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Botić, Katarina

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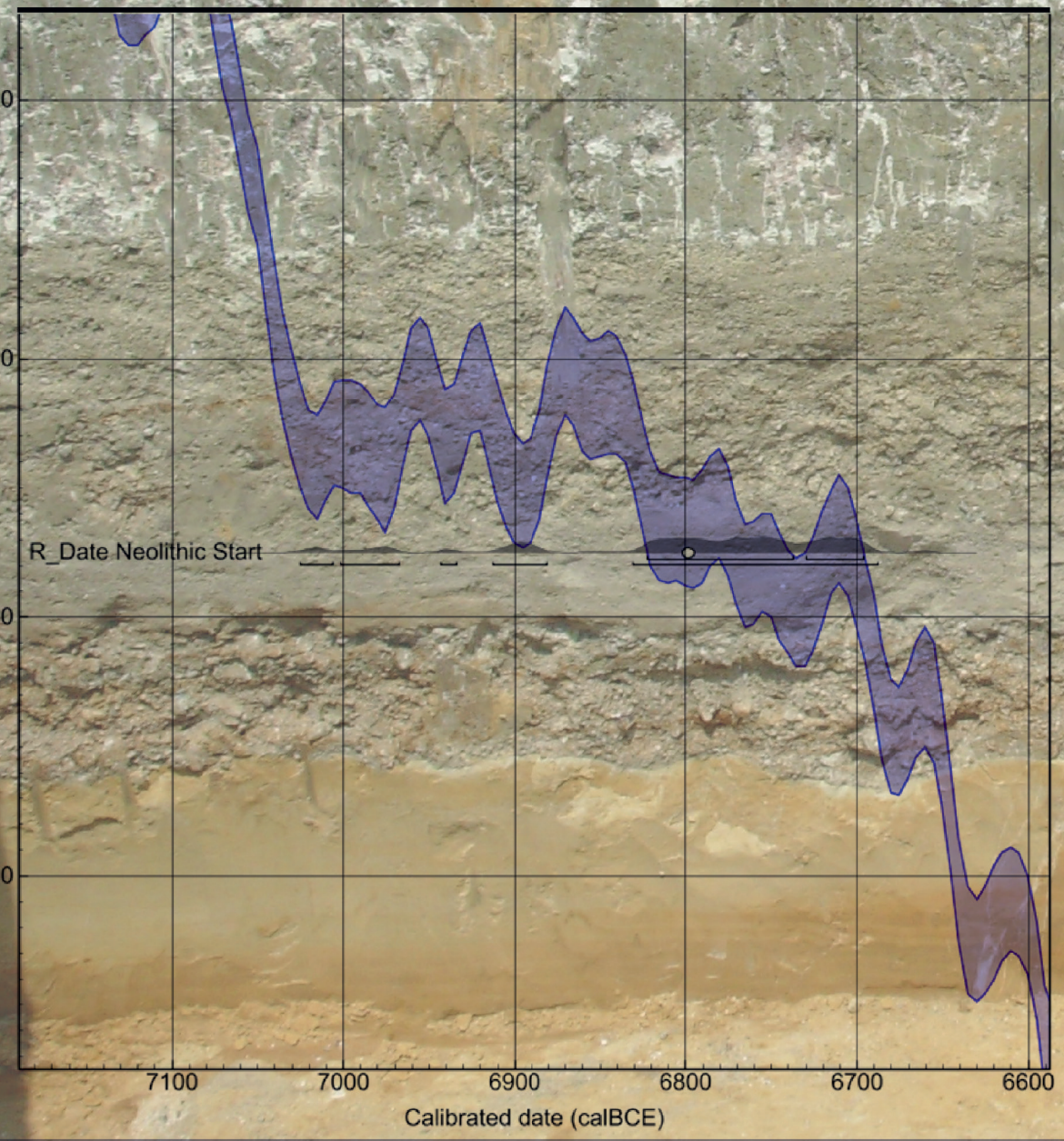

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Edited by Miroslav Marić, Jelena Bulatović and Nemanja Marković

