

## The beginnings of salt exploitation in the Carpathian Basin (6<sup>th</sup>–5<sup>th</sup> millennium BC)\*

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**ABSTRACT** – While there are ample data for salt exploitation in later prehistory, in the Neolithic, i.e. 6<sup>th</sup>–5<sup>th</sup> millennium BC, archaeological data from Southern Central Europe remain scanty. The paper attempts to give an overview of Neolithic salt research in the Carpathian basin. Both the archaeological traces and the research of Neolithic salt extraction activity are rather uneven there. While the eastern half had close contacts with Transylvanian salt regions, the western part, i.e. Transdanubia, lacks salt sources of any kind. The obvious need for salt gave rise to the search for salt-rich areas within reach of the early LBK migration in Central Europe, and indeed, these groups had rapidly settled in three key salt regions in Western and Central Germany, as well as in Little Poland. One of the reasons for the rapid migration and long-term contacts with these zones might thus have been access to salt. In general terms, it is in many cases highly probable that some sites specialised in salt exploitation, and that certain regions served as settings for exchange networks.\*

**IZVLEČEK** – Kljub temu, da je na voljo množica dokazov za izrabo soli v pozni prazgodovini, je podatkov za južni del srednje Evrope v neolitiku (6. in 5. tisočletje pr. n. š.) zelo malo. V prispevku predstavljamo pregled raziskav neolitske izrabe soli v Karpatski kotlini. Tu so neenakomerni tako arheološki sledovi kot raziskave neolitske izrabe soli. Vzhodni del je imel bližnje stike s transilvanskimi ležišči soli, v zahodnem delu, Transdanubiji, pa virov soli ni. Potreba po soli je povzročila iskanje s soljo bogatih območij znotraj dosega migracij zgodnje LBK v srednji Evropi. Tako so te skupnosti hitro poselile tri ključne s soljo bogate regije v zahodni in osrednji Nemčiji, kot tudi v Mali Poljski. Eden ključnih vzrokov za hitre migracije in dolgoročne stike s temi območji je lahko bila prav sol. Zdi se, da so se v mnogih primerih posamezna najdišča specializirala za izkoriščanje soli in so nekatere regije igrale ključno vlogo v omrežjih menjave soli.

**KEY WORDS** – Neolithic salt exploitation; 6<sup>th</sup>–5<sup>th</sup> millennium long-distance networks; spread of farming; Central Europe

### Introduction

In focusing on the Neolithic, several salt regions were identified south and east of the Carpathian Ranges, above all in Bulgaria, Serbia and the Adriatic Carst (Nikolov 2008; Gaydarska-Chapman 2007; Tasić 2000; Montagnari-Kokelj 2007). However, this small paper attempts to give an overview of Neolithic salt research in the Carpathian Basin. Both the archaeological traces and the research of Neolithic salt extraction activity are rather uneven there. While in several cases it is highly probable that a site specialised in salt exploitation, or certain regions

served as settings for exchange networks, there are hardly any archaeologically tangible finds to prove it. It is not possible to track salt exploitation with finds, especially in their find contexts, before the early 5<sup>th</sup> millennium; therefore, I begin by summarising the scarce results, starting with this period, the Carpathian Late Neolithic.

Going back in time, direct evidence from earlier Neolithic phases in the Central Carpathian Basin is still little more than hypothetical. Nevertheless, there is

\* This paper is an extended version of a chapter published in Harding, Kavruk 2013.

a fact that makes the acquisition of salt more than probable: salt is clearly necessary for maintaining human life, and it is even more essential when the proportion of meat and fish protein decreases and the basis of the diet turns vegetarian along with the appearance of the first domesticated plants; in other words: at the onset of the Neolithic transition (in the Carpathian Basin: 6000–5800 calBC), hunter-gatherer consumption gradually changed to a diet that was increasingly based on cereals. The Neolithic lifestyle also meant animal domestication. Sheep, goats and cattle were brought into the Carpathian Basin in an already domesticated form and it was necessary to supply them with salt. These physiological needs were, however, complemented by other reasons for having access to salt, such as the preservation of food and leather, or festive meals within the community; in other words, salt also had a social function (Chapman, Gaydarska 2003.203).

Thus, where there were no salt springs, salt must have been imported. It seems sensible to collect facts on settlement patterns and also parallel finds from other regions, especially salt regions in order to make a first attempt at reconstructing a possible early salt network. This network, which must have existed, may turn out to be a major key to understanding the different types of social and cultural development in the 6<sup>th</sup> and early 5<sup>th</sup> millennia BC. For this reason, it is worth trying to trace this network back to the earliest Neolithic centuries, and specifically to the Neolithic transition. Therefore, in the second part of this paper, I attempt to reconstruct a possible new salt route that may have played a role in the Neolithisation process from Transdanubia to Central Europe.

In order to avoid confusion by looking for finds that are not expected in a certain region, it is necessary to distinguish three types of activity that could have been connected with salt in the Neolithic. Firstly, it is pointless to look for finds, mainly pottery fragments, that were used for evaporating salt water anywhere else than in the immediate vicinity of salt springs. The second activity connected with salt was distributing it to salt-poor regions. In order to detect these routes, the network needs to be traced back with the help of mutual import finds or other indicators, such as local commodities and types of raw material. It is almost impossible to find out how the salt was carried; the objects may not have been vessels, but more probably, bags made of leather or textile; like salt, these are archaeologically invisible. Finally, of the third type of activity, *i.e.* the consumption of

salt, there is also no direct archaeological indication. Logically, this third case should be seen in regions that have no salt springs, like the centre of the Carpathian Basin. Therefore, the present summary is an attempt to infer salt use and salt routes with the help of this tripartite approach.

### **Firm evidence for salt production and trade in the Late Neolithic**

The technique for acquiring salt in the Neolithic may have consisted of nothing more than heating salt water in pots. More complicated techniques probably did not develop in the Carpathian Basin before the Middle or Late Bronze Age (Harding, Kavruk 2013).

In the Carpathian Late Neolithic, *i.e.* the first half of the 5<sup>th</sup> millennium BC, the Lengyel cultural group forms a large circle from Transdanubia expanding to the Munich Basin, Moravia and to the Malopolska area in South Eastern Poland. This latter is one of the major salt regions of Europe, and these are the first Lengyel sites with pottery that can be connected to salt production. Vessel types in the context of briquetage occur here (Kaczanowska 2006.104–105; Fries-Knoblach 2001). Given the well-documented cultural connection within the Lengyel circle in Central Europe, it is probable that communities living in the huge Lengyel-Stichband-Moravian painted and Münchshöfen cultural area were connected with Malopolska salt production, and that the Lengyel communities there also traded in salt. Other commodities revealing the existence of dense cultural and exchange contacts are assumed by tracking the routes of finds such as marble arm rings (Zápotocká 1984). Similarly, in the East Carpathian salt area, ceramic finds associated with brine evaporation occur in the Cucuteni A culture (Cavruc, Chiricescu 2006.202).

The contacts, as seen from the archaeological point of view, were traditionally seen as having gone through Moravia. In the past two decades, however, it has become clear that another route can be reconstructed in addition to the Moravian valleys. Nándor Kalicz was able to range a series of Lengyel sites along the North East Hungarian Mountains that are linked to related sites and find complexes in East Slovakia (Vizdal 1973; Kalicz 1994; Šiška 1995; Pavúk 1986; 1991). In this way, the Lengyel settlement area of Western Hungary expanded through Eastern Slovakia (Pavúk 2007; Vizdal 1986; Raczky et al. 1994) reaching the Wieliczka salt region around

Kraków (Jodłowski 1977; 2000; Kamienska-Kozłowski 1990; Nowak 2007; 2009.90–93, 152, 692–693).

