, characterized by the rectangular outline of rims. It should be explained, however, that the fragments of rims from hollow-pedestalled bowls cannot always be distinguished from flat-based bowls with similar rims, from conical bowls, or deep, globular bowls. The state of preservation of the outer surface of thin-walled pots does not allow to reconstruct, with few exceptions (Fig. 18: 5), their painted decorations. The ornament of thin incised parallel lines (Fig. 17: 4) or a meander pattern is relatively frequent. A possibility that the thin incised ornaments were accompanied by black paint (which is typical for the early phase of the AVK—e.g. Vizdal, 1997: fig. 11: 1, 2, 3a, 3b) cannot be excluded, but the black paint has not been preserved at Moravany.

2. Conical bowls

The identified sherds of this type of pots have rectangular rims. Only the smallest bowls in this group have round rims (Vizdal, 1998: fig. 4: 1). Probably, the bowls varied a great deal in respect of height and diameter. Because the soil conditions on the site were “aggressive,” the black paint that must have been present has not been preserved.

3. Deep, globular bowls

Pots ascribed to this group vary in size. The rims are rectangular with the exception of the smallest bowls. These bowls have mild S-shaped profiles. The lower part of the belly of these bowls was decorated with plastic knobs. They had, sometimes, a horizontal perforation (Fig. 16: 4) (to describe such knobs as “handles” would be incorrect). The bowls were decorated with an incised ornament (Fig. 15: 3); sporadically traces of black paint have been preserved.

4. Bowls with conspicuous collars (this group is heterogeneous as one attribute brings together vessels that are in fact different; however, this category has been commonly accepted in the literature, e.g. Šiška, 1989: 68).

To this group are ascribed small vessels with collars (Fig. 17: 1, 7) and globular vases. Their common feature is the rectangular cross-section of the belly and a cylindrical collar. Such a shape of the belly was probably obtained by pushing the walls of the vessel outwards from the inside. The bellies are additionally marked by flat knobs. Small, looped handles also occur. On the outer surfaces of the vessels faint traces of black-painted ornaments have been preserved. Sherds of a small vessel are decorated with uncharacteristic incised ornament (Fig. 17: 1). Fragments of a large vase-like vessel show a very well-preserved black-painted ornament of broad, wavy bands and thin parallel lines (Fig. 17: 3). This vessel was made of clay with almost no temper, which is exceptional at Moravany. We could even speak, tentatively, about an imported item in this case.

5. Barrel-shaped pots

To this group belong medium- and thick-walled sherds of barrel-shaped pots distinguished by a very high content of mineral and organic temper. These sherds were discovered in features 1/98 (in trench G), 2/99A, 3/01 and 2/01. The most common decoration are impressions (Figs 15: 2; 18: 6) or a combination of impressions and incisions (Figs 15: 1; 18: 4). A decoration of slanting, short, incised lines is also present (Fig. 18: 3). Moreover, practically each vessel of this type had double, plastic knobs located in the upper part (Fig. 16: 3).

6. Storage vessels

In features 1/98 and 3/01 thick-walled sherds of storage vessels were discovered. To this group belong sherds with plastic bands, decorated with round or oval impressions (Figs 15: 4; 16: 5), also sherds with an ornament of sole finger-impressions (Fig. 18: 8). The ceramics in feature 1/98 had a decoration of flat, round plastic bosses with an additional, small boss in the centre (Fig. 15: 5). The surface of these vessels was intentionally roughened by, probably, using fingers (Fig. 16: 7).

7. Low, thick-walled bowls (roasting pans)

Among bowls of this type there are conical (Fig. 15: 8) as well as slightly rounded forms (Fig. 15: 7). A fragment of a vessel that can be ascribed
Fig. 16. Selected pottery. Scale: a – 1, 4, 6, 8; b – 2, 3, 5; c – 7
Fig. 17. Selected pottery. Scale: a – 1, 5, 6; b – 2, 4; c – 3, 7
Fig. 18. Selected pottery. Scale: a – 1a, 1b, 2, 7, 9; b – 3, 4, 6; c – 5, 8
to this group comes from a miniature bowllet (Fig. 16: 8).

It seems that the frequency of the black painted decorations was high. However the state of preservation of the outer surface of almost all thin-walled vessels (hollow-pedestalled bowls and some conical bowls) and thick-walled collared vases does not allow to reconstruct – with few exceptions – their painted decorations. The ornament of thin incised parallel lines (Figs 15: 3; 17: 2, 4, 6; 18: 4) is relatively frequent but wide incised lines (almost grooves) also occur (Figs 15: 1; 16: 1, 2). The most common decoration of the thick-walled vessels are impressions or a combination of impressions and incisions (Figs 15: 1; 18: 4) as well as a decoration consisting of short, incised lines (Fig. 18: 3). There are also plastic bands with finger impressions (Figs 15: 9; 16: 5).

Small, miscellaneous clay artefacts are represented by items with a decorative function such as clay pendants of an almost round shape, pieces of a clay armlet, a pendant in the shape of a tooth (Fig. 18: 1), and an awkwardly formed (?) object in the shape of a rod (?) (Fig. 18: 2).

Chrono-cultural setting of the pottery

The analysis of attributes of the pottery from Moravany shows that this pottery should be ascribed to the early Neolithic, and more precisely to the Eastern Linear Pottery culture. In M. Vizdal’s opinion these ceramics should be connected to the Kopčany group, which term refers to the early phase of the AVK in the Eastern Slovakian Lowland (Kalicz and Makkay, 1977: 18–37; Šiška, 1989: 58–74; Vizdal, 1997: 44). However, among the ceramic finds we can identify specimens with more archaic features and with younger features. The former ones, which are slightly similar to the Körös-Cris attributes, include: 1) high frequency of the thick-walled pottery with impressions, 2) rectilinear, black-painted motifs, 3) broad incisions, 4) plastic bands with finger impressions, 5) finger impressions and short, incised lines. As to the latter ones we should mention: 1) thin incisions, 2) vases with high, cylindrical neck, 3) spiral and wavy, black-painted ornaments (close to the ornaments of the Raškovce group – Šiška, 1989: 91–101). In such a situation there appears a risk of a subjective selection of certain features and overestimation of features considered to be typical of one or another culture group. Our intention is not to question the methodology used so far for the distinguishing of taxonomic (“cultural”) units and phases, but to point to “exceptions” which – after all – occur regularly and do not correspond to the accepted models.

CHIPPED STONE ARTEFACTS

Major technological group structure

The investigated series of 4386 chipped stone artefacts included: 159 cores and fragments (3.63%), 1647 flakes (37.5%), 1063 blades (24.2%), 996 chips (22.8%) from retouch or preparation, 468 tools (10.6%). There were, besides, 42 fine fragments of artefacts that are difficult to assign to one of the enumerated groups, and 2 hammerstones, 7 pebble fragments and a lump of dye.

The inventory structure, dominated by flakes, is indicative of on-site local working of raw materials in a full cycle. Possibly, some reduction cycles (notably with the use of a hard hammer) were executed by poorly trained knappers, whereas the presence of a number of cores reduced by means of pressure technique indicates that this is the work of specialized knappers. We wonder whether the presence of specialized knappers can be identified as a particular phase of settlement functioning, or whether the two forms of production: specialized and domestic co-occurred during the occupation. The high standard of skills of the inhabitants of the settlement is confirmed by the fact that a relatively small number of cores were exploited in blank production. On average, about 20 blades were obtained from one core (chips excluding) i.e. the number close to the number of blades obtained in the workshop-next-to-mine in pit 1 at the middle Neolithic Lengyel culture site at Sąspów (21 blades – Dzieduszycka-Machnicka and Lech, 1976).

Raw materials

A variety of raw materials were exploited at the site, of which obsidian was the most important. It was used to produce as much as 88.8% of all the artefacts. Obsidian was supplied to the site in the form of unworked concretions from its deposit areas located at about 60 km to south-west. Among other rocks there were: limnoquartzites
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(3.4%), radiolarites (2.8%), and Ondava hornstone (1.6%). In addition to these raw materials, individual artefacts were recorded at Moravany that were made from 16 other siliceous rocks, or even, occasionally, sedimentary rocks, whose deposit areas in most cases have not been identified. Of special interest is the discovery of a trapeze made from chocolate flint whose deposits are located at the northern edge of the Holy Cross Mountains in Poland, and a blade from Cretaceous flint from deposits in the Volhynia–Podole Plateau (Western Ukraine). These two artefacts confirm the existence of long-distance indirect (mediated) exchange with early farming LBK communities in the Vistula and in the Dniester basins.

Cores

The collection contained 159 cores: 130 intact specimens and 29 fragments. In terms of raw material structure, obsidian cores are most frequent (125 specimens – 78.6%), followed by cores from limnoquartzites (20 – 12.6%) of which 5 specimens were from Boldogkövarálja type. Cores from other rock types are much less frequent: radiolarite (9 – 5.7%), Ondava type hornstone (3 – 1.9%), and individual specimens from quartz and white patinated flint (Jurassic or erratic). When the variability of raw materials in the group of cores (6 types) is compared with raw materials variability in the group of tools and debitage (21 types) it can be seen that only some of the exploited rocks, most frequently obsidians and limnoquartzites, were used on-site in the full cycle of processing, beginning from cores.