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Contents

Introduction

It is probably best assumed that the passage of time has been an important part of human reality for as long as humanity has existed. The notion of time, although likely not understood and measured by early hominids as it is today, was a self-evident fact of the cycles of life that each of us undertakes, from the moment of birth to the day of death. It became even more important to understand and measure when humans first attempted to understand their environment, to put it under their control. Perhaps at first, it was enough to realise when it was a period of cold or hot weather, a time of bounty and scarcity but as the complexity of human livelihood began to emerge with the onset of the Neolithic, the concept of time must have started to matter even more. Time, an intangible concept that cannot be rewound, renewed or traded, is an intricate part of daily lives governing our actions and cycles. The realisation that we can measure and organise it in the order of the occurrence of events to establish its flow was as important to the humans of the past as much as the concept of growing your own food resources and living in organised societies settled in specific environments. Certain authors (Aveni 1989) argue that the perception of time is inborn to living beings, evidenced through behaviours regulated by circadian cycles, but the measurement of time is surely a cultural product. Mankind, most likely even before the time of the Homo Sapiens, must have been aware of the biological time, evidenced in the individual phases of life that each living being goes through from birth to death. But the motion beyond that realisation, one that would cause the development of the concept of physical time; the time that exists as an external, measurable entity, must have demanded more than the inborn quality.

The measurement of time must have started very early in human prehistory, but the perishable character of material evidence from the human past partially prohibits us from discovering the point when it occurred. Additionally, even if material evidence is to be found, would we be able to, from our perspective, understand its character of timekeeping with certainty? If we were to argue the measurement of time came about in the Palaeolithic, then the material evidence is very limited due to, ironically, the sheer amount of time that has passed since. Perhaps then, it is possible to proxy search for other probable indicators of the existence of time as a concept among the current hunter-gatherer tribes that still occupy secluded parts of Earth today, avoiding contact with contemporary human societies of the 21st century? Certain studies (Sinha et al. 2011) have indicated that hunter-gatherer tribes in Amazon lack the linguistic structure that relates time and space or even lack words for time or terms associated with measuring time, like month or year. This, however, does not prevent them from talking about events and their sequence of occurrence, but it illustrates that, for them, the concept of time does not exist independently of events. Is it then prudent to assume that the Palaeolithic hunter-gatherers must have had the notion of seasonal cycles, possibly to keep track of which food sources to look for when, but surely not had them organised in calendars, rather as a series of interconnected and overlapping events related to certain natural phenomena (e.g. climatic cycles)? Would it be far-fetched to suspect that these Palaeolithic societies did not count the cycles of time but rather related them to events easily identifiable and transferable by the collective memory? This concept seems logical from the aspect of the short time scale that the hunter-gatherers were living on, based on recurring seasonal changes. It would also imply that their time was highly dependent on narratives passed down from generation to generation.

If no evidence of quantitative timekeeping can be found in the Paleolithic, can it then be identified in the Neolithic? Sedentary life and plant cultivation go hand in hand with the concept of longer annual or perennial cycles based on prolonged planning, food production, and harvesting management. While hunter-gatherers were influenced by individual seasons of climatic changes, Neolithic farmers would need to rely on at least annual cycles to know the adequate periods for sowing, cultivation and harvesting. It is safe

to assume that these annual cycles would have already been known from the repetitive cyclical motions playing out above our heads – the astronomical cycles of constellations and the Sun and the Moon. The nature of these measurements is still unclear in the Neolithic period, as a key ingredient, writing, was still missing, depriving us of material evidence. Undoubtedly, the astronomical cycles have had an important role in the development of time measurement and the emergence of codified calendars, the basis for the earliest known systems of time measurement that would appear in the later periods.

Thus, moving to the earliest material evidence for timekeeping records may be pertinent, which originates in the Sumerian and Dynastic Egyptian periods (Greengus 1987; Polcaro 2013) from about 2200 BCE. However, it should be assumed that there would have been even older records since the writing system predates these earliest chronological records by almost a millennium. The Sumerian calendars were lunisolar, based on 12 lunar months, subdivided into seasons and organised around natural cycles like day (the regular rising and setting of the Sun), lunar month (the transition of the Moon through its cycle of phases) and solar cycle (the change rising and setting positions of the Sun throughout its annual cycle), while the Egyptian was solar based. The historical stage for chronology was thus set, driven by the need of emerging complex societies to record their time for posterity. Another side effect of the timekeeping was the creation of dynastic histories, the first relative chronological system known, albeit envisaged as a justification for the immense power vested in rulers rather than as a recording of the passage of time. Thus, a twofold split in chronology appeared, with shorter scaled civil time recording short-term astronomical cycles and regulating civil life, while historical time dealt solely with larger time scales that spanned periods from the current rulers back to the mythical, often divine, ancestors. The historical time was often referred to as sacred time, which must always be cyclical time as its existence made the present time (Eliade 1959). These cyclic events in which sacred times recreated the rituals originating from past sacred events from the long-gone periods often resulted in the creation of great years, truly long cycles which would often span multi millennia that were to repeat themselves over and over again.

