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ASPECTS REGARDING THE ECONOMY OF THE OTOMANI COMMUNITIES IN NORTH-WESTERN TRANSYLVANIA. DATA CONCERNING THE MIDDLE BRONZE AGE AGRICULTURE IN LIGHT OF THE INVESTIGATIONS CARRIED OUT IN THE CAREI-BOBALD TELL

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Introduction

Inside the culturally diverse Carpathian Basin, the region incorporating the north-eastern part of Hungary and the north-western part of Transylvania[1] set the scene for the development of a specific culture displaying marked similarities in its bronze working and pottery production. The development of a so called mixed intensive farming economy[2] – "Western Asian and South-East European type of farming" based on intensive agriculture[3] and animal husbandry based in the surroundings the fortified and multi-layered central settlements known as tells,[4] changed the prehistoric environment of the region at a previously unknown level. (Sümegi 1998, 368sqq; Sümegi-Bodor 2000, 84, 93sq Fig. 3–6; Sümegi 2013, 154, 170; Fischl, Reményi 2013, 729 Fig. 2; Fischl

[1] The name of the region was designated as 'North-Western Transylvania' instead of 'North-Western Romania'. The preferred designated refers to a quite limited region, a subdivision of the larger area known as North-Western Romania, which also incorporates the territories situated to the north of the Someșul Mare River, i.e. parts of what is today Sălaj, Maramureș and Bistrița-Năsăud Counties. On the other hand, the region comprising the Nir and the Carei Plain, as well as the Eriu Valley, bordered to the north and east by the Ecedea Marsh and the swamplands of the lower course of the Crasna River situated north of the Someșul Mare, often had a distinct cultural evolution compared to the neighbouring geographical territories (Molnár 2014, 14.).

[2] According to Amy Bogaard the two components of intensive mixed farming are: 1) the well-outlined somewhat smaller area of intensive crop cultivation, marked by careful tillage, weeding and manuring, and 2) the fields near the settlement used for herd keeping. In addition to the need of excess production, both activities required considerable work input, albeit still within the confines of the mobilisation capabilities of individual household units. The main purpose of animal husbandry was the production of meat, although the processing of the by-products was also important. A smaller percentage of oxen can be found within the cattle stock, used as specialised beasts of burden (Bogaard 2005, 179sqq.).

[3] The term 'intense agriculture' implies a system in which an increased work input in terms of both quantity and efficiency per a certain unit of agricultural land leads to a higher crop yield (Bogaard 2004, 21.)

[4] Inspite of repeated attempts aimed at setting up a proper classification and terminology in the archaeological literature (Meier-Arent 1991, 78; Kănčev 1995, 75sqq; Poroszlai 1998, 183sq; Bailey 1999, 94sqq; Gogâltan 2002, 11sqq; Gogâltan 2005, 79sqq; Goldberg–Macphail 2006, 225sqq; Gogâltan 2008, 40; Dani–Fischl 2009, 103sqq; Horváth 2009, 159sqq; David 2010, 563sqq; Parkinson, Gyucha 2012, 105sqq; Gogâltan 2012, 13sq; Németi, Molnár 2012, 12sqq; Molnár 2014, 12sq.), the majority of polystratified settlements are still considered to be tells. One of the most pertinent definitions of the term, together with an extremely detailed presentation of its etymology, was put forward by Florin Gogâltan. The author considers that settlements designated as tells should have a thickness of over 1 m and incorporate at least three levels of habitation belonging to the same culture, on the other hand, the settlements of the same thickness with two levels of habitation belonging to the same culture should be designated as 'tell-like settlements' (Gogâltan 2002, 11sqq.) Thomas Link on the other hand is sceptical with regard to the possibility that the identification of tells can be asserted in quantitative and metric terms, although endorses the utilisation of the term in the case of settlements with two-three levels of habitation/development (Link 2006, 10sq.). The proportion of built areas within a settlement, and the distance between the structures can be a further indicator for the development of the respective settlements (Chapman 1989, 35sqq.). Furthermore, the comprehensive paper by Ferenc Horváth on the question of tells within the Carpathian Basin contains a series of observation regarding the terminology and the criteria of classification asserted in the current archaeological literature (Horváth 2009, 159sqq.)

et alii. 2013, 358 Fig. 3.)[5] Despite the marked social stratification and stricter societal organisation aimed at a more efficient exploitation of the existing resources, indicated by the abundance of prestige objects,[6] and the collective construction of the settlements' defences,[7] the respective settlements preserved their rural character throughout the period. With regard to the North-Western Transylvanian Otomani communities, the image that is gradually emerging is that of a well organised, fairly hierarchic tell-community, with a complex social structure, composed of modular units.[8]

The development of the settlement network and tells on the Carei Plain and the Eriu Valley is closely linked from a chronological viewpoint to the evolution of the Otomani Culture. The aforementioned Middle Bronze Age culture can be placed roughly between the end of the Early Bronze Age and the end of the so-called Koszider period. The respective period starts with the disappearance of the broom-brushed and textile-marked pottery[9] typical for the Sanislău group and the third phase of the Early Bronze Age period, lasting until the emergence of the material culture assigned to the post-Otomani groups (e.g. Cehăluț). From a chronological point of view the three subdivisions of the Middle Bronze Age can be equated with the main development phases of the Otomani Culture (MB I-Otomani I, MB II-Otomani II, MB III-Otomani III). The chronology of Middle Bronze Age cultures is based on Bóna István's excellent three-period chronological system. (Bóna 1992, 17.)[10]

5 According to Pál Sümegi the northern limit of the Bronze Age cultures employing West Asian and South-West European agricultural production modes, together with intense agriculture and corresponding system of relations was on the Great Hungarian Plain. The spatial distribution of tells in the Carpathian Basin corresponds with the so-called Köppen BS area, which ensured optimal climacteric and ecological conditions. The northern limit of the tell-distribution in the Carpathian Basin corresponds with the division line between various climacteric and vegetation areas. The sum of the environmental factors determines the framework for the social and economic development of the tell communities. According to Sümegi the environment of the Middle Bronze Age tells which in addition to the natural vegetation assemblages is marked by new, cultivated varied variety of plants, corroborate the central economic role played by tells.

6 The existence of social hierarchy and of a group of warriors is proved by the vast majority of bronze weapons and jewellery unearthed in the area of North-Western Transylvania and North-Western Romania. (Reviews on topic of bronze metallurgy in Western Romania and North-Western Transylvania: Hänsel 1998, 21; Gogâltan 1999, 128sqq, 195sq; Molnár 2011, 272sqq; Găvan 2012, 57sqq.) The carrying of weapons is the warrior elite's means of individual and collective identity expression, and also represents a new symbolic means of exercising power. (Earle 2000, 39sqq; Earle, Kristiansen 2010, 9sq; Fischl, Reményi 2013, 732; Earle 2013, 357.) Bronze weapons falling in the category of prestige goods are the primary indicators of the social hierarchy in the study area. (Firth 1973, 77sqq; Halas 2002, 351sqq.) In the present state of research so far in the Carei Plain and Eriu Valley not a single sword was discovered, and only 8 daggers belonging to the Middle Bronze Age are known. For detailed analysis: Molnár 2011, 295sqq. One eastern type dagger discovered in 2012 by our colleague Liviu Marta at Carei-Bobald (KB III grave, feature Cx50) with the occasion of archaeological research of the bypass route of Carei is unpublished. It needs to be emphasised that all the discovered daggers represent different and mainly not locally produced types.

7 The fortifications of the Middle Bronze Age Otomani tells indicate the evidence of a forming central authority. The fortifications are operating as symbols of the power system, elements of collective group identity, and playing role as well in the protected in practice and control of the adherent areas. In addition to the excavation of the large ditches and building of the ramparts, also the maintenance of defensive system required significant manpower mobilization and proper central co-ordination. For opinions on the topic see: Renfrew, Bahn 1999, 197; Harding 2000, 274, 294sq; Sahlqvist 2001, 89; Duffy 2008, 129sqq; Reményi 2003, 55sq; Otterbein 2004, 12sqq, 118sqq; Kristiansen, Larsson 2005, 225sqq; Neustupný 2006, 2sqq; Chapman, Gaydarska, Hardy 2006, 20sq; Harding 2007, 32, 40, 147sqq; Parkinson, Duffy 2007, 100, 125; Gogâltan 2008, 39; Thrane 2009, 13sqq; Earle, Kristiansen 2010, 14sq; Earle, Kolb 2010, 75, 85; Németi, Molnár 2012, 53, Molnár, Nagy 2013, 8.

8 The investigated societies from North-Western Transylvania seem to be closer to the tribal/segmented societies than to the complex, hierarchized chiefdoms. (Molnár, Nagy 2013, 9.) From an economic point of view, in the case of smaller communities with focused workgroups there seems to be a less significant difference between the modular and hierarchical ethos, while in case of larger groups the differences are more significant. (Fuller, Stevens 2009, 52.)

9 The existence of broom-brushed and textile-marked pottery to the north of the Crișul Alb River is a hitherto undecided mater (Gogâltan 2000, 125; footnote 37, Németi, Molnár 2001, 76). According to recent information received by courtesy of Florin Gogâltan, such finds were discovered at Oradea-Salca-Pepinieră in 2017 during development-led excavations. The question of the separation line between the territories of the Sanislău group dated to the final phase of the Early Bronze Age and the communities individualised through their use of broom-brushed and textile-marked pottery is still open for question. Hopefully the investigations at Pișcolt/Piskolt-Ógát (Németi 1999, 45) will provide an answer to the presence or absence of this pottery type (Early Bronze Age IIIb) in the Eriu Valley (For the separation line between the Eriu Valley and the Carei Plain, see: Benedek 1960, 141sqq; Benedek 1967, 141sqq; Benedek 1996, 11sqq.).

10 Thus in the BM I period we can talk about the late development phase of the Vatya I–II, Gyulavarsánd I, Füzesabony I–II, Vatina I and Hatvan Cultures. During the BM II period witnessed the late development phase of the Vatya III, Gyulavarsánd II, Füzesabony III, and Hatvan Cultures as well as the Cornești-Črvenka (Vatina) group. In the BM III period,

The refined chronology of the Middle Bronze Age was based on local radiocarbon determinations as well as the stratigraphic and typo-chronological observations made at the tells in Carei-Bobald and Mezőterem-Kendereshalom.[11] Based on the radiocarbon data from Wietenberg, Otomani-Gyulavarsánd and Füzesabony-Otomani, published in the Romanian, Hungarian, and Slovakian archaeological literature (Raczky, Hertelendi, Horváth 1992, 44sqq; Forenbaher 1993, 220, 251sqq; Popa, Boroffka 1996, 56; Kadrow 1997, 235; Furmánek, Veliačik, Vladár 1999, 17, Tabelle 2; Barta 2001, 20sq; Görsdorf et alii. 2004, 88sqq; Gördorf et alii. 2005, 468; Jaeger 2010, 317; Dietrich 2014, 171, Anhang 2; Withlow et alii. 2013, 38; Kavruk et alii. 2014, 135; Duffy 2014, 193; Ciugudean, Quinn 2015, 149sqq; Németh 2015, 187; Gogâltan 2015, 73; Jaeger, Olexa 2014, 170; Olexa, Jaeger 2015, 159; Olexa, Nováček 2015, 15; Jaeger 2016, 131.)[12], in addition to the mostly unpublished C14 analysis regarding the Otomani Culture,[13] as well as the application of the Bayes statistical model (2σ) (Bronk Ransey 2009, 337sqq; Bolohan et alii. 2015, 132sqq.). the Middle Bronze Age can be roughly dated between 2075−1530 BC.[14] In light of the modelled C14 data, the MB I period can be placed in the 2070–1890 BC interval, the MB II phase in the 1910–1730 BC interval, while the MB III phase can be dated to the 1760–1530 chronological segment.[15] On account of the typo-

the Bodrogszerdahely phase of the Füzesabony Culture can be synchronized with Gyulavarsánd III, the early phase of the Suciu de Sus Culture and the development phase of the Vatya Koszider. The most recent discoveries belonging to the Füzesabony, Gyulavarsánd, Madarovce and the Vatya Koszider Cultures, can be placed in the late stages of the BM III period (Molnár 2014, 16).

[11] For the stratigraphy, see Németi, Molnár 2012, 37sqq. Despite the ^{14}C data from Romania, Hungary and Slovakia, the matter is still less than straightforward. With regard to the Middle Bronze Age radiocarbon data one can observe the fluctuations in the calibration curve as well as the slight dispersion of the final values (Raczky, Hertelendi, Horváth 1992, 45; Gogâltan 1999, 70; Forenbaher 1993, 246, Fig. 5.) The radiocarbon data collected and published in Hungary and Slovakia is mostly quite old, the analysis being carried out in the since defunct research institute from Berlin. These were however recalibrated by the authors of some recent studies (Gogâltan 1999, 75sqq, 221sqq Annexe 1; Fischl et alii. 2013, 361; Duffy 2014, 291sqq Apendix A).

