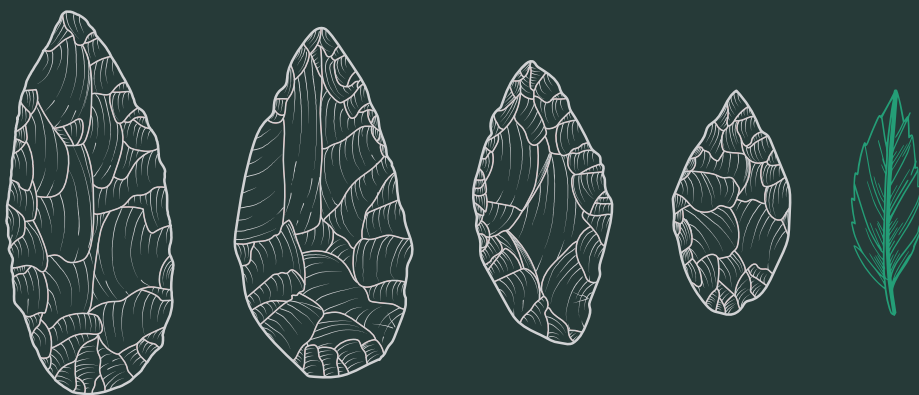




From tea leaves to leaf-shaped tools

STUDIES
IN HONOUR OF ZSOLT MESTER
ON HIS SIXTIETH BIRTHDAY



LITIKUM KÖNYVTÁR 2

EDITED BY
ATTILA KIRÁLY

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Editor:
Attila Király



ELTE
EÖTVÖS LORÁND
UNIVERSITY



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INSTITUTE OF ARCHAEOLOGICAL SCIENCES,
ELTE EÖTVÖS LORÁND UNIVERSITY,
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2023



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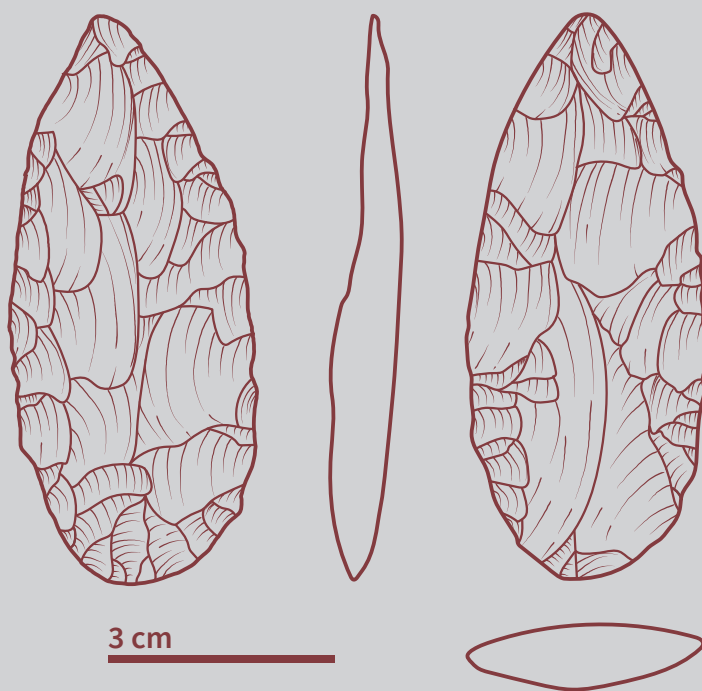
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Szeletian leaf-shaped tool.
After Kozłowski *et al.*, 2009, Planche 11.



A team picture of the Sajóbábony excavations from 2022, one of Zsolt's ongoing projects. In addition to the generations of students, his colleagues are seen – Agnès Lamotte (the lady on the left) and Pierre-Gil Salvador (in the middle, in a cap). Dalma Kerekes stands next to Agnès in pink, she is one of Zsolt's current students, as well as Máté Miklós Beke, who holds the sign from the right. Péter Szolyák on the right in a red shirt, director of the Herman Ottó Museum in Miskolc, is one of Zsolt's first students. *Photo:*

Agnès Lamotte, drawing: after Kozłowski et al., 2009.



Öcsöd-Kováshalom and the Neolithic ceramic technological tradition in Hungary

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Abstract. The Early and Late Neolithic artefact assemblages of Öcsöd-Kováshalom represent 700 years of nearly continuous local development during the Neolithic period. This study focuses on the temporal dynamics of ceramic transformations, that occurred in different paces concerning the forms, forming techniques and decoration of vessels. Decoration, as a device of social communication, displayed great variability in space and time. Vessel forms, constrained partly by function, rather responded to periodicaly occurring regional trends. The technological system had been following new claims and challenges only partially; it preserved archaic elements that eventually contributed to the formation of the Late Neolithic Tisza Culture. The character of the examined ceramic material prohibits us from reconstructing entire *chaînes opératoires*. The samples offer a set of identified technological markers, that refer to several characteristics of the manufacturing process within the technological system, represented by the artefacts.

Keywords: Techniques of pottery manufacturing process, Neolithic ceramic development, Great Hungarian Plain

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1. Öcsöd-Kováshalom and the Neolithic development of the Great Hungarian Plain

The history of food-producing communities of the Carpathian Basin began in close association with the Anatolian-Balkan Neolithisation process, albeit somewhat later, at the beginning of the 6th millennium BC. This closed basin with its ecologically complex regional structure played a pivotal role in the Neolithic development of Europe, due to its strategic location (Tringham, 1971; Sherratt, 1983; Bánffy, 2006; Müller, 2010; Raczky, 2019). Moreover, an extensive system of relationships between the local cultures and communities ensured the importance of this region in the past, as it does for us today. The complex hydrological structure of the Carpathian Basin acted on this communication network, enabling low-effort maintenance of long-distance relationships (Kovács, 2013a). Among the manifold directions of these relationships, research favoured connections between the Balkans/Southeast Europe (Vinča) (Raczky, 1988, 1992a; Horváth, 2006) and West/Central Europe (*Linearbandkeramik*, LBK) (Bánffy & Oross, 2009; Jakucs *et al.*, 2016), corresponding the mainstream of the Neolithisation process. Exploration of the northern (in the direction of Poland) (Sebők, 2007, p. 113) and eastern (towards Romania and Ukraine via Transylvania) (Virag, 2015) directions became a priority issue in research only recently.

The Great Hungarian Plain occupies the lowest-lying central area of the Carpathian Basin. A mosaic of natural habitats (Sümegei *et al.*, 1998; Sümegei *et al.*, 2005) had been emerging in this waterlogged, seemingly closed region, which was also reflected in its past cultural diversity, especially during the Neolithic (Raczky & Anders, 2003, p. 157; Raczky & Anders, 2009, pp. 40–43). Concerning this period, three territorial units can be delineated along the River Tisza, with different dynamics of developments, different inner transformations and external impulses

(Fig. 1). The Upper Tisza region located North-Northeast from the estuary of the Sajó/Hernád rivers, characterized by intensive transformations and connections with Northern Transylvania and Poland (Chapman, 1995; Sebők, 2007; Kozłowski & Nowak, 2010; Virag, 2015; Sebők & Faragó, 2018, p. 152). Extensive contacts lent a unique character to the Middle Tisza area: right and left tributaries (Zagyva, Körös, Berettyó) with rich and diverse microregions spliced far-fetching communication networks together in this confluence region. One such microregion is the widely recognized Körös-Berettyó area due to the Esztár group (Kalicz & Makkay, 1977, pp. 52–54; Goldman & Szénászkzy, 1995) and Herpály culture (Kalicz & Raczky, 1987a, 1987b; Kalicz, 1995; Kalicz *et al.*, 2011). Along the western tributaries, microregional groups are known with connections towards the North Hungarian Range and Transdanubia (Kalicz & Makkay, 1977, pp. 159–162; Bánffy, 1999; Csengeri, 2014; Domboróczki, 2018). A thorough investigation of these sites has to be undertaken. The Lower Tisza region began at the estuary of the Körös River with strong ties to the South during the entire Neolithic era (Banner, 1960, pp 36–55; Horváth, 1994, pp. 99–100; Horváth, 2006; Paluch, 2011).