In the case of obsidian coring techniques represent different technological sophistication. Two types of core reduction can be distinguished depending on the method of blank detachment: 1) core reduction based on the use of a hard hammer, or a punch, 2) core reduction by means of pressure technique.

In the first type core reduction comprised the following types of operational sequences:

A. A simple sequence of mixed flake (more often) or blade (less often) detachments on small (2–3 cm high) chunks or obsidian concretions; blades or flakes were detached after the platform had been shaped by a single blow, on a flat or slightly convex flaking surface (Fig. 19: 1–5),

B. A sequence represented by relatively small (2–4 cm) blade cores on obsidian concretions with the base prepared by several scars, whereas the flaking surface, shaped by blade scars, extends onto core sides and the back (Fig. 19: 6). One of these cores is flat, for flakes, with centripetal reduction in the advanced phase, especially on the core back (Fig. 19: 7). Blade cores were exploited by rounding the flaking surface until, in the residual phase, a subdiscoidal shape was obtained (Fig. 20: 1),

C. A sequence represented by a macroblade subconical core, with the flaking surface extended onto core sides, and a prepared platform (Fig. 20: 2). This core does not seem to be an initial form – little reduced – belonging to the previous group. In all likelihood, in an early phase of reduction, the core was brought from a workshop next to deposits of Carpathian obsidian type 1.

D. A sequence represented by a group of double-platform cores for flakes, also small (2–3.5 cm) in diameter (Fig. 20: 3, 4), that in the final phase of reduction were subdiscoidal and, then transformed into splintered pieces (Pl. 2: 6),

E. Cores on flakes; this sequence is represented by a core for blades (made on the narrow face of a flake – Fig. 21: 1) and three cores for flakes with the flaking surface installed on the ventral side (Fig. 21: 2–4).

Core reduction by pressure technique is documented by a relatively small group of blade cores, mainly cylindrical, sometimes subconical. These cores are small (2.5–4.2 cm), but this could result from the fact that they represent, in most cases, residual phases of reduction. Less exploited is a subconical core with eight blade scars on the convex surface and an attempt – nearly failed – at platform rejuvenation in order to obtain an acute coring angle (Fig. 21: 5). Another core is residual, cylindrical, with the platform carefully prepared by centripetal blows and detachments on the platform edge. The flaking surface is almost completely rounded, with only a small cortical area of the surface left (Fig. 21: 6). Another core of this type has two convex flaking surfaces: on one side there are earlier blade scars partially cut when the platform was rejuvenated; as a result an obtuse coring angle was formed, on the other side (where reduction could not continued when a large flake had been detached removing blade scars) the cor-
Fig. 19. Selected chipped artefacts. Cores
Fig. 20. Selected chipped artefacts. Cores
Fig. 21. Selected chipped artefacts. 1–8 – cores, 9 – overpassed flake
ing angle remained acute (Fig. 21: 7). Another residual blade core was a double-platform specimen with unique traces of postero-lateral preparation (Fig. 21: 8). When conical blade cores were exploited a product of technical accidents were overpassed flakes that removed entire core tips (Fig. 21: 9; Fig. 22: 1).

A unique specimen was a carinated micro-lithic core made on an obsidian chunk (Fig. 22: 2). Cores from other raw materials evidence the use of reduction sequences similar to those used for obsidian. Cores from limnoquartzite included an initial, single-platform specimen; the platform is unprepared, the distal part with preparation, made on a plaquette (Fig. 22: 3), and a residual, subconical single-platform core for blades and flakes (Fig. 22: 4). One of the cores made from Boldogkövarálja limnoquartzite was reduced by means of pressure technique; this is a subconical core for blades, strongly exhausted: just as in the case of obsidian cores on front side the platform rejuvenation produced an obtuse core angle, whereas on the back side reduction was continued after the platform had been rejuvenated (Fig. 22: 5).

Cores made from radiolarite are all short (2–3 cm), for flakes, with unprepared platforms and broad flaking surfaces (Figs 22: 6, 7; 23:1). Cores made from Ondava hornstone are initial, single-platform, without preparation (including platform), made on pebbles (Fig. 23: 2).

Single-platform cores (70.8%) are more numerous than double-platform specimens (only 13.8%). Multiplatform cores (3.1%), with perpendicular scars (3.8%) and discoidal cores are much less frequent.

As far as shape is concerned the biggest group are flat and conical cores. Cylindrical (the most regular obsidian cores) and discoidal cores are few.

A special, although small, group of cores (3 specimens) were bipolar splintered pieces on relatively thick flakes from obsidian (Fig. 23: 3, 4) and limnoquartzite (Fig. 23: 5).

**Flakes**

The settlement at Moravany yielded 1647 flakes, most of them made from obsidian (86.2%). As much as 41.1% (678 specimens) are specimens that have been preserved as fragments, broken or fractured. The proportion of flakes less than 2 cm long is fairly high (367 – 22.2%). Detailed analysis was done on 506 intact specimens more than 2 cm long. The main body of these flakes comes from preliminary phases of core exploitation, from decortication and the shaping of flaking surfaces and platforms. Wholly cortical specimens are as much as 19.1% – which is a higher proportion than at the Lengyel workshop close to the mine at Saspów, pit 1 (Dzieduszycka-Machnikowa and Lech, 1976) where cortical flakes account for 16.4% of all the specimens, or in the Bükk culture workshop from Humenne (12.9%) (Kaczanowska and Kozłowski, 2002). Non-cortical specimens are 36.5% (185).

Analysis of the dorsal pattern of flakes indicates that preliminary preparation of cores consisted mainly in decortication by detaching a series of flakes. Subsequently reduction began. A more complex preparation was rarely used. It is documented by only 7 trimming flakes. Nearly half of the flakes exhibit unidirectional dorsal and ventral pattern (239 – 47.2%). Only 15% (76 specimens) are with a perpendicular scar pattern that confirms change of orientation of cores. A more frequent operation was the shaping or trimming of the platform, evidenced by flakes with centripetal scars (42 – 8.3%), typical tablets (2 specimens) or small flakes from platform rejuvenation (13 – 2.6%). Sometimes, a core was also shortened by removing the whole flaking surface and the distal end (5 overpassed flakes mentioned earlier – Figs 21: 9; 22: 1).

It should be remembered that part of the flakes were re-worked into retouched tools. Nearly a half of all the end-scrapers were made on flakes. Also frequent are flakes with retouch on smaller or larger sections of lateral edges (62 specimens).

A large series of very fine chips (996 specimens of which 90.9% were made of obsidian) was recorded, split off during retouch or, more often, during core exploitation or rejuvenation. They document a full cycle of tool production and rejuvenation on-site.

**Blades**

Blades were produced almost only from obsidian. The analyzed 1063 blades and fragments were identified. As many as 1027 (96.6%) were
Fig. 22. Selected chipped artefacts. 1 – overpassed flake, 2–7 – cores
Fig. 23. Selected chipped artefacts. 1–5 – cores, 6 – refitting of three blades from feature 1/98
made from obsidian. The proportion of this raw material in the group of blades is distinctly higher than its average proportion at the site.

Most blades have been preserved as fragments (804 specimens). In the group of fragments proximal parts predominate. Such proportion can be seen not only at Neolithic sites; the predominance of proximal parts among fragments was registered at Mesolithic sites in Poland (Schild et al., 1975: 19). Usually, blade fragmentation was interpreted as an operation of correcting the blade profile to adapt it for use as tools (Kaczanowska, 1971). In the case of Mesolithic sites Schild et al. (1975) are inclined to favor the point of view holding that breaking was an intentional operation, whereas the location of the break was accidental. In the analyzed assemblage proximal parts are most numerous (389 specimens). There were 223 mesial fragments and 183 distal fragments. Naturally, besides the intentional operation of blade breaking, some blades were broken accidentally.

In the group of blades there were 20 specimens whose dorsal surface was entirely cortical. Although the proportion of cortical specimens in the group of blades is lower than among flakes (3.9 and 19.2% respectively), yet it confirms that some cores had been exploited without flaking surface preparation but using the cortical blade technique, possibly after the platform had been prepared. After the first blade had been detached the flaking surface was extended and blades with lateral cortex were obtained (164 specimens, i.e. 32.7% of the intact blades). In the case of this method of core reduction the proportion of blades must have been relatively high, not much lower than that of flakes. For this reason the proportion of both flakes and blades was increased by adding the specimens that were modified by retouch: tools on blades and on flakes. Then the proportion of flakes becomes 39.2% whereas that of blades is as much as 33.2%. It seems likely, therefore, that a large part of cores for blade blanks was exploited without preparation.