[12] All in all 60 C14 datasets were modelled using the Bayes statistical method. In recent years new important data have been published from the sites such as Wietenberg in Central Transylvania, Otomani-Gyulavarsánd in North-Western Transylvania and North-Eastern Transylvania (Tarhos 26 site; Toboliu-Dealul Zănăcanului) and the Füzesabony-Otomani Culture in Slovakia.

[13] With regard to the Transylvanian finds belonging to the Otomani Culture, there are 17 unpublished C14 analysis from Carei-Bobald. Furthermore, according to the information kindly provided by H. Ciugudean there are several hitherto unpublished C14 data from the Central Transylvanian Wietenberg as well. The contemporaneous nature of the two cultures is proven by the emergence of Wietenberg imported pottery in Otomani archaeological complexes. This can potentially facilitate the unitary and more precise interpretation according to the Bayes model. Given the distance between the cultures and the lack of direct cultural contact, the recently published C14 data regarding the Transdanubian Incrusted Pottery and the Vatya Culture were not considered here, see Jaeger, Kulcsár 2013, 289sqq; Kiss et alii. 2015, 23sqq; Jaeger 2016, 92sqq.

[14] The precise chronological interval obtained from the modelling of all available C14 data from Füzesabony-Otomani (SL), Otomani-Gyulavarsánd (RO-HU) and Wietenberg (RO) is: 2075−1537 BC. With regard to the decrease of the lower limit of the interval, see footnote 13. I wish to express my gratitude to Florin Drașovean for the help offered in the processing of the data.

[15] The precise chronological interval obtained from the modelling of all available C14 data from Füzesabony-Otomani (SL), Otomani-Gyulavarsánd (RO-HU) and Wietenberg (RO) is: MB I: 2075−1892 BC; MB II: 1911−1731 BC; MB III: 1764−1537 BC. The data processed according to the Bayes statistical model, without taking into consideration the results obtained from the since defunct research institute based in Berlin (Bln-) have provided slightly different precise chronological intervals: MB I: 2074−1856 BC (the difference in the lower end of the interval is in this case more significant, given the low amount of usable data); MB II: 1937−1734 BC; MB III: 1766−1531 BC (the slight difference in the limits of the interval is caused by the fact that the highest amount of new C14 data refers to the MB III period). It has to be underlined that in all cases the chronological values were rounded down. Both instances of modelling provided overlapping chronological interval limits for all three phases of the Otomani Culture. The partial overlapping of the C14 data also indicates the importance of the so-called transition phases observed in the case of the archaeological material. The Otomani II–III interphase concept (associated with the layers of the Otomani-Cetatea de Pământ III–V) introduced by Ivan Ordentlich seems more and more plausible. In the author's view in the material culture of the Otomani II-III interphase still dominated by forms and ornaments characteristic to the Otomani II phase, already start to emerge elements belonging to the next phase (Ordentlich 1973, 85sq.) I. Ordentlich also considers that these changes in the forms and decoration 'only appear' during the classic Otomani II interval (Ordentlich 1973, 57). These transformations are also described while presenting the first layer belonging to the settlement at Sălacea-Dealul Vida (Ordentlich 1973, 182), where this level is linked to the phase of peak development of the Otomani II period (Ordentlich 1973, 183.) In light of the new research carried out at Carei-Bobald, it has to be mentioned that the Otomani II–III interphase seems rather to indicate the beginning of the Otomani III phase, rather than the peak development level of the pottery from the Otomani II phase, as considered previously (Molnár 2011, 293 footnote 127; Molnár 2014, 23, footnote 177.)

chronological and stratigraphic analysis of the repertoire of forms and decorations pertaining to the Otomani pottery, the MB III period can be divided into two phases.[16] This is corroborated by the radiocarbon data (C14 AMS) coming from specific archaeological contexts. According to the Bayes statistical model (2σ), the MB IIIa phase is dated to 1760–1690 BC, while the MB IIIb phase dates to the 1690–1530 BC interval.[17]

The geographic environment

The Carei Plain stretches on the eastern half of the region known as the Nir Plain/Nyírség, with an average altitude of 150–160 m above sea-level, towering above the neighbouring Eriu Valley with a 30–40 m height difference. (Molnár 2014, 27sq.) (Fig. 1/1) The studied area was once bordered on the eastern side by the Vermes Marsh, a swampy area wedged between the continental dunes of the Eriu Plain, to the west by Crasna's marshy floodplain, and to the north-east by – what was once Europe's largest eutrophic marsh covering as area of 400 km^2, until its drainage in the 1890s – the Ecedea Marsh. (Geografia 1992; Karácsonyi 1995, 7sqq, Németi Molnár 2012, 14sqq, Molnár 2014, 27sqq.) The southern part of the highly fragmented territory characterised by mostly high water levels, includes the Eriu and the Barcău floodplains (both flowing into the Nagysárrét), which in effect amount to a web of backwater channels filled up periodically and old riverbeds, rather than a continuous proper floodplain. (Glaser 1939, 303sq; Benedek 1967, 28, 30.) The huge sand alluviums – dotted with inter-dune marshes and small open waters – are grooved with the creeks of the Tisa, Someş and Crasna Rivers, formed at the end of the Ice Age and were gradually shaped by the wind into today's landscape. The farming and later the industrial activities, the regulation of the rivers, and the draining of the Ecedea Marsh transformed the once diverse Bronze Age landscape into today's artificial steppe ('*pusta*').

The Carei Plain, the Eriu Valley and the north-eastern area of Hungary was part of a wider geographical region displaying the same vegetation. (Sümegi, Bodor 2000, Fig. 4.) Comparing the results of palynological investigations made at different points in the Great Hungarian Plain, with the evaluation of samples from the Eriu Valley, we can state that the area of the Carei Plain comprised a wooded steppe vegetation and a corresponding climate. (Sümegi, Bodor 2000, 87, Fig. 3, 4; Bogdan, Diaconeasa 1960, 141sqq.) Based on the Eriu Valley's pollen diagram, the studied area was covered with a forest block which had a significant quantity of hazel-nut bushes mixed with oak and European spruce pine. (Benedek 1967, 28sq; Bogdan, Diaconeasa 1960, Fig. 4)[18] The drop in

[16] B. Hänsel divides the Middle Bronze Age III period into two distinct phases (Hänsel 1968, 165sqq.). This view is shared by W. David, who believes that the Reinecke B period can be divided in two, both phases having specific types of settlements, cemeteries, and bronze hoards (David 1998, Fig. 14–15). W. David's argument rests on the fact that the bronze hoards from Téglás, Zajta, Turda, and Békés, differs in terms of composition from those discovered at Dunaújváros (Kosziderpadlás I), Áporka, Mezőberény, Kolodnoje, and Krüssow, also dated to the Middle Bronze Age III period (Koszider period). (David 2002, 247). The designation 'late development stage of the Middle Bronze Age III' put forward by I. Bóna is an appropriate one (Bóna 1992, 17). The pottery of this last evolution phase of the tells in Transylvania is of an exceptional beauty (with 'baroque' decoration) and is tightly linked to the 'classical' period of the Otomani Culture. According to the recent archaeological investigations and the C14 data collected at Carei-Bobald, the 'late pottery' has emerged sometimes during the first stage of the Middle Brone Age IIIa period, evolving until the end of the Middle Bronze Age period. The proportion and frequency of the 'late pottery' in the Otomani IIIa habitation levels and complexes displays microregional and local differences.

[17] The precise chronological interval obtained from the modelling of all available C14 data from Füzesabony-Otomani (SL), Otomani-Gyulavarsánd (RO-HU) and Wietenberg (RO) is: MB IIIa: 1766−1694 BC; MB IIIb: 1695−1537 BC. The data processed according to the Bayes statistical model, without taking into consideration the results obtained from the since defunct research institute based in Berlin (Bln-) have provided the following chronological intervals: MB IIIa: 1766−1670 BC; MB IIIb: 1706−1531 BC.

[18] For the sample collected at Eriu-Sâncrai see Benedek 1967, 28. The author, Zoltán Benedek managed to collect a larger amount of pollen in a 410 cm high section, and a depth of -3.6–4.1 m, within a brown clay layer with strips of yellow clay. Without using C14 dating, the analysis of the pollen samples revealed the following species: *Pinus* (70–80%), *Betula* (10–17%), *Picea, Alnus, Ulmus, Corylus, Abies, Fagus* and *Tilia* in small proportions. The *NAP* pollen material is present in a proportion of 20–30%, with a significant share of *Graminaae, Chenopodiaceae* and various *Artemisia* species. For the samples collected in the Érkávás-Vársziget point see Benedek 1967, 29. The 240 cm long section yielded at a depth of -1.6–2.0 m the following species: *Quercus, Ulmus, Frasinus, Tilia*, *Salix* pollen in a proportion of 30%, while the share of the *NAP* pollen is 20%. The author also reported pottery fragments in the layer. For the sample collected at Cheșereu see: Bogdan, Diaconeasa 1960, Fig. 4: *Picea* (31.33%), *Carpinus* (1.33%), *Betula* (1.33%), *Alnus* (0.66%), *Quercus* (26%), *Tilia* (4%), *Ulmus* (1.33%), *Salix* (4.66%), *Corylus* (20%), *Graminaae* and *Cypraceae* (NAP–66%), *Caryophyllaceae* (4.66%), and *Filis* (4%). The emergence of the *Carpinus*, occurs simultaneously with the decrease in the share of *Quercus mixtum*. The proportions of the *Ulmus* also drop dramatically, however the proportions of *Picea* reach their peak at this point. The decrease in proportions of both *Quercus* and *Tilia*

the pollen proportions of downy oak, lime tree (*Tilia*), ivy (*Hedera*), together with the emergence of pollens indicating hornbeam, reeds and sedges, diatoms, spiked water-milfoil and *Sparganiaceae*, suggests the onset of a period marked by a colder and wetter climate. The pronounced pollen proportions of cereals and still water-loving plant species together with the reduction in tree pollen indicate the Middle Bronze Age communities' increasing environment-shaping activities. In parallel with the intensification of the human impact, the lake system slowly filled up and the lakesides gradually became marshy. (Sümegi 2003, 182; Juhász 2005, 62sq; Sümegi 2013, 163sq.) The sub-boreal period of the Holocene, known as the 'beech-forest phase' by palynologists (Cârciumaru 1996, 9sqq; Tanţău et alii. 2009, 164.),[19] is characterized by a steady, continuous cooling of the climate, with no significant fluctuations and increased rainfall. (Davis et alii. 2003, 1711; Sümegi et alii. 2004, 407; Medzihradszky, T. Bíró 2007, 21sq; Tanţău et alii. 2009, 170; Feurdean et alii. 2010, 2203sq, Fig. 4; French 2010, 46, Tabel 2.1.) Recent investigations set in North-Western Romania indicate that he landscape was dominated by beech forests combined with oak and hornbeam. The increasing presence of beech, combined with that of various water plant species, peat moss and trampled weed, according to the pollen evidence, suggests a natural environment marked by open forests, marshes and moors. (Feurdean 2005, 439, 444, Fig. 2, 4–5.)[20] The faunistic and palynological study of the Bátorliget Bog, located in the Carei Plain's vicinity, indicates a more open forest with a rich scrubland formed at the end of the Neolithic period and persisting in the Middle Bronze Age. According to the investigations, besides large beasts, the environment favoured the thriving of so-called light-preferring molluscs (which sought sunny environments with open vegetation), bank voles, forest dormice, wood mice, as well as species preferring open areas dominated by grassland and bushes, such as the common vole, the European mole, and lizards. The list is completed by a series of species which preferred wetlands, such as the European water vole, as well as various types of frogs and snakes. (Sümegi 2003, 181sqq; Sümegi 2004, 326.) Paleoenvironmental analysis of the Pocsaj Marsh, evolved through to the eutrophication of one of the Eriu River's branches, presents a similar picture. The palynological and malacological research data sets reveal a marshy area dotted with open stretches of water. From the specific floodplain environment suitable for grazing, weed-covered open pastures emerged alternating with forest blocks and loess-covered surfaces. (Sümegi 2005, 133sqq Zone 4.)[21] During this period, the Great Plains transformed into a forested steppe, the rainfall-fed abandoned river channels filled with water and the marshes were flourishing. (Kácsonyi 1994–1995, 195sqq; Willis 1997, 200; Berglund 2003, 9.) The size of the flood plain areas changed depending on precipitation amount. Due to the decomposition of organic matter and soil erosion, as well as the soil and organic matter washing in from the high banks on the Carei Plain – characteristic for the forested-steppe zone (Badea et alii. 1983, 618; Ciută 2009, 67.) – the soil became thicker, more waterlogged, with a high humus content (in excess of 7%), poor in mineral salts and phosphates. (Karácsonyi 1995, 8; Ghinea 2002, 363.) The significant amounts of cereal and trampled weed pollen discovered during the palynological investigations highlights the use of

indicates a period marked by colder climate. The consistent presence of *Graminaae*, *Cypraceae* and *Diatomaae* indicates an open, marshy environment actively used for crop cultivation (Bogdan, Diaconeasa 1960, 153). It must be mentioned that the collection and analysis of the pollen samples occurred on a 20 km area between the three modern localities where the valley of the Eriu is the narrowest (Bogdan, Diaconeasa 1960, 147). Given that the opening of the valley is still quite considerable even in this area, the 150 pollen grains collated can have both local and exterior origins (Jakobson, Bradshaw 1981, 80sqq; Sümegi, Bodor 2000, 86). Considering that we are dealing with an open hydrological system, the deposition of external cereal pollen during the flood period is possible. This is perhaps the explanation for the high proportion of *Picea* pollen. The extra-local pine pollen can originate from the forests from the neighbouring areas. (Farcaş et alii. 1999, 806) Consequently, the pollen diagram based on the samples collected from the old dried out riverbed reflects only partially the paleovegetation and the climate of the region (Fall 1987, 396sqq, Sümegi 2005, 131).