Öcsöd-Kováshalom is located in the middle part of the Great Hungarian Plain, next to the Körös River. This Late Neolithic settlement was excavated between 1980–1987 (Raczky *et al.*, 1985), becoming a widely known site both in Hungarian and in international research (Raczky, 1987, 1992b; Lichardus & Lichardus-Itten, 1997; Link, 2006). Öcsöd represented a special settlement type, the so-called tell-like settlement, which is characteristic of the northern zone of the Southeast European tell distribution (Kalicz & Raczky, 1987a; Raczky, 1987, 2015). The 45.5-hectare area of the open site integrated smaller settlement nuclei of half hectares. According to the magnetic survey, a triple enclosure system was

built around and within the settlement. The inner section was about 150 meters in diameter, while the outer one terminated a 500-meter-wide area (Füzesi *et al.*, 2020). At the nucleus with the most intensive surface scatter, a multilayered settlement was excavated by Pál Raczky and his colleagues. 160 cm thick strata contained two main settlement horizons. The structure of this central residential area was defined by 12 buildings with post structures and trench foundations. Distinct activity areas and two groups of burials were aligned to the buildings. In the excavated assemblage, there were more than 80,000 ceramic sherds (Raczky, 2009; Raczky & Füzesi, 2016a; Raczky *et al.*, 2018).

Apart from the well-recognized Late Neolithic remains, the site revealed material of a previous occupational horizon, which has barely been investigated so far (Raczky, 1986; Éva Marton's MA thesis in 1987, unpublished). These Körös culture settlements were implemented evidently into the European Neolithization process, they played an important role at the regional scale of the Carpathian Basin (Anders & Siklósi, 2012; Bánffy, 2013). The first settled communities created an intensive settlement network in the central part of the Great Hungarian Plain. To the north of this zone, pioneer Neolithic communities also were identified by Hungarian research in recent years (Domboróczki *et al.*, 2010; Domboróczki & Raczky, 2010; Domboróczki, 2012). The site of Öcsöd-Kováshalom was located at the northern periphery of this coherent and intensive occupational area (Bittner, 2012). The size and structure of the Early Neolithic settlement are less explored at the site because of the dense cover of Late Neolithic remains. At the main part of the excavation, artefacts of this early period appeared sporadically in the features of the multilayered Late Neolithic settlement. Intact Early Neolithic features occurred in one trench at the site margins, where three excavated pits provided 1140 ceramic

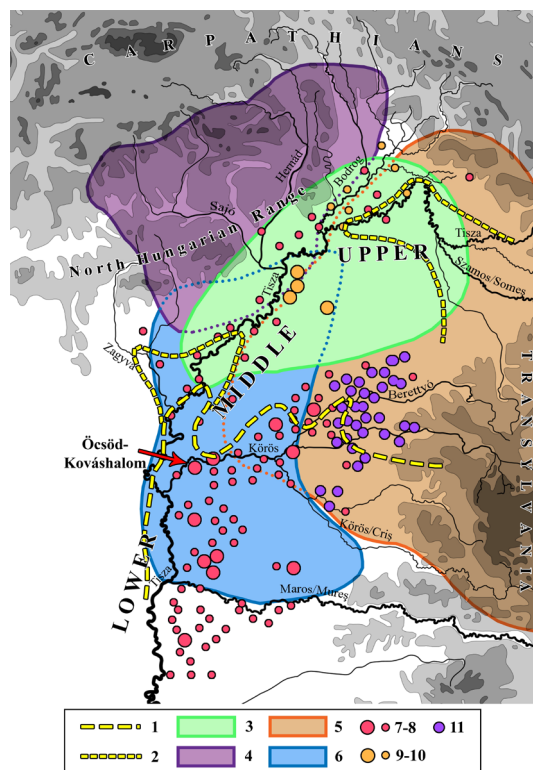


Figure 1. Dynamics of Neolithic development in the Upper, Middle and Lower Tisza Regions, based on the main cultural entities. Early Neolithic (after Anders & Siklósi, 2012): 1: intensive settlement area of the Körös culture, 2: pioneer Neolithic communities north of the primary zone. Middle Neolithic (after Raczky, 1989; Raczky & Anders, 2003): 3: early ALPC, 4: Bükk culture, 5: Esztár group and painted ceramic assemblages of Transylvania, 6: Szakálhát culture. Late Neolithic (after Raczky & Füzesi, 2016a): 7–8: tells and horizontal settlements of the Tisza culture; 9–10: tells and horizontal settlements of the Csöszhalom group; 11: tells of the Herpály culture (prepared by the author).

sherds. According to these observations, the early settlement was located in a narrow zone along an old meander of the Körös River. This situation corresponds to the general settlement pattern of the period (Sherratt, 1983; Makkay, 1982, pp. 116–119).

The chronological framework of the present summary rests on data of uneven quality. On typo-chronological grounds, the Körös assemblage can be dated to the classical phase of the Körös culture, which means three hundred years between 5850 and 5650 cal BC (Oross & Siklósi, 2012, pp. 152–154). The Late Neolithic assemblage is framed by radiocarbon dates, spanning between 5210 and 4850 cal BC (Raczky, 2009, p. 103; Raczky & Füzesi, 2016a, pp. 31–34). Middle Neolithic (Alföld Linear Pottery culture, ALPC) artefact scatters are also known from the excavation, indicating continued use of the site and its surroundings. However, archaeological features were not found from this period. The hypothesized continuity in settlement activities (Raczky & Füzesi, 2016a, p. 18; Kovács *et al.*, 2017) does not equal to the continuity of the excavated assemblages through the periods. Despite the lack of continuity, these two assemblages represent a significant section of Neolithic development, which can be modelled in the above-mentioned three regions.

The nested complexity of social, ecological and technological developments forms a distinct topic of research. The conceptual framework of archaeological cultures grasps these far-fetching processes together, by which we can interpret the ever-growing pool of data about these phenomena. In the southern zone of the Great Hungarian Plain, the development is characterized by a succession of archaeological entities such as Körös, ALPC, Szakálhát, and Tisza. There were two crucial facts in this succession. The first fact is the contact between the late Körös groups with their southern origins, and the ALPC communities with their northern origins, who had been spreading to the south (Kalicz & Makkay, 1977, pp. 26–29; Makkay, 1982, pp. 51–52; Raczky, 1989, pp. 234–235, Fig. 6, 8; Horváth, 1994). The second fact is that the Late Neolithic Tisza culture emerged in the context of a gradual internal transformation within the Szakálhát group (Makkay, 1982, pp. 60–

63; Kalicz, 1989, p. 104; Raczky, 1992b, p. 164). The Late Neolithic assemblage of Öcsöd-Kováshalom testifies to these cultural transformations (Raczky, 1992b, pp. 164–167; Füzesi & Raczky, 2018, pp. 91–94). Among the recovered artefacts, ceramic sherds with their technological, functional and stylistic aspects represent the spectrum of variables pertinent to an effective analysis of cultural change. The analyzed assemblages represent the two above-mentioned facts of change, hence we can interpret the ceramic development of the Neolithic based on these artefacts.