By contrast, the cultural history of the east Hungarian Alföld groups further south does not seem connected with the Malopolska area. Much more probably, however, they had successful long-distance networks with the East Carpathian mountainous region and acquired salt from the springs there (Sófalvi 2005.22–23). The existing links and the exchange between late Neolithic Alföld cultural groups and their contemporary Transylvanian neighbours is proven by the many shared features and imported finds in the archaeological research of the past few decades (Kalicz-Raczky 1984; Paul 1992; Ignat 1998; Ignat et al. 2000 a; 2000b).

Perhaps it was mainly these intensive and long-lasting contacts that were responsible for the fact that the distribution of middle and late Neolithic Alföld settlements remained stable. The late LBK regional groups, as well as the following Tisza-Herpály-Csőszhalom groups, remained within the original LBK distribution area and did not expand or move during the 6<sup>th</sup>–5<sup>th</sup> millennium BC. This stable, immobile geographic extension may not be independent of social changes, as some settlements became more central and important to such an extent that the first tell sites started to grow along with the formation of a settlement hierarchy consisting of significant centres in terms of economy, distribution, demography and

rituals (Chapman 1989.38–39; 1994; 1997.140–148; Bánffy 2002). The settlement hierarchy in the East Hungarian Alföld seems to have formed parallel to the birth of a stratified society (Raczky, Anders 2009; Bánffy 2007a; 2007b; Chapman, Siklósi 2010; Kalicz et al. 2011). I certainly do not mean that the contacts with Transylvania, and within this, access to salt springs there, were the only or even the main reason for the specific later cultural and social development of the later Neolithic Alföld culture. The processes may have been connected with the fact that within the Carpathian basin that was both ecologically and culturally divided southeast-northwest, Eastern Hungary rather belonged to the fringes of the Balkan Neolithic circle. Still, contacts and a dense exchange network formed part of this link. To what extent the salt trade was a reason or a result is a hard question to answer at the moment; nevertheless, salt seems to have played an important role in this development.

#### Access to salt at the beginnings of food production

As mentioned above, in the centuries before the late Neolithic Lengyel, Tisza and related cultures, direct archaeological evidence for the use of salt is lacking. However, there are some apparent links and contact zones that can be associated with salt. Areas within the Carpathian Basin reveal quite different possibilities, which lead us to infer different strategies to access salt.

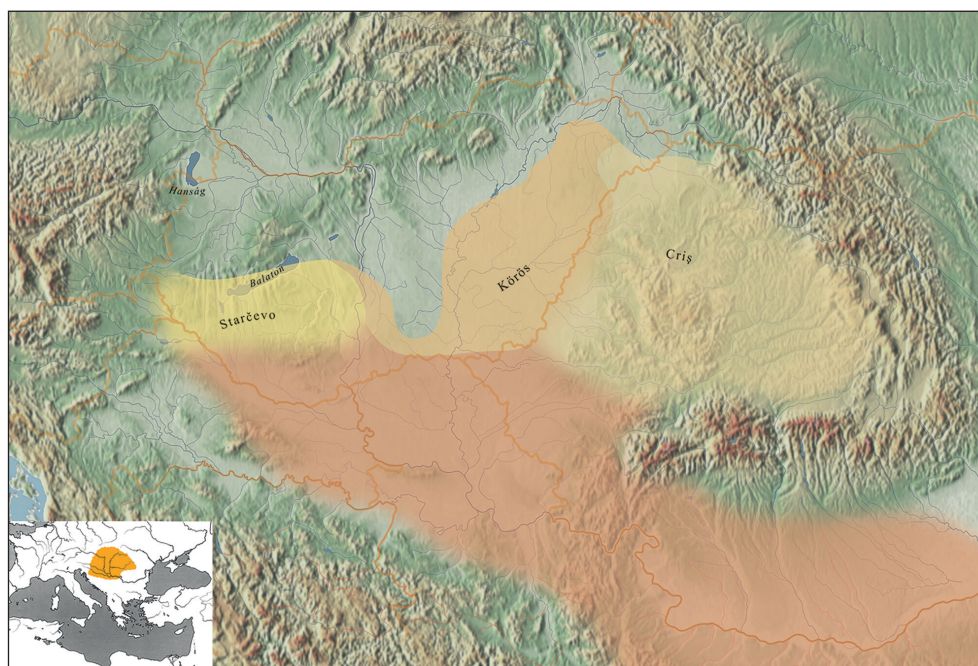


Fig. 1. Map showing early Neolithic cultural formations in the Carpathian Basin (E. Bánffy).



At the northern periphery of a large South East European cultural circle, three groups formed, the Starčevo, Körös, and Criş cultures, which occupy roughly the southern half of the whole basin (Fig. 1). Among many similarities, there are also some basic differences between the westwards expanding Starčevo and the Körös-Criş in the eastern half, *i.e.* the Alföld, and in Transylvania. The settlement pattern, the subsistence strategy and the long-range networks are the consequences of many environmental and cultural factors (Bánffy, Sümegei 2011; 2012), which in several ways differ in the three groups, although essential differences occur between the Starčevo culture in the western basin and the other two in the east. The various possibilities for access to salt may partially account for these differences.

The earlier research connected to the East Carpathian area focused mainly on tracking down salt springs and only secondarily on sorting out the historical and prehistoric periods during which they may have been in use. We now have firm evidence that salt waters were first exploited in the Eastern Carpathians, *i.e.* the almost 200 salt springs found in Romania and Moldavia, already at around 6000 BC (Weller-Dumitroaia 2005; Weller et al. 2011; Danu et al. 2010; Munteanu et al. 2007). Pottery fragments of the Criş culture occur at Poiana la Lunca, Calabatoaia and Cucuieti within the context of or nearby salt springs (Cavruc, Chiricescu 2006.195). Some early Neolithic sites are known in Transylvania and in Moldavia which reflect a specifically close correlation with salt springs (Ursulescu 1984.41; 2001). Furthermore, some Neolithic sites have been investigated farther west in Transylvania, which, according to the excavators, may have been linked to salt (Ignat 1983; 2001; Lazarovic, Lazarovici 2012); one such settlement is Gura Baciului near Cluj.

The site Gura Baciului is located in the immediate vicinity of salt springs (Maxim 1999; Lazarovici, Maxim 1995). According to the excavators, the stratified site was inhabited for the whole period of the early Neolithic Criş culture with broad contacts within the East Carpathian Early Neolithic (Lazarovici, Maxim 1995.346–352). The radiocarbon sequence supports the long sequence of some 800 years (Spataro 2008.92). The site was thought to have played a role in salt exploitation and trade by the authors and also by Nenad Tasić (2000.40).