19 The spread of beech (which appeared during the early Holocene, see the case of Bátorliget) in the foreground of the Carpathians was gradual, emerging on the Great Hungarian Plain starting with the late Copper Age (3300–2500 BC) according to the pollen-based models (Sümegi et alii. 2012, 285sq.).

20 Preluca Ţiganului is situated at 730 m above sea level in the Gutâi Mountains. The sample-collecting point the Oaș/Avas Basin is situated at some distance from the Carei Plain. The segment of the pollen diagrammed relevant to the Middle Bronze Age period contains the following plant species: *Artemisia*, *Chenopodiaceae*, *Poaceae*, *Apiaceae*, *Caryophyllaceae*, *Asteraceae*, *Dipsacaceae undiff.*, *Sphagnum* spp., *Rumex acetosa*, *Rumex Acetosella*, *Plantago lanceolata*, *Poaceae*, *Equisetum* and *Myriophyllum*.

21 The Pocsaj area is considered to be the gateway of the Eriu Valley, the meeting point of Barcău and Eriu Valleys: Dani 2005, 307.

ploughing in agriculture. (Sümegi 2005, 133.)[22] Agricultural activities have an effect on the diversity of natural vegetation and cultivated species alike. (Gyulai 2012, 302.) The archaeological and archaeozoological data also reveals that the region's large agricultural and farming communities developed less extensive pastures and croplands through deforestation. According to Petr Kuneš and his collaborators, the amount of open land not covered with forest in Eastern-Central Europe during the late Holocene, represented 20% of the entire region throughout this period. (Kuneš et alii. 2015, 23sqq.)[23] The logging activities indicated by the cyclical changes in the proportion of tree pollen, has ensured not only easier hunting, more efficient animal husbandry and farming, but has also provided the fuel required for metallurgy and pottery production alike. (Behre 1988, 633sqq, Sümegi 1999, 196; Sümegi, Bodor 2000, 87; Sümegi 2003, 206; Sümegi 2004, 330; Sümegi 2005, 133sqq; Fărcaş, Tanţău 2004, 230sqq; Juhász 2005, 63, Tanţău et alii. 2009, 172; Feurdean et alii. 2010, 2203sqq.)

Society and economy

The farming economy consisting of field-rotating crop cultivation and grazing animal husbandry was only suitable for sustaining a community composed of a limited number of individuals. The amount of work input per land area unit required by field-rotating agriculture, especially the preparation of the farmlands exerted a considerable strain on smaller communities. (Lüning 2000, 52sqq.) Based on the analogy provided by ethnological and ethnographic models it can be asserted that the economy of the Carei-Bobald tell was based on the intense cooperation of the local households. (Hendon 1996, 56; Hendon 2006, 274; Roscoe 2009, 71sqq; Carballo, Roscoe, Feinman 2012, 111sq; Anders, Raczky 2013, 81.)[24] The corporate power exertion of the household units (Earle 2002, 18; Wright 2004, 67; Brück 2000, 288; Skoglund 2009, 202.)[25] provided the basis for the economic decision making and mobilisation which determined the framework of the individual's daily life.[26] This in turn allowed the mobilisation of the

[22] The situation is similar on the Pocsaj Marsh where the joint presence of pollens belonging to *Polygnomum* and *Centaurea cyanus* indicaes systematic crop cultivation and hence a considerable anthropogenic effect on the environment. According to Pál Sümegi the consistent presence of *Chenopodiaceae*, *Polygonaceae* and *Fagopyrum esculentum* in addition to cereal pollens indicates the emergence of agriculture which coexisted with a gathering-storing type economy.

[23] In the view of the authors the anthropogenic effect on the environment increased starting with the beginning of the 2nd millennium BC. According to the analysed samples starting from 1500 BC there is a sharp increase in the quantities of beech (*Fagus*) and cereal pollen. An interesting observation made by Petr Kuneš and his collaborators is that starting from 500 BC, the wildfire deforestations stopped paying a significant role in the dynamic of the forests.

[24] The independent and active socio-economic role of the household can only be asserted in the context of hierarchal social structures i.e. in the case of tribes and chiefdoms (González-Ruibal 2006, 144sqq.). For Paul Roscoe and his team, the segmentary society, i.e. composed of equivalent modular segments from New-Guinea with its social structures created on a single level of organization (household units and different combination groups of household units) provides optimal framework for the handling of tension generated by different interests and for the formation of *prosocial behaviour* (*social optimality*) serving the interests of the society. In his opinion the structure of low population number societies is not hierarchical but a modular social system. With regard to the notion of subsistential and political economy see: Johnson, Earle 2000, 23sqq.

[25] The corporate power strategy mostly based on a network of family ties and alliances has a first and foremost local character. The decision making and cooperation is based on certain social rules which ensure the solidarity of the community. The household is an essential component of the system which ensured the learning environment in these early societies. It is here that the members of the community are familiarised with the basics of social behaviour and the fundamental norms of equality and inequality. In the development and legitimation of the individual and collective identities, an essential factor was the connection to a stable home (dwelling, household) in some cases over multiple generations. The household ensured the framework for the internal and external distribution of the produced goods, for the transmission of knowledge, rules and rights regarding material possessions, and reproduction, not only in biological terms, but also in the sense of integration of the group's younger members. This constitutes the social behavioural components of the household. (Wilk, Rathje 1982, 618sqq.)

[26] With regard to the notion of household, see Molnár 2014a, 91, 99sqq. According to Eugene Hammel's general definition, the household is the smallest social group that attended to the maximum of communal tasks (Hammel 1980, 251). The cooperation of the household units clearly exceeds the level of everyday life activities and their simple synchronisation (Padder 1993, 114; Brandon, Braile 2004, 4sqq). Processual archaeology views the household units as production and consumption structures capable of a uniform behaviour and rational decision making (South 1977, 2sqq, 86sq; Beaudry 1989, 85; South 1988, 27) or as the quantifiable basic units of social and economic subsistence (Allison 1999, 1; Sørensen 2010, 124sq, 135sqq, Table 5.1.) In this sense the household unit is the basic social component of subsistence, a strategy aimed at satisfying the productive, distributive, and disseminative needs of the community's members. (Wilk, Rathje 1982, 618sqq). This strategy however changes according to the nature of the family situated at the core of the household (Wilk, Netting 1984, 3.). We have to keep in mind that the actors of the cultural processes and the creators of economic goods were often represented by individuals and

work force and production means needed for fairly large scale endeavours and the simultaneous work on a number of different assignments. (Fuller, Stevens 2009, 38sq, Fig. 6.2.)[27] The intensity and the manner of land use was decisive in terms of the sustainability and the balance of the community's economy. (Halstead 2002, 105.) The communal ownership of the farmland, divided into well separated parcels worked by the individual household units, contributed significantly to the economic cooperation within the community, especially the protection against pests and the higher degree of efficiency in the utilisation of resources. (Fuller, Stevens 2009, 39; Johnston 2013, 324; Carballo, Roscoe, Feinman 2012, 111.)[28] This however did not affect the social stratification, the inner competition, or the overall power and hierarchy of the ruling elite over the entire society. (Németi, Molnár 2012, 53sqq. Bradley 1978, 268sqq; Fleming 1985, 131sqq; Netting 1990, 22; Sherratt 1997, 74sq; Harding 2000, 129sq, 150sqq; Brück 2000, 282; Johnson, Earle 2000, 30sq, Fig. 3.)[29]

The Otomani communities, which increasingly relied on an agricultural economy, gradually expended their hold on new exploitable territories.[30] The increase in size of the farmlands can-

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social groups with antagonistic interests (Hodder 1991, 6; Dietler, Herbich 1998, 239; Brandon, Braile 2004, 7). When examining the households, one must not lose sight of the distribution of responsibilities according to the age and gender of their members (Price 1999, 30sqq). With regard to the 'small-group dynamics' and the 'task-oriented' decision making see: Johnson 1982, 392sqq, Figure 21.2, Figure 21.3.

27 The archaeological investigation of the Carei-Bobald tell has hitherto revealed 12 dwellings or dwelling portions belonging to the Otomani Culture. The population of the tell can only be estimated in conjectural terms at this point. Based on the nature of the houses belonging to the various stages of the Otomani Culture as well as the hitherto published estimations (15 houses/90 individuals/hectare; 4–8 houses/24–48 individual/hectare, see: Artursson 2010, 101) the inhabitants living within the fortified precinct of the tell did not exceed 50–60 individuals. In the case of the tells from Hungary Marie-Luis Sørensen put forward a figure of 5–7 individuals per dwelling. According to the author by the end of the Middle Bronze Age this figure increases to 9–11 individuals per dwelling (Sørensen 2010, 127, Table. 5.2.). According to Alexandra Anders and Pál Raczky whenever larger tasks involving the entire community or a part of it exceeded the cooperational and organisatoric levels of the household, new group-configurations overriding the households emerged to take over the operations (Raczky, Anders 2013, .80sq, 1 kép.). A similar view is expressed by Richard Wilk is (Wilk 1983, 100).

28 With regard to the problem of private land property and the classification of land in the category of inheritable goods, see Earle 1998, 91; Gibson 2008, 46sqq; Robert Hunt has put forward the notions of open access and commons, the latter can probably be applied to the present case. (Hunt 1998, 11sq.) Based on the examples known so far from Europe we can suppose the implementation of the double system in agriculture. The garden-like crop fields situated around the settlements and divided into small parcels were completed by a system of narrow rectilinear crop fields situated on the terrace of the Mérges Stream (Johnston 2013, 319sqq.). Based on archaeological and ethnographic analogies Maria Hajnalová and Dagmar Dreslerová have asserted that the parcels must have had dimensions of 20 × 20 m or 20 × 40 m. The longer, rectilinear crop fields were either used for the cultivation of single species of crops, or were divided into smaller crop fields growing different species (Hajnalová, Dreslerová 2010, 173; Hajnalová 2012, 162)

29 Ploughing and sowing were both time and energy consuming. The evolution towards a more intense crop cultivation demanded an increased amount of work input. Cross-ploughing enabled the economical and efficient working of regular-shaped parcels. In this case the field worker needed to turn around fewer times. The dimensions of the regular-shaped 'individual parcels' worked by one household, based on the identified prehistoric property lines and experimental archaeology in various places in Europe are as follows: 2500 m^2 (England), 1600 m^2 (Europe) and 600–850 m^2 (Northern Europe; according to the recent investigations a plot of 1 km^2 contained two-three farms). Starting from the Middle and Late Bronze Age up until the Late Iron Age the so-called 'Celtic plot system' (1100 BC–AD 200) the 20–40 m long parcels constituted a system of block shaped fields spreading across multiple hectares (Speck et alii. 2003, 141sqq; Lang 2007; Hajnalová, Dreslerová 2010, 191sq; Hajnalová 2012, 162; Johnston 2013, 322sqq.) M. Hajnalová analysing the Bronze Age agriculture in modern-day Slovakia, considers that in order to sustain a household comprising 4–6 individuals with the necessary amount of food, the intense cultivation of a plot of 0.8–1 hectares was called for. This territory had to be increased to 3.75 hectares is crop rotation was employed (Hajnalová 2012, 161). Among the enumerated dimensions, the most plausible lower limit seems to be 600 m^2. Such an area could have been ploughed in a day while the harvest could have been collected in an even shorter period (Lindquist 1974, 29; Bradley 1978, 267, 270; Wright 2004, 74; Mikkola 2005, 49sqq; McIntosh 2006, 119sq; Earl, Kolb 2010, 64; Johnston 2013, 316sqq.). According to the ethnological and archaeological evidence the integrated and corporative power strategies could be present simultaneously in a community, however in the majority of cases one of them always enjoyed a dominant position (Skoglund 2009, 202, 213).