The dorsal side of majority of blanks have scars from earlier detachments (283 specimens – 56.3%). As a rule the scars are unidirectional (444 – 88.6%). There are only 11 blades with opposite dorsal scars (2.2%). Among blades a group of trimming (9) and a group of sub-crested blades (10) were identified. They could have been either produced away from the settlement and brought to it as completed products, or two coring methods may have existed on-site: without preliminary preparation (the most common type) and with the pre-core stage. The latter hypothesis seems more plausible as neither the raw materials nor dimensions in the case of trimming, sub-crested, and crested blades differ from other blades at the site.

Blades are usually small. The biggest group comprises of specimens from 2.5 to 4.5 cm long (310 specimens – 61.8%). The specimens longer than 4.5 cm are only 14.2% of all the blades. In the group of longest blades items from raw materials other than obsidian are more frequent.

Of particular interest are artefacts from Ondava hornstone. In feature 1/98 three slender blades detached from the same core and making a refit were discovered (Fig. 23: 6a–6c). In the same feature, from the same core another blade may have been detached: slender, elongated. These blades were detached from a core with preparation restricted only to the platform.

The series contained only a few blades (3.4%) with parallel edges and interscar ridges, and the same thickness of proximal and distal parts. These blades must have been made using a fairly advanced technique – possibly, this was, perfectly mastered, punch technique, or, which is also likely, the pressure technique.

Retouched tools

End-scrapers

At Moravany there were 29 end-scrapers that in terms of blank types can be divided into two groups:

1. End-scrapers on blades (11), represented by 5 specimens on macroblades with fairly steep, weakly convex fronts (Fig. 24: 1–4), 6 specimens, also on macroblades, whose proximal parts are broken off, with fine lateral retouch semistep and weakly convex, steep fronts (Fig. 24: 5–10). Blade end-scrapers were made from obsidian (6), radiolarite (3), and limnoquartzite (2).

2. End-scrapers on macroflakes (9) with steep or semistep, slightly convex fronts (Fig. 24: 11–14), with proximal parts broken off. There were also microflake specimens (5) with arched fronts (Figs 24: 15–17; 25: 1, 2). Two medium-size specimens on flakes are of interest: they are irreg-
Fig. 24. Selected chipped artefacts. End-scrapers
Fig. 25. Selected chipped artefacts. 1–6 – end-scrapers, 7 – bec, 8–13 – burins
ular in shape, with inverse retouch extending onto the side (Fig. 25: 3, 4). Flake end-scrapers were made from obsidian (9) and Boldogkövá- rálja type limnoquartzite (3), radiolarite (1), and opal (1).

Moreover, an end-scaper was made on a small fragment of a red radiolarite plaquette (Fig. 25: 5) and another specimen was made on a residual obsidian core (Fig. 25: 6). One flake specimen has a kind of bec made by inversely retouched notch (Fig. 25: 7).

**Burins**

The small number of specimens with burin scars (8) and their atypical character indicates that burin technique was not systematically used as a technique of tool production or as a specific method of core reduction. Most probably burin scars appeared accidentally when flakes and blades were being used.

A specimen made on an obsidian blade resembles a dihedral burin (Fig. 25: 8). In all likelihood, which is indicated by the angle between burin scars and the blank surface, this is the result of impact fractures formed when tough materials were being perforated. The inverse splintering on the left edge could be the effect of the pressure exerted by the haft. Functionally this tool was probably a perforator.

A burin-on-a-snap made on a macroblade from Boldogkövávarálja limnoquartzite is in all likelihood the only tool intentionally shaped as a burin (Fig. 25: 9). Three Corbicau burins (the burin blow is transversal, from the retouched edge) was the effect of pressure on the retouched lateral edge of a blade (Fig. 25: 10) or an obsidian flake (Fig. 25: 11). Three other specimens (of which one was made on an obsidian flake) were probably an attempt to shape cores on flake fragments (*transches d’éclat*) (Fig. 25: 12, 13). Three burin spalls (two from red radiolarite and one from Boldogkövávarálja type limnoquartzite) were also recorded (Fig. 8: 1, 2).

**Truncations**

A total of 27 blade specimens with obverse lateral retouch. In respect of the shape of retouched edges they can be divided into the following groups types:

1. Distal, transversal truncations (11) made on medium size blades (Fig. 26: 3–7); only 2 specimens are shortened (Fig. 26: 8, 9). Moreover, three truncations have lateral retouch (Fig. 26: 10); one specimen of them has, exceptionally, inverse retouch (Fig. 26: 11), and one has a kind of impact fracture in the distal part (Fig. 26: 12).

2. Straight, distal truncations (7) made on medium-size blades (Fig. 26: 13–16). One specimen is shortened (Fig. 26: 18) and a macblade specimen has fine, lateral retouch (Fig. 26: 17).

3. S-shaped truncations (2) made on medium-size blades (Figs 26: 19; 27: 1).

Only one specimen has a straight truncation shaped in the proximal part by inverse retouch (Fig. 27: 2). There were two atypical specimens: one was shaped by fine retouch, present also on the edges (Fig. 27: 3) and the other had retouch on a transversal break in the proximal part (Fig. 27: 4). Only several truncations have traces of using as a sickle insert (Fig. 27: 5).

One double-truncation was registered with slightly oblique truncations (Fig. 27: 6); possibly, another specimen might also be a double truncation, although typologically it resembles end-scaper combined with truncation (Fig. 27: 7).

Obsidian truncations are most numerous (13); they are followed by specimens from Boldogkövávarálja type limnoquartzite (5), radiolarite (2), chalcedony (1) and quartzite (1).

**Geometric microliths and backed pieces**

Trapezes and their fragments (25) are the most frequent in this group. A rectangle and two rhombs were also recorded.

The following types of trapezes could be distinguished:

1. Trapezes on macroblades (4) (Fig. 27: 8–10) that, basically, could be ascribed to double truncations, but the metrical boundary between the latter category and microlithic trapezes is not sharp. One specimen in this group had alternate truncations (Fig. 27: 11). One specimen was made from chocolate flint (Fig. 27: 8), the others from obsidian.

2. Microlithic trapezes (9) as a rule are fairly short, with the width only slightly larger than the height (Fig. 27: 12–17); only two specimens are more wide (Fig. 27: 18). One of the longer specimens has a proximal truncation with an impact fracture on the ventral side (Fig. 27: 19). There is,
Fig. 26. Selected chipped artefacts. 1, 2 – burin spalls, 3–19 – truncations
Fig. 27. Selected chipped artefacts. 1–7 – truncations, 8–22 – trapezes
besides, a small trapeze with two notches shaped by alternate retouch on the longer edge (Fig. 27: 20). All these specimens are made from obsidian.

3. Fragments of small trapezes (11) are with one truncation preserved: either a distal (5) (Figs 27: 21, 22; 28: 1–3) or a proximal truncation (6) (Fig. 28: 4–9) have been preserved. One specimen has impact fractures both in the distal part as well as on the break in the proximal part (Fig. 28: 3). All the specimens are from obsidian.

In the group of geometric inserts are of special interest including an obsidian rectangle with fine retouch on one side (Fig. 28: 10), a rhomb with three retouched sides (it resembles, in fact, a tanged point – Fig. 28: 11) made from Boldogkővarály type limnoquartzite, and an obsidian rhomb with retouch on four sides (Fig. 28: 12).

Backed implements are few and not very typical (5): a mesial fragment of a backed piece with a retouched opposite side (Fig. 28: 13), two backed pieces with a slightly arched blunted back and a finely retouched, straight, opposite edge (Fig. 28: 14, 15), a thick backed flake with finely retouched opposite edge, partially damaged (Fig. 28: 16), and an asymmetrical, one-sided crested blade with steep retouch on part of one edge: both – the crest and blunted back – forms an implement resembling the angulated backed blade (Fig. 28: 17). All the specimens were made from obsidian.

Perforators and becs

There were seven becs and atypical perforators, all made from obsidian. Blade perforators (2) had slightly asymmetrical points (Fig. 28: 18, 19). One specimen had an impact fracture in the distal part. Alternate perforators (2) were also made on blades (Fig. 28: 20, 21).

An asymmetrical bec was shaped by two Clactonian notches in the proximal part of a thick blade (Fig. 28: 22). Another bec was made on a thin thermal plaquette of Ondava hornstone (Fig. 28: 23). The third specimen was shaped on a cortical flake by two notches on the side opposite to the large notch (Fig. 28: 24).

Retouched blades

Retouched blades are the most important tool group. In the analyzed series there were 257 blades with lateral retouch which accounts for 54.9% of retouched tools; 98.4% of retouched blades were made from obsidian. Blades with bilateral and with unilateral retouch can be distinguished.

1. Blades with bilateral retouch – 123 specimens. Among them the following specimens were registered:

1.1. Specimens with continuous, semi-steep retouch (50). In this group there were, both, fine, almost microlithic bladelets with straight edges shaped by semisteep retouch (Fig. 29: 1, 2) and larger blades, resembling classical *lames retouchées* (Fig. 29: 3–6). Most specimen, however, are with inconspicuous notches shaped by fine, semi-steep retouch which causes that lateral edges are undulating (Fig. 29: 7–9). In two cases fine, flat retouch on the ventral side covers small sections of the edge. A possibility that this retouch is the effect of use cannot be excluded (Fig. 29: 10, 11). Five specimens have transversal retouch: distal or on the break, simple (Fig. 29: 12, 13) or shaping a notch.