The development of the concept of time did not end there. The cyclic time of the Bronze Age middle eastern societies began to be replaced by the notion of linear time, irreversible and not traced back to prior events in the Early Iron Age. This notion is deeply connected with the appearance of Judaism and monotheistic concepts of the Universe, which has its creation, lasting period and ending point (Goldberg 2000). Ancient Greek philosophers also tried to grasp the nature of time and the concept of chronology, introducing infinite time into the matter. The Sophist philosopher Antiphon claimed that time is not a reality, but a concept or a measure (Dunn 1996), while Parmenides saw it as an illusion because change is impossible and illusory (Hoy 1994). Somewhat later, Plato, in his Timaeus, stated that the time was created by the Creator and identified it with the period of motion of the heavenly bodies, of which he specially commented on the so-called Great Year, a complete cycle of the equinoxes around the ecliptic; effectively the return of the planets and the "fixed stars" to their original relative positions, a process that takes about 25,800 years (Plato 2001). This notion, derived from ancient astronomical observations of the movement of stars and constellations in the night sky, contributed further to the notion of linear time that early Christian authors will additionally advance in their attempts to synchronise and record the timeline of early Christianity.

In his Confessiones, St. Augustine noted that the world was neither timeless and eternal nor created at a certain point in the time series, but that the world and time were created together and also stated, "There are three times; a present of things past, a present of things present, and a present of things future" (Augustine 1992, XI:26). For Augustine, time is God's creature and God is the beginning and the end. This position reflects Neo-Platonism with an added splash of Aristotelian time as a linear stream, flowing from a beginning towards an end. This idea of linear time would not change much in the Early Medieval period. However, the theological view of time considers time to be of the material world only and that time ceases to exist in the immaterial after-world when they give way to eternity. Thus, time is an imperfect reflection of the heavenly life that awaits the worthy in this transitory world. Life on this Earth is time-bound and limited, while heavenly life is timeless and everlasting.

On the opposite end of the spectrum, in the Mediaeval period, earthly time is still a flow of moments, measured in terms of cyclical movements of the celestial bodies and the rhythm of nature (Polcaro 2013, 5). Timekeeping became very important, especially when serving religious needs, like Epiphany, Christmas, Annunciation and others. These calculatory problems occupied early Christianity, and many computations were made in attempts to fix the dates of these major events until finally, a Benedictine monk Bede Ven-

erabilis published his study De temporum ratione in 725 AD. With the advent of the developed and Late Medieval period and the resurrection of town life that sprang around fortified castles of nobility, a new concept of time started to appear, centred primarily on acquiring economic and social wealth and prestige. The prohibition of usury, which forbade Christians from making money out of money loans and credits with interest, started giving way to money lending, which required exact determination of the lending period dependent on the universal measurement of time. By the late 14th century, even time itself became viewed as a commodity that could be parcelled out and measured on an even scale. The invention of mechanical devices for time measurements – mechanical clocks enabled this organisation of daily life by the clock. In the Renaissance, the concept of time as a precious good became an everyday topic for intellectual elites like Michel de Montaigne or Giordano Bruno (Ashcroft 2018).

The rise of science in the Modern period, starting from the late 15th century, brought about changes in paradigms in many aspects of life, often breaking away from well-established traditions. The concept of time was not left unchanged either in this process. Examining the material or physical world led scientists like Galileo to state that an objective reality exists with its intrinsic properties, independent and distinct from the individual perceiving it (Galilei 2017). Galileo, one of the greatest minds of his period, considered time and motion to be two of these properties. However, another, perhaps the best-known scientist of the period, Isaac Newton, was credited with the introduction of absolute time alongside concepts like absolute space and absolute motion. In his Philosophiae Naturalis Principia Mathematica, Newton states: "Absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external, and by another name is called duration: relative, apparent, and common time, is some sensible and external (whether accurate or unequable) measure of duration by the means of motion, which is commonly used instead of true time; such as an hour, a day, a month, a year" (Newton 1687).

However, Newton's view of the time was not the only one in existence and was furthermore soundly opposed by another prominent intellectual figure of the period, Gottfried Leibniz, who considered that space and time are for him purely relative "an order of coexistence, as time is an order of successions. For space denotes, in terms of possibility, an order of things that exist at the same time, considered as existing together, without entering into their particular manners of existing" (Leibniz's third letter to Clarke – February 25, 1716).

These views on space and time gave birth to the absolute concept of time (Newton) and a relational one (Leibniz) based on different logical priorities of space and time concerning objects and material processes. The key question and difference lie in the dilemma of whether the existence of space and time allows the existence of objects or does the existence of objects creates space and time. Despite all advancement over the century, it is just these views that, to this day, govern, more or less, the Western concept of time, which also lies at the heart of the archaeological notion of time.