30 The considerable use of beasts of burden and the presence of *segetalia* which were characteristic for cereals suggest an agricultural economy starting from the end of the 3rd millennium BC. Based on the iconographic depictions the use of the heavy scratch plough (with wooden share, straight yoke, without mouldboard and coulter, having a low centre of gravity suitable for the deep ploughing of already cleared fields) and of the light scratch plough which required lower traction power suitable for the shallow ploughing of rocky, forested or weed-grown fields, can be asserted from the middle of the 2nd millennium BC. The use of a certain type of scratch plough was based on environmental factors as well as the choice of the community (Balassa 1973, 28sq, 57sqq; Balassa, Ortutay 1980, 188sq; Sheratt 1980, 317; Gyulai 2010, 100.).

not be simply explained by the higher demand of agricultural surplus production brought about by growing social competition. The economic change is instead linked with the general societal and structural transformations occurring during the Middle Bronze Age. (Brück 2000, 275sqq; Gyulai 2010, 100.) The complex relation between crop cultivation and animal husbandry is indicated by the fact that the gradual switchover to an agricultural economy occurred in parallel with the increase in the numbers of the livestock. (Sheratt 1997, 74sq, 219; Rémenyi 2003, 53; Jaeger 2011, 152.)[31] The local communities adapted to the new environmental circumstances gradually switching over to a specialised animal husbandry based on the breeding of cattle[32], horse and swine. (Choyke, Bartosiewicz 2000, 51sq; El Susi 2002, 250sqq.) The archaeozoological evidence, i.e. the percentual distribution of the animal bones clearly indicates the decrease of subsistence hunting, and its ancillary role in the economy of the Otomani communities.[33] Furthermore, the distribution of species within the livestock and the butchering trends, highlighted again by the archaeozoological investigations, indicates the lack of major periods of economic crisis in the life of the North-Western Transylvanian tells. (Haimovici 1987, 38sqq; Bökönyi 1988, 124; El Susi 2002, 243sqq; Gál 2005, 150, Tabel 4.)[34]

Agriculture was the cornerstones of the Otomani communities' economy (Gyulai 2010, 100.)[35], according to Ildikó Szatmári, the surroundings of the major settlements were littered with large croplands, often amounting to several hectares. (Szatmári 2002, 52.)[36]

According to the ethnographic analogies from the Great Hungarian Plain the extent and location of the farmland was determined by the geographic and ecologic characteristics of the area (Balassa, Ortutay 1980, 39; Györffy 1983, 101sqq.).

31 One of the main criteria of an agricultural economy is the existence of an adequate number of beasts of burden and of sufficient winter forages. Systematic crop cultivation relied on the existence of a large livestock, which ensured the fertilization of the fields. According to Paul Halstead large scale agriculture and excess production was only possible with the use of specialised beasts of burden and of the plough driven by oxen. (Halstead 1995, 11sqq; Hajnalová 2012, 161sq; Johnston 2013, 323sq.). Ethnographic analogies show that poorer agricultural communities who lacked oxen used cows for ploughing (Balassa, Ortutay 1980, 190sq). According to Amy Bogaard evidence indicates that cows were commonly used for this type of work starting from the Neolithic period. (Bogaard 2005, 183.) According to the archaeozoological data available from the settlements of the Carei Plain and the Eriu Valley among the cattle of the Otomani-Cetatea de Pământ (comprising 40% of the archaeozoological material) between one quarter and a half of the individuals were oxen (based on the horns and the metatarsi: 9.09 / 20.83%) (Haimovici 1987, 44sq; El Susi 2002, 251). In the case of the cattle stock of the Carei-Bobald tell (36%), the analysis of the horns revealed that oxen had a share of 5.6% (El Susi 2002, 243, 251.) According to Maria Hajnalová and Dagmar Dreslerová the presence of the specialised beasts of burden within the archaeozoological material of the settlements can be an indicator of the growing farmlands only when corroborated by the wider spectrum of cultivated crops. Excess production was achieved through the increasing of the cultivated plots. The strenuous sowing process during the Middle Bronze Age both in spring and in autumn overlapped with the harvesting period. The 'bottleneck effects' developed during the agricultural year as well as the varying available workface also determined the extent of the of the crop fields. (Fuller, Stevens 2009, 38, 40.) The weed plants present in the archaeobotanical assemblages indicate the 'horticultural type' cultivation of smaller fields (for the types of cultivated fields, see Johnston 2013, 314sqq.). The crop fields can be viewed as the extension of the households beyond the actual living area (Charles et alii. 2002, 133; Hajnalová, Dreslerová 2010, 191sq; Hajnalová 2012, 162; Johnston 2013, 325.).

32 The cattle also played the role of social status marker. (Comaroff 1992, 108sqq; Wright 2004, 74; Thrane 2009, 18.)

33 Hunting must have had a varying importance for the Otomani-Gyulavarsánd communities. The proportion of hunted wild animals is usually low in the settlements belonging to the Otomani Culture (12–21%). The preferred game was the deer, although its share very rarely exceeded 10%. The share of the wild boar bones in 6.2%, while aurochs bones make up 3% of the wild animal bone assemblage. Bison, wild hares, wildcats, and beavers are only represented in minute proportions (Bader 1978, 131sq; Haimovici 1987, 39sqq; El Susi 2002, 252; Choyke 1998, 163, Table 1, Bindea 2008, 95sqq.). Erika Gál's analysis underlined the high proportion of game relative to the average (25.7%) within the archaeozoological assemblage of the Békés-Városerdő tell. The high proportion of hunted game is considerable given that the share of deer (12.5%), bison (5.7%), and aurochs (5%) corresponds to the figures reported at other sites (Gál 2017, 153sq.).

34 Crisis are suggested by the increase in the share of game consumption, the decrease of domestic animal bones and the mass butchering of young domestic animals (Hodder 1979, 449.). Within developed communities with stable agricultural economies the production and commercial value of oxen was considerable. The livestock mainly comprised adult individuals (Vretemark 2010, 165).

35 According to Maria Hajnalová the archaeobotanical material from Slovakia indicates that the subsistential economy of the Bronze Age communities was based on agriculture. (Hajnalová 2012, 160.) A similar view is held by Paul Halstead with regard to the Bronze Age economy in modern-day Greece. (Halstead 2002, 108.)

36 This is difficult to assess without the analysis of pollen samples collected in the immediate vicinity of the settlement. The analysis of the palynological samples collected from the surroundings of the Carei-Bobald tell by the researchers of the Cologne University, put forward by Astrid Röpke (et alii.) on 9–13. October 2017 at the 2nd international LOEWE

If we transpose the map of the Otomani settlement structure of the Carei Plain and Eriu Valley unto the region's soil map, it will become evident that the majority of the settlements are either situated on areas with fertile, soft mollisol type soils having high humus contents, or on medium moist hydromorphic soils.[37] (Fig. 3/1–2) It would seem that the economic potential of certain areas was among the essential criteria when choosing the place for the founding of new settlements. (Sümegi 2013, 163sq.) For instance, the high baiscity mollisol chernozem soils from the surroundings of the tell at Carei-Bobald were quite suitable for high efficiency crop cultivation. (Harta 1982, CC1és CL1 types; Jakab 2004, 164sqq.)[38]

The agricultural activities of the Ottoman communities of the Carei Plain and the Eriu Valley is further documented by certain archaeological finds, such as various agricultural implements made of animal bone, grinding stone, (Ordentlich 1974, 136; Chidioșan 1984, 31sq, Pl. 3−5; Roman, Németi 1990, 40sq; Németi 1995, 124; Németi, Molnár 2007, 141 t. / 8, 150 t. /6–7, 151 t. /1–2, 152 t. / 5.)[39] as well as the charred grains discovered in Otomani-Cetatea de Pământ (Ordentlich 1964, 135sqq; Ordentlich 1968, 141sqq; Cârciumaru 1996, 94sq, 144; Ciută 2009, 104.)[40] and Carei-Bobald, in 1988 (Cârciumaru 1996, 94)[41] and 2013–2016. (Molnár et alii. 2014, 26; Ciută, Molnár 2014, 87sqq; Molnár et alii. 2017, 37.)[42]

The previous research of the Carei-Bobald tell revealed 12 houses/parts of houses belonging to the Otomani culture. From these, one must be mentioned: a surface house with a rectangular ground plan, oriented north-west–south-east, a side of length 8 m, excavated in 1988. The house had a circular inner fireplace, repeatedly plastered to the floor, grindstones, pottery (both intact and broken on spot), as well as a larger quantity of charred cereal grains. The cereal remains were discovered in three heaps. The circumstances of discovery suggest that these were kept in baskets or other storage objects made of organic material, which were destroyed when the house burnt down. The outer surface of the collapsed walls made of daub was covered with a neatly smoothened thin layer of wall-plaster. The upper part of the walls were once decorated with spiral frieze. (Roman, Németi 1990, 40.)

The archaeobotanical analysis of the charred cereal samples taken from the tell at Bobald, weighing around 1 kg, proved that the local communities were not specialised on a single type of crop, relying instead on polycultures. (Gyulai 2001, 92; Gyulai 2010, 100.) During the second part of the Middle Bronze Age (MB II), the two most important staple crops were the emmer (*Triticum dicoccum* 22.7%)[43] and the barley (*Hordeum vulgare*

Conference, unfortunately did not contain any prehistoric pollen. We wish to express our gratitude for the information provided by the aforementioned authors.

37 The productivity of the intensive farmlands was closely connected to the moisture content and water saturation of the soil. (Sheratt 1980, 315.)

38 We are aware that the extensive (1:100 000) soil maps were drawn up using small numbers of oil trenches (25–30 trenches per 100 hectares at best). This fact calls for the cautious formulation of any kind of assertions.

39 During the Carei-Bobald excavations carried out between 2010 and 2017, several hitherto unpublished grindstones and antler hoes of various size were discovered.

40 The two samples collected from the layer dated by Ivan Ordentlich to the Otomani II–III transition period, according to the analysis undertaken by Mari Cârciumaru contain the following species, the 1st sample (13. trenches, 11 grids, -160cm): einkorn/*Triticum monoccum* (2.2%), emmer/*Triticum dicoccum* (5.5%), spelt/*Triticum spelta* (44.7%), bread wheat/*Triticum aestivum* (46%), barley/*Hordeum vulgare* (1.3%), darnel/*Lolium temulentum* (0.3%); the 2nd sample: *Triticum monococcum* (2.2%), a *Triticum dicoccum* (88.5%), a *Triticum cf. spelta* (9.3%). It is interesting to note that the charred grains of the 2nd sample are considerably smaller in size than those of the 1st sample. This may be due to an unfavourable climatic change, deterioration of the soil, or premature harvesting. Furthermore the grains are somewhat damaged. This aided their subsequent grinding or boiling (Cârciumaru 1996, 144). The charred grains of the 3rd sample were collected from the floor of dwelling designated as 'house A' at Otomani-Cetatea de Piatră, belonging to the 3rd development phase of the culture. The only information available regarding the context of discovery is that the sample belongs to the Otomani III phase. The palynological analysis of the sample provided the following results: *Triticum monoccum* (1.2%), *Triticum cf. dicoccum* (3.2%), *Triticum cf. spelta* (57.7%), *Triticum aestivum* (36.4%), *Hordaeum vulgare* (0.8%), *Vicia sp.* (0.2%), *Lolium temulentum* (0.5%). The latter are not cultivated crops, their presence can be linked to the weeds that grew in the crop fields together with the cereals.

41 The charred grains were discovered in 1988 by the director of the excavation János Németi on the floor of a classical Otomani II dwelling ('house 1'). The respective house was discovered in the 4th grid of the S3/1988 trench at a depth of – 1.6 m.

42 The charred grains were discovered between 2013 and 2016 (in the area excavated since 2010) in the daub demolition and on the floor of the house in the C1 and C4 trenches.

43 The emmer is a highly adaptable crop. It is mostly sown in early autumn, but it is also used as a spring crop when the climate or the condition of soil does not prevent the sowing of the winter wheat. In certain cases the deficiencies of the winter wheat also impose the spring sowing. According to M. Cârciumaru and his collaborators the agriculture of the Otomani communities was based on the cultivation of emmer (Cârciumaru, Pleșa, Mărgărit 2005, 53, 56.)