The latest sites connected to salt lie still farther west, at the Romanian-Hungarian border. The publication of Méhtelek and the Méhtelek group itself is seen

as part of a whole regional sub-group within the Körös-Criş culture. According to a hypothesis based on the network of flint raw material, this group is connected with both the Körös and the Criş formations (Mester, Rácz 2010), but according to Nándor Kalicz, the Méhtelek group is mainly linked with the Körös tradition (Kalicz 2011; 2012). Kalicz explains his inference with the following arguments: “During the past few decades ... a series of Körös settlements have been discovered in County Bihar in Romania: the finds from these sites along the Ér, the Szamos and their tributaries have much in common with the Körös material from the Alföld. Farther to the north in the Szilágyság, sites yielding mixed assemblages of the southern Alföld Körös culture and the Méhtelek group can be noted, especially regarding figurines. The formerly enigmatic gap between Méhtelek and the southern Alföld Körös culture was thus bridged and it seems likely that the Körös communities advancing northward followed the Ér Valley and simply avoided the sandy region of the Nyírség ... Three routes leading to the Upper Tisza region used by Körös communities could thus be distinguished: one along the Tisza, the other along the Ér Valley (in the Partium), and a third in the Szamos Valley. These routes clarify various aspects of cultural contacts” (Kalicz 2011.45). As a consequence, the contact routes, bolstered by several finds, including the special flat ‘slab’ figurines so typical of the Méhtelek group, can be reconstructed convincingly between the East Hungarian and West Romanian Körös-Criş and the Transylvanian, Moldavian salt regions. Kalicz himself presumed that – apart from participating and forging the long-distance network of obsidian – salt may have played a crucial role within these contacts by considering it possible that the Méhtelek communities participated in salt trading (Kalicz 2012.121). Within Körös culture itself, a certain funnel-shaped, coarse pottery type (see Ibrány-Nagyverdő, Kalicz 2012.Fig. 3.10) is sometimes assumed to have been used for evaporating salt water (Fries, Knoblauch 2001.Taf. 6.1). Similar types from later periods are considered indeed to have been used for briquetage. However, once it was presumed that it was pointless to seek pottery used for evaporation anywhere else than in the vicinity of salt springs where it must have happened, the argument about the importation of such pots from salt-poor regions in connection with salt exploitation is not useful.

The Méhtelek group, regarding its Körös cultural roots and its geographical position near Criş settlements, may have had a mediating role. According to

recent information, it did not overlap with the period of the earliest Alföld LBK (in contrast with Pavúk's (2004:74) view), and the Transylvanian connections of the Szatmár group (early LBK) are quite uncertain. The implication that the salt network may have been continuous is only supported by the reviving connections between the Northern Alföld and Transylvania, when late LBK territorial groups formed, *i.e.* in the last centuries of the 6<sup>th</sup> millennium BC. The Esztár group in the eastern part of the Alföld, with its painted pottery, which is closely related to the Lumea Noua group in Western Transylvania, needs to be mentioned here (Goldman, Szénászký 1994; Gligor 2009).

After outlining possible long-distance connections between Transylvanian salt and the East Hungarian Körös culture, we need to draw attention to a newly researched and described branch, *i.e.* a Western expansion of the Körös culture in Southern Hungary: what resources might they have had for supplying themselves with salt? A small group of people of the Körös culture settled far away in a very limited area in the Danube-Tisza interfluvium. In recent years, a dense settlement 'niche' has been detected along the left Danube bank: 50 Körös sites, all located in the floodplain (Bánffy 2012; 2013; Kustár 2012). The traces of the probably small settlements are – with two exceptions – known from surveys. It can be assumed that the large number of sites does not reflect a dense population; much more probably, some semi-mobile communities can be envisioned that left the traces of several sites through generations. The state of research of Körös settlements along the Danube has been summarised, but how these people could have been supplied with the necessary salt and the absence of sources for it are not touched upon.

According to maps showing the main salt resources in Europe (Saile 2000; 2008; Tasić 2000; Fries, Knobloch 2001), the central part of the Carpathian Basin (*i.e.* today's Hungary) is a region entirely lacking salt springs. The only chance to obtain salt in this area may have been to find and exploit some minor alkali ponds in the lowlands, *e.g.*, those close to Szarvas in the Alföld, but these were barely enough to meet even one village community's

needs (Fig. 2). These ponds occur even more rarely close to the narrow settlement area along the Danube. The summarising publication (Bánffy 2013) contains some reflections on possible reasons for the Körös groups' abandoning the Danube. These implications involve climate conditions. In the marshy oxbows of the Danube, even a slight rise in the water level flooded the small arable islets or made them impossible to access.

Social problems were perhaps equally important: these groups were left in an isolated position with no apparent contacts to the west, where Transdanubian Starčevo groups were located; the contacts were even less possible to the more or less unsettled area to the north and south, and a sandy area to the east. After struggling to establish life on the Danube for some generations, this 'enclave' probably had good reason to return to the Alföld by the same routes by which they had arrived, *i.e.* the stream valleys crossing the sand back to the valleys of the Tisza and Körös rivers, where they could re-join their fellow communities. In this way, they may have chosen the advantages not only of the bigger community identity and wider kinship, but also easier access to commodities essential to life, like salt.

### Access to salt played an important role in the Neolithic transition in Western Hungary and Central Europe

It is a fact that the Western Carpathian Basin, Transdanubia, is a region expressly poor in salt. Even the nearest salt deposits at Tuzla in Bosnia (Tasić 2000) are located far away, in a region with which the first Transdanubian farmers (the people of the Starčevo

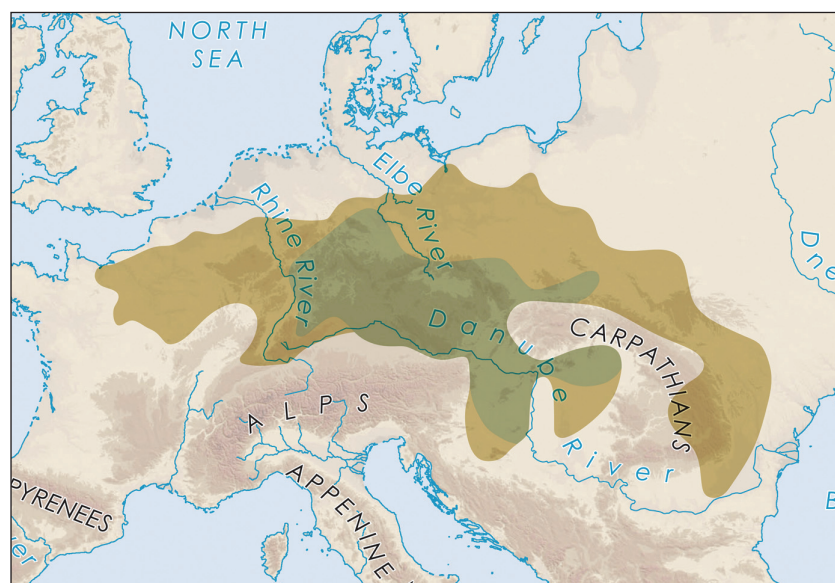


Fig. 2. Alkali ponds in the Danube Tisza Interfluvium region (R. Balázs).



culture) did not have particularly close contacts. It has also become an accepted fact that the first farmers of Central Europe, *i.e.* the people of the LBK culture, formed in the Western part of the Carpathian basin, which was also the last transformation in Europe that happened with the major participation of ‘colonisers’ (Zvelebil 2001). A third fact is that these communities rapidly spread to today’s Austria, Moravia and South Germany along the Danube, to the Halle/Saale region to the North and towards Southern Poland, probably both through Moravia and Germany. After some 150 years, a second wave of expansion followed. As a result, vast regions in Europe, from the Paris Basin to Ukraine turned to the LBK type of sedentary farming (Fig. 3). Let me scrutinise this process with regard to salt.

The first farmers of North Balkan origin (the people of the Starčevo culture), crossed the Drava River and occupied a wooded, hilly landscape until they reached the marshy Balaton region, where they must have met and mingled with local foragers (Bánffy 2000; 2004; Bánffy et al. 2007). The expansion to the heartland of Central Europe was so rapid that it left no typological differences in the archaeological record (Quitta 1960; Lüning 1988) and – at least until the beginnings of the expansion – successive phases cannot be pinpointed with radiocarbon dates (Gläser 1991; Lenneis, Stadler and Windl 1996; Lüning 2005.60–62. Bánffy, Oross 2010). Flint provenance studies also bolster the idea of migration and direct contact (Lenneis, Lüning 2001; Biró 2001; 2002; 2005; Pavlu, Vokolek 1992; Ramminger 2011).