2. Dynamics of changes in Neolithic ceramic forms and decoration

The traditional approach to the study of spatiotemporal patterning among archaeological sites utilized the formal and stylistic variability of pottery. Interpretation of ceramic vessels as functional items and material imprints of human decisions only appeared in the mid-20th century. This paradigm shift is attributed to Anna O. Shepard and her new methods of ceramic analysis (Shepard, 1956 (1995); Tite, 2017, pp. 8–9). Although ceramic technology became the most dynamic field of investigation (Rice, 1987, pp. 113–163; Orton *et al.*, 1993, pp. 113–131; Hunt, 2017, p. 5), still, multifaceted criticism against the typo-chronological approach (Meier-Arendt, 1994; Rück, 2009, p. 175, Fig. 15) that forced change in formal-stylistic studies. These transformations in international research during the 1990s (Tite, 2017, pp. 11–12) affected Hungarian ceramic analysis only after the turn of the millennium, in the past few years. The assemblage and microregional perspectives of these new studies set the stage for a reinterpretation of Neolithic developments, and the role of pottery in it (Sebők & Kovács, 2009; Kovács, 2013b; Marton, 2013; Csengeri, 2015; Füzesi, 2016; Füzesi *et al.*, 2017; Raczky & Füzesi, 2016b, 2018; Sebők, 2018a; Füzesi & Raczky, 2018; Jakucs *et al.*, 2018). This

article focuses on ceramic technology, but for the sake of a balanced picture of the changes in the course of the Neolithic period, I also will sketch formal and stylistic processes that are connected (Hodder, 1981, pp. 215–216; Rice, 1987, pp. 244–245, 274–275; Sinopoli, 1991, pp. 84–85; Santacreu *et al.*, 2017, p. 189; Sebők, 2018b).

The first synthesis about the Körös as the pioneer food-producing culture was published by Ida Kutzián in 1944 (Kutzián, 1944). Since then, the number of sites and assemblages has multiplied, hence the editorial board of the 2012 British Archaeological Reports (BAR) volume could offer a significantly more complex synthesis of this culture and its owner society (Anders & Siklósi, 2012). Nevertheless, the assemblages investigated so far are moderate or the editors did not aim for an exhaustive publication, except for a few inventories from the region of the Körös rivers (Oross, 2007; Makkay & Starnini, 2008). Besides the thoroughly reported Ecsefalva, János Makkay and Elisabetta Starnini published assemblages of six sites from the territory of Szarvas and Endrőd. The publication contains drawings of 500 whole profiles and several other sherds. Evaluation of these artefacts yet has to be undertaken, apart from a detailed formal-typological table of the publication. Consequently, we have only a partial understanding of the pottery sets in use during the Early Neolithic period. The Körös assemblage of Öcsöd-Kováshalom is too restricted to represent the whole spectrum of Early Neolithic pottery forms. To gain a more complete picture, I assembled a diagram of individual vessels of the other published Körös assemblages. From the Körös and Middle Tisza region, the nearest sites are Szajol-Felsőföldek, Szolnok-Szanda (Raczky, 2012) and Ecsefalva (Oross, 2007), 30 and 50 km away from Öcsöd respectively.

The analysis compares 44 vessels from the three mentioned sites (Oross, 2007; Raczky, 2012), which can not be considered a statistically sig-

nificant sample but it allows the identification of several basic tendencies concerning vessel types (Fig. 2: 1). Identification of ceramic forms was based on rim diameter, height and type of profile. The five basic form types represent different size ranges, and the individual vessels also significantly differ in their proportions. For example, the heights of biconical bowls (A) are almost constant, while their diameters are extremely variable. The inner proportion of conical and ovoid bowls (B–C) is distributed between 1:1 and 1:2. Even wider dispersion can be seen in the proportions of spherical closed vessels (D), which otherwise have a relatively closed size range. Globular and biconic pots (E) display great variability of proportions and sizes, similar to conical bowls. The individual vessel types delineate loose sets on the diagram by their metrical and formal attributes. The insufficiency of the Körös assemblage from Öcsöd is well-illustrated by the low number of firmly identified variants, compared to the vessel inventory of Ecsefalva (Oross, 2007, pp. 505–509, 535–536). The recognizable forms typically were conical and ovoid bowls, or globular pots and storage jars (Fig. 2: 2–6). Although the Öcsöd-Kováshalom assemblage fits well in this picture, its extremely fragmented nature (only 3 whole profiles were possible to reconstruct) renders its form data irrelevant.

However, the Late Neolithic assemblage contains 240 vessels which could be reconstructed into complete shapes of the Late Neolithic community's ceramic inventory. Data on this throughout published assemblage (Füzesi & Raczky, 2018) were analyzed by variables similar to the previous ones (rim diameter, height, type of profile). This diagram (Fig. 3) displays not only a more complete but a more regular pattern than the same graph for the Early Neolithic. Divergence in the proportions of individual vessels is restricted, even at the higher end of the size range. As all the detailed data are published, on this graph, I

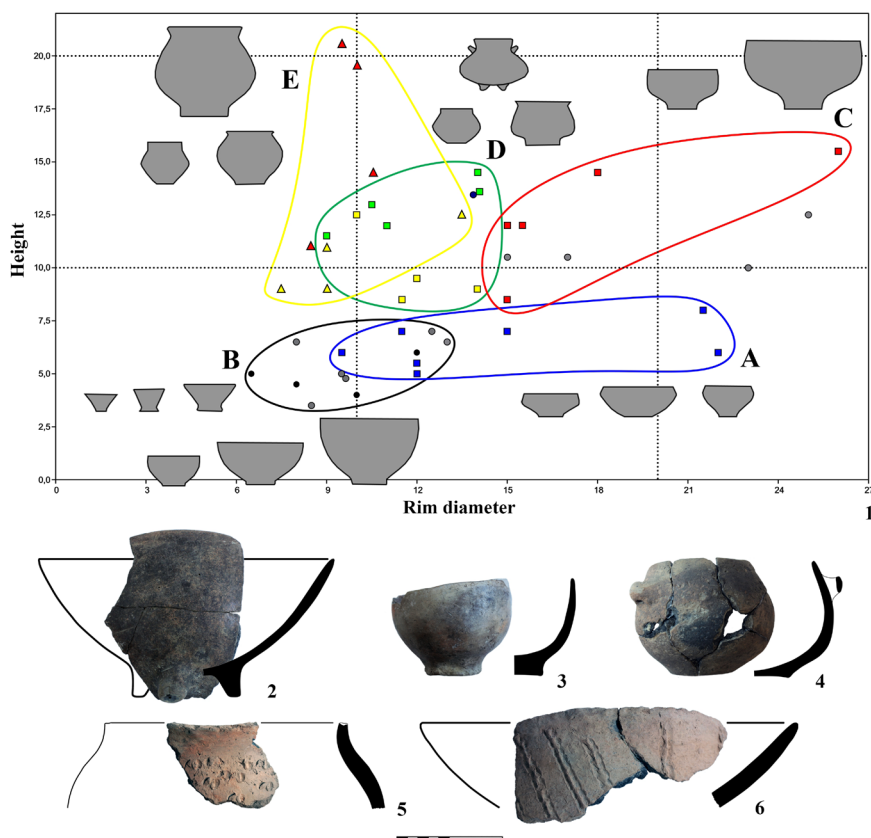


Figure 2. Ceramic forms in the Körös culture. 1: Vessel types based on height, rim diameter and profile type. Data from Szajol-Felsőföldek, Szolnok-Szanda, and Ecsegfalva. 2–6: Typical ceramic forms of the Öcsöd-Kováshalom site (prepared by the author).

emphasized only five technologically significant vessel types, whose radial arrangement also mirrors the regularity of the vessel spectrum. In comparison with the Early Neolithic spectrum, there are not only new categories (vessels with 2–3 mm wall thickness) but the enlargement of the formal – supposedly the functional – spectrum is also detectable. The consistency of vessel forms was a new phenomenon at the beginning of the Late Neolithic, testifying to a more regulated ceramic production.