In its earliest periods, modern archaeology heavily relied on the concept of relative chronologies, particularly when dealing with recorded histories of human societies being studied. It is of no surprise because no way of establishing absolute age existed in that period. The interest in the ancient Middle East and Graeco-Roman periods heavily relied on epigraphic sources listing periods, rulers and important events. However, the oldest known archaeological chronology developed was the one of a Danish archaeologist C.J. Thomsen, curator of the National Museum of Denmark, who divided the prehistoric period into the Stone, Bronze, and Iron ages (the scheme was published in 1836 in his book Ledetraad til nordisk Oldkyndighed). By the end of the 19th century and the beginning of the 20th, relative chronologies were an everyday item in the archaeological kit (e.g., Petrie 1899; Reinecke 1899, 1902), helping establish the relative age of finds and sites throughout the world.

Relative chronology remained a principal archaeological tool for chronological placement of material cultures until the mid-20th century when Willard Libby proposed an innovative method applicable to organic materials which enabled absolute dating of finds based on the measure of decay of carbon-14, an unstable isotope of carbon. This method brought back the absolute time scale to archaeology in a revolutionary manner, making possible more precise historical and prehistoric chronologies across the periods. Libby, a professor of chemistry at the University of Chicago, realised that carbon-14, an isotope abundant in the atmosphere, is embedded into the organic living matter during its life cycle through respiration, food and liquid consumption and that its accumulation ceases with the death of the organic. He proposed that if one could establish the amount of carbon-14 in an object, one could estimate that object's age using the

half-life of the unstable carbon-14 isotope, i.e., the rate of decay of the original isotope quantity to half of the starting value. For this method to work, Libby assumed that the concentration of carbon-14 has been constant for thousands of years and that the isotope moves readily through the atmosphere, biosphere, oceans and other bodies of water in a known process as the carbon cycle. The first factor was later proven to be generally true, but for the second, Libby had to calculate a ratio of carbon-14 atoms per every carbon atom on Earth, which appeared to be one carbon 14 atom per every 1012 carbon atoms. Following this, he calculated the mixing of carbons across different reservoirs resulting in a prediction of carbon-14 distribution across features of the carbon cycle. Further research by Libby and others established its half-life as 5,568 years (later revised to 5,730 ± 40 years), providing another essential factor in Libby's concept. In 1949 Libby and Arnold published their results (Libby and Arnold 1949), proving the success of the method and paving the way for its introduction into the world of archaeological chronologies.

Libby's discovery helped resolve multiple issues in the sphere of anthropology and archaeology, including the notion that civilisation originated in Europe and diffused outwards into the rest of the world. By dating man-made artefacts from Europe, the Americas, Asia, Africa and Oceania, archaeologists could establish that civilisations developed in multiple independent sites across the globe. Spending less time trying to determine artefact ages, archaeologists could now ask more searching questions about the evolution of human societies and behaviour in prehistory.

Radiocarbon dating in Southeast Europe made its maiden steps in the 1960s and continued in the early 1970s, with first data published from sites like Starčevo, Karanovo, Sesklo, Vinča and others (Kohl and Quitta 1966; Lawn 1973; Nandris 1968; Vogel and Waterbolk 1963) illustrating the importance of Southeast Europe as a prominent corridor for the introduction of the Neolithic way of life into Europe. Since then, the amount of radiocarbon measurements has increased immensely, creating new insight into the dynamics of the emergence and development of the Neolithization of Europe. Old schematics of parallel relative chronologies of material cultures in the region became infused with absolute dates from many sites in the region, creating a detailed narrative of events that would shape the identity of Europe's earliest farmers spanning over two thousand years.

To this great narrative of the Neolithic period and its chronology, we contribute and dedicate our volume in the hope that new generations of researchers will find it useful for research and the creation of new questions and topics that still exist out there and are waiting to be explored and placed in the ever-growing mosaic of knowledge that archaeologists build in an attempt to understand our past and origins better.

The Editors

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7.

North Croatian Late Neolithic relative and absolute chronologies: current state of research

Katarina Botić

Abstract Relative chronology of the Late Neolithic in the Sava-Drava-Danube interfluve region (northern Croatia) was introduced in the 1960s and following decades when diversification of pottery styles was more closely studied and named as separate cultures. The most substantial contribution to building a micro-regional relative chronology based on the typology of pottery finds was that of S. Dimitrijević, with later attempts by Z. Marković to re-define relative chronology and add to the still scarce typology of already established pottery stiles. However, splitting up relative chronology into three or four stages of the same "culture" prevailed and is still in use.