1.2. Blades with continuous retouch on one edge and partial on the other (34). One edge has simple, semisteep retouch, whereas the other has fine, notched retouch on its small section; sometimes the retouch is alternate semisteep and notched (Fig. 29: 14). Blades with alternate retouch are also present: on one edge the retouch is ventral, fairly regular, semisteep, on the opposite edge the retouch is dorsal, discontinuous, flat (Fig. 29: 15).

1.3. Blades with bilateral, discontinuous retouch (39). Specimens with notched retouch on both edges (20) (Fig. 29: 16–18), and, sometimes, with asymmetrical notches were distinguished. One specimen is with proximal, inverse notch (Fig. 29: 16). Of interest is a strangled piece on a regular blade. Moreover, there were: i) blades with bilateral, denticulated retouch (4), ii) blades with notched-denticulated retouch (4), iii) blades with denticulated-notched retouch on one edge and simple retouch on the opposite edge (10), iv) blades with alternate retouch (1) (Fig. 29: 21).

2. Blades and bladelets with continuous, unilateral retouch (130):

2.1. Regular blades with continuous, semi-steep, simple retouch on one edge (48) (Fig. 29: 19, 20).

2.2. Robust, irregular blades with notched or denticulated-notched retouch (8) (Fig. 29: 22).
Fig. 28. Selected chipped artefacts. 1–9 – trapezes, 10 – rectangle, 11, 12 – rhombes, 13–17 – backed pieces, 18–21 – perforators, 22–24 – bec
Fig. 29. Selected chipped artefacts. Retouched blades
Fig. 30. Selected chipped artefacts. 1–5 – retouched blades, 6–12 – retouched flakes
One specimen had fine, alternate retouch on the opposite edge.

2.3. Bladelets with unilateral micoretouch (6). These are specimens with extremely fine retouch, or with regular, semisteep retouch. A specimen with a distinct impact fracture in the distal part could be used as an arrowhead (Fig. 30: 1).

2.4. Blades with extremely fine, irregular, discontinuous, obverse retouch sometimes restricted to a dorsal notches (68) (Fig. 30: 2).

2.5. A specimen with a distal, inverse notch (Fig. 30: 3) and a blade with a proximal inverse notch and retouch thinning the base (Fig. 30: 4) and a specimen with inverse proximal retouch shaping a kind of a tang (Fig. 30: 5) also belong in this group.

Retouched flakes

The group of flakes numbered 65 specimens represents the following types:

1. Flakes with unilateral retouch (28). As a rule, the retouch is very fine, less often semisteep, obverse (Fig. 30: 6, 7). Occasionally, the retouch is thicker, semisteep shaping lateral notches.

2. Flakes with bilateral retouch (16). Most often the retouch is continuous on one edge, whereas on the opposite edge it covers only small sections; sometimes, on one edge the retouch is notched or alternate notched (Fig. 30: 8–10). A specimen with bilateral, dorsal retouch (Fig. 30: 11) was also recorded.

3. Flakes with unilateral retouch and retouch in the distal part (8). The retouch can be inverse, fine, semisteep (Fig. 30: 12), or on one edge it is fine, delicate, while in distal part it is thick, semisteep, denticulated-notched (Fig. 31: 1). Flakes with very fine unilateral retouch, in the distal part, and partially covering the opposite edge also occur.

4. Flakes with lateral retouch and a notch in the proximal part (2) (Fig. 31: 2).

5. Flakes with fine retouch round the entire circumference (2) or with semisteep retouch, resembling raclettes (Fig. 31: 3, 4).

6. Flakes with retouch limited to the distal (6) or to the proximal part (2) (Fig. 31: 5).

Denticulated-notched tools

Besides flakes and blades with partial, denticulated-notched retouch there were 5 specimens that can be interpreted as definite tool types:

1. Three obsidian flake tools with transversal distal notches: in two cases the notches are obverse (Fig. 31: 6, 7), in one case the notch is Clactonian, inverse (Fig. 31: 8).

2. An obsidian blade with a lateral, fairly shallow notch.

3. A denticulated tool made round the entire circumference of a discoidal core from Boldogkövarája type limnoquartzite (Fig. 31: 9).

Side-scrapers

A small side-scraper made on an unworked chunk of Ondava hornstone was recorded (Fig. 31: 10).

Pic type tools

There were two robust pic made on thermal chunks (silicified limestone and Boldogkövarája type limnoquartzite), with pointed tips shaped by alternate retouch (Fig. 31: 11) or by two, alternate Clactonian notches (Fig. 31: 12).

Sickle inserts

Among lithic artefacts from Moravany sickle inserts are not numerous. Besides the several retouched truncations with silica gloss, mentioned earlier, and sporadic tools with silica gloss transformed by secondary retouch, there were only two unretouched blades used as sickle inserts, mounted obliquely in the hafts (Fig. 31: 13, 14). All these specimens were made from limnoquartzite. The small proportion of artefacts with sickle gloss has been caused by the fact that functions of obsidian artefacts – predominating in the collection from Moravany – have not been identified by macroscopic identification of use-wears.

Scatter-pattern of lithic artefacts

In the investigated part of the site at Moravany the traces of chipped stone production were concentrated in two features: 1/98 and 2/99, where a total of 3627 artefacts were uncovered forming 82.7% of the analyzed inventory. Both the number of artefacts as well as the structure of the two assemblages is very similar. The features are remains of workshops next to dwellings where both debitage products and retouched tools concentrated. The basic raw material in the two features was obsidian, although other rocks also occur (in feature 2/99 as many as 14 tools were
Fig. 31. Selected chipped artefacts. 1–5 – retouched flakes, 6–8 – notched flakes, 9 – denticulated tool, 10 – side-scraper, 11, 12 – pic, 13, 14 – sickle inserts
We suppose that the organization of lithic production was not based on specialization: in the dwellings or in front of houses (assuming that the features 1/98 and 2/99 were clay-pits next to houses) obsidian blanks and tools, in full cycle, were produced. The members of the community inhabiting the overground dwellings participated in the production process; the houses were associated with pits where waste from debitage as well as worn tools were discarded. The contents of the pits document a variety of activities. The presence, in both pits, of cores and blanks produced by means of advanced punch or even pressure technique is puzzling. Their presence suggests that some knappers, participating in the production, were highly skilled. Two possibilities can be considered: either the presence of cores worked by pressure technique was related to episodes when specialized knappers lived in the settlement as permanent community members, just like in some settlements of the Balkan FTN, or itinerant craftsmen visited the settlement (such a model is also considered in the case of macroblade industries of the Balkan FTN). However, the bulk of artefacts was produced to meet the needs of particular household clusters and by the community members who also performed other tasks and activities.

Discussion

The basic raw material utilized in chipped industry recorded at Moravany was obsidian, like in other sites of the early AVK in Eastern Slovakian Lowland (Table 1). Its contribution ranges from 88.9% at Moravany to 97.6% at Zemplínske Kopčany. In general, it is slightly higher in sites which are located closer to deposits. Nearby deposits of obsidian (Carpathian I) are situated in the area of Viničky, Malá Bara, and Štreda nad Bodrogom (Kaminská and Duda, 1985), which is at a distance of 30 (Slavkovce, Zemplínske Kopčany) to 45 km (Moravany, Zbudza, Zalužice). It seems that the inhabitants of each of these settlements conducted expeditions to obtain the raw material. On the other hand, similar share of obsidian in various sites and the presence of rough nodules point to the lack of the centers of secondary distribution. Perhaps the first groups settling down the territories north of the Ondava river mouth arrived into new areas with a supply of raw material, as evidenced in the cache found at Slavkovce (Kaczanowska and Kozłowski, 1997). It consists of 34 obsidian nodules and weighs a total of over 13 kg.

Other raw materials found in the early Neolithic inventories from Eastern Slovakian Lowland come from more distant outcrops. Possibly it reflects some contacts with groups who lived in more distant regions. As regards Moravany, Zabudza, and Zalužice limnoquartzites rank behind obsidian. Its deposits are most probably located in north-eastern Hungary. The occurrence of small quantities of radiolarites, probably originating from Klippen Belt stretching along the Carpathians, suggests the contacts with areas lying north of the area under consideration. The share of radiolarites decreases with increasing distance from these deposits. It amounts to 2.8% at Moravany whereas only individual specimens were identified at Slavkovce. In the assemblages from Moravany, Zbudza and Zalužice (in the latter site both in earlier stage and in younger one) single specimens of Volhynia flint occur. It should be mentioned that this raw material reached central parts of the Tisza basin during the development of the Körös-Cris (see the site of Ecsegfalva).

In comparison with other early AVK sites in Eastern Slovakian Lowland, inhabitants of the settlement at Moravany used a much wider range of stone raw materials. Some were strictly of local origin (e.g., Ondava flint extracted from alluvia of the Laborec river), others came from distant territories (“chocolate” flint from the middle Vistula basin), others are still of unknown provenance. They all demonstrate the broad contacts of the inhabitants of this village.