Nevertheless, local and microregional regularity is a relative phenomenon, different spatial and temporal tendencies occurred in Late Neolithic ceramic assemblages of the Great Hungarian Plain. There are significantly more assemblages of this age known from preliminary reports, ready for comparative study (Füzesi & Raczký, 2018, pp. 89–91). Although decoration was the prime variable in the definition of archaeological cultures (Tisza, Herpály, Csőszhalom), regional differences in vessel forms

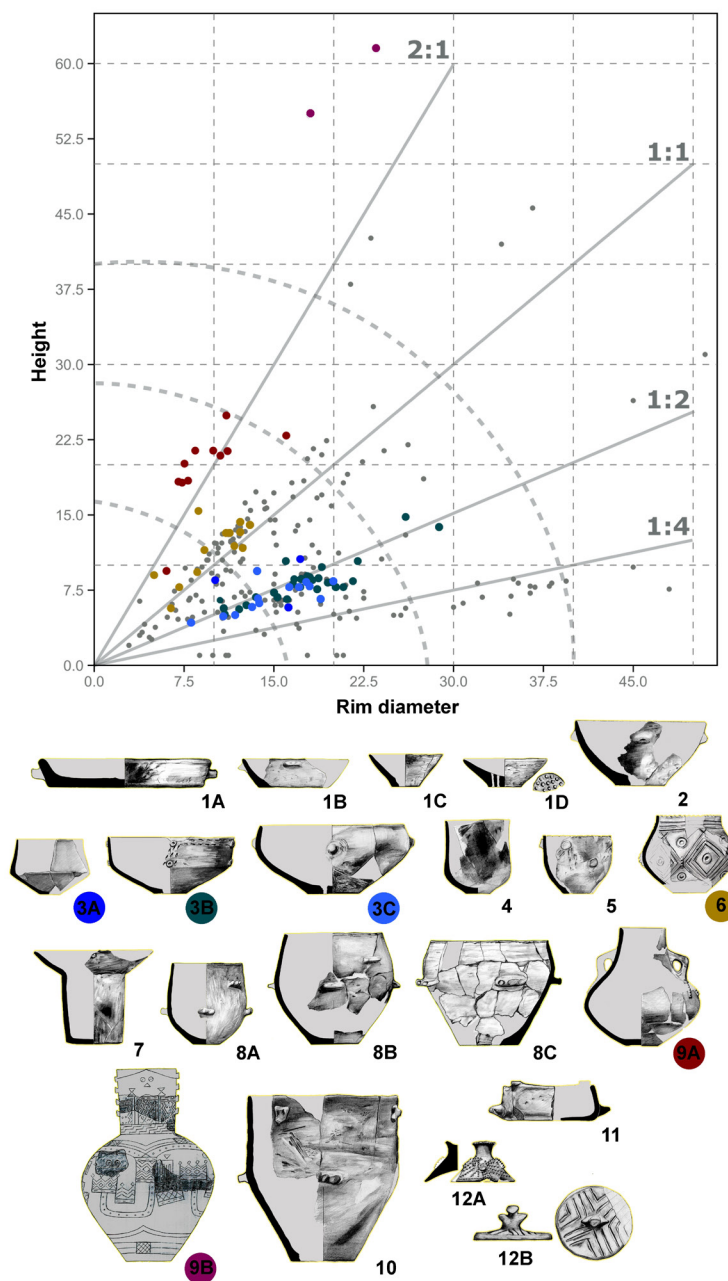


Figure 3. Ceramic forms of the Tisza culture at Öcsöd-Kováshalom. 1: Vessel types based on height, rim diameter and profile type, compiled after 240 reconstructed vessels. 2: Vessel types of the Late Neolithic assemblage. The forms highlighted with different colours were suitable for technological observations (prepared by the author).

Figure 4. The main decoration techniques of the Early (1–8) and Late Neolithic (9–16) assemblages from Öcsöd-Kováshalom. 1–2: barbotine, 3–4: pinched decoration, 5–6: finger and nail impressions, 7–8: incised and grooved decoration, 9: plastic implementation, 10: engraved decoration, 11–12: incised decoration, 13: black painted, 14–15: incision together with red painting, 16: resin and straw decoration (prepared by the author).



also played a prominent role in those distinctions (Bognár-Kutzián, 1966; Kalicz & Raczky, 1987a; Kalicz, 1989, pp. 104–105). The formal variation can be traced back to different microregional traditions (Raczky & Anders, 2003, pp. 155–158), that were strong enough to pervade the changing material culture (Kalicz *et al.*, 2011, pp. 48–55; Sebők, 2012; Sebők & Faragó, 2018, pp. 152–153, 170–171). The coherence in the wide area of the Tisza-Herpály-Csőszhalom complex was displayed by new, special vessel types, e.g. the so-called flowerpot-shaped vessels. These new forms, as well as their decorations, became hallmarks of the Late Neolithic material culture on the Great Hungarian Plain (Sebők, 2018a, Fig. 11; Füzesi & Raczky, 2018, p. 92).

Based on the formal development of Neolithic ceramics, an ever-expanding, periodically renewing vessel set can be reconstructed, in which regional differences slowly increased through time. Despite these changes, the assemblages give an impression of constant transformation of the ceramic inventory. The comparison of decoration techniques shows radical changes, which is an organic feature of the most important stylistic attribute. The three main functions of style, defined by Prudence M. Rice (Rice, 1987, p. 267), are evident in the 1500-years-long Neolithic period in the Alföld. The changing settlement patterns (Makkay, 1982; Sherratt, 1983; Domboróczki, 2009; Raczky & Anders, 2009; Gyucha *et al.*, 2015; Füzesi, 2016, pp. 387–388; Raczky & Füzesi, 2016a, pp. 15–19), the increasing social complexity (Siklósi,

2013) and the stylistic change in ceramics (Füzesi, 2016, pp. 378–380; Sebők, 2018a) were parallel, connected processes, during which pottery decoration fulfilled its role, the strengthening of group cohesion, emphasized social differentiation and intergroup demarcation. Because of these functions, the decoration is one of the most dynamic datasets that can be investigated by archaeology.

In the Early Neolithic assemblages the dominant techniques (Fig. 4: 1–8), like classic barbotine, “*Schlickwurf*”, and various impressions or incisions, were used for filling the surface (Kutzián, 1944, p. 6; Trogmayer, 1964, pp. 68–70; Trogmayer, 1968; Makkay, 1978, p. 25; Raczky, 1983, pp. 162, 169, 181, 187; Kalicz, 2000, p. 298; Oross, 2007, pp. 537–540). The individual decoration elements were often ordered in rows or arched bands. The signalling value of these techniques and patterns was exceedingly low. Communicative functions must have been fulfilled by other artefacts and phenomena, as pintaderas with complex decorations testify (Kutzián, 1944, p. 8, Tab. XLVI; Tringham, 1971, pp. 83–84; Makkay, 1984, pp. 22–23; Makkay, 2005; Raczky, 2012, pp. 93–94). The role of ceramics in social communication intensified during the Middle Neolithic period, probably due to the growing appreciation of feasting (Kalla, *et al.*, 2013; Hayden, 2014; Hastorf, 2017, pp. 194–204), implied by the invasive and complex decorations on vessels connected to consumption (Sebők, 2007, pp. 109–111; Füzesi, 2016, pp. 381–382; Sebők, 2018b, pp. 19–21). Following this trend, in the Late Neolithic, a complex and colourful system has been appeared, in which the decoration techniques, styles, and vessel forms tightly intertwined (Fig. 4: 9–16). Besides incision, which originated in ALP traditions, other techniques also appeared on Late Neolithic sherds, like painted, impressed and applied decorations (Sebők, 2007, 2018b, 2022; Sebők & Faragó, 2018; Füzesi & Raczky, 2018, pp. 79–81). A particular decoration technique of the Late Neolithic used special ma-