Attempts to define the absolute chronology are still scarce. Although a fair number of radiocarbon dates have been published, especially in the last 20 years, the quality of samples, lack of sampling strategy, and problematic results received render most of them poorly usable. In addition, there have been no attempts to build a local chronology by combining Bayesian modelling of radiocarbon dates with full statistical seriation of finds from individual sites. This paper focuses on problems related to the past methodology, a new approach to building a more precise local chronology and discusses conclusions about the Late Neolithic micro-regional chronology of several recently published papers.

Keywords: Sava-Drava-Danube interfluve, Late Neolithic, history of research, radiocarbon dates, local chronology

Introduction

Late Neolithic relative chronology in the Sava-Drava-Danube interfluve region (northern Croatia) was established in the 1960s and following decades when diversification of pottery styles was more closely studied and named as separate cultures. The most substantial contribution to building a micro regional relative chronology, primarily based on the typology of pottery finds, was that of S. Dimitrijević, with later attempts by Z. Marković to re-define relative chronology and add to the still scarce typology of already established pottery stiles (Table 1). However, the division of relative chronology into three or four stages of the same "culture" prevailed, and is still primarily used.

Attempts to define absolute chronology are recent and still scarce. Although a fair number of radiocarbon dates have been published, especially in the last 20 years, the quality of samples, lack of sampling strategy, and problematic results received render most of them poorly usable. In addition, there have been

no attempts to build a local chronology through combining Bayesian modelling of radiocarbon dates with full statistical seriation of finds from individual sites. This paper focuses on problems related to the past methodology of relative and absolute chronology, a new approach to building a more precise local chronology and discusses conclusions about the Late Neolithic micro regional chronology of several recently published papers.

S. Dimitrijević (1968; 1971; 1979)		
Older phase	I-A	Vinča B-1 **Klokočevik – Klinovac**
	I-B	Vinča B-2
Middle phase	II	Vinča C
Younger phase	III	Vinča D1/D2
Z. Marković (1994: 63)		
Older phase	I-A	Vinča B-1
	I-B	Vinča B-2
Middle phase	II	Vinča C
Younger phase	III	Vinča D
Transition phase (late Neolithic / early Eneolithic)	IV	end Vinča D-2 / Vinča D-3
S. Dimitrijević 1978; 1979 Brezovljani type of the Sopot culture		
Z. Marković 1984; 1985; 1994; 2012 Ražište type of the Sopot culture		

Table 1. *Relative chronology of the Sopot culture in relation to the Vinča culture, after S. Dimitrijević and Z. Marković.*

Regional settings

Although the Sava-Drava-Danube interfluve is considered as one micro geographical region, in the archaeological sense, it is split into three distinct zones: 1) eastern zone (Eastern Slavonia); 2) central zone (around Požega Valley); 3) western zone (Moslavina-Bilogora region) (Figure 1). Late Neolithic regional chronology, as it is perceived today, includes classical Sopot (defined by Dimitrijević as a by-product of late Starčevo and Vinča contacts; Dimitrijević 1968; 1979) in Eastern Slavonia and Western Syrmia, Ražište style in the central zone (defined by Z. Marković), so far documented on the sites in in its eastern part (Marković 1985; 1994; 2012; Marković and Botić 2014; 2016; Botić 2018; 2020a), and late Ražište and Brezovljani styles in the western zone. Ražište style appears along the classical Sopot style on some of the sites in the central zone, while other sites, as far as it is possible to discern from published data and partially reviewed material, contain exclusively classical Sopot style remains. It is still unclear what the precise chronological relation between these sites is, i.e. if some are older or contemporary. Western zone is the least well defined archaeological zone because radiocarbon dates are mostly missing; only two AMS dates were published for Gornji Brezovljani site (Figure 1: 26) (Botić 2020: 198), none exist for Korenovo sites, although typo-chronological and technological problems were discussed on several occasions (e.g. Težak-Gregl 1993; Spataro et al. 2021). Pottery-based chronology is not adequate to explain most probable parallel occurrence of Korenovo and Ražište styles as it is seen in the contexts of Baranya County (southern Hungary) sites and their correlation with earliest Vinča and early LBK in the wider region (cf. Jakucs 2020; for comparison between pottery-based chronology with that based on pottery and radiocarbon dates cf. Jakucs and Voicsek 2016; Jakucs et al. 2016).