**Fig. 3. Map showing the distribution of the first farmers (LBK culture) in Central Europe (S. Hansen, modified by E. Bánffy).**

The LBK migration from Transdanubia was also recently confirmed by non-archaeological methods. New publications on ancient DNA analyses and also stable isotope analyses (Smrčka et al. 2008; Zvelebil, Pettitt 2008; Nehlich et al. 2009; Szécsényi Nagy et al. 2012; 2014; 2015; Haak et al. 2005; 2010; Ammerman et al. 2006) have shed new light on the nature and tempo of the first farmers’ mass migration. To date, the notion that population groups moved from Transdanubia towards the inner parts of Central Europe can be seen as a thesis supported by both archaeological and data from natural sciences.

In spite of growing knowledge about this dynamic mobility, the reasons are still not obvious. Several hypotheses have been suggested. One explanation based on a possible rapid population growth (based on examples from the Near East) proved mistaken (Petrasch 2001; Bánffy, Oross 2010). The archaeological evidence and the radiocarbon data indicate that the expansion from Transdanubia to Bavaria (Lüning 2005; Nadler 2010) and to the Saale River (Kaufmann 1983) took no longer than 50 to 100 years, or two to four generations at around 5600–5500 calBC. An explanation for this rapid expansion invoking population growth would call for a totally implausible 5.4% growth over four generations, whereas early LBK population growth could not have been more than 0.1% (a figure based on a consideration of infant and child mortality rates, generally bad health conditions and accidents). This low population growth correlates with the number of LBK settlements in Germany. Jörg Petrasch concludes that demographic growth was not the reason behind the rapid LBK expansion (Petrasch 2001.21).

es that demographic growth was not the reason behind the rapid LBK expansion (Petrasch 2001.21).

In his discussion of the possible causes triggering migration, David Anthony offers several explanations. For me, his most important observation was that negative ‘push’ and positive ‘pull’ forces can be distinguished among the causes leading to migration (Anthony 1990.898). Consequently, one type of the causes that may trigger migration arises in the area of origin: overpopulation, climate deterioration, draught, famine and

social tension. Several examples can be quoted for the other type, from history: one common feature of these is preliminary contact with the target area. Low population density, fertile soil, proximity to water, good climate, and possible raw material sources are all factors that make a particular new area attractive. If exchange relations can also be created and maintained, an area of this type usually attracts settlers.

‘Push’ forces in terms of overpopulation or climatic deterioration can be rejected in the case of the LBK expansion. In contrast, there is evidence for almost all of the ‘pull’ forces. The main emphasis is on the incentives that triggered the largest expansion in prehistory. Obviously, there were several different causes as “*migration is a social strategy*” (Anthony 1997:22).

An important new discovery provides the basis for implications for a better understanding of the LBK migration. Today, there is evidence for pre-Neolithic, hunter-gatherer communication and contact networks between Transdanubia and the regions to the northwest (Mateiciucová 2004; 2008). The survival of this subsistence strategy into the Neolithic becomes clear once the local Mesolithic population is supposed to have mingled with the first Balkan farmers in the Balaton region (Bánffy 2004). The causes for the migration may have ranged from the need for a common area where groups living at great distances from each other could exchange various commodities and ideas, to the need to pool efforts in order to perform certain tasks and to cultivate marriage alliances and other kinship ties. The presence of Szentgál radiolarite in Moravia and in Southern Germany, and of Danubian shells also in Germany are modest indications of these networks in the archaeological records.

In order to justify the idea that contact networks may (also) explain the Central European expansion, let us quote some arguments for similar prehistoric phenomena. As Curtis Runnels and Tjeerd van Andel have noted, the Neolithic expansion, together with its innovations, can be conceptualised as a trade commodity forming the basis of wealth, whose acquisition was probably an attractive option (Runnels, van Andel 1988:102). In Germany, the earlier, western contact network of the Mesolithic population was also exploited by the early farmers, and judging from the growing intensity of the contacts they probably improved and expanded it. A. Zimmermann has convincingly argued that the central places (ger.

*Zentrale Orte*), whose emergence can hardly be dissociated from the settlement concentrations (ger *Siedlungskammer*) (Zimmermann 1995:61–62), were the main settings for down-the-line exchanges. The communal identity, the remarkably uniform material culture and the most likely similar social structure remained virtually unchanged for many generations. This would suggest that the contact networks remained in place until the time of the later LBK groups in Transdanubia and the Flomborn phase in Germany, perhaps even for some time afterwards. What remains to be explored is the mutual interest that formed the basis of these contact relations. What commodities were traded between these distant groups?

As to the Transdanubian formative LBK groups moving northwest and keeping contact with the ‘pioneer’ inhabitants for a longer time, archaeologists have already detected, researched and published many kinds of similarities in settlement types, architecture, burial habits, object types *etc.*, documenting contact between different regions. However, these are necessarily restricted to artefacts and other finds made from non-perishables, such as various stone raw materials and clay. To date, there are three types of find that verify the existence of the earliest LBK route: pottery, unified clay figurines and the Transdanubian red radiolarite. These occur over distances of more than 1000km, *e.g.*, in the Wetterau region in West-Central Germany. The clay objects reflect a strong tradition, but the raw material of flint must be seen as proof of a direct long-distance network. Yet there is still no firm reason to see these objects as targets of exchange; much more possibly, they simply moved along with people.

Obviously, the actual range of traded commodities must have been much wider and no doubt included wares that leave no trace in the archaeological record, such as furs, textiles, leather and leather articles, as well as foodstuffs. I shall not discuss other possible aspects of these contacts, such as the possible exchange of craftsmen, of individuals introducing a new technology to a particular region, or marriage and kinship ties between groups. These contacts will perhaps never be detected unless many more LBK cemeteries containing well-preserved skeletal remains are uncovered.

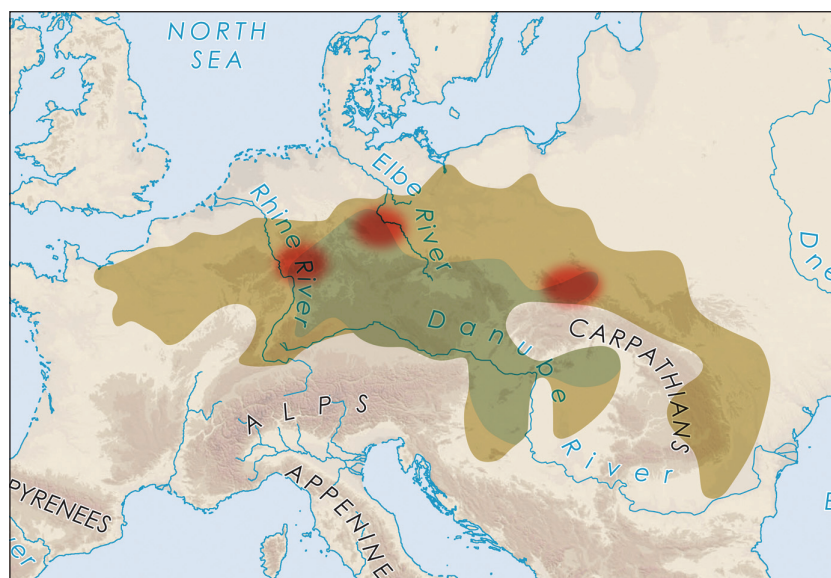
The idea that the commodity received for the wares of Transdanubian origin may also have been salt first occurred to me when I visited the Bad Nauheim-Niedermörlen settlement. The finds from this site reflect