terials – resin and straw. The settled term of this complex technique (Kalicz and Raczky, 1987a, p. 20; Sebők, 2007, p. 109) in archaeology is only partially substantiated for the moment. The matrix is proven to be a resin (Raczky & Sándorné Kovács, 2009); scientific investigations into the inlay material are currently in progress. Patterns constructed of straw sticks were applied to a special type of cup of small size and fine quality (Fig. 4: 16). The use of standard traditional techniques also had changed, they were all ordered into different decorative patterns suitable for broadcasting messages (Wiessner, 1989; Rice, 1987, p. 267), even the most simple applied implementations, as opposed to the Early Neolithic filling patterns. The complex decorative patterns available since the second half of the Neolithic were able to communicate similarly complex messages. Together with the central message carried by the main motif, other sophisticated details and patterns can be observed that gave way to the expression of individual or group identities (Hoyer, 2005, Abb. 2; Pechtl, 2015, pp. 566–567).

3. Technological observations in Neolithic ceramic material from Öcsöd-Kováshalom

After this short introduction of the Neolithic formal and decorative ceramic traditions in the Great Hungarian Plain, we can not synthesize a similarly comprehensive view of ceramic technological traditions, since this kind of research does not have a long history in Hungary. Instrumental ceramic studies began in Hungary after an archaeometry conference held in 1998 (Jerem & Bíró, 2002), although with moderate success, as only a few experts took up these methods later on (Pető *et al.*, 2010, pp. 66–77; Kreiter *et al.*, 2012, pp. 9–10). Among them, Attila Kreiter earned international recognition (Kreiter, 2007; Kreiter *et al.*, 2017; Kreiter *et al.*, 2019). Apart from instrumental methods, experimental archaeology provided the first studies in Hungary about production and

formation technology. A Hungarian potter and restorer, László Gucsi, had experimented with vessels from the Copper and Bronze Ages (Gucsi, 2000, 2006, 2009). His studies engaged in the technical and practical requirements of vessel production (Gucsi & Szabó, 2018, pp. 223–226). His early views anticipated the results of Louise Gomart who established the French research traditions. Gomart's 2014 publication contains a technological analysis of two Early and two Middle Neolithic sites from Transdanubia and the Great Hungarian Plain (Gomart, 2014; Gomart *et al.*, 2020). She had identified several pottery-manufacturing processes based on forming techniques, that widened the earlier, anecdotal observations in ceramic research. Concerning pot-building, János Makkay and Elisabetta Starnini reached similar conclusions as László Gucsi, although they published their results only as interpreted drawings (Makkay & Starnini, 2008, pp. 87–89). The past few years also witnessed new complex studies which combine stylistic analysis, material tests and the investigation of forming techniques. A published case for the Neolithic is the site Balatonszárszó-Kis-erdei-dűlő (Kreiter *et al.*, 2017). The insufficient cases in technical analyses cause a lack of comparative data, rendering our preliminary results hypothetical, imperfect and regional in scope. The assemblages analyzed by Louise Gomart could be used as an analogy and starting point for our research. In recent years, further significant advances have been made in the ceramic research in Hungary. In the Transdanubian region, a project on a broad spectrum of Neolithic ceramic production and use is being coordinated by Tibor Marton (Marton *et al.*, 2020). In the Alföld region, Eszter Solnay has started to work on ceramic technology under the mentorship of L. Gomart (Solnay, 2021, 2023).

Our first important experience is, that relatively more technological observations are required for the Early Neolithic sample, in com-

parison with the Late Neolithic one. The early collection contains 1,285 sherds altogether, while of the nearly 80,000 pieces strong late sample, we analyzed 11,000 sherds during our technological study (Füzesi, 2019). The great discrepancy in quantity between the Early and Late samples is mainly caused by the difference in tempering materials. The popular organic tempering in the Early Neolithic sample allowed more observations, but the overall improvement in the manufacturing process through the Neolithic also has to be taken into account during interpretation. This latter phenomenon can support our hypothesis about the long-term inheritance of pottery-producing traditions (Shepard, 1956 (1995), p. 357; Arnold, 1985, pp. 220–224; Rice, 1987, pp. 459–466; Lathrap, 2010, pp. 32–33, Fig. 3: 4–5). Our observations are based on poorly realized joinings and “fortunate” breakages. The majority of cases displayed horizontal and vertical breakage surfaces, broken or disconnected handles and plastic elements. Most data were recorded on the base of vessels. This crucial region of stability served as the basis of the evaluation in both assemblages. The other avenue of observation, i.e. surfaces of sherds provided more restricted information. The often unfinished inner surfaces of vessels have proven to be good indicators but almost exclusively in cases of closed forms (globular vessels, biconic vessels, and jugs). Several surface treatments and surface filling decorations had been used in both examined periods (slip, burnishing, Schlickwurf, barbotine, resins, and different incised patterns), which obscured traces of forming.

The fragmentation of the Early Neolithic ceramics and the character of the Late Neolithic artefacts in our samples prohibit us from reconstructing whole *chaînes opératoires* (Roux, 2017). Instead, the samples offer a set of identified technological markers, that refer to several characteristics of the manufacturing process within the technological system represented by the artefacts

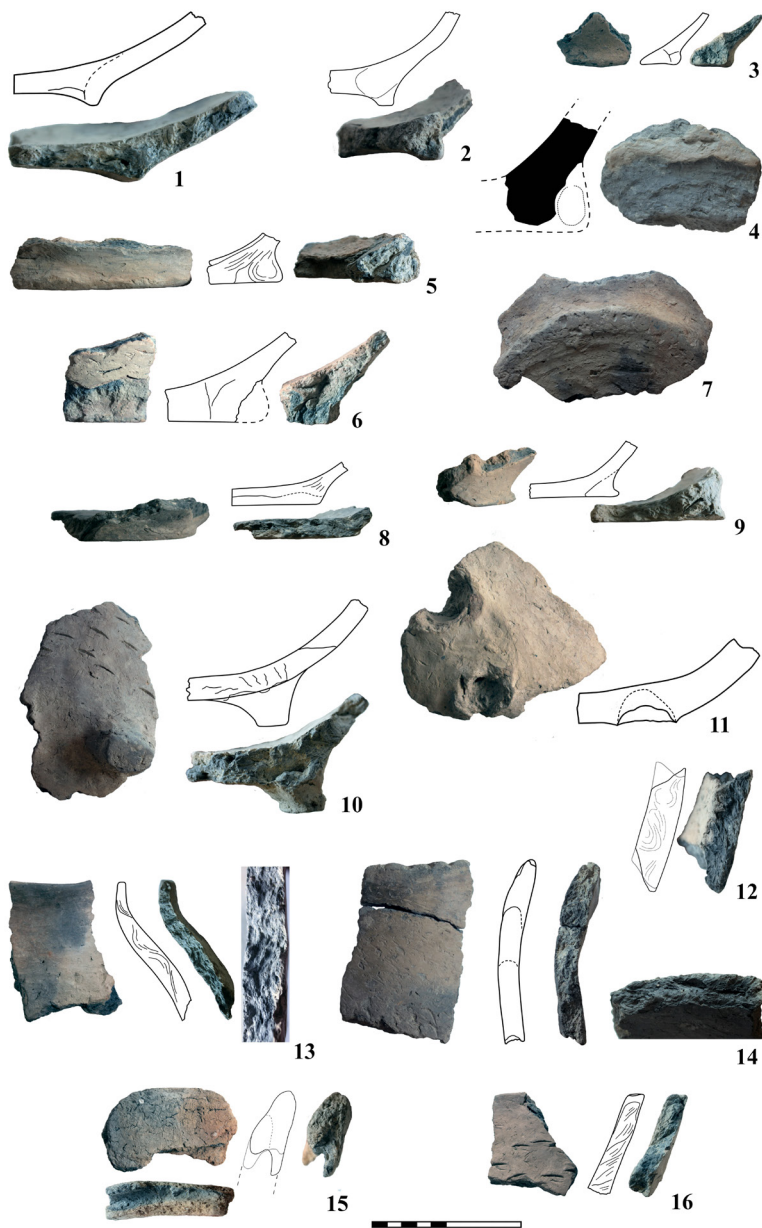


Figure 5. Forming techniques of the Early Neolithic assemblage from Őcsöd-Kováshalom. Modelling of the base (1–11), coiling of the body (12–14) and shaping of the rim (15–16) (prepared by the author).