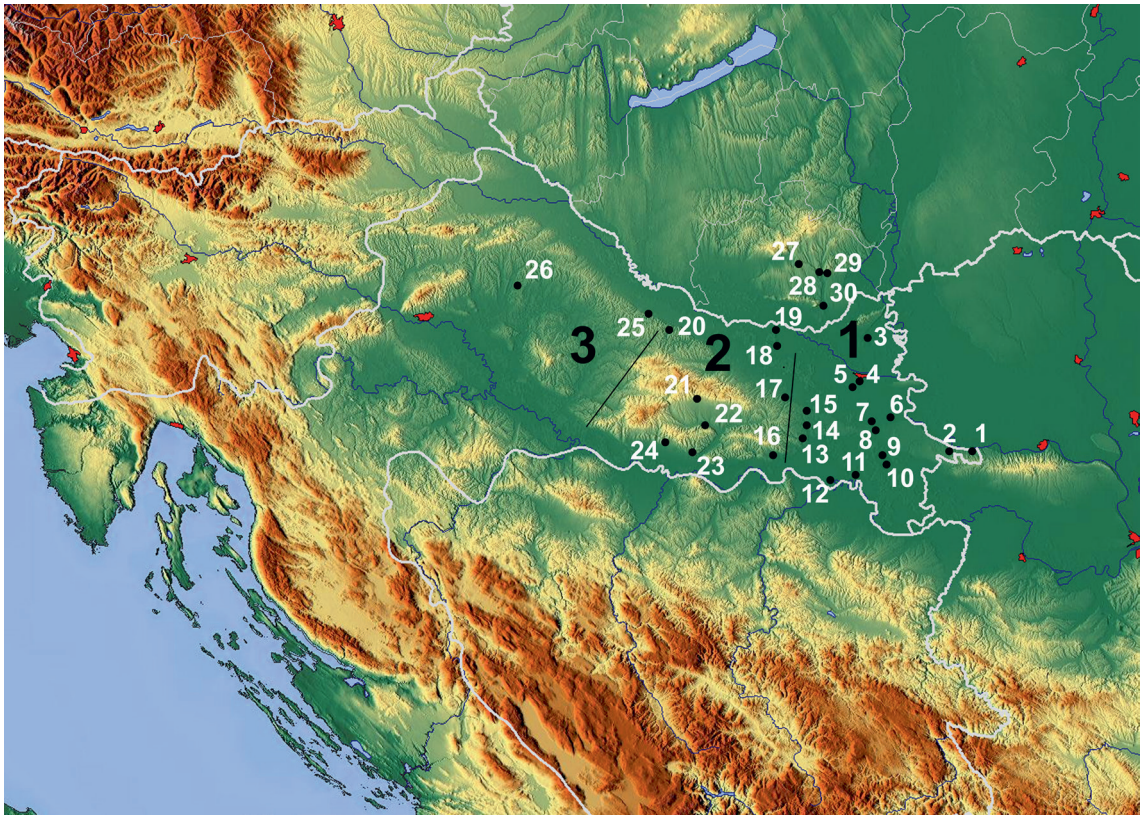

Figure 1. *Map of sites and zones (1 eastern; 2 central; 3 western):*

1 Ilok – Ađanski kraj / Krstbajer; 2 Bapska – Gradac; 3 Kneževi vinogradi – Osnovna škola (Elementary School); 4 Osijek – Hermanov vinograd; 5 Čepin – Ovčara / Tursko groblje; 6 Bršadin – Pašnjak pod selom; 7 Vinkovci – Zablaće; 8 Vinkovci – Sopot; 9 Privlaka; 10 Otok – Gradina / Mandekov vinograd; 11 Županja – Dubovo–Košno; 12 Kruševica – Njivice; 13 Novi Perkovci – Krčavina; 14 Ivandvor – šuma Gaj; 15 Gorjani – Kremenjača; 16 Klokočevik – Klinovac; 17 Podgorač – Ražište; 18 Golinci – Selište; 19 Donji Miholjac – Vrancari; 20 Pepelana; 21 Radovanci; 22 Vidovci – Glogovi; 23 Nova Gradiška – Slavča; 24 Nova Kapela – Ravnjaš; 25 Virovitica – Brekinja; 26 Gornji Brezovljani; 27 Szemely-Irtás; 28 Szederkény-Kukorica-dülö; 29 Versend-Gilencsa; 30 Villány-Villányvirágos