73.4%). (Wasylikowa 1991, 215.)[44] In addition, smaller quantities of einkorn (*Triticum monococcum* 0.4%),[45] wild emmer (*Triticum cf. dicoccoide* 0.3%), common bread wheat (*Triticum aestivum* 1.1%),[46] and its subspecies the *Triticum sp. vulgare* (1.6%), bromus (*Bromus sp.* 0.1%), and sorrel (*Rumex acetosa* 0.1%) (Cârciumaru 1996, 68; Ciută 2009, 102.)[47] can also be found within the collected sample.

During the 2002 excavation campaign at the Carei-Bobald tell, a pottery vessel was discovered in the backfill of pit G7 from trench 7, containing around 300 acorns and oak galls (*Quercus robur*). The acorns were probably roasted prior to being deposited in the vessel dated to the third phase of the Middle Bronze Age (Otomani IIIb) (Roman, Németi 2003, 76sq; Ciută 2007, 53sqq; Ciută 2009, 103.)[48]. (Fig. 4 /1, 4, 5) The earlier archaeobotanical results are completed by the analysis of the charred cereal grains discovered at the aforementioned site between 2013 and 2016. (Fig. 4/3) During these campaigns[49] the investigations uncovered the remains of a house situated at depths between -1.10/1.30m and -1.70/1.80 m, and belonging to the Otomani IIIa phase.[50] The small-sized house with multiple construction phases, fitted with four open hearths,[51] and at least

[44] According to Peter Stika and Andreas Heiss it was the most common crop of Early- and Middle Bronze Age Europe (Stika, Heiss 2013, 359sq). Barley is well adapted to the climatic fluctuations, provides a high yield, has a short growing period and is rich in vitamins B-, A- and E, having thus an excellent nutritional value. It is questionable whether the large proportion of barley identified in the palynological samples collected from Care-Bobald indeed demonstrates its large-scale cultivation around the tell, as asserted by M. Cârciumaru and his collaborators (Cârciumaru, Pleşa, Mărgărit 2005, 71, 74; Gyulai 2010, 42.). According to present botanical experiments the later (colder) sowing period is ideal for the winter barley. The experiments carried out by the Karcag Research Institute of the Debrecen University the barley sown at a late period contained higher quantities of proteins (Puskás et alii. 2014, 366).

[45] Einkorn does grow in low quality shelly soil as well, is resistant to disease (e.g. wheatrust, flourdew) and to cold. Furthermore due to its strong and flexible stem, the plant is not toppled by the rain. Einkorn flour produces a flat, somewhat dry, but tasty bread. It is mainly sown in early autumn, but can also be planted in the spring. According to M. Cârciumaru and his collaborators it was used by the Otomani communities as an ancillary crop, accompanying other staple species. Occasionally it is sown together with barley. According to Ferenc Gyulai einkorn contains the highest amount of minerals among the hulled cereal species (Gyulai 1999, 299; Cârciumaru, Pleşa, Mărgărit 2005, 46, 50; Gyulai 2010, 274).

[46] The bread wheat belonging to the family of naked or free-thrashing cereals is a very adaptable and species containing high ammounts of gluten, and thus a high nutritional value. It quickly became an important staple crop. The species provides a larger yield, however it requires more intense tillage than its hulled counterparts. The palynological assemblages comprised of bread grains, wheat mixed with einkorn, and bush vetch are increasingly common. (Emődi et alii. 2011, 447sq.) According to Marin Cârciumaru and his collaborators it was cultivated at a high level by the Otomani communities around the Cultures eponymous site. (Cârciumaru, Pleşa, Mărgărit 2005, 60sqq.)

[47] Contrary to the view expressed by the Romanian researchers, the bromus and the sorrel were not 'ancillary crops' but rather weeds growing in the crop fields, indicating the incipient state of the mending of the fields. (Bálint 2008, 173.)

[48] Acorns probably belonged to the diet of the inhabitants of the Carei-Bobald tell, and was probably grinded and added to the wheat flour. Similar finds were reported at the sites of Nižná Myšľa and Včelince (Furmánek, Veliačik, Vladár 1999, 132; Hajnalová, Furmánek, Marková 1999, 232sqq; Jaeger 2011, 153.)

[49] During 2013 and 2016–2017 the area opened in 2010 was researched, which was subsequently divided into four trenches designated as C1, C2, C3, and C4, each having 5 × 5 m divided by a cross-shaped 0.5 m wide balk. In the course of the 2013 campaign the balk had to be demolished due to its poor condition thus resulting in a single excavation area, however the initial partition and the designations were maintained, the documentation being carried out according to the initial tranches.
The damage occurred to the edges of the trench called for the extension of the excavation area, which resulted in a 12 × 13 m sized trench starting from 2016, incorporating 156 m^2. Molnár et alii. 2016, 37.

[50] According to the emerging outlines and the post holes it seems that the buildings had an East–West orientation for the optimal heat intake provided by sunlight (Pásztor 2013, 202). The thick, multi-layered clay floor of the house emerged at a depth of approximately -1.10–1.30 m. The floor yielded a rich variety of archaeological finds consisting of large numbers animal bones, pottery, deer antler fragments and grindstone fragments.

[51] Inside trench C1, a daub demolition layer (Cx14) yielded the *in situ* discovery of a number of intact beakers and a whetstone. In their vicinity and to the north of hearth V8 discovered in the northern end of the C1 trench, some areas covered with charred grains were discovered. The V8 hearth from the C1, outlined at a depth of -160 cm was cut by a grave (M 44) which destroyed approximately half of it. The diameter of the hearth was approximately 65–80 cm and was built on the yellow clay floor of Cx17 with a substructure of compact clay with a layer of pottery fragments for better insolation raised with 6–8 cm above the floor. The surface of the hearth is strongly burnt. In trench C1 to the south-east of the V8 hearth, at a depth of -143 cm a second hearth was discovered, named V7. The diameter of the sub circular structure is approximately 42 × 43 cm, constructed on a yellow clay floor (Cx17, see description above). The surface of the hearth is strongly burnt. Hearth V7 and the clay floor Cx17 are damaged by the cut of the M11 late medieval grave. Grinds 9–11 west/6–8 N yielded a 1 × 1 m large clay 'platform' having a sub rectangular shape, resulted from the application of a thicker layer of clay on the researched surface. In the middle of the platform there was a hearth, named V6 of oval shape,

three portable hearths,[52] was probably the home of a small family (around 8 × 8 m) and subsequent to its destruction by fire, was rebuilt following the original ground plan.[53] The implications of these observations are linked to complex questions regarding personal necessities, social status, and life cycle. (Szeverényi 2013, 215sqq.)[54] The structure adapted to the wind direction reflects the construction techniques and technical standards of the time.[55] The respective house yielded a considerable amount of charred cereal grains discovered during the 2013 campaign. A considerable part of the material was recovered from the vicinity of the portable hearths[56] documented inside the building (approx. 20% of the total sample amount).[57] It is a

having a diameter of 60 × 80 cm. The hearth is built on a 6–8 cm thick platform placed on the yellow clay floor Cx17. The colour of the clay of the hearth is lighter, containing more limonite than the clay of the floor. The surface of the hearth is strongly burnt, displaying a 2–3 cm thick vitrified crust. Inside the hearth pottery fragments were discovered belonging to fine ware vessels decorated with grooves, placed in a horizontal position. These fragments are not part of the V6 hearth's substruction being part of the crust, probably for obtaining a higher level of heat. In the western part of the platform there was a 8/12–14 cm wide ditch having a grey fill. The narrow ditch 1.20 m long, named Cx18, tangential to the 1 × 1 m platform, could have been the foundation trench of and inner fence which divided the internal space.

The fourth hearth named V9, emerged in the immediate vicinity of the western edge of trench C2 at a depth of -1.50 m on the Cx 17 floor (under the Cx14 daub demolition layer). The sub circular hearth has a diameter of approximately 60 × 30 cm. The surface of the hearth is strongly burnt. The hearth was cut by a modern feature observed in trenches C1 and C2.

52 The excavation at Százhalombatta-Földvár showed that, more than one type of hearths were used in terms of size and structure in one dwelling. According to Magdolna Vicze the analysis of the type and the size, furthermore the archaeozoological and macrobotanical investigation, combined with the heavy fraction analysis proved that these were cooking utensils serving very specific purposes within the process of food processing (Vicze 2013, 183).

53 Based on previously encountered cases the floor of the house was completely redone on one occasion in addition to being renovated in certain areas over multiple occasions.

54 We can assert that the intentional destruction of the houses is closely linked to questions of cultural memory and collective identity. The cyclical house torching was a transition ritual as a result of which the dwelling was redefined as an 'ancestral place', thus taking on social and ideological value. The ritual torching of the house was followed by the levelling of the area and the building of a new house. The cathartic experience of the burning involved narratives concerning the beginning of a new era and the constancy of the ancestor's dwelling. Through the ritual and the remembering the community insured the persistence of its self-image. According to Ian Hodder the life cycle of the houses, their rebuilding with more resistant materials in a precisely defined place, played an important role in the development of material remembrance and through this of the communal, collective memory. The process of human remembrance is closely linked to the material world, the houses – according to the concepts of cognitive archaeology – are the objects of external symbolic storage (Renfrew 1998, 4; Hodder 2005, 131sq; Raczky, Anders 2009, 78; Brück, Fokkens 2013, 92sq.).

55 Based on the investigation of the Bronze Age houses of the Carpathian Basin Emília Pásztor concluded that their orientation was intentional and they can be classified into groups according to the orientation, which was determined mainly by the non-environmental, cultural factors. The various directions often have social and cultic symbolic meanings. The direction of the winds in the Carpathian Basin is quite instable, the main wind direction providing only about 15–35% of the winds. Out of the investigated 35 sites, in 17 cases, i.e. almost 50%, the researchers found that there is no connection between the main wind direction and the orientation of the houses. (Pásztor 2013, 205sqq.). According to Joanna Brück the characteristic traits of the buildings transcend the level of proportions and technical solutions characteristic of the respective period. Consequently the recurrences in the orientation of the entrances may have followed symbolic and cosmological requirements, e.g. the orientation of the entrance corresponded with the position of the position of the Sun during the winter solstice (Brück 1999, 158sq.).

56 A 36–40 cm diameter, intensely used (based on its burnt surface) portable hearth was discovered on the floor of the house in trench C1. The portable hearth discovered under the demolition of the daub wall was no fitted with a raised floor. Half of the structure was destroyed by the medieval grave M 44. In the same area in the C2 trench under the daub demolition layer at a depth of -1.33 m a platter (small altar?) was discovered decorated with incised spirals and fitted with four small legs. This, along with a number of small-sized vessels was found fallen in an upside-down position and broken on spot. Inside trench C4, at a depth of -1.30 m a 50 cm tall, portable hear was discovered with a diameter of 100–110 cm and internal raised floor. For the sake of stability, both its inner and outer side was subsequently plastered to the yellow clay floor. The hearth was once repaired, as indicated by the 1–2 layers of plastering. Probably the repairing operation was also meant to modify the functionality of the hearth. This may be indicated by the plastering of the broken raised floor of the hearth. The interior of the hearth is thoroughly burnt. The third hearth fitted with a raised floor was discovered in trench C2, partially inside the edge of the excavation at a depth of -1.70 m on the floor (under the daub demolition layer). The diameter of the hearth is approximately 60 cm.

57 The palynological finds collected between 2013 and 2016 were discovered in the southern side of the house. A number of 6009 charred grains were recovered in trench C4, while trench C1 yielded only 1102 such finds. The calibrated radiocarbon dating (C14 AMS, 1σ) of the palynological material recovered from the floor of the house was carried out at the Institute for Nuclear Research at Debrecen (Hungary). The interval provided by the analysis is: 1742–1708 (64.5%). According to the publication by Ferenc Gyulai the macrobotanical finds from the tell settlement at Alpár-Várdomb (the assemblage consisting mainly of spelt and barley in addition to a small amount of emmer) were discovered in vessels deposited in pits and in the vicinity of the hearths inside the dwellings (Gyulai 1992, 66; Jaeger 2011, 152).

well-known fact that portable hearths were among the standard inventory of Bronze Age houses of the Carpathian Basin, which – if used properly – proved to be safe and energy-efficient cooking implements. (Fischl, Kiss, Kulcsár 2001, 163sqq; Gucsi 2001, 196sq; Romsauer 2003, 20sqq; Vicze 2013, 183sqq.)