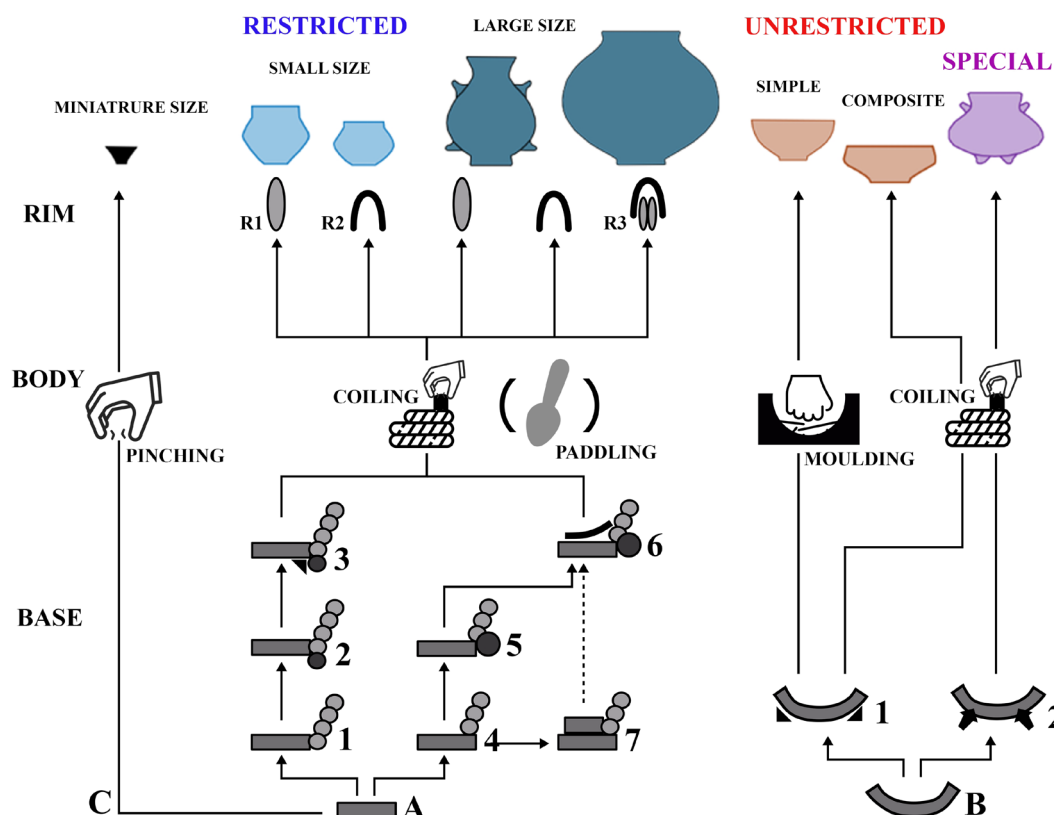


Figure 6. Characteristics of the pottery manufacturing process. Set of identified technological markers in the Early Neolithic assemblage of Öcsöd-Kováshalom (prepared by the author).

(Gomart, 2014, pp. 155–157; Kreiter *et al.*, 2017, pp. 117–120; Gomart & Ilett, 2017; Květa *et al.*, 2017; Neumannová *et al.*, 2017, pp. 173–174).

3.1. Forming techniques of Early Neolithic ceramic material

We present our results following the steps of vessel forming, from bottom to top (Fig. 5: 1–16). In the Early Neolithic sample, wall fragments dominate, the 99 basal sherds and 141 rim fragments add up only to 7.8% and 11.0% respectively. This distribution suggests that our data concern

mostly the bodies of vessels, but due to the distorting effect of technological characteristics and possibilities of observation, the bases had been found more informative. János Makkay and Elisabeta Starnini observed similar tendencies (Makkay & Starnini, 2008, pp. 79, 87)

Forming the base was the first step in vessel manufacture, divided the sherds into two groups. In the majority of cases, the initial element equals a clay disk (A; Fig. 5: 1–6), more rarely, the base was formed by moulding (B; Fig. 5: 10–11). The most frequent base type was built by coiling on a

clay disk of one (A1–6) or two layers (A7; Fig. 5: 8). The second factor in this evaluation was the position of the first coil: beside/around (A1–3; Fig. 5: 1–2) or above the disk (A4–7; Fig. 5: 4–5, 8). In some cases, it could be proved that this coil was the first step of the manufacturing process and the disk was a closing element. It is proven by the fingerprints on the bottom (Fig. 5: 7). The second type built above the disk had more complex versions. Its typical element was a large coil placed on the outside of the base (A5–6; Fig. 5: 4–6). This has resulted in a high, profiled basis, characteristic of the Körös culture (Kutzián, 1944, p. 69; Oross, 2007, p. 496; Raczky, 1983, p. 181; Makkay & Starnini, 2008, p. 78). Cohesion was ensured by finger impressions (Fig. 5: 4, 6), as earlier mentioned in other cases. The complex versions occurred more frequently in both disk-based types (A3, 6; Fig. 5: 1, 5). The third type is connected to the moulding technique (B). This occurred not only in the case of unrestricted bowls but in special vessels with legs too (B2; Fig. 5: 10). The legs were fixed in holes punctured into the moulded part of the base (Fig. 5: 11).

The building of the body was made by the coiling technique exclusively. All three basic coiling types (U, S, N) (Neumannová *et al.*, 2017, p. 174, Fig. 1) were identified in the Körös assemblage (Fig. 5: 12–16), but the N-type coiling was the most frequent. Only a few pieces of data could be gathered about the forming of the body. Traces of the paddle-and-anvil technique (Rice, 1987, pp. 136–137) appeared on some sherds. The follow-up covering and filling of the surface (for example with barbotine or impression) made it difficult to identify this technique. The shaping of the rim in most cases meant the application of the last coil (R1; Fig. 5: 13–14). Nevertheless, in some cases, complementary elements were used, which resulted in an extra, largely folded band around the last coil (R2; Fig. 5: 15) (Gomart & Illett, 2017). In

one case, a complex rim was built from several overlapping coils (R3).

Summarizing our observations into one figure (Fig. 6), we applied a flowchart-like model in which we marked not only the manufacturing steps listed above but the most important categories of vessel sets also. The episodic nature of our observations and the high degree of variability allowed us to present only the most important, regularly occurring types. Besides those, several unique or unrecognized variants can be represented in the fragmentary collections.