Exploitation was based on single platform core with very limited preparation (mainly of striking platforms). Comparison of the techniques of lithic exploitation at Moravany to other sites of the early AVK indicates that the way of coring was quite diverse. Sites located in eastern Slovakia, such as Slavkovce and Zalužice, simultaneously with the dominance of single-platform, mostly subconical and cylindrical cores, contain the double-platform cores, designed specifically.
for flakes, which do not occur at Zbudza (Kaczanowska and Kozlowski, 1997). In turn, on the Hungarian sites in the mid-Tisza basin we observe, in addition to the dominant usually quite regular single-platform cores, the presence of cores with altered orientation (Mezokövesd, Kötelek). Also, the eastern variant of transition stage from the Körös-Cris culture to the AVK is characterized by diverse morphology of cores (mainly single-platform); at Méhtelek they are primarily specimens with flat flaking platform while at Ibrány with narrow one (Starnini, 1993, 1994, 2001).

The technique used for producing blanks at Moravany is similar to that used in other sites. Blade blanks recorded in most of the sites of early AVK is characterized by the length of 2.5–4.5 cm within one mode between 3.0 and 4.0 cm, thus similarly to the blades from Moravany. However, blade blanks of the length 5–6.3 cm were identified at Zbudza and Zalužice. In the Hungarian sites, former parameters are typical for the eastern variant of “transition”, from Ibrány as well as for northern one, known from Kötelek. By contrast, in sites like Méhtelek and Mezokövesd there are two modes of the length of blades (2–4 and 6–8 cm), and in other “transitional” assemblage from Tiszaszolos we have even three modes (Dombóréczi, 2009).

Mostly blade blanks were used to produce tools while end-scrapers were produced deliberately from both blades and flakes. As regards tool structure, laterally retouched blades predominate at Moravany (54%). Second place is taken by retouched flakes, followed by microliths (including backed pieces – 33 specimens), end-scrapers (29), and truncations (27). Very similar pattern can be found in other early AVK sites in Eastern Slovakian Lowland (Slavkovce, Zbudza, Zalužice, and Zemplinske Kopčany – Table 2). Such a model of quantitative structure has evolved in Körös-Cris culture and prevailed also in AVK sites in northern Alföld (e.g. Füzesabony-Gúbakut – Table 2). In the Košice Basin, a slightly higher share of end-scrapers was observed in case of the site Čečejovce (Kozlowski, 1989). The model of assemblages with a predominance of laterally retouched blades over other tools are still visible in some sites of Bükk culture, e.g. at Humenné, located at the foot of the Vihorlat Mts. However, at site Šarišské Michaľany, which is situated in Šariš Basin, group of tools is dominated by end-scrapers. Such a situation possibly mirrors spatial differences within flint industry of the Bükk culture caused by the contacts with the LBK.

Thus, within chipped assemblages of the early AVK in Eastern Slovakian Lowland three basic types can be distinguished, with reference to the frequencies of the morphological groups:

– Type 1: blades with lateral retouches > retouched flakes > end-scrapers > trapezes and other microliths. This type includes Moravany, the younger phase of Zalužice, and Zemplinske Kopčany.

<table>
<thead>
<tr>
<th>Raw material</th>
<th>Moravany</th>
<th>Slavkovce</th>
<th>Zbudza</th>
<th>Zalužice, younger phase</th>
<th>Zemplinske Kopčany</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Obsidian</td>
<td>3898</td>
<td>88.9</td>
<td>204</td>
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<td>6</td>
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<td>3</td>
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<td>1.6</td>
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<tr>
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<tr>
<td>‘Volhynian’ flint</td>
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<td></td>
<td>2</td>
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<tr>
<td>Others</td>
<td>143</td>
<td>3.3</td>
<td>8</td>
<td>3.8</td>
<td>18</td>
</tr>
</tbody>
</table>

Table 1

Raw material structure of chipped industry in Moravany compared to other AVK assemblages in Eastern Slovakian Lowland.

M. Nowak et al.
– Type 2: retouched flakes > retouched blades > end-scrapers > trapezes and other micro-liths. This type occurs at Slavkovce.

– Type 3: retouched blades > end-scrapers > retouched flakes > trapezes and other micro-liths. Inventories of this type occur at Zbudza and at an earlier phase of Zalužice.

Differences between the assemblages did not arise from the properties of raw materials used, because they are all based on the obsidian. In all these sites a full production cycle took place and the artefacts produced off-site constitute only a small portion. In the first study of inventories from Eastern Slovakian Lowland (Kaczanowska and Kozłowski, 1997) a difference between the assemblage from Slavkovce (which was classified here as Type 2), and remaining ones were interpreted in terms of a different chronology. This hypothesis is still valid and supported by the high proportion of retouched flakes in a transitional, Körös/Linear site at Ibrány. However, on the other hand, the frequency of retouched flakes at Méhtelek is low. Differences among tool kits can be associated not only with stylistic seriation, but also with the specific subsistence activities conducted by the inhabitants of each settlement.

ARCHAEOBOTANY

From the Moravany site two groups of plant remains were found: 1) seeds, fruits, and vegetation part of plants, and 2) fragments of wood charcoal (Lityńska-Zając et al., 2008). This material comes from three kinds of samples: soil samples, burnt clay and charcoal pieces that were manually recovered in their concentration places. In total, 128 soil samples (water sieved with mesh sizes of 0.2 and 0.5 mm and flotated with mesh sizes of 0.5 and 1 mm), 140 charcoal samples, and 141 samples of burnt clay were analyzed.

Seeds and fruits of cultivated and wild plants

All plant material (charred diaspores and impressions on burnt clay) was identified by means of comparative collection and specialist literature. Examinations were carried out with 10–40 magnification (Lityńska-Zając et al., 2008).

Most of the classified plants remains represent cereals species. This was determined on the base of charred material (caryopsis and basal parts of glumes) and imprints on burnt clay. Daub pieces contained impressions of grains and vegetative plant parts (fragments of spikelet, "spikelet

<table>
<thead>
<tr>
<th>Tool group</th>
<th>Moravany</th>
<th>Slavkovce</th>
<th>Zbudza</th>
<th>Zalužice, older phase</th>
<th>Zalužice, younger phase</th>
<th>Zemplínske Köpčany</th>
<th>Füzesabony, older feature</th>
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<tbody>
<tr>
<td>End-scrapers</td>
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<td>20.8</td>
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<td>Truncations</td>
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<td>9.3</td>
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<td>6.1</td>
<td>11.1</td>
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<td>1.7</td>
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<td></td>
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<tr>
<td>Becs</td>
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<td></td>
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<td>2.5</td>
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<td>Microliths</td>
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<td>1.7</td>
<td>7.4</td>
<td></td>
<td>3.6</td>
</tr>
<tr>
<td>Retouched blades</td>
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<td>16.7</td>
<td>31.2</td>
<td>45.6</td>
<td>54.3</td>
<td>43.2</td>
<td>67.8</td>
</tr>
<tr>
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<td>31.5</td>
<td>17.2</td>
<td>19.3</td>
<td>16.1</td>
<td></td>
<td>7.4</td>
</tr>
<tr>
<td>Denticulated-notched tools</td>
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<td></td>
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<td>Side-scrapers</td>
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<td>1.7</td>
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<td>Pics</td>
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<td>Unretouched sickle inserts</td>
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<td>5.0</td>
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<td>3.7</td>
<td></td>
</tr>
<tr>
<td>Fragments</td>
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<td></td>
<td></td>
<td>1.7</td>
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<td></td>
</tr>
<tr>
<td>Total (N)</td>
<td>468</td>
<td>54</td>
<td>192</td>
<td>69</td>
<td>86</td>
<td>81</td>
<td></td>
</tr>
</tbody>
</table>

Table 2

Percentages of the major tool groups in Moravany compared to other early AVK sites
forks”, as well as basal parts of glumes and chaff), some of them having charred and/or dried specimens preserved inside. Hulled wheats: emmer *Triticum dicoccon* Schrank. and einkorn *Triticum monococcum* L. were dominant among the identified cereals and most of the cereals belonged to emmer (Table 3). Also, common barley *Hordeum vulgare* recorded as imprints of a few caryopsis and spikelet fragments were documented. However, the biggest number of specimens represents one or both of the two mentioned wheat species *Triticum dicoccon* vel *T. monococcum*. A part of poorly preserved material was described as unidentified cereals *Cerealia* indet. or as unidentified cereals and/or wild grasses *Cerealia* indet. vel Poaceae indet.

A small number of wild herbaceous plant remains were found both in the soils samples and in the burnt clay (Table 4). On the basis of charred seeds three species: *Chenopodium album* L., *Saponaria officinalis* L. and cf. *Solanum nigrum* L. were determined. Several grains were identified to the level of genus brome-grass *Bromus* sp. A part of the material preserved on daub (un-charred chaff fragments) and charred four grains and two very damaged seeds were classified only to the grass Poaceae indet. and legume Fabaceae indet. families. Seeds and fruit of *Chenopodium album* L., *Stellaria gramineae* L., *Fallopia convolvulus* (L.) Á. Löve, *Polygonum aviculare* L., *Scleranthus annuus* L. vel *S. perennis* L., *Viola* sp. and Caryophyllaceae were preserved in un-charred conditions. These specimens may represent an admixture from the modern time, as a result of contamination during the handling of the samples in the field or an accumulation of plant remains caused by animals.