Between 2013 and 2016 the excavated house at Carei-Bobald yielded some 7116 charred grains, of which 6055 belonging to various cereal species.[58] The analysis of the grains revealed the fact that during the third phase of the Middle Bronze Age (MB IIIa) the two most important staple crops of the tell's inhabitants were the spelt (*Triticum spelta*, 57.49%) and the emmer (*Triticum dicoccum* 37.38%). In the case of 133 (1.86%) pieces, the analysis could only reveal that they belong to the wider family of cereals (*Cerealia*). Further 193 (2.71%) pieces could only be ascribed to the wheat family (*Triticum sp.*). A total of 14 grains were identified as einkorn (*Triticum monococcum*, 0.19%). Barley (*Hordeum sp.*, 0.014%) and rye (*Secale sp.*, 0.014%) was only found in minute amounts, most often together with hulled wheat.[59] The presence – albeit a low one – of borage (*Borago officinalis,* 0.08%)[60], various sedges (*Carex sp.,* 0.08%), and *Poaceae* (*Poaceae sp.,* 0.17%), stands as proof for the anthropogenic landscape composed of large grasslands littered with areas of wetland.[61] Altogether only two charred capsules can be ascribed to the category of legumes (*Leguminosae*, 0.03%). The existence of horticulture is proven by the discovery of field mustard (*Brassica rapa*, 0.014%) and ervil seeds (*Vicia ervilia*, 0.014%),[62] as well as peas (*Pisum sativum*, 0.014%). (Ciută, Molnár 2014, 91.) The collected samples further yielded traces of a series of species usually thriving on the edge of deciduous forests, in cutting areas, and in scrublands, such as the cornelian cherry (*Cornus mas.*, 0.014%), the dwarf elder (*Sambucus* cf. *ebulus*, 0.014%) and the black elder (*Sambucus nigra*), indicating that the diet of these communities was completed to a certain extent with wild plants. This data further suggests possible instances of deforestation. (Fig. 5/1)

An interesting and highly uncommon find[63] is that of a Middle Bronze Age flat bread most likely made of spelt, discovered inside the hearth that was attached with clay to the floor of the investigated house. (Ciută, Molnár 2014, 91.)[64] (Fig. 6/1, 2)

According to the comprehensive studies regarding crop cultivation in the Carpathian Basin (Hajnalová 1983, 606sq; Wasylikowa et alii. 1991, 214–17 (analyses the archaeobotanical finds from 25 sites); Hajnalová 1993, 112sq; Hajnalová 1996, 131sqq, Tab 1; Stika, Heiss 2012, 411sqq; Stika, Heiss 2013, 348sqq.-analyses the archaeobotanical finds from 46 sites; Gyulai 1992, 66sqq; Gyulai 1993, 21sqq; Endrődi, Gyulai 1999,

58 The identification of the macrobotanical material was carried out with the help of a low-magnitude microscope (2X–4X; Novex AP), and the selection process was done manually. The photographs were taken with a Nikon D800 camera. The identification of the species was based on the external characteristics of the individual grains using the specialised studies and corpora. The designation of the plant species is taken from Zohary, Hopf 2000.

59 Rye is an accompanying plant of the hulled cereals, and not a cultivated crop (Gyulai 2010, 45).

60 The borage is suitable for human consumption (containing calcium, potassium and various salts), both as a spice herb and as an oil source.

61 Based on ethnographic analogies it is possible that the borage, the sedges and the *Poaceae* could have been mixed in with the cereal grains during threshing, if this process was carried out on a fallow, or if the harvest was dragged across uncultivated fields (Balassa, Ortutay 1980, 186sqq; Györffy 1983, 135sqq.).

62 The bush vetch, which is poisonous if eaten raw, was commonly consumed in the form of porridge in the Carpathian Basin during the Middle Bronze Age (Gyulai 2010, 102).

63 Hitherto the only prehistoric bread discovered on the territory of Romania was the one from Sucidava-Celei (dated by radiocarbon analysis to 2275 BC). Its composition revealed the presence of barley (*Hordeum vulgare*), curly dock (*Rumex crispus*) probably used for the raising of the bread and flax (*Linum usitatissimum*) grains (Cârciumaru, Pleșa, Mărgărit 2005, 68). The territory of the Otomani-Gyulavarsánd Culture until recently yielded only one bread fragment. This was discovered in 1991 on the floor a burnt-down house at the Túrkeve-Terehalom tell (belonging to the so-called MB I Otomani level) (Gyulai 1997, 178; Gyulai 2003, 65, 36. kép; Gyulai 2010, 302, 279/Fig. 451–452). A further interesting find belonging to the Füzesabony-Otomani Culture is a clay loaf discovered in a ritual pit at Nižná Myšľa (MB III), which contained charred grains of spelt, emmer, einkorn, bromus, and *Chenopodium album* (Hajnalová 1991, 125sq; Hajnalová 1996, 137; Olexa 2002, 90, Fot. 105; Jaeger 2016, 103.)

64 The microscopic analysis of the organic remains revealed the existence of a porous dough which was well-mixed and fermented, made from high-quality flour, the small holes indicating the use of a type of cereal with a high gluten content. For an indisputable identification and the analysis of the texture and the composition of the organic matter the find was compared with a sample from a charred bread interior made with traditional methods by B. Ciută. (see the fragment from the left side of Fig. 6/2). It is interesting that the bread seems to have been made from a spelt-type wheat given that the caryopsis collected from the place of discovery of the bread was found contain mostly emmer (*Triticum dicoccum*). This observation has important implications regarding the differentiated utilisation of various types of wheat within the same household. Are we dealing with a coincidence or with the conscious use of certain cereal types and dietary preferences?

27sqq; Furmánek, Veliačik, Vladár 1999, 130sqq; Hajnalová, Furmánek, Marková 1999, 231sqq; McIntosh 2006, 103sqq; Duffy 2008, 122sq; Gyulai 2010, 96sqq; Ciută 2012, 55; Hajnalová 2012, 49sqq; Heiss, Stika 2013a, 78sqq; Duffy 2014, 102; Jaeger 2016, 73sq.)[65] the most popular crops included einkorn, emmer,[66] and hulled barley.

The evidence suggests that hulled barley, spelt,[67] and the broomcorn millet[68] were of secondary importance. A similar conclusion was reached by Ferenc Gyulai based on the paleobotanical analysis of the macrofossils discovered in the tell cultures from Hungary. According to the aforementioned author bare was cultivated both for human consumption and as animal forage. (Gyulai 1993, 25sqq.)[69]

Based on the literature on the subject, the dominant legume and oil plant species in the Carpathian Basin were the lentils, peas, rapeseed (*Camelina sativa*)[70] and safflower (*Carthamus tinctorius*/safflower).[71] Further important species included the bitter vetch (*Vicia sativa*) and the field bean (*Vicia faba*).[72] The charred grains also included small quantities of common vetch (*Vicia sativa*) as well as grass pea (*Lathyrus sativus*). (Stika, Heiss 2013, 355, Tab. 19.5.)[73] According to the archaeobotanical data available at the present, the crop most commonly used for bread-making by the Otomani communities of the Carei Plain and the Eriu Valley was the spelt (*Triticum spelta*)[74] and the emmer (*Triticum dicoccum)*. (Cârciumaru 1996, 144.)[75] Among the cereals cultivated in the respective region, the emmer displays a medium percentual presence throughout the 2nd and 3rd phases of the Middle Bronze Age, while the considerable rise in the use of spelt can be observed starting with the final phase of the same period (MB III). According to the Romanian specialists,

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65 The representativity index of the species list regarding the Middle Bronze Age is quite high: RI–548, see Stika, Heiss 2013, 354. According to the comprehensive study by Ferenc Gyulai the hulled cereals (especially einkorn) are of great importance during the Bronze Age (Gyulai 1999, 297sq, Table 1).

66 The archaeobotanical analysis of the contents of a storage pit from Košice-Barca revealed that emmer made up 70% of the charred grains, while barley provided 20%. Only 1% of the material proved to be spelt (Gašaj 2002, 43; Jaeger 2011, 152).

67 According to Peter Stika and Andreas Heiss the European spelt developed in the region north of the Alps before the Bronze Age. The beginnings of spelt cultivation in Europe are generally dated to around 2300 BC (Akeret 2005, 285). The abovementioned authors asserted that starting from the Early and Middle Bronze Age it was one of Western and Central Europe's most common cereals, from where it spread to the Carpathian Basin (Stika, Heiss 2013, 361). A further new type present in the Carpathian Basin is a glume wheat similar to the tetraploid Timopheev type, i.e. the emmer like spelt wheat, however its distribution and agricultural significance is difficult to assess at this point (Kohler-Schneider 2001, 116sqq; Heiss, Stika 2013a, 78; Stika, Heiss 2013, 355, 361). The ecological characteristics of the emmer like spelt must have been similar to those of the Timopheev wheat (*Triticum timopheevii)*. The latter is especially resistant to drought as well as to the main diseases, such as powdery mildew, *Pucciniomycetes*, and *Ustilaginales* (Mikó et alii. 2014, 315).

68 Both types of millet are especially common in Europe in the Neolithic as well as the Bronze Age (Zohary, Hopf 2000, 83sqq.). The broomcorn millet from being an ancillary crop, became a staple crop during the Middle and Late Bronze Age (Stika, Heiss 2013, 360sq).

69 According to the view of Ferenc Gyulai the agriculture of the Otomani and Vatya Cultures is generally representative for the Middle Bronze Age agriculture.

70 The plant cultivated for its oil-rich seeds was domesticated from the crop field weed. It needs little water and nitrogen, and therefore it can grow in places where other crops usually do not grow (Zohary, Hopf 2000, 138sq; Stika, Heiss 2013, 363). Its systematic cultivation can be documented starting with the Middle and Late Bronze Age (Kroll 1983, 58sq; Kučan 2007, 41sqq.).

71 The well-known spice and dye plant the safflower, which preferred the sunny environments is commonly used in popular as cough medicine. Its remains were discovered in the Middle Bronze Age sites at Túrkeve-Terehalom (HU) and Feudvar-Mošorin (SRB). (Gyulai 2010, 104sq.)

72 The significance of vegetables, beyond their important place in the food chain, resides in their ability to trap nitrogen from the atmosphere found in symbiosis with *Rhizobium s.l.* bacteria. Thus the crop rotation comprising of cereals and legumes ensured the maintaining of the soil's fertility (Zohary, Hopf 2000, 92; Cârciumaru, Pleșa, Mărgărit 2005, 144sq; Fraser et alii. 2011, 2799, 2803; Stika, Heiss 2013, 355, 362sq.).

73 The Middle Bronze Age species and their RI index: grass pea (*Lathyrus sativus*): 4; lentil (*Lens culinaris*): 50; garden pea (*Pisum sativum*): 40; bitter vetch (*Vicia sativa*): 20; field bean (*Vicia faba*): 10; gold of pleasure (*Camelina sativa*): 16; safflower (*Carthamus tinctorius*): 11; flax (*Linum usitatissimum*): 14; opium poppy (*Papaver somniferum*): 5; grapevine (*Vitis vinifera*): 2.

74 The large proportion of spelt in the palynological assemblages of North-Western Transylvania is an interesting phenomenon. According to Ferenc Gyulai the spelt, viewed as the lowest category hulled cereal (it has the lowest protein content among the hulled crops, with only 1.5 times that of the bread wheat) was never among the important prehistoric staple crops of the Carpathian Basin, and was never cultivated systematically (Gyulai 2010, 294).

75 The charred grains discovered in the Carei-Bobald tell display the characteristics of hulled cereals growing in their natural environment. Their *rachis* is very fragile and easily breaks up into small *spicula*. The grain upon ripening does not fall out of the *spiculum*. This is meant to aid the natural reproduction and the spontaneous spreading of the plant. This was a disadvantage for cultivation as the rate of grain loss during the harvest was high and it needed further processing following threshing (Torma 1999, 68; Bálint 2008, 173).

it is not at all accidental that emmer is usually associated with einkorn, and occasionally with barley in the paleobotanical assemblages. (Ciută 2009, 118.)[76] The current state of research does not allow us to assert the existence of landraces,[77] however it is beyond any doubt that the Late Bronze Age communities from North-Western Transylvania displayed a high degree of awareness with regard to the microclimatic and edaphic characteristics of their region which in turn permitted them to assess in advance the rate of success of certain crops in particular areas. (Gyulai 2001, 93; Gyulai 2008, 125; Gyulai 2010, 101.)[78]

This can potentially provide an explanation for the fact that despite the very high presence of bread-wheat (*Triticum aestivum*, 46% and 36.4%) in the Eriu Valley during the transition period between Otomani II and III as well as in the Middle Bronze Age III phase, is totally absent from the Middle Bronze Age III phase assemblages discovered in the Carei Plain.[79] The ecological changes occurred during the transition period between the Middle Bronze Age phase II and III[80] probably determined the shift from the agricultural economy based overwhelmingly on the cultivation of emmer (*Triticum dicoccum,* 88.5%) and to a lesser degree of spelt (*Triticum spelta,* 44.7%) to the almost exclusive cultivation of spelt, which assured a high crop yield in the context of the new ecological situation during the transition period between the Otomani II and III phases in the Eriu Valley. This shift is even more evident on the Carei Plain, given that the archaeobotanical material from the Middle Bronze Age II phase does not include evidence for spelt, however during the next period this species becomes the dominant crop in the respective region (57.49%). The inhabitants of the Carei tell

[76] Based on the finds the possibility of so-called mixed crops cultivated together arises, first of all in the case of hulled cereals. (Balassa, Ortutay 1980, 192; Gyulai 2010, 102; Gyulai 2012, 299).