The pinching technique (Rice, 1987, p. 125) (C) is usually used for the smallest, miniature-sized vessels. The disk-based shaping of the vessel base was specific to the restricted vessels. The body was built exclusively by the coiling technique in this group. The moulding technique appeared mostly in unrestricted vessels. A special section of the ceramic material was constituted by vessels with legs, which appeared in both restricted and unrestricted forms. The different forming techniques were implemented in the production of distinct vessel types, hence it is not unequivocal whether they represent different manufacturing traditions within Early Neolithic communities. For this, several techniques should be applied parallel to each other, as alternatives. Such alternative application is manifested only in the different disk-based type variants.

3.2. Forming techniques of Late Neolithic ceramic material

72 sherds of the Early Neolithic artefacts provided technological marks in connection with forming (5.8%), while in the Late Neolithic sample, we observed 381 cases, although these were only 3.5% of the 11,000 sherds. One-third of the identified technological marks referred to the application of handles and plastic elements in the latter sample. The Early Neolithic material lacked this kind of marks, hence there is an

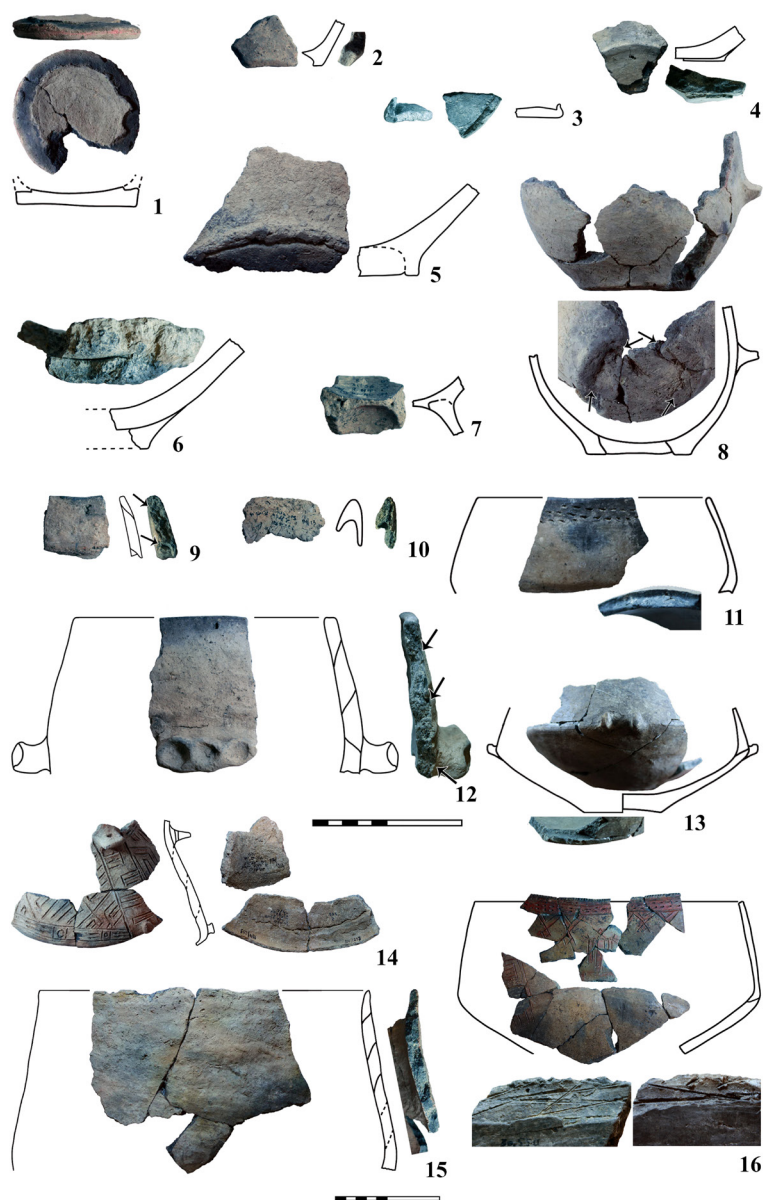


Figure 7. Forming techniques observed in the Late Neolithic assemblage from Öcsöd-Kováshalom. Modelling of the base (1–8), shaping of the rim (9–10), coiling of the body (12, 14–15) and joining interfaces along the belly (11, 13, 16) (prepared by the author).

even more pronounced difference between the two compared periods (5.8% vs. 2.2%). This difference goes beyond quantitative. Theoretically, reconstruction of an entire chaîne opératoire of vessel forming became feasible with the help of the 240 reconstructed Late Neolithic vessels. Still, we could not reach such a conclusion because the additions during restoration obscured the possibilities of technological observations on breakage surfaces. Consequently, we command more data about ceramics of the Late Neolithic settlement, but our results are displayed only on hypothetical flowcharts about *chanîes opératoires*, just like in the previous case (Fig. 8).

Modelling of the base was executed mainly by disk-based techniques (A). Both disk-base types appeared, the first coil beside (A1; Fig. 7: 2, 5, 8) and above from disk (A2–3; Fig. 7: 1, 3). Opposite the Early Neolithic assemblage, complex versions were missing in Late Neolithic ceramic. The composite base was represented by a two-disks-based version (A3; Fig. 7: 6). New elements of the assemblage were the pedestalled vessels (A4; Fig. 7: 7). The lower part of this type was formed with coils fitted to the bottom and disk. The introduction of pedestals at the Early-Middle Neolithic boundary was not without antecedents (Kalicz & Makkay, 1977, pp. 20–21; Raczky, 1983, pp. 171; Makkay & Starnini, 2008, pp. 79–80). The small- and ring pedestals made their appearance in late Körös assemblages, they are considered not only as formal but as technological antecedents of these vessel accessories. The A2–3 type base formation, present in the Körös material from Öcsöd, is comparable to the later pedestals, which are prevalent in variable sizes north of the River Körös (Füzesi & Raczky, 2018, pp. 92–93).

Similar to the Early Neolithic assemblage the N-coiling was also a frequent body-forming technique in the Late Neolithic (Fig. 7: 9, 12, 14–15), however, the U-coiling was present as well. Due to the bigger sizes of the shreds, we could identify

not only parts of 1–2 coils but also longer sequences. In one case we observed a directional reverse of the joining interfaces along the belly line of a biconical bowl (Fig. 7: 12). When more sherds were reconstructed into a vessel unit, patterns of breakage helped in identifying the coiling technique. One such reconstruction pieced together 86 adjacent sherds into a 72 cm tall storage jar with special face decoration and a peculiar biography (Raczky, 2009, p. 105; Raczky & Füzesi, 2016b, pp. 26–29; Raczky *et al.*, 2018, pp. 124–130). Special storage jars with human face representations can be traced back to the Middle Neolithic ALP tradition (Kalicz & Koós, 2000; Raczky & Anders, 2003; Sebők & Kovács, 2009; Csengeri, 2011; Sebők, 2018a). The breakage pattern on this specimen suggests the use of coils which were transformed into 6–8 cm strips.

A new technological attribute among the Late Neolithic finds was indicated by straight break surfaces on the belly lines (Fig. 7: 11, 13). This breakage usually is associated with carinated forms and sharpened bellies. The moulded base was in use already in the Early Neolithic; the novel trait by the ALP tradition originated in the northern part of the Great Hungarian Plain, was the use of moulding for the entire vessel section under the belly line or greatest diameter (D) (Gomart, 2014, p. 157). After forming the conical lower part of these vessels, they allowed the ware to dry, in order to gain sufficient structural strength. The following, third manufacturing step was to build the upper part of the vessel, usually in a cylindrical shape. This forming process was carried out in different scales, from smaller bowls to larger pots. In some occasions, the joint interface along the belly line was articulated by incision and impression to ensure better cohesion (Fig. 7: 16). The upper part was always built up with the coiling technique, while the lower part was probably formed by moulding. This manufacturing process differed from other solutions for vessel manufac-

ture in the Early Neolithic technological system. A large globular jug offers an appropriate example of this dissimilarity (Raczky, 1987, p. 75, Fig. 28). Along the belly of this black-painted vessel, a straight break surface was present, just as in the case of the previously mentioned bowl and pot, which testified the coiling of the upper section. Moulding up until the maximum diameter, then coiling – this special technique set the ALPC apart in the northern part of the Great Hungarian Plain (Gomart, 2014, pp. 158–159).