(physical map: https://maps-for-free.com/; *made by K. Botić)*

Late Neolithic micro regional relative chronology

Despite intensified archaeological excavations, especially in the last 15 years, there was almost no change in relative chronology. Sopot culture, defined by S. Dimitrijević (1968; 1979) based on several Eastern Slavonian sites and consequent relative chronology, was later disputed by Z. Marković (1994), mostly considering the latest regional and final phases of the Neolithic and the beginning of the Eneolithic (Table 1). At that time, Ražište and Brezovljani styles were defined as regional variants of the Sopot culture, later than its initial phase. New regional research, however, dates the coeval existence of the Vinča A, early LBK, Ražište and Korenovo styles at the Szederkény-Kukorica-dülö site near Pécs (Figure 1: 28), starting slightly after 5350 BC (Jakucs 2020), with probable contemporaneous occupation of Donji Miholjac – Vrancari and Podgorač – Ražište sites (Figure 1: 27) (Jakucs 2021) south of the Drava River (Botić 2018; 2020a) in the central zone. Moreover, some of the sites exhibit additional diversification of pottery styles, including sites south of the Drava River, or even a degree of 'hybridisation' such as at the Szemely-Irtás site (Figure 1: 27) (Jakucs 2021) in the later phase of the Ražište and Korenovo styles. Ražište pottery style appears among the surface finds at the Villány-Villányvirágos site (Figure 1: 30), the southernmost Baranya site at the moment (Horváth 2006: 321, Fig. 2). The initial Sopot I-A phase was identified by Dimitrijević on only one site:

Klokočevik – Klinovac (Figure 1: 16) (Dimitrijevič 1968: 1979: 268). However, this site is situated in the eastern part of the above mentioned central zone, i.e. out of the territory of the initial Vinča appearance and formation of the Sopot culture (Burić 2015). Dimitrijević published only a short description of layers in the two profiles of the excavated trenches and very sparse pottery finds (Dimitrijević 1968; 1971; 1979). Phases I-A and I-B he also saw at Otok – Gradina / Mandekov vinograd site (Figure 1: 10); although material was published only in drawings, it is apparent that there are differences between these two sites and that some of the shards from Klokočevik may very well be linked to the LBK decoration style (cf. Dimitrijević 1971: T. XI: 3, 6). For example, fragment no. 6 must have been very problematic for his chronology because it was omitted in 1979 (Dimitrijević 1979: T. XLV); fragment no. 3 was firstly dated to the I-A phase in 1971 and later to the I-B phase in 1979. There are several other examples. Material from Otok, on the other hand, has more common traces with the Vinča style (cf. Dimitrijević 1968; Burić 2009; 2011).

Dimitrijević considered the end of the Sopot culture (phase III) in the eastern zone parallel to Vinča D1/D2 phases while Marković (1994; 2012) added phase IV parallel to the Vinča D2/D3 phases. Milojčić's phase Vinča C–D (Milojčić 1943; 1949; Whittle et al. 2016) was not recognized (Table 1). In the past, methodology of field research consisted of spits defined by the depth of a spade which was problematic when excavations were carried out on multi-layered / tell sites; this is apparent in the publications where stratigraphy of the sites was discussed on profiles of the excavated trenches, only rarely the ground plans, and very small selection of finds. Methodology of field research in the last 20 years changed and is based on stratigraphic units permitting better control of the content of each archaeological feature. However, publication of archaeological features without or with small amount of selected finds is still very much in use.

New excavations carried out at the eponym Sopot tell site revealed the youngest constructions dated to the Sopot IV phase (Krznarić Škrivanko 2015: 378–379). After personally examining some of the finds from these features, we can confirm that they belong to the Sopot IV phase as described by Z. Marković (1994). We thank M. Krznarić Škrivanko and Vinkovci Town Museum for this opportunity. Excavations at Bršadin – Pašnjak pod selom site (Figure 1: 6) (Botić 2019; 2020b) documented a Late Neolithic settlement; some of the pottery finds exhibit more chronologically sensitive Vinča or Vinča like elements similar to those from the other sites, such as Bapska, Divostin, Vinča and Gomolava, in the layers dated to the phases from Vinča C to D1 (Botić 2020b). It is, however, difficult to discern what typical vessel forms of the Sopot "culture" are, although both elements of the phases Sopot III (after Dimitrijević) and Sopot IV (after Marković) are present. New excavations at Bapska – Gradac site (Figure 1: 2) documented pottery finds from the Sopot III / Vinča D phases (Burić 2011) which confirms earlier Dimitrijević's finds from this site (Dimitrijević 1968).

In the central and western zones, in the Drava River valley, Seče style appears at the same late period (late 5th millennium; Marković 1994; problems with pottery style-based chronology are also connected to this style and to this specific region, for more see "Marković 2012), while Brezovljani style most probably continues in the same region during most of the 5th millennium (see note 2). Lasinja pottery style already appears in some parts of the Sava-Drava-Danube interfluve at that time (e.g. Balen 2008; Marković 2012; Rajković 2018; Čataj 2018). Brezovljani style pottery appears in the central zone as well, eg. Nova Gradiška – Slavča, Pepelana (Figure 1: 20, 23) and other sites (Mihaljević 2013). Despite recent attempts to summarise the chronology of the Sava-Drava-Danube interfluve in the 6th and 5th millennium BC (Balen et al. 2014; 2018 etc.), it is clear that the state of published research is not adequate to resolve apparent problems.