surprisingly strong ties with Transdanubia. The Mörlener Bucht area is rich in haematite deposits (*Schade, Lindig and Schwitalla 1999.28*), although, this red paint is not rare enough to form the basis of exchange relations. However, Bad Nauheim lies in an area rich in salt. Excavations conducted near Niedermörlen have brought to light the unique remains of extended Celtic and Roman salt mining. Wendelin Leidinger, who studied the remains of Neolithic salt production in more northerly regions (Westphalia), has described in detail how the earliest Linear Pottery communities in that area

produced salt by evaporation and cleaning (*Leidinger 1983; 1996; 1997*). Therefore, it is possible that this easily transportable and valuable commodity, essential to the diet, for food preservation and for feeding livestock, was exchanged for commodities from the Danube valley. Tasić considered salt and access to salt deposits, regions having soils rich in salt and briny waters, as major factors in the Neolithisation of the Balkans (*Tasić 2000*). Trade in salt played an important role in the cultural development of this region and also in its contacts with other areas in later periods (*Monah 1991*).

A negative statement must be made to complete the picture of migration connected with salt. The Hallstatt region near Salzburg in the Salzkammergut, the Upper Austrian region, is rich in salt deposits and lies closer to Transdanubia, so why would the first farmers have gone so far for salt? The distribution of the Early Neolithic sites indicates that the migration route led along the north bank of the Danube, through the Munich Basin to southwest Germany. In spite of the shorter distance, the salt mines in Hallstatt were unknown in the 6<sup>th</sup> millennium BC and can thus be rejected as a possible source. This fact probably enhanced the importance of the Wetterau and Aldenhoven regions.

One of its archaeological indicators is the striking typological resemblance between the find assemblages from Transdanubia and Germany; another is the use of Szentgál radiolarite in some areas, although good quality stone was available locally (*Gehlen, Zimmer-*



**Fig. 4. Map showing the distribution of the first farmers (LBK culture) in Central Europe, with the three major salt regions marked (S. Hansen, adapted by E. Bánffy).**

*mann 2012.669*); yet a third is the long-term contact relations spanning not one, but several generations, as reflected in the finds from Bad Nauheim.

It may become possible to detect salt (sodium chloride) in the matrix of pots that were used for salt production (*Horiuchi et al. 2011*). However, in the Neolithic briquetage would only be found where salt production occurred, *i.e.* near salt springs. How salt was transported from salt-rich areas to the salt-poor central Carpathian Basin is hard to say, but, as assumed above, it was not only the salt that was perishable, but the bags or sacks that may have been used to carry it would have left no archaeological traces.

I find it more useful to consider the distribution map of the first farmers in Central Europe. In Figure 4, where the darker patch shows how far the first wave of the LBK reached, it becomes apparent that the three most distant, ending in West Germany, in the Elbe Saale region and in Malopolska, are three major salt regions. Was this pure chance?

To connect salt and the Central European migration at the onset of the Neolithic today is hardly anything more than speculation, a hypothesis. This is hardly surprising, given that it coincides with the scarcity of data on the Mesolithic-Neolithic transition and the actual process of Neolithisation itself. Future research, with new archaeological and scientific methods can test the hypothesis of the relationship between the Neolithic transition and access to salt.



## References

- Ammerman A. J., Pinhasi R. and Bánffy E. 2006. Comment on "Ancient DNA from the First European Farmers in 7500-Year-Old Neolithic Sites". *Science* 312(5782): 1875–77.
- Anthony D. W. 1990. Migration in archaeology: the baby and the bathwater. *American Anthropologist* 92(4): 895–914.
1997. Prehistoric migration as social process. In J. Chapman, H. Hamerow (eds.), *Migrations and Invasions in Archaeological Explanation*. British Archaeological Reports IS 664. Oxbow. Oxford: 21–32.
- Bánffy E. 2000. The late Starčevo and the earliest Linear Pottery groups in Western Transdanubia. *Documenta Praehistorica* 27: 173–185.
2002. A stuck process: urbanisation in the Carpathian Basin. In K. Jones-Bley, D. G. Zdanovich (eds.), *Complex societies of Central Eurasia from the 3<sup>rd</sup> to the 1<sup>st</sup> Millennium BC. Regional specifics in light of global models*. JIES Monograph No. 45. Washington DC: 492–503.
2004. *The 6<sup>th</sup> Millennium BC boundary in Western Transdanubia and its role in the Central European transition (The Szentgyörgyvölgy-Pityerdomb settlement)*. Varia Archaeologica Hungarica 15. Publicationes Instituti Archaeologici Academiae Scientiarum Hungaricae. Budapest.
2007. Cultural contacts between Neolithic Eastern and Western Hungary (the findings of the 1957 Csőszhalom excavation). In J. Kozłowsky, P. Raczky (eds.), *The Lengyel, Polgár and related cultures in the Middle/Late Neolithic in Central Europe*. The Polish Academy of Arts and Sciences, Eötvös Loránd University. Institute of Archaeological Sciences. Kraków: 71–81.
2010. The "earliest" and the "earlier" phase of the LBK in Transdanubia. In D. Gronenborn, J. Petrasch (eds.), *The spread of Neolithic to Central Europe*. Römisch-Germanisches Zentralmuseum Tagungen, Bd. 2. Mainz: 255–272.
2012. The main zones of the Körös culture 3.4. South Western zone. The Körös culture settlements in the Danube – Tisza interfluve. In A. Anders, Zs. Siklósi (eds.), *The First Neolithic Sites in Central/South-East European Transect. Volume III. The Körös Culture in Eastern Hungary*. British Archaeological Reports IS 2334. Archaeopress. Oxford: 53–68.
- Bánffy E., Bognár-Kutzián I. 2007. *The Late Neolithic tell settlement at Polgár-Csőszhalom: the 1957 excavation*. British Archaeological Reports IS 1730. Archaeolingua Central European Series 4. Oxbow. Oxford.
- Bánffy E., Eichmann W. J. and Marton T. 2007. Mesolithic foragers and the spread of agriculture in Western Hungary. In J. Kozłowsky, M. Nowak (eds.), *Mesolithic-Neolithic interactions in the Balkans and in the Middle Danube Basin*. Proceedings of the XV World Congress (Lisbon, 4–9 September 2006) Vol. 6. British Archaeological Reports IS 1726. Archaeopress. Oxford: 53–82.
- Bánffy E. with contributors 2013. *The early Neolithic of the Duna-Tisza Interfluve, Southern Hungary*. British Archaeological Reports IS. Archaeolingua Central European Series 7. Archaeopress. Oxford.
- Bánffy E., Sümegi P. 2011. The Environmental contexts of earliest Neolithic settlement and architecture in western Hungary. In A. Hadjikoumis, E. Robinson and S. Viner (eds.), *Dynamics of Neolithisation: Studies in honour of Andrew Sherratt*. Oxbow. Oxford: 232–266.
2012. The early neolithic agro-ecological barrier in the Carpathian Basin: a zone for interaction. In P. Anreiter, E. Bánffy, L. Bartosiewicz, W. Meid and C. Metzner-Nelsick (eds.), *Archaeological, cultural and linguistic heritage. Festschrift for Erzsébet Jerem in honour of her 70<sup>th</sup> birthday*. Archaeolingua 25. Archaeolingua Alapítvány. Budapest: 57–69.
- Biró T. K. 2001. Lithic materials from the Early Neolithic in Hungary. In R. Kertész, J. Makkay (eds.), *From the Mesolithic to the Neolithic*. Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok, September 22–27, 1996. Archaeolingua 11. Archaeolingua Alapítvány. Budapest: 89–100.
2002. Advances in the study of early neolithic lithic materials in Hungary. In E. Bánffy (ed.), *Prehistoric studies in memoriam I. Bognár-Kutzián*. Antaeus 25: 237–241.
2005. The lithic finds from Szentgyörgyvölgy-Pityerdomb. In E. Bánffy (ed.), *Archaeology and settlement history in the Kerka valley, S-W-Hungary*. Antaeus 28: 217–251.
- Cavruc V., Chiricescu A. (eds.) 2006. *Sarea, timpul si Omul*. Editura Angustia. Sfintu Gheorghe.
- Chapman J. C. 1989. The early Balkan village. In S. Bökönyi (ed.), *Neolithic of Southeastern Europe and its Near Eastern connections*. Varia archaeologica Hungarica 2. Institute of Archaeology of the Hungarian Academy of Sciences. Budapest: 33–53.