Three of aforementioned taxa may correspond to habitats of anthropogenic origin. *Bromus* species belong to a genus whose species are related to cereal cultivation (e.g. *B. secalinus* L., *B. arvensis* L.), ruderal habitat (*B. sterilis* L., *B. tectorum* L.) and meadow habitat (*B. hordaceus* L.). Unfortunately, due to the degree of determination to the genus level of such material, it is impossible to assess these findings.

*Chenopodium album* is recorded most often and most abundantly in subfossil materials (Wasylkowa, 1983), likely because of their enhanced seeds productions (over 100000 seeds per year – Tymrakiewicz, 1962; Domanska, 1982). At present white pigweed is associated primarily with ruderal habitats. Quite often it also occurs in various sowing, especially in crops of garden vegetables and root crops. It appears also in the fields of cereals. It is characterized by wide ecological amplitude, but grown better on rich soils.

Black nightshade *Solanum nigrum* is an annual herb, also occurring in ruderal habitats and can be related to cereal cultivation. *Solanum*

---

**Table 3**

<table>
<thead>
<tr>
<th>Name of taxa</th>
<th>Kind of remains</th>
<th>Daub</th>
<th>Soil samples</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>imprint</td>
<td>charred</td>
<td>dried</td>
</tr>
<tr>
<td><em>Triticum dicoccon</em></td>
<td>caryopsis</td>
<td>12</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>glume</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spikelet</td>
<td>5</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td><em>T. monococcum</em></td>
<td>caryopsis</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spikelet</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><em>T. dicoccon</em> vel <em>T. monococcum</em></td>
<td>caryopsis</td>
<td>27</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>glume</td>
<td>2</td>
<td>1</td>
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<td></td>
<td>spikelet</td>
<td>10</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td><em>Hordeum vulgare</em></td>
<td>spikelet</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>caryopsis</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><em>Cerealia</em> indet.</td>
<td>chaff</td>
<td>+</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>caryopsis</td>
<td>+</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><em>Cerealia</em> indet. vel Poaceae indet</td>
<td>chaff</td>
<td>0</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>
Saponaria officinalis is growing in fertile, neutral or alkaline and containing calcium carbonate soils and wet soils (Tymrakiewicz, 1962).

Soapwort *Saponaria officinalis* represents habitats located in the riversides or other permanently wet sites. They frequently coexist with willow communities. It is very interesting taxa because was known and applied in folk medicine (Podbielkowski, 1985). Active substances include saponins, occurring in the whole herb, but especially in the root.

In Moravany hulled wheats predominated among the cereals. Most of the remains belonged to emmer *Triticum dicoccon*, accompanied by less represent remains of einkorn *T. monococcum*. Compared to wheats, barley *Hordeum vulgare* was less abundant. Plant material indicates that hulled wheat play an important role in agricultural system of the early Neolithic settlers.

The same cereals appeared in two other sites from early AVK in Eastern Slovakian Lowland: Slavkovce and Zalužice (Litynska-Zajac, 1997; Litynska-Zajac *et al.*, 2008: 89). Taking into account foregoimg taxonomic compositions (Table 5) as well as early Neolithic structures of cultivated plants recorded in adjacent regions (Bérczy, 1997; Dulnoki, 2005; Gyulai, 2007; Hajnalova, 1993: 104–108; Hajnalova, 2007; Wasylikowa *et al.*, 1991), it seems probable that wheat was the principle cereal cultivated by early AVK people in the area under discussion. Both wheat species were probably cultivated in the same fields as they have similar edaphic requirements and similar life cycles (Hajnalová, 2007: 306; Januševič, 1976; Jones and Halstead, 1995; Kreuz, 2007: 273–274). Barley had minor, if any importance since its remains are very scarce in many early Neolithic contexts in Central Europe and it is commonly considered as a weed grown in wheat fields (Kreuz *et al.*, 2005).

In the studied samples from Moravany there were small number of wild herbaceous plant remains. Therefore, any reconstruction of former plant communities cannot be made. Nevertheless, it can be shown that except of *Saponaria officinalis* all those taxa could have been related to anthropogenic and ruderal habitats, such as cultivation. Presence of *S. officinalis*, which occurs in wet habitats, indicates that this species was purposely carried into the settlement, probably from Šarkan or Ondava valley. This plant is a curative and poisonous one, and its roots were also used for cleansing.

In conclusion, we would like to repeat the already expressed opinion (Litynska-Zajac *et al.*, 2008) that a relatively small number of cereals and weeds do not prove the low participation of domesticated plants in human diets. First, there is no indication for the predominance of ‘wild’ food in the diet of Moravany inhabitants. Second,

### Table 4

<table>
<thead>
<tr>
<th>Taxa name</th>
<th>State of preservation</th>
<th>Kind of remains</th>
<th>Number of specimens</th>
</tr>
</thead>
<tbody>
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<td>charred</td>
<td>grain</td>
<td>1, 2*</td>
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<tr>
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<td>seed</td>
<td>15</td>
</tr>
<tr>
<td><em>Saponaria officinalis</em></td>
<td>charred</td>
<td>seed</td>
<td>17</td>
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<tr>
<td><em>cf. Solanum nigrum</em></td>
<td>charred</td>
<td>seed</td>
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</tr>
<tr>
<td>Fabaceae indet.</td>
<td>charred</td>
<td>seed</td>
<td>2</td>
</tr>
<tr>
<td>Poaceae indet.</td>
<td>charred</td>
<td>grain</td>
<td>4</td>
</tr>
<tr>
<td><em>Stellaria graminea</em></td>
<td>uncharred</td>
<td>seed</td>
<td>2*</td>
</tr>
<tr>
<td><em>Chenopodium album</em></td>
<td>uncharred</td>
<td>seed</td>
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</tr>
<tr>
<td><em>Fallopia convolvulus</em></td>
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</tr>
<tr>
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<tr>
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<tr>
<td>Caryophyllaceae indet.</td>
<td>uncharred</td>
<td>seed</td>
<td>3</td>
</tr>
</tbody>
</table>

* – charred remains preserved inside the imprint
palaeoeconomic data (and their interpretations) from the Tisza Basin suggest that the agro-pastoral mode of subsistence was important for the First Neolithic societies (Bartosiewicz, 2005; Bogaard, 2004a; Craig et al., 2005). Reconstructions of the Holocene history of the Šarkan valley demonstrate that the activity of the first farmers did not significantly transform the local environment (and this is a typical situation in the Carpathian Basin and the Balkans, not only during the early Neolithic). Consequently, we are of the opinion that the spatial extent of the cereal farming was rather small; i.e. emmer and einkorn were cultivated together on small fields located near the village houses. Hypothetically, such a situation would imply an intensive mode of cereal husbandry (Bogaard, 2002, 2004a, 2004b). However, the set of acquired plant remains, especially weeds, is too modest to evaluate hypothesis of the kind. It should be also remembered that understanding the term “intensive cultivation” within Neolithic contexts and the question of its attributes is still ambiguous (e.g. Kreuz et al., 2005: 249, 251).

**Wood charcoal fragments**

In the identification of charcoal each fragment is the unit of. It was usually broken manually along the three anatomical sections: transverse, longitudinal tangential and longitudinal radial. Then each fragment was observed using a reflected light microscope with light and dark fields. Detailed information and micrographs were supported by Scanning Electron Microscope (Fig. 32). Identifications were made in comparison with anatomical atlases (Jacquiot et al., 1973; Schweingruber, 1990) and specimens coming from a modern reference collection. Most of the taxa are classified to genus level and the identification of species is given on the basis of its unique presence in the local vegetation. The anatomical characteristics do not permit to distinguish between *Carpinus betulus* and *C. orientalis* (Schweingruber, 1990); nevertheless, the modern distribution of both species may suggest that the charcoals might represent *C. betulus* (Tutin et al., 1964–1993).

Among 2784 charcoal fragments 15 taxa were identified to subfamily, genus or species level (Table 6; Fig. 32). These charcoal fragments were found dispersed in archaeological features, in the context that represent the dumping or leaving rubbish area. They reflect the remains of different wood burning activities but mainly correspond to domestic fuel wood deposited within a long-term span. Similar charcoal assemblage usually provides high diversity of taxa and thus may form a specific sample of local woody vegetation.

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<th>Taxe name</th>
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<tr>
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<tr>
<td></td>
<td>spikelet</td>
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<tr>
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</tr>
<tr>
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<td>glume</td>
<td>97</td>
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</tr>
<tr>
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<td>+</td>
</tr>
<tr>
<td>Cerealia indet. vel Poaceae indet.</td>
<td>chaff</td>
<td>+</td>
</tr>
</tbody>
</table>

### Table 5

Remains of cereals from Moravany compared to other early Neolithic sites in Eastern Slovakian Lowland
To sum up, the charcoals coming from that kind of archaeological context may serve for the reconstruction of ancient plant communities (Chabal, 1988, 1997; Badal Garcia, 1992; Heinz and Thiébault, 1998; Ntinou, 2002; Carrión Marco, 2005; Lityńska-Zajęc and Wasylkowa, 2005).