One of the typical vessels of this period was the above-mentioned cup, with fine quality and a special resin-and-straw decoration technique (Kalicz & Raczky, 1987a, p. 20; Raczky, 1987, p. 68; Sebők, 2007, p. 109). Forming these types of vessels must have required a different technique as their walls were thin (2–3 mm) and their matrix was pure. According to our hypothesis, the applied technique involved moulding or casting, but we need further data to verify this claim. Vessels with the same quality appeared at the end of the Middle Neolithic in the Carpathian Basin, in the territory of the Bükk culture (Lichardus, 1974, p. 22; Kalicz & Makkay, 1977, p. 45; Csengery, 2001, p. 75). This ware then became widespread due to its high quality and special decoration (Strobel, 1997, pp. 77–79; Virág, 2009, pp. 13, 24, Fig. 2; Szilágyi *et al.*, 2011, p. 160, Fig. 1; Lazarovici & Lazarovici, 2015, pp. 11–13). A similar ceramic type also appeared at the same time, in Late Szakálhát contexts in the central-southern Alföld region – and also in the Öcsöd-Kováshalom assemblage (Kalicz & Makkay, 1977, p. 89). The degree of technological similarity between these two wares still has to be determined (Technological studies on Bükk fineware: Szilágyi *et al.*, 2011).

The identified set of technological markers unveils a ceramic production system which both retained archaic traditions and followed contemporary technological innovations (Fig. 8). We observed a considerable number of technological

traits, mainly among rough-ware ceramics, which were already in use during the Early Neolithic period. Concerning the execution of vessel bases, only the basic types survived (EN A1, 4, 7 = LN A1–3), while complex forms either disappeared or set the stage for pedestalled vessels (EN A2 ≈ LN A4). Characteristic technological attributes of the Late Neolithic assemblage were the partial drying during the forming phase, and the specific moulding technique typical for ALP ceramic tradition. Both traits are associated with composite vessel types that were determining features of the archaeological assemblages by their forms and decorations as well.

4. Summary of changes in Neolithic technological traditions

The two analyzed assemblages represent 700 years of almost continuous development during the Neolithic period, at the location of Öcsöd-Kováshalom, in the regional frames of the Great Hungarian Plain. A comparative technological study of Early and Late Neolithic ceramic assemblages from this site revealed the considerable time-depth and several connections of pottery craft traditions. At the same time, stylistic and formal analysis of these assemblages testified explicitly to a transformative process.

Taking a broader interpretative scope, this study focused on the temporal dynamics of these transformations, which occurred at different paces concerning the forms, forming techniques and decoration of vessels (Campbell, 2012, p. 319, Fig. 6). Formal and stylistic traits that are traditionally used to identify archaeological culture-units had been changed to a high degree. Decoration, as a device of social communication, also displayed great variability in space and time (Wiessner, 1989, pp. 56–58; Parkinson, 2006, p. 36; Whittle, 2009, p. 104). Vessel forms, constrained partly by function (Rice, 1987, pp. 274–275; Sinopoli, 1991, pp. 84–85; Füzesi & Raczky, 2018, pp. 70–79), rath-

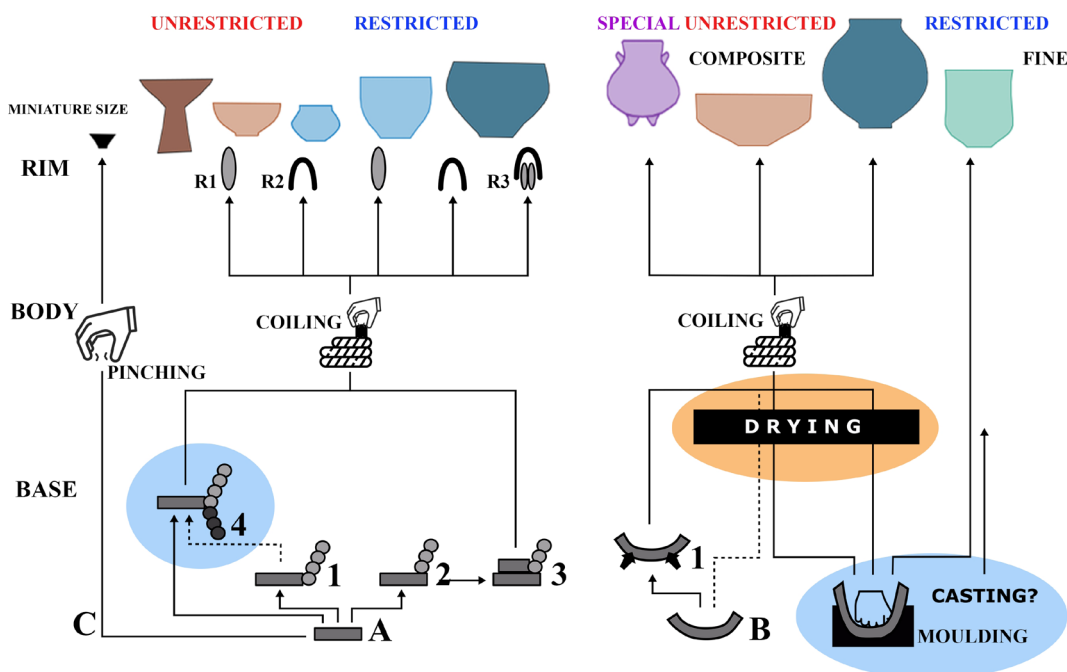


Figure 8. Characteristics of the pottery manufacturing process. Set of identified technological markers in the Late Neolithic assemblage of Öcsöd-Kováshalom. Details highlighted with colours represent technological innovations in the course of the Middle Neolithic (blue) and at the beginning of the Late Neolithic period (red) (prepared by the author).

er responded to periodically occurring regional trends (Raczky, 1988, pp. 20–21, 28; Raczky, 1989, p. 234; Budja, 2015, pp. 536–538, 544), the appearance of local variants was less typical. At the same time, the technological system only partially followed new claims and challenges; it preserved archaic elements that eventually took part in the formation phase of the Late Neolithic Tisza culture (Fig. 8).

The combined analysis of the three basic aspects of ceramics and the comparison of their different transformation dynamics at Öcsöd-Kováshalom highlight the differences in the underlying content and social connotations of these phenomena.

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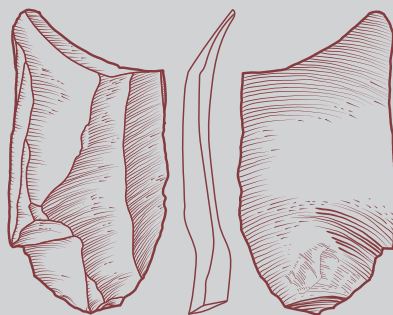
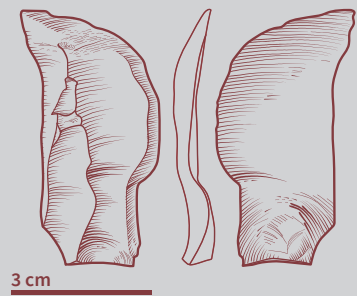
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Blades from the Neolithic Boldogkőváralja depot.
Drawing after Jean-Georges Marcillaud.