1994. Social power in the early farming communities of Eastern Hungary – perspectives from the Upper Tisza region. *Jósa András Múzeum Évkönyve* 36: 79–99.
1997. The origin of tells in Eastern Hungary. In P. Topping (ed.), *Neolithic landscapes*. Neolithic Studies Groups Seminar papers 2. Oxbow Monographies 86. Exeter: 139–164.
- Chapman J., Gaydarska B. 2003. The provision of salt to Tripolje Mega-sites. In *Tripoljan settlement-giants*. International symposium materials. Nacionalna Akademia Nauk Ukraini. Institute of Archaeology. Kiiv 2003: 203–210.
- Danu M., Gauthier E. and Weller O. 2010. Human impact and vegetation history on salt spring exploitation (Halabutoaia-Tolici, Petricani, Neamt, Romania). *International Journal of Conservation Science* 1(3): 167–173.
- Fries-Knoblach J. 2001. Gerätschaften, Verfahren und Bedeutung der eisenzeitlichen Salzsiederei in Mitteleuropa. *Leipziger Forschungen zur Ur- und frühgeschichtlichen Archäologie* 2: 1–46.
- Gaydarska B., Chapman J. 2007. Salt in Bulgaria. In D. Monah, G. Dumitroaia, O. Weller and J. Chapman (eds.), *L'exploitation du sel a travers le temps*. Constantin Matesa. Piatra Neamt: 147–161.
- Gehlen B., Zimmermann A. 2012. Rohmaterial und Grundformspektren als historische Quellen: Beispiele aus dem Frühneolithikum Mitteleuropas. In H. Floss (ed.), *Steinartefakte vom Altpaläolithikum bis in die Neuzeit*. Tübingen publications in prehistory. Kerns Verlag, Tübingen: 659–678.
- Gläser R. 1991. Bemerkungen zur absoluten Datierung des Beginns der westlichen Linienbandkeramik. *Banatica* 11: 53–64.
- Goldman Gy., Szénászkzy J. 1994. Die neolitische Esztár-Gruppe in Ostungarn. *Jósa András Múzeum Évkönyve* 36: 225–230.
- Gligor M. 2009. *Așezare neolitică și eneolitică de la Alba Iulia. Lumea Nouă în lumina noilor cercetări*. Editura Mega. Cluj.
- Haak W., Forster P., Bramanti B., Matsumura S., Brandt G., Tänzer M., Vilems R., Renfrew C., Gronenborn D., Alt K. W. and Burger J. 2005. Ancient DNA from the First European farmers in 7500-year-old Neolithic sites. *Science* 310: 1016–1018.
- Haak W., Balanovsky O., Sanchez J. J., Koshel S., Zaporozhchenko V., Adler Chr. J., Der Sarkissian C. S., Brandt G., Schwarz C., Nicklisch N., Dresely V., Fritsch B., Balanovska E., Vilems R., Meller H., Alt K. W. and Cooper A. 2010. Ancient DNA from European Early Neolithic Farmers Reveals Their Near Eastern Affinities. *PLOS Biology* 8(11): e1000536. doi:10.1371/journal.pbio.1000536
- Harding A. F., Kavruk V. with contributors 2013. *Explorations in Salt Archaeology in the Carpathian Basin*. Archaeolingua 28. Archaeolingua Alapítvány. Budapest 2013.
- Horiuchi A., Ochiai N., Kurozumi H. and Miyata Y. 2011. Detection of chloride from pottery as a marker for salt: A new analytical method validated using simulated salt-making pottery and applied to Japanese ceramics. *Journal of Archaeological Science* 38: 2949–2956.
- Ignat D. 1983. Tipuri de locuințe în așezările apartinând culturii Starčevo-Criș din Nord-Vestul României (Types d'habitations dans les sites appartenant de la civilisation Starčevo-Criș du nord-ouest de la Roumanie). *Crisia* 13: 9–16.
1998. *Grupul cultural neolitic Suplacu de Barcău (Suplacu de Barcău. The Neolithic cultural group)*. Editura Mirton. Timișoara.
2001. The early Neolithic in North-West of Romania. In F. Drașovean (ed.), *Festschrift für Gheorghe Lazarovici*. Bibliotheca historica et archaeologica Banatica 30. Mirton. Timișoara: 69–89.
- Ignat D., Hajdú Zs. and Nagy E. Gy. 2000a. *Neoliticul în Județele Bihor și Hajdú-Bihar – Bihar és Hajdú-Bihar neolitikuma*. Muzeul Tarii Crișurilor – Debreceni Déri Múzeum. Oradea-Debrecen.
- Ignat D., Hajdú Zs., Nagy E. Gy. and Sümegi P. 2000b. *“Biharország” neolitikuma. Válogatás a környék újkőkori leleteiből. Neoliticul în Județele Bihor și Hajdú-Bihar. Neolithic of the Bihar area*. Exhibition catalogue. Déri Múzeum, Debrecen. Debrecen-Oradea.
- Jodłowski A. 1977. Die Salzgewinnung auf polnischem Boden in vorgeschichtlicher Zeit und im frühen Mittelalter. *Jahresschrift für Mitteldeutsche Vorgeschichte* 61: 85–103.
2000. *Salt work in Wieliczka*. Museum of Salt work. Wieliczka.
- Kaczanowska M. (ed.) 2006. *Dziedzictwo cywilizacji nad-dunajskich Małopolska na przełomie epoki kamienia i miedzi (The Danubian heritage: Lesser Poland at the turn of the stone and copper ages)*. Biblioteka Muzeum Archeologicznego w Krakowie Tom I. Muzeum Archeologiczne w Krakowie. Kraków.

Kalicz N. 1994. Wenden des Spätneolithikums im Oberen Theißgebiet. *A Jóna András Múzeum Évkönyve* 36: 263–290.

2011. *Méhtelek. The First Excavated Site of the Méhtelek Group of the Early Neolithic Körös Culture in the Carpathian Basin*. British Archaeological Reports IS 2321. Archaeolingua Central European Series 6. Archaeopress. Oxford.

2012. Méhtelek-Nádas. The first excavated site of the Méhtelek fazies of the Early Neolithic Körös culture in the Carpathian Basin. In A. Anders, Zs. Siklósi (eds.), *The First Neolithic Sites in Central/South-East European Transect. Volume III. The Körös Culture in Eastern Hungary*. British Archaeological Reports IS 2334. Archaeopress. Oxford: 113–123.