However, not all of the taxa are taken into consideration as representative for Neolithic woody flora since some of them represent contaminated material (Table 4). The aforementioned

Fig. 32. SEM micrographs of selected charcoals from Moravany. 1 – *Quercus* sp. deciduous – transverse section (T.S.), bar = 100 µm, 2 – *Fraxinus excelsior* – T.S., bar = 250 µm, 3 – *Ulmus* sp. – T.S., fungal hyphae inside of plant tissue, bar = 100 µm, 4 – Rosaceae/Maloideae – T.S., bar = 100 µm, 5 – Rosaceae/Maloideae – longitudinal tangential section (L.T.S.), bar = 50 µm, 6 – *Corylus avellana* – T.S., bar = 100 µm, 7 – *Corylus avellana* – longitudinal radial section (L.R.S), bar = 10 µm, 8 – *Salix* sp./*Populus* sp. – T.S., bar = 50 µm, 9 – *Salix* sp./*Populus* sp. – L.T.S., bar = 50 µm
assumption is based on three radiocarbon datings and stratigraphic observations (Lityńska-Zając et al., 2008; Moskal-del Hoyo and Kozłowski, 2009). First, two taxa (Fagus sylvatica and Carpinus betulus) that represent the most recent flora concerning the Holocene migration of trees in Europe (Ralska-Jasiewiczowa et al., 2004) were dated in order to confirm their early presence in local vegetation. The results of AMS radiocarbon datings gave much younger age for both trees: 3,285±30 BP for F. sylvatica (Poz-22308) and 1,060±30 BP for C. betulus (Poz-22309). As a consequence, all charcoal fragments belonging to these taxa were excluded from Neolithic assemblages due to modern contamination (postdepositional factors). Second, some charcoal fragments

---

**Table 6**

Results of anthracological analysis from Moravany. Absolute number of charcoal fragments and relative frequency of the sum (%). Modified after Lityńska-Zając et al., 2008, table 3

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<th>3/00</th>
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<th>2/01</th>
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Recovery method applied

- Manually recovered samples (140)
- Water sieved samples (20 × 20 l.)
- Flotation samples (108 × 10 l.)
that are found in the bottom of archaeological features present a group of different taxa composition, mainly corresponding to coniferous wood and birch representing deciduous ones. Among them, the most interesting was a taxon identified as *Picea* sp. or *Larix* sp., two trees that do not grow at present in the vicinity of the site based on their ecological requirements (Miklós, 2002). The AMS dating of one charcoal piece indicated its provenience from Interpleniiglacial (26,950±230 BP; Poz-22307). Therefore, all charcoal fragments of *Picea* sp. or *Larix* sp. are also considered as contamination due to depositional factors. Moreover, for further interpretation of the Neolithic charcoal assemblage, all the other taxa that came from the same context (bottom of the pits) and belong to typical trees for the Pleistocene of Slovakia (Hajnalová and Krippel, 1984) most probably cannot be taken into account.

Among Neolithic charcoals, the dominance of oak (*Quercus* sp.), ash (*Fraxinus excelsior*) and elm (*Ulmus* sp.) is outstanding. The other taxa were represented by single specimens. Prevailing taxa at Moravany were probably most abundant in the site’s proximity because the most frequent categories are found easier in the anthracological samples (Ntinou, 2002). The dominance of oak may suggest the presence of deciduous oak forest which could have predominated in rich soils present in neighboring area. In oak woodland, different oak species accompanied by hazel as a predominant shrub layer component could have appeared. Also, diverse species belonged to Rosaceae family could have occurred as undergrowth or in the forest edge. Ubiquities and light-demanding species of birch could have also appeared within this formation. Elm, ash and maple species mostly could have occurred in wet and shady zones with permanent good water supply (Polunin and Walters, 1985; Ellenberg, 1988). Due to less competitive ability within deciduous woodlands, Scots pine might probably have occupied some extrazonal and azonal habitats (Kreuz, 2008).

On the other hand, high frequency of ash and elm indicate that also riverine forest was present in the vicinity. The latter may correspond to mixed wood developed on rich soils in the area characterized by occasional flooding. Ash (*Fraxinus excelsior*) and elms (*Ulmus minor, U. Laevis*) dominate in tree layer, habitually accompanied by oak that is mainly represented by pedunculate oak (*Quercus robur*). In this plant community also field maple (*Acer campestris*) is common, whereas in shrub layer hazel (*Corylus avellana*) and hawthorn (*Crataegus monogyna*) belonging to Rosaceae family are widespread (Polunin and Walters, 1985: 90–91). Moreover, other taxa documented in charcoals such as elder (*Sambucus* sp.) and alder buckthorn (*Frangula alnus*) may represent wet woodlands. Besides, alder (*Alnus* sp.) and willow or poplar (*Salix sp./Populus sp.*) that prefer the habitats along the valleys of rivers and streams might formed riverine forest. All these plant communities might have grown in the proximity of Šarkan and Ondava river.

The deforestation of great scale did not occur in the Atlantic period (see above) in the vicinity of a Neolithic site. Furthermore, the list of tree taxa may imply rather broken canopy of local forests. This assumption might be based on the presence of taxa that usually do not regenerate well in closed forest such as oak, ash and hazel (Kreuz, 2008). The existence of wet woodlands on rich soils in the vicinity of Neolithic settlement seems to indicate good environmental condition for subsistence strategies: proximity of the river, lands suitable for cultivation and rich in tree species forests with developed undergrowth that provide wood, fuel, fodder, food supply (nuts, acorns and fruits), appropriate grazing area, etc.

The region of Eastern Slovakian Lowland does not offer other palaeobotanical data from the Atlantic period (Rybničková and Rybníček, 1996). Nevertheless, the development of mixed deciduous forests dominated by oaks was also documented in south-western Slovakia and north-eastern Hungary (Krippel, 1971; Willis et al., 1995; Gardner, 2002; Hajnalová and Hajnalová, 2005).

Finally, the Moravany assemblage provides some palaeoethnographic information. First, it can be demonstrated that oak wood was used as construction material since it was found *in situ* in the form of burnt fragments of a post (2/03) and also was documented in the burnt clay (pit 1/01). Another undetermined wood fragment was found in the pit 3/01. Furthermore, in one sample from the feature 1/01 an imprint of leaf belonging prob-
ably to alder (cf. *Alnus* sp.) was also detected (Lityńska-Zając et al., 2008). Second, different kinds of wood were utilized as firewood and therefore the ease of wood collection and its transportation may be a major factor in its selection. In this respect, dry wood recovered from forest may be a very suitable source for fuel wood (Asouti, 2005; Asouti and Austin, 2005; Moskal-del Hoyo et al., 2010; Salisbury and Jane, 1940; Shackleton and Prins, 1992; Théry-Parisot, 2001). Indeed, some charcoal fragments from Moravany indeed present fungal hyphae (Figure 32: 3) that may reflect pre-burning microbial activity. Hence, this may confirm the recovery of dead and easily collectable wood (Asouti, 2005; Moskal-del Hoyo et al., 2010; Théry-Parisot, 2001).

**RADIOCARBON CHRONOLOGY**

We obtained 36 $^{14}$C dates from within the excavated units (Table 7). Twenty four of them were of charcoals (of which 22 from anthropogenic features), and 12 from organic temper of Neolithic pottery (Kozłowski et al., 2003; Kalicki et al., 2004; 2005). Six of the dates were clearly beyond the general time frame of the Neolithic in north-eastern part of the Carpathian Basin. These older dates are: Poz-22307, Ki-9250, Ki-9246, and Ki-9248 as well as younger ones: Poz-22308, and Poz-22309. Therefore, they have not been included into the sum of calibration simulations, however they are obviously relevant to the credibility of the obtained dating. The simple sum of 29 dates (without aforementioned six dates and date Ki-9251, obtained from outside anthropogenic context) provides the range of 5,990–4,610 cal. BC for 2σ probability and of 5,610–5,050 cal. BC for 1σ probability ($\mu = 5,280\pm 340$ cal. BC i.e. 5,620–4,940 cal. BC) (Fig. 33).

The sum of the probabilities simulated separately only for “Neolithic” dates obtained from charcoals of anthropogenic objects (Fig. 34) gave the following results: 2σ probability – 5,990–4,720 cal. BC, 1σ probability – 5,620–5,060 cal. BC, $\mu = 5,390\pm 280$ cal. BC i.e. 5,670–5,110 cal. BC. A similar procedure for the dates obtained only from pottery (Fig. 35) gave, in turn, the following results: 2σ probability – 5,630–4,590 and 4,370–4,070 cal. BC, 1σ probability – 5,550–5,000 cal. BC, $\mu = 5,120\pm 360$ cal. BC i.e. 5,480–4,760 cal. BC.