[77] According to the current state of art the shape index of the charred grains discovered on the hitherto excavated Otomani sites is hitherto unknown, as such it would be premature to talk about artificially developed local species, especially considering the deficiencies in our knowledge of the ecological characteristics of the region (Gyulai 2012, 301).

[78] According to Robert Netting and Amy Bogaard the cooperation and collective work activities brought about by the need of excess production, in addition to the experience of systematic cultivation of the farmlands led to the development of the household's specific ecological knowledge (Netting 1990, 26, 40; Bogaard 2005, 180, 183.) In the case of communities displaying a lower level of social stratification the cooperation ('mechanical solidarity') needed for the collective work enterprises was based on a common set of values. (Fuller, Stevens 2009, 39.) The people of the Bronze Age observed the inherent needs of particular species as well as their yield, and selected the primary crops based on these factors (Gyulai 2012, 299). The emmer is quite resistant to most pathogens as well as to climatic and edaphic changes. Contrary to einkorn it is better suited to lowlands and provides a consistent yield even in poor soil conditions (Torma 1999, 68; Bálint 2008, 174sq). According to Ferenc Gyulai the charred grains discovered together with traces of various weed plants at Túrkeve-Terehalom tell suggests that the respective community sowed in the autumn (Gyulai 1993, 67). According to Maria Hajnalová the Bronze Age communities living in modern-day Slovakia sowed both their hulled (einkorn, emmer, and spelt) and free-thrashing cereals during the autumn. While the spelt and the bread wheat was harvested at the middle of summer, emmer and einkorn was only harvested a little bit later on. The author considers that during the spring they sowed the barley and the millet which was followed by the legumes (Hajnalová 2012, 160). Based on the botanical experiments carried out in Martonvásár the sowing period (either in October, November or March) does not influence the grain number per spike. However, the longer vegetative period of the winter wheat (especially the wheat sowed in early October) does increase the number of offshoots and thus the overall grain number, thus providing a better yield. The delay in the rapid growth of the plant means that it could survive the early spring cold, and the longer growth time increasing the grain number of the wheat (Kiss et alii. 2013, 213sqq.).

[79] The Carei-Bobald community was familiar with the free-thrashing bread wheat since it figures on the species list of the Otomani II period, however its systematic cultivation was probably hindered by soil issues or other deterrents.

[80] The increase of the settlement numbers during the classical development period (Otomani II) was probably connected either to the shift in the spatial dynamics of the settlements or an increase in the population. During the Middle Bronze Age III phase a part of the settlements become gradually uninhabited, a process which primarily affected the sites in the Eriu Valley. The abandonment of the settlements must have had climatic (during the so-called Koszider period the amount of winter rainfall increased, causing the water saturation of the soil, the average summer temperature decreasing as well) and ecological reasons (Prentice et alii. 1996, 192; Sümegi 2013, 170; Fischl, Reményi 2013, 734; Molnár, Nagy 2013, 34sq.). The abiotic environmental stress effects (especially the sudden temperature fluctuations and the variations in rainfall, especially the drought) can cause a drop in the yield of up to 60% (Jones 2002, 187 – with regard to methodological questions; Barabás, Bedő 2013, 10, Varga, Veisz 2013, 86sq.). According to Réka Aranyi and her collaborators the magnitude of decrease in the yield due to lack of rainfall depends on the length of the drought, its intensity as well as the development stage of the crops. The water shortage affecting the plants at an early stage during flowering is associated with a low assimilation of CO_2 that causes an overall decrease of the grain numbers. The water shortage affecting the plant after flowering has a negative effect on the grain fullness (Aranyi et alii. 2014, 51). According to John O`Shea and his collaborators during the Middle Bronze Age III phase a dry, droughty period ensued starting with 1700 BC (Sherwood et alii. 2013, 139sqq.). This is possibly reflected by the smaller grains contained in the second palynological assemblage discovered at Otomani-Cetatea de Pământ.

continued to use emmer as a secondary crop during the Middle Bronze Age III phase. The main difference is that the tell community from Carei-Bobald based its agriculture on the cultivation of barley during the Middle Bronze Age II phase (73.4%)[81], shifting subsequently, along with the rest of the period's communities, to a spelt-based agriculture (57.49%). The extremely low incidence of trampled weed (*Bromus sp.*[82], *Lolium temulentum*[83], *Rumex acetosa*[84]) indicates the careful mending of the crop fields or the thorough cleaning of the harvest in a later phase. (Fuller, Stevens 2009, 40sqq. – the process could have involved multiple phases as well; Gyulai 2010, 103.)[85] Both cases seem to indicate instances of corporate collaboration between households. The absence of weeds usually associated with root vegetables, suggests their lack of contact with the segetal weeds, this in turn indicating the proliferation of an organized agricultural economy. (Rademacher 1968, 11sqq; Willerding 1986; Gyulai 2010, 63.) The combination of segetal plants associated with cereals (bromus/*Bromus sp.*, darnel/ *Lolium temulentum*) and ruderal species (sorrel/*Rumex acetosa*) in the archaeobotanical record indicates the mosaic-like division of the farmland into cultivated fields and fallows situated in each other's vicinity. (Nesbitt 2006, 8; Kuneš et alii. 2015, 24sq.) According to Ferenc Gyulai the occurrence of botanical remains linked to tall segetal species within the collected cereal samples indicates that the sowing occurred in autumn and the crop was harvested using sickles, and cutting the stem at two-thirds of its length. (Gyulai 2010, 103.)[86] The absence of weeds usually associated with root vegetables and their territorial differentiation from the weeds of the *segetallia* category indicates a crop cultivation based on ploughing. The comprehensive and comparative study regarding the presence of weeds on both extensively and intensively cultivated farmlands, carried out by Amy Bogaard, Michael Charles and their collaborators revealed that the occurrence of segetal weeds can be linked to cereal crops sown in the autumn while *chenopodia* (*Chenopodioideae*) usually occurs in the context of intense horticulture. (Jones et alii. 1999, 167sqq; Bogaard et alii. 2000, 129sqq; Bogaard et alii. 2001, 1171sqq; Charles et alii. 2002, 133sqq; Bogaard et alii. 2005, 505sqq; Ellenberg, Leuschner 2010, 877sqq.)[87]

[81] In the current state of research we are unable to tell whether the inhabitants of the Carei-Bobald tell during the Middle Bronze Age II phase only cultivated large amounts of barley on exceptional occasions or perhaps this reflects the nature of their agriculture. At any rate, according to our knowledge there are very few traces of barley cultivation in the Eriu Valley during this period.

[82] The *Bromeae* belonging to the family of *Poaceae* preferred the wet soils rich in humus. They thrive on crop fields, grassland, ruderal grounds and fallows. Its flowering period is set between the end of June and the end of July. See Czimber, Varga 1999, 27, 49, 75sqq.

[83] The darnel, also known as 'false wheat', which produced poisonous grains was a weed plant growing mainly in the winter barley and wheat fields. Its presence on fallows is also quite frequent. It preferred a cooler climate (15–20 °C) and a wet environment (Holm et alii. 1979, 391). Mark Nesbitt lists it exclusively among the weeds growing in crop fields. The darnel has a longer stem and larger grains than other *Poaceae*, some of its variants were domesticated (Kislev 1980, 361sqq; Nesbitt 2006, 9).

[84] The plant belonging to the *Polygonaceae* family usually grows on meadows, pastures wetlands, and forest clearings. Its leaves have a high vitamin content, ripening in the July–August period. It is easily recognizable from its sour taste and its shape, being commonly used in popular medicine, and suitable for human consumption (Paume 2013, 184).

[85] The presence of perennial weeds was commonly linked to the plough-based agriculture, while their absence was thought to indicate the implementation of intense manual agriculture or the constant cultivation of certain parcels (Jones 2002, 188). The harvested crops mixed with considerable amounts of weeds had a shorter storage life (Hajnalová 2012, 162). The simultaneous harvesting of the crops and the weeds growing on the farmlands meant that the share of weeds occurring in the yield was around 1–5% (Harrold, Nalewaja 1977, 389sqq; Filep et alii. 2013, 193). The total lack of weeds can be explained by the clearing of new plots by fire as part of the field-rotating system, the extreme heat potentially destroying both the grains and the rhizomes inside the ground. In this way the first year of cultivation required less tillage and weeding (Ellenberg, Leuschner 2010, 770). The ash produced by the fires contributed to the increase of the soil's organic content ensuring a higher yield. Francois Sigaut draws attention to the fact that during the second and third year the presence of weeds increases greatly (Sigaut 1975, 18sqq, 99).

[86] According to the author the presence of bromus indicates an unfertilized calcic loess soil, rich in nutrients, but can also suggest soil deterioration. According to Amy Bogaard the crop was mainly sowed in autumn. (Bogaard 2005, 183.)

[87] It is unknown whether the 'garden-like' (horticultural) cultivation of crops would produce mainly *Chenopodioideae* type weeds mixed with segetal weeds. The small-scale cultivation practiced in the near past and in present times does not follow the criteria of horticulture (Jones et alii. 1999, 168sqq.). The comparative studies carried out on the island of Evvia (Central Greece), Asturia (North-Western Spain) and traditional farmlands in Germany. The intensely worked, fertilised small gardens in Evvia were quite weedy, yielding especially various variants of *Chenopodioideae*. The experimental research carried out in Asturia revealed that crop rotating cultivation of winter spelt and einkorn and millet caused the mixed spread of *Chenopodioideae* and segetal weeds (*Secalitaea*) (Bogaard et alii. 2000, 130sq; Charles et alii. 2002, 137sqq.). The period of germination of segetal weeds is usually set in the autumn, while *Chenopodioideae* commonly germinate in the spring, although there are exceptions for both categories. Their share within the crop yield depends on the

Based on the model provided by Dorian Fuller and Chris Stevens (Fuller, Stevens 2009, 37sqq.), the harvest required a considerable collective effort on behalf of the Carei Plain and the Eriu Valley communities,[88] this being subsequently followed by the post-harvest operations which effectively ended the large-scale collective cooperation.[89] Afterwards the further processing of the deposited grains occurred at the level of the individual households. (Fuller, Stevens 2009, 40; Hajnalová 2012, 113sq, 158sq.)[90] The bromus mixed in among the spelt and emmer, was probably consumed together with the respective cereals. (McIntosh 2006, 102; P. Hartyáni, Nováki, Patay 1968, 12sqq; Tomczynska, Wasylikowa 1988, 281sqq; Klichowska 1977, 36sqq; Gyulai 2012, 301sq.)[91] The very low share of legumes (*Leguminosae*, 0.03%), field mustard (*Brassica rapa*, 0.014%), ervil (*Vicia ervilia*, 0.014%),[92] and peas (*Pisum sativum*, 0.014%) indicates for the moment that horticulture had an ancillary role in the food production of the communities of the Carei Plain.[93] A similar use was probably attributed to wild plants and berries, such as the vitamin rich cornelian/*Cornus mas.*, the black elder/*Sambucus nigra,* the dwarf elder/*Sambucus* cf. *Ebulus*, and acorns/*Quercus robur*, which were seasonally collected.

The recent experiments carried out in Western Europe showed that the less pretentious cereal species in terms of climatic and soil conditions such as the einkorn *(Triticum monococcum)*, spelt (*Triticum spelta*) and emmer *(Triticum dicoccum)* naturally contain 50% more proteins and carbohydrates than bread wheat (*Triticum aestiva)*.[94]

The natural fat content of the hulled cereal species is 30% higher than that of the free-thrashing variants. (Körber-Grohne 1989, 41sqq; Gyulai 1999, 299; Bálint 2008, 175sq; Gyulai 2010, 273sq.) According to experimental archaeology studies carried out in Hungary, the cultivation of einkorn without soil regeneration, use of chemical fertilizers and pesticides, provides an average crop yield of 1.6 tonnes, measured over five years. (Torma 1999, 69sqq – the yield: 18–25 times the sowed grains; Gyulai 2001, 103; Bálint 2008, 175; Hajnalová, Dreslerová 2010, 181, 195, Tab.5.) Based on ethnographic evidence the crop fields

period of sowing and the intensity of the cultivation (Bogaard et alii. 2005, 505sq; Ellenberg, Leuschner 2010, 877sqq.).

88 The plants were cut at midway between the *auricula* and ground level, the straw being subsequently used for forage or for house roofs. Certain species such as the emmer do not grow to a uniform height (Hajnalová 2012, 160; Gyulai 2010, 103).