Kalicz N., Raczky P. 1984. Preliminary report on the 1977–1982 excavations at the Neolithic and Bronze Age tell settlement at Berettyóújfalu-Herpály. Part I: Neolithic. *Acta Archaeologica Hungarica* 36: 85–136.

Kalicz N., Raczky P., Anders A. and Kovács K. 2011. *Preserved by ancestral fires. Pictures of an excavation. The Neolithic village at Berettyóújfalu-Herpály*. Pytheas Printing house. Budapest.

Kamińska J., Kozłowski J. K. 1990. *Entwicklung und Gliederung der Lengyel- und Polgár-Kulturgruppen in Polen*. Warszawa-Kraków.

Kaufmann D. 1983. Die ältestlinienbandkeramischen Funde von Eilsleben, Kr. Wanzleben und der Beginn des Neolithikums im Mittelelbe-Saale-gebiet. *Nachrichten aus Niedersachsens Urgeschichte* 52: 177–202.

Kustár R. 2012. Catalogue of Körös culture sites in Bács-Kiskun county. In A. Anders, Zs. Siklósi (eds.), *The First Neolithic Sites in Central/South-East European Transect. Volume III. The Körös Culture in Eastern Hungary*. British Archaeological Reports IS 2334. Archaeopress. Oxford: 323–329.

Lazarovici Gh., Lazarovici C.-M. 2012. Some Salt Sources in Transylvania and their Connections with the Archaeological Sites in the Area. In M. Alexianu, O. Weller and R.-G. Curca (eds.), *The archaeology and anthropology of salt*. Proceedings of the International Colloquium, 1–5 October 2008. Al. I. Cuza University (Iași, Romania). British Archaeological Reports IS 2198. Archaeopress. Oxford: 89–110.

Lazarovici Gh., Maxim Z. 1995. *Gura Baciului*. Muzeul National de Istorie a Transilvaniei. Cluj-Napoca.

Leidinger W. 1983. Frühe Salzgewinnung in Werl, Kreis Soest, Westfalen. *Archäologisches Korrespondenzblatt* 13: 269–274.

1996. Salzgewinnung an den Solquellen der Saline Werl. In R. Just, U. Meisner (eds.), *Das Leben in der Saline: Arbeiter und Unternehmer*. Schriften und Quellen zur Kulturgeschichte des Salzes 3. Technisches Halloren- und Salinemuseum. Halle/Saale: 189–215.

1997. Salzgewinnungen den Solquellen der Saline Werl. In *Werl 1997 gestern, heute, morgen. Ein Jahrbuch der Stadt Werl und des Neuen Heimat- und Geschichtsvereins Werl e. V.* Verlag der A. Stein'schen Buchhandlung. Werl: 1–27.

Lenneis E., Stadler P. and Windl H. 1996. Neue <sup>14</sup>C-Daten zum Frühneolithikum in Österreich. *Préhistoire Européenne* 8: 97–116.

Lenneis E., Lünig J. 2001. *Die altbandkeramischen Siedlungen von Neckenmarkt und Strögen*. Universitätsforschungen zur prähistorischen Archäologie 82. Habelt. Bonn.

Lünig J. 1988. Frühe Bauern in Mitteleuropa im 6. und 5. Jahrtausend v. Chr. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 35: 27–93.

2005. Bandkeramische Hofplätze und absolute Chronologie in der Bandkeramik. In J. Lünig, Chr. Fridrich and A. Zimmermann (eds.), *Die Bandkeramik im 21. Jahrhundert*. Symposium Brauweiler 2002. Rahden/Westfalen: 49–74.

Mateiciucová I. 2004. Mesolithic traditions and the origin of the Linear Pottery culture (LBK). In A. Lukes, M. Zvelebil (eds.), *LBK dialogues. Studies in the formation of the Linear Pottery culture*. British Archaeological Reports IS 1304. Archaeopress. Oxford: 91–107.

2008. *Talking stones: The chipped stone industry in Lower Austria and Moravia and the beginnings of the Neolithic in Central Europe (LBK), 5700–4900 BC*. Dissertationes Archaeologicae Brunenses/Pragensesque 4. Muni Press. Brno.

Maxim Z. 1999. *Neo-eneoliticul din Transilvania*. Biblioteca Musei Napocensis 19. Muzeul National de Istorie Transilvaniei. Cluj-Napoca.

Mester Zs., Rác B. 2010. The spread of the Körös Culture and the raw material sources in the northeastern part of the Carpathian Basin: a research project. In J. K. Kozłowski, P. Raczky (eds.), *Neolithisation of the Carpathian Basin: Northernmost distribution of the Starčevo/Körös culture*. Polska Akademia Umiejętności/Budapest, Insti-



tute of Archaeological Sciences of the Eötvös Loránd University, Kraków. Kraków-Budapest: 23–36.

Monah D. 1991. L'exploitation du sel dans les Carpates orientales et ses rapports avec la culture de Cucuteni-Tripolje. In V. Chirica, D. Monah (ed.), *Le paléolithique et le néolithique de la Roumanie en contexte Européen*. Bibliotheca Archaeologica Iassensis 4. Iasi: 387–400.

Munteanu R., Garvan D., Nicola D., Preoteasa C. and Dumitroaia Gh. 2007. Cucuieti-Slatina Veche (Romania). Prehistoric exploitation of a salt resource. In D. Monah, Gh. Dumitroaia, O. Weller and J. Chapman (eds.), *L'exploitation de sel a travers de temps*. Editura Constantin Matasa. Piatra Neamt: 57–70.

Montagnari-Kokelj E. 2007. Salt and the Trieste Karst (North-Eastern Italy). In D. Monah, Gh. Dumitroaia, O. Weller and J. Chapman (eds.), *L'exploitation du sel a travers le temps*. Constantin Matasa. Piatra Neamt: 161–189.

Nadler M. 2010. Landnahme in Mainfranken – Eine Siedlung der Ältesten Bandkeramik bei Wallmersbach Stadt Uffenheim, Landkreis Neustadt a. d. Aisch-Bad Windsheim, Mittelfranken. *Das archäologische Jahr in Bayern*: 11–16.

Nehlich O., Montgomery J., Evans J., Schade-Lindig S., Pichler S. L., Richards M. P. and Alt K. W. 2009. Mobility or migration: a case study from the Neolithic settlement. *Journal of Archeological Science* 36: 1791–1799.

Nikolov V. (ed.) 2008. *Providia-Solinstata prehistoric salt-production center. The 2005–2007 excavation seasons*. Bulgarian Academy of Sciences. National Institute of Archaeology and Museum. Sofia.

2011. Provadia-Solnitsata (NE Bulgaria): A Salt-Producing Center of the 6<sup>th</sup> and 5<sup>th</sup> Millennia BC. In M. Alexianu, O. Weller and R.-G. Curcă (eds.), *Archaeology and Anthropology of Salt: A Diachronic Approach*. Proceedings of the International Colloquium, 1–5 October 2008. Al. I. Cuza University, Iași, Romania. British Archaeological Reports IS 2198. Archaeopress. Oxford.

Nowak M. 2007. Transformations in East-Central Europe between 6000 and 3000 BC: local vs. foreign patterns. *Documenta Praehistorica* 33: 143–158.

2009. *Drugi etap neolityzacji ziem Polskich*. Knięgarń akademicka. Kraków.

Pavlu I., Vokolek V. 1992. Early Linear Pottery culture in the East Bohemian Region. *Pamätky archeologické* 83: 41–87.

Pavúk J. 1986. Siedlungswesen der Lengyel-Kultur in der Slowakei. *Béri Balogh Ádám Múzeum Évkönyve* 13: 213–223.