The broader ranges are difficult to acknowledge, both in reference to the beginning and end of the early Neolithic in Eastern Slovakian Lowland, when compared with datings of the first Neolithic in north-eastern part of the Carpathian Basin (Biagi and Spataro, 2005; Biagi et al., 2005; Domboróczky, 2009; Horváth and Hertelendi, 1994; Hertelendi et al., 1995; Kozłowski and Nowak, 2007; Whittle et al., 2002). They suggest a date too early for Moravany. It means that dates around 6,000/5,900 cal. BC would have been even earlier than the beginning of the Körös-Cris culture in the Great Hungarian Plain. On the other hand its disappearance seems also to

![Fig. 33. Sum of probabilities of “Neolithic” radiocarbon datings from anthropogenic features](image)

![Fig. 34. Sum of probabilities of “Neolithic” radiocarbon datings from anthropogenic features obtained on charcoals](image)
be too late. For this reason, the ranges set by the single standard deviation, as well as by the average values and accompanying standard deviations seem to be more close to prehistoric reality. In such a case we should pinpoint the beginning of the settlement around 5,600 cal. BC. We note here, however, a difference between the dates from charcoals and pottery. The former indicates the beginning at ca. 5,620 and 5,670 cal. BC, while the latter at ca. 5,550 and 5,480 cal. BC. In our opinion the date of 5,600 cal. BC or even older seems to be still too early, again when compared with the dates from neighbouring regions as mentioned above, the pottery stylistics, and characteristics of lithic industry. As a result, the date determined by the pottery seems to be more likely and thus the beginning of the settlement at Moravany falls ca. 5,500 cal. BC. It should be mentioned that pottery dating of this kind give usually “broad” results (Gomes and Vega, 1999; Stäuble, 1995), i.e. a large proportion of such dates is younger than actual age of the dated pottery. By contrast, the oldest part of the range obtained for the combined pottery dates corresponds to the actual age of the pottery (Kaminská et al., 2009).

As for the charcoal dates, undoubtedly we should draw our attention to possible contamination of the infillings of either anthropogenic features or even dated samples by older charcoal, which was recorded in clayey layers (see the date Ki-9250 – Table 4) where the anthropogenic pits were dug into. This is also confirmed by the older dates obtained from infillings of some features (Poz-22307, Ki-9246, Ki-9248 – Table 7).

The most recent dates (around 5,000 cal. BC) obtained for 1σ probability and average with its standard deviations (Fig. 33) seem also to be inappropriate, i.e. they are too late. First and foremost, we should draw attention to the fact that the corresponding dates obtained for the pottery (Fig. 35) are even younger (5,000 and 4,760 cal. BC). This means that the global result is somewhat rejuvenated by these dates. It has been previously emphasized that such dates are mostly too young, and consequently the middle and especially(!) the younger parts of their calibration intervals should be rejected. Similar dates for charcoals (Fig. 34) are of course a little earlier, i.e. 5,060 and 5,110 cal. BC. Moreover, in the case of charcoal dates a contamination of samples by carbon of less (see date Ki-9251 – Table 7) or more (see dates Poz-22308, Poz-22309 – Table 7) younger age cannot be ruled out. On the other hand, the problem of old wood generally requires taking into account

### Table 7

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<tr>
<th>Sample No.</th>
<th>Date BP</th>
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<th>Feature /trench</th>
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the rather younger part of the ranges resulting from the combination of such dates. Thus, as a hypothesis, we propose a range of 5,200–5,100 cal. BC for the end of the settlement.

Radiocarbon dates by themselves are not able to give the answer to the question about the time frames of the settlement. We need to make in this regard the summary of relevant radiocarbon data and to include typological data from the site and archaeologically and geographically similar phenomena.

DISCUSSION AND CONCLUSION

The boundaries of the Moravany settlement were tentatively determined. Taking into account the distribution of anthropogenic features and the scattering of artefacts on the ground surface, its area can be estimated at 2–3 hectares. It is a relatively large area for an early Neolithic site. Our assessment indicates that the site was not a seasonal camp or a short-term settlement. The archaeological evidence highlights the contention concerning the permanency of the village as follows: 1) the full chain of lithic (mainly obsidian) tool production; 2) large features, some of which contained “dense” archaeological material; 3) post-holes; 4) traces of contacts with the territories situated north of the Pozdišovský Range including Transcarpathian contacts.

It is difficult to determine whether the settlement functioned during the entire postulated time interval, i.e. 5,500–5,200/5100 cal. BC, or only in part of this range. If we consider the first alternative as more probable, the question arises whether the settlement covered an area of 2–3 hectares all that time, or was smaller, and dwellings as well as other structures circulated within this area from time to time. Currently, it is impossible to respond to this question.

One explanation is the ambiguous chronological position of the pottery. As we noted above, it demonstrates both archaic and time-progressive attributes. In theory, such a situation would reflect multiphase development within the settlement (two or three phases?). On the other hand, all these attributes have been recorded jointly, both in horizontal and vertical dimensions. Therefore three basic, alternative interpretations should be hypothesized.

1. This is an effect of secondary mixing of archaeological remains that originally belonged to different phases of the settlement, which is possible due to penecontemporaneous intensive erosion. Radiocarbon dates would have confirmed such alternative. Thus, the settlement in such a case would have functioned over the whole periods 5,500–5,200/5,100 cal. BC.

2. We deal with a relatively early Neolithic settlement, around 5,500–5,300 cal. BC, with progressive attributes in ceramics, *inter alia* announcing stylistics of the Rašowce group (Šiška, 1989).

3. The settlement could have existed around 5,300–5,100 cal. BC, as demonstrated by older ceramic attributes (of the Kopčany group type and even of the Kőrős-Cris culture type) that continued to be utilized alongside younger ones.

Currently, on the basis of previous studies of pottery, lithics (see also remarks below), and radiocarbon dating, it is impossible to assess, which scenario is most likely. Perhaps the lack of evidence of anthropogenic impact in the early Neolithic environment around the site would have been an argument in favor of shorter time duration of settlement. Thus, either scenario No. 1 or No. 2 should be taken into account, i.e. short life of the settlement (*ca.* 100–200 years), within the period of *ca.* 5,500 to 5,200/5,100 BC. On the other hand, the whole area where early Neolithic remains are scattered was settled and exploited. Therefore, we suggest here, that the spatial size of the village was relatively considerable.
Somewhat similar situation as in the ceramics is noted concerning the chipped industry. There are visible features which derive from the tradition of the FTN (the most significant are tools with lateral retouches and microliths), but on the other hand some new attributes have been also recorded. In sum when this industry from Moravany is viewed against the background of the transition from Körös-Cris to AVK and in the context of early AVK it should be emphasized that in taking the style, the technology and the morphology of Eastern Linear lithics, it was different in space and time. In this process, the interactions between the FTN Balkan tradition (macroblade technology including pressing technique, lateral retouches, off-site blank and tool production, the presence of extra-local raw materials, low artefact discard) and adaptations to ecological conditions and raw materials north of the Central-European Agro-Ecological Barrier (Sümegi and Kertes, 2002) can be observed. These adaptations are manifested primarily through the on-site way of organization of production, using local or meso-local raw materials (obsidian, limnoquartzites, hornstones, and in more northern sites radiolarites), “mediolithic” technology in blade production, growing role of transversal retouches (truncations, end-scrapers), and high artefact discard. Besides the transformations that are directly the result of changes in environmental conditions, some of them, mainly in the morphological (stylistic) and functional structure of tools, could have been the result of economic changes in the northern part of the Carpathian Basin. This means, acquiring a stronger technical role in hunting, gathering, and fishing although it would be difficult to see such changes at Moravany. Elements of both the FTN Balkan model and adaptive innovations in the Körös-Cris – AVK transition and in the early AVK occur in varying degrees and different configurations in south-eastern Slovakia and north-eastern Hungary.

If the settlement at Moravany already existed around 5,500–5,400 cal. BC, it would be possible to correct the chronological sequence of the Neolithic in the Eastern Slovakian Lowland, established by S. Šiška (1989). According to his work, the Neolithic period began with the so-called Kopčany group. As S. Šiška did not have radiocarbon dates, he could not set up 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. In the new scenario the Kopčany group would appear earlier. It would be possible that its earlier part developed at least from 5,500 cal. BC partly alongside the Szatmár group in the northern part of the Great Hungarian Plain.

Even if the settlement at Moravany functioned only about 5,300–5,100 BC, its inhabitants belonged to the first Neolithic population in the Eastern Slovakian Lowland. Because there are no unquestionable traces of Late Mesolithic occupation in eastern Slovakia (including Moravany), we could hardly identify a local Neolithisation based on indigenous hunter-gatherer populations. Neither does the technology of stone processing point to a local Neolithisation, as it is interpreted in the early Neolithic traditions of the Great Hungarian Plain. Taking into account all data, it seems that the most plausible interpretation is that the settlement at Moravany was established by a group who, more or less, were directly descended from a tradition of Körös-Cris culture.

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