89 In the case of the so-called lowland style of agriculture the thrashing of the harvested crop occurred on a thrashing-floor situated in the immediate vicinity of the crop field and required a high level of organisation as well as a considerable human and animal workforce, as the harvest was transported on low four-wheel carriages (Balassa, Ortutay 1980, 186sqq; Györffy 1983, 136qq.).

90 The archaeological literature draws a clear line between production – and consumption places (Halstead 2002, 105). The grain finds of the Carei Plain and of the Eriu Valley come from the settlements, i.e. the consumption sites of the cereals. The archaeological investigations carried out on the Carei Plain hitherto only revealed the existence of a few storage pits lined with clay (Roman, Németi 1990, 41; Németi 1995, 125). The existence of surface granaries is not corroborated so far by archaeological evidence. According to the current state of research it seems that further storage places for the crops were the lofts of houses.

91 Evidence from the Middle Bronze Age as well as the Early Iron Age suggests the consumption of bromus.
According to Ferenc Gyulai the *Chenopodioideae* and the bromus are secondary plants that reached the level of domestication, and were under a selection pressure (e.g. the bromus adopted some of the traits of wheat such as the large grains), however by the end of the tell cultures they drop out of the line of cultivated plants and thus fail to effectively become crops.

92 Ferenc Gyulai considers that the bush vetch porridge remains inside the late Nagyrév vessel discovered in Tószeg-Laposhalom was not only consumed as a gourmet meal, but the bromus was in fact cultivated together with the regular crops during the Early and Middle Bronze Age. (P. Hartyáni, Nováki, Patay 1968, 22; Gyulai 2012, 303sq.)

93 The cultivation of peas and bush vetch became generalised in the Carpathian Basin during the Middle Bronze Age III phase (Gyulai 2010, 103).

94 For the review of the experiment results see Gyulai 2010, 271sq. For the nutritional value of various cereals see Cârciumaru, Pleșa, Mărgărit 2005, 66. The raw protein and carbohydrate content of the grains is closely linked to the soil's nitrogen level (Gyulai 1999, 299; Gyulai 2010, 273). Among the first measures for the protection of the soil's nitrogen content was the incipient crop rotation (rotating the cultivation of crops and legumes) and the frequent change of the crop fields. The short-lived fallows and stubbles between two cycles of cultivation, together with the pasturing of livestock which resulted in the fertilising of the fields (in addition to manure, the urine rich in nitrogen, potassium and phosphate was equally important) was an effective way of regenerating the fertility of the soil. (Bogaard 2015, 33sqq; Shiel 2016, 14sqq; Bogaard 2016, 25sqq.). According to M. Hajnalová the fallows aimed at regenerating the soil were left in place for a maximum period of five years during Early and Middle Bronze Age (Hajnalová 2012, 160). In Paul Halstead's view the small scale mixed farms mainly employed crop rotation rather than the fallowing of cultivated land (Halstead 2002, 106). The successful cultivation of smaller fields in the Northern-Transylvanian varied environment required at least the partial use of crop rotation, in order to provide larger yields. The existence of excess crops consumed with the occasion of various banquets was the result of favourable climatic and ecological conditions (Jones, Halstead 1995, 103sqq; Horváth 2009, 162; Hajnalová 2012, 161sq.).

					Abbreviations cf. =corresponds/probably the data is given in%
Name of the plant species	**Otomani-Cetatea de Pământ**			**Carei-Bobald MB II**	**Carei Bobald MB IIIa-b**
	Layer, interphase Otomani II–III		**House 'A' Otomani III**	**House, 1988**	**House, 2013–2016**
Cerealia					1.86
Triticum sp.					2.71
Triticum cf. dicoccoide				0.3	
Triticum monococcum	2.2	2.2	1.2	0.4	0.19
Triticum dicoccum	5.5	88.5	3.2	22.7	37.38
Triticum spelta	44.7	9.3	57.7		57.49
Triticum aestivum	46		36.4	1.1	
Triticum sp. vulgare				1.6	
Hordeum sp.			0.8		0.014
Hordeum vulgare	1.3			73.4	
Secale sp.					0.014
Vicia sp.			0.2		
Vicia ervilia					0.014
Leguminosae					0.03
Brassica rapa					0.014
Pisum sativum					0.014
Lolium temulentum	0.3		0.5		
Bromus sp.				0.1	
Rumex acetosa				0.1	
Poa sp.					0.17
Borago officinalis, *Carex sp.*					0.08
Cornus mas					0.014
Sambucus cf. ebulus					0.014
Quercus robur					100

Table 1. The archaeobotanical material discovered in the settlements belonging to the Otomani Culture in the Carei Plain and the Eriu Valley

obtained through deforestation and incineration of existing vegetation with minor tillage work and without weeding and fertilizing produced an initial crop yield of 1500–3400 kg of grains per hectare. The employment of field-rotation in certain cases increased the yield by 25–50 times or even 100 time. (Bogaard 2004, 21sq, Table 2.1.)[95] The crop yield of winter cereals was larger and more stable than that of the crops sowed in spring. (Sheratt 1980, 317.)

If we accept the figures put forward by Maria Vretemark and Klaus Goldman regarding the yearly necessities of prehistoric man in terms of meat and cereal consumption, and compare them to an average crop yield of 1.6 tonnes, the food supply was enough to satisfy the needs of the tell's inhabitants. (Goldmann 1982, 197sqq; Vretemark 2010, 167sq.)[96]

The intense cultivation of small crop fields by the North-West Transylvanian Otomani communities provided a reliable, flexible and diverse subsistence without disrupting the ecological balance.[97]

[95] According to Francois Sigaut the proportion of the sowed grains and the yield can only be interpreted knowing the sowing technique and the quantity of sowed grains (Sigaut 1975, 119sq.). Based on ethnographic analogies from Romania 28.2 l of spelt or emmer can produce a yield of 100–200 kg/hectare. The sowing seeds were selected among the best grains of the previous harvest. If the winter crop fails, it is sometimes repeated in the spring, although with a considerable seed loss (Hajnalová, Dreslerová 2010, 176sq.).

[96] Researchers calculate an amount of 200 kg cereal and 50 kg meat consumption per year for an average prehistoric individual. According to Ferenc Gyulai the proposed yield is too low, instead the average yield per hectare was around 2.5 tonnes (Gyulai 2010, 106sq.).

[97] According to Paul Halstead the subsistential economy of modular societies relied on small scale intensive agriculture

The empirical agricultural strategies included the additional cultivation of vegetables and fruits, which further reduced the risk of short term famines. (Butzer 1996, 146; Harding 2000, 143sqq; Halstead 2002, 108; Jaeger 2011, 153.) The members of the Otomani communities enjoyed a fairly high standard of life according to the standards of the time.[98]

Although it is difficult to make objective assertions with regard to the daily life on the tell settlements, it is highly likely that the inhabitants employed a 'plantation' type of agriculture. The dimensions of the North-Western Transylvanian tell settlements excludes the possibility that large-scale cultivation could have occurred on their grounds. (Gogâltan 2008, 53; Artursson 2010, 102.) It is much more reasonable to locate these farmlands within a 5–6 km radius of the settlements. (Binford 1982, 6sq; Renfrew, Bahn 1999, 242.) According to the Chisholm economic model of space use, the crop fields are located within a radius of 700 m/1–2 km from the central settlement. (Chisholm 1979, 47sqq.)[99] This is where the designated members of the community worked the fields, and from where they returned to their homes. With the growing degree of economic land utilisation, the floodplains and the dryland loess surfaces were gradually incorporated into the agricultural activities. Within the production areas, so-called economic zones can be differentiated. (Goldmann 1987, 53sqq; Neustupný 1991, 326sqq; Sümegi 2009, 470sqq.) The outer limit of the central settlement's hinterland, comprising a communal territory of c. 4–8 km^2 having a polygonal shape due to its adaptation of the local topography corresponded to the outer ring formed by the satellite settlements of the tell. (Kuna 1991, 332sq; Sümegi 2009, 474.)[100] (Fig. 7/1, 2.) The understanding of the economic area developed around the Carei-Bobald tell can be aided by the modified version of the von Thünen economic model. According to the model, the spatial structure of the production area surrounding the central settlement, in addition to the effect of the environmental factors, is shaped by the work availability of the community and the optimisation of the energy input. (Thünen 1926; Sümegi 2009, 470sqq; Sümegi 2013, 166sq.)[101] (Fig. 8 /1, 2.) The wetlands surrounding the Carei-Bobald tell had a considerably hindering effect on transport and communication. It is beyond our knowledge whether the inhabitants used a main road, open throughout the year, or whether they used multiple periodic trails to access certain areas within the production zone.[102] The agricultural lands, constantly extended through deforestation and thus having gradually more elongated shapes and a mosaic-like distribution should be located on the plateaus situated to the south and north-east of the tell. (O'Shea 2011, 163.)[103] In the absence of palynological investigations the exact location of the cultivated areas as well as their dimensions are hitherto unknown.

In our view the location and extent of the tell's agricultural area is to a large extent determined by the location of the satellite settlements. While during the Otomani I period, the only external settlement (Bobald I–1b) was situated in the vicinity of the tell's defensive ditch (at a distance of 96 m in a bee-line), the agricultural area should also

(weeding, manuring, perhaps watering), combined with sedentary small scale mixed livestock keeping. The stratified, hierarchal societies relied instead on specialised extensive field rotating agriculture. The latter's effect on the environment is considerably greater than that of intensive agriculture (Halstead 2002, 106sqq.).

98 Michael Smith considers the quantity and variety of possessed goods, the exchange relations, the social relations as well as the stylistic networks of material culture to be the main living-standard indicators of the ancient household (Smith 2015, 3).

99 For the ethnoarchaeological application and the critique of the model see: Stone 1991, 343sqq.

100 The notion of 'community area' (Neustupný 1991, 326) – based on prehistoric social and economic theory – renders a mosaic-like spatial structure to the cultural landscape. The theory of common economic space highlights the particularities of the studied community's economic and social system and the collective behaviour patterns it determines.

101 According to Johann Heinrich von Thünen's economic model the economic and production areas surrounding the central place in a concentric circle were meant to satisfy the basic economic needs of the central settlement. The various production areas enumerated by the German geographer starting from the centre are: the area of vegetable, fruit and dairy production, the area of wood production, the crop cultivating area, the agricultural and animal husbandry area, the three-way farming area, the livestock area. The ideal concentric distribution of the areas is in theory possible in the context of a homogenous natural environment, in reality however these areas are distorted according to the environmental characteristics and the settlement network of the respective area.

102 The solid-wheeled miniature clay wagon models indicate that the use of carriages by the Otomani communities (Bóna 1975, 164; Bóna 1992a, 74sq; Boroffka 2004, 349sqq; Schuster 2007, 30sqq; Jaeger 2011, 152; Bondár 2012, 57sqq.).

103 The elongated shape of the cultivated areas derives from their gradual increase by way of deforestation. According to the von Thünen/Chisholm model the easy and rapid access to the areas under intensive cultivation was of a primordial importance. (Chisholm 1979, 37; Stone 1991, 350.)

be located in neighbourhood of the tell, within a radius of 700 m. (Fig. 8 /1, 2.)

If the Thünen model is indeed correct, and there was a special area designated for the flocking of the livestock, an ideal ground for this would have been a comb separated by the satellite settlement by a creek, and extending to the floodplain of the Mérges Stream. This function of the respective area could have lasted until the Otomani II period, when a new satellite settlement developed here (Bobald II, 269–380 m in bee-line from the tell). (Fig. 8 /1, 2.)

During the Otomani II period the ring of satellite settlements besides Bobáld I–1b, a Bobáld II, which continued from the previous period, also included two new additions situated at a greater distance: Bobald IV 1.8 km from the tell in bee-line, and Carei-Spitz located at 3 km from the central settlement. (Fig. 7 /1, 2.) The satellite settlements are all situated to the north-east of the tell. The agricultural area on the other hand is thought to have developed to the south and north-east, on the terrace of the Mérges, within a radius of 700 m/1–2 km suggested by the Thünen-Chisholm model. The area around the Carei-Spitz settlement was probably used for animal husbandry, given that before the river regulation the area was a floodplain.

There are chances that the land use described above did in fact remain in place in the Otomani III period. The neighbouring satellite settlements of Bobald I–1b and Bobald II did however end their existence by the Middle Bronze Age III phase. Their place was taken over by the Bobald I–2a settlement developed on the southern side of the tell at a distance of 140 m in bee-line. (Fig. 8 /1, 2.) The communities of Bobald VI and Carei-Spitz continue their existence. The satellite settlement of Bobald VI was situated on the line which marked the limit of the intensive farmland belonging to the Carei-Bobald tell. The settlement at Carei-Spitz, according to the evidence of repeated systematic field-walking campaigns was probably a smaller farmstead.

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