1991. Lengyel-culture fortified settlements in Slovakia. *Antiquity* 65: 348–357.

2004. Early Linear Pottery culture in Slovakia and the Neolithisation of Central Europe. In A. Lukes, M. Zvelebil (eds.), *LBK dialogues. Studies in the formation of the Linear Pottery culture*. British Archaeological Reports IS 1304. Archaeopress. Oxford: 71–82.

2007. Zur Frage der Entstehung und Verbreitung der Lengyel-Kultur. In J. Kozłowski, P. Raczky (eds.), *The Lengyel, Polgár and related cultures in the Middle/Late Neolithic in Central Europe*. The Polish Academy of Arts and Sciences and Eötvös Loránd University. Kraków: 11–28.

Petrash J. 2001. “Seid fruchtbar und mehret euch und füllet die Erde und machet sie euch untertan”: Überlegungen zur demographischen Situation der bandkeramischen Landnahme. *Archäologisches Korrespondenzblatt* 31: 13–25.

Paul I. 1992. *Cultura Petrești*. Editura Museion. București.

Quitta H. 1960. Zur Frage der ältesten Bandkeramik in Mitteleuropa. *Prähistorische Zeitschrift* 38: 1–38; 153–188.

Raczky P., Meier-Arendt W., Kurucz K., Hajdú Zs. and Szikora Á. 1994. A Late neolithic settlement in the Upper Tisza region and its cultural connections (Preliminary report). *A Jóna András Múzeum Évkönyve* 36: 231–236.

Raczky P., Anders A. 2009. Settlement history of the Middle Neolithic in the Polgár micro-region (the development of the Alföld Linearband pottery in the Upper Tisza region, Hungary). In J. Kozłowski (ed.), *Interactions between different models of neolithization north of the Central European Agro-Ecological Barrier*. Polska Akademia Umiejętności. Kraków: 31–50.

Ramminger B. 2011. Zur wirtschaftlichen Organisation der ältestbandkeramischen Siedlung Schwanfeld am Beispiel der Felsgesteinforschung. In J. Lüning (ed.), *Schwanfeldstudien zur ältesten Bandkeramik*. Universitätsforschungen für prähistorischen Archäologie, Band 196. Habelt. Bonn: 119–221.

Runnels C., van Andel T. 1988. Trade and the origins of agriculture in the Eastern Mediterranean. *Journal of Mediterranean Archaeology* 1: 83–109.

Saile T. 2000. Salz im ur- und frühgeschichtlichen Mitteleuropa – eine Bestandsaufnahme. *Berichte der Römisch-Germanischen Kommission* 81: 130–235.

2008. Early salt-making in Central Europe: Patterns of salt production and trade in the Neolithic. *Analecta Archaeologia Ressorviensia* 3: 97–127.

- Schade-Lindig S., Schwitalla G. 1999. Das Steinzeitdorf von Hempler. In *Denkmalpflege und Kulturgeschichte. Landesamt für Denkmalpflege Hessen 1*: 26–32.
- Siklósi Zs. 2010. *A társadalmi egyenlőtlenség nyomai a késő neolitikumban a Kárpát-medence keleti felén (Traces of social inequality in the Late Neolithic, in the eastern half of the Carpathian Basin)*. Unpublished PhD dissertation. ELTE Institute of Archaeological Sciences. Budapest.
- Smrčka V., Erban V., Hložek M., Gregerová M. and Dočkalová M. 2008. Reconstruction of mobility: comparison between the analysis of Sr isotopes in a set of Neolithic skeletons from the Vedrovice cemetery, and the petrographical analysis of pottery in graves. *Anthropologie. International Journal of the Science of Man* 46: 233–238.
- Sófalvi A. 2005. *A Sóvidék a középkorban (The Só region in the Middle Ages)*. Haáz Rezső Múzeum. Székelyudvarhely.
- Spataro M. 2008. Early neolithic pottery production in Romania: Gura Baciului and Seusa La Cararea Morii (Transylvania). In D. Bailey, A. Whittle and D. Hoffmann (eds.), *Living well together? Settlement and materiality of South East and Central Europe*. Oxbow Books. Oxford: 91–100.
- Szécsényi-Nagy A., Keerl V., Jakucs J., Bánffy E. and Alt K. W. 2012. *Ancient DNA from middle Neolithic Hungary suggests a common ancestry of LBK in Central Europe*. Poster presented for the “First farmers” conference at Cardiff, May 2012. Cardiff.
- Szécsényi-Nagy A. and 27 coauthors. 2014. *Tracing the genetic origin of Europe's first farmers reveals insights into their social organization*. *bioRxiv* (first posted online September 3). Access the most recent version at doi: <http://dx.doi.org/10.1101/008664>
- Szécsényi-Nagy A. and 27 coauthors. 2015. Tracing the genetic origin of Europe's first farmers reveals insights into their social organization. *Proceedings of the Royal Society B: Biological Sciences* 282: 20150339. <http://dx.doi.org/10.1098/rspb.2015.0339>
- Tasić N. 2000. Salt use in the Early and Middle Neolithic of the Balkan Peninsula. In L. Nikolova (ed.), *Technology, Style and Society. Contributions to the innovations between the Alps and the Black Sea in prehistory*. British Archaeological Reports IS 854. Archaeopress. Oxford: 35–40.
- Ursulescu N. 1984. *Evoluția culturii Starčevo-Criș pe teritoriul Moldovei*. Suceava.
2001. Local variants of the Starčevo-Cris culture in the Carpato-Nistean area. In F. Drașovean (ed.), *Festschrift für Gh. Lazarovici*. Mirton. Timișoara: 59–67.
- Vizdal J. 1973. *Zemplín v mladšej dobe kamennej*. Pre Zemplinske Muzeum. Košice.
1986. Rettungsgrabung in Ižkovce im Jahre 1985. In B. Chropovsky, H. Friesinger (eds.), *Internationales Symposium über die Lengyel-Kultur*. Nové Vozokany 5–9. November 1984. Nitra-Wien: 305–312.
- Weller O., Dumitroaia G. 2005. The earliest salt production in the world: an early Neolithic exploitation in Poiana Slatinei-Lunca, Romania. *Antiquity* 79(306): [www.antiquity.ac.uk/ProjGall/weller](http://www.antiquity.ac.uk/ProjGall/weller)
- Weller O., Brigand R., Nuninger L. and Dumitroaia Gh. 2011. Spatial Analysis of Prehistoric Salt Exploitation in Eastern Carpathians (Romania). In M. Alexianu, O. Weller and R.-G. Curcă (eds.), *Archaeology and Anthropology of Salt: a diachronic approach*. British Archaeological Reports IS 2198. Archaeopress. Oxford: 69–80.
- Zápotocká M. 1984. Armringe aus Marmor und anderen Rohstoffen im jüngeren Neolithikum Böhmens und Mitteleuropas (Náramky z mramoru a jiných surovin v mladším neolitu Čech a střední Evropy). *Památky archeologické* 75(1): 50–130.
- Zimmermann A. 1995. *Austauschsysteme von Silexartefakten in der Bandkeramik Europas*. Universitätsforschungen zur Prähistorischen Archäologie 26. Habelt. Bonn.
- Zvelebil M. 2001. The agricultural transition and the origins of neolithic society in Europe. *Documenta Praehistorica* 28: 1–26.
- Zvelebil M., Pettitt P. 2008. Human condition, life and death at an early neolithic settlement: bioarchaeological analyses of the Vedrovice cemetery and their biosocial implications for the spread of agriculture. *Anthropologie. International Journal of the Science of Man* 46: 195–218.