Site	**Total dates**	AMS	Charcoal	Short lived sample
Virovitica – Brekinja	**2**		2	
Donji Miholjac – Vrancari	**4**	4	1	3
Podgorač – Ražište	**3**	3	1	2
Golinci – Selište	**1**	1	1	
Novi Perkovci – Krčavina	**2**		2	
TOTAL	**12**	**8**	**7**	**5**

Table 2. *Total number of radiocarbon dates for the Middle – Late Neolithic in the eastern part of the central zone (late Starčevo, LBK, early Vinča, Ražište styles).*

Site	**Total dates**	AMS	Charcoal	Short lived sample
Nova Gradiška – Slavča	**9**	4	9	
Radovanci	**1**	1		1
Nova Kapela – Ravnjaš	**4**	4	4	
Vidovci – Glogovi	**5**	5	5	
Pepelana	**1**		1	
Gornji Brezovljani	**2**	2	2	
TOTAL	**22**	**16**	**21**	**1**

Table 3. *Total number of radiocarbon dates for the Middle – Late Neolithic in the central and west zones (Korenovo – not dated, Sopot, Brezovljani styles).*

Site	**Total dates**	AMS	Charcoal	Short lived sample
Bapska – Gradac	**7**	5	2	5
Bršadin – Pašnjak pod selom	**11**	11		11
Čepin – Ovčara / Tursko groblje	**4**		4	
Županja – Dubovo–Košno	**6**		6	
Gorjani – Kremenjača	**4**	4	1	3
Ivandvor – šuma Gaj	**6**	6		3
Kneževi Vinogradi – Osnovna škola	**1**			1
Kruševica – Njivice	**1**		1?	
Osijek – Hermanov vinograd	**2**		1	1
Otok – Mandekov vinograd	**3**		1	2
Privlaka – Gradina	**2**		1	1
Vinkovci – Sopot	**26(29)***	9(12?)	22	4(7?)
Vinkovci – Zablaće	**4**	4		4
TOTAL	**77(80?)**	**39(42?)**	**38(39?)**	**35(38?)**

* Three dates published without the error (excluded from modeling)

Table 4. *Total number of radiocarbon dates for the Middle – Late Neolithic in the east zone (Sopot, Vinča styles). ? – data on AMS measurements and nature of samples not provided in the published material.*

Late Neolithic regional absolute chronology

A large number of radiocarbon dates primarily appeared in publications as a result of the large-scale rescue excavations, which intensified after 2005. We used 111 radiocarbon dates (Tables 2–4) for the period of micro-regional Late Neolithic collected from publications(for details about most of these dates, see Botić 2017: 223 etc., Supplement 2; Bršadin – Pašnjak pod selom, Botić 2020b; Gorjani – Kremenjača, Šošić Klindžić et al. 2019; Vinkovci – Zablaće, Krznarić Škrivanko 2020; very likely, a substantial number of radiocarbon dates are still waiting to be published) but there are disagreements about their context. Many of these dates were published without or with very scarce archaeological context other than features. Consequently, it is not always acceptable to attribute them to the Sopot culture/style. About 56% were AMS dated; short-lived samples were used for only 39 out of 63 AMS measurements (human or animal bones, seeds and non-charred plant macrofossils). In general, the poor sampling strategy was the main problem (Burić 2015), and it has continued until the present.

Another problem in building site-by-site or general micro-regional chronology is an uneven distribution of available radiocarbon dates throughout the three zones and among the sites: most of the radiocar-

bon dates are available for the eastern zone (East Slavona and Western Syrmia), while only a few dates are available for most of the sites in all three zones and very few sites were dated by ten or more radiocarbon dates. This is illustrated the best by simple sums of dates (Figures 2–4): the central zone is split between two graphs because its eastern part, for the moment, is mainly dated earlier (and it has specific chronological continuity, diverse from the other zones as can be seen in Figure 2; Table 2) than its southern/western part. However, only 12 dates, out of which 8 AMS are available for this zone (Figure 2), and only 7 (5 AMS) date the period between the earliest documented transition to the Middle Neolithic (from about 5400/5350 BC) to the mid-5th millennium(four dates from Donji Miholjac – Vrancari site and one from Podgorač – Ražište site (Table 2); the date from Golinci – Selište site is somewhat younger, as are the rest of the dates from the Podgorač – Ražište and Novi Perkovci – Krčavina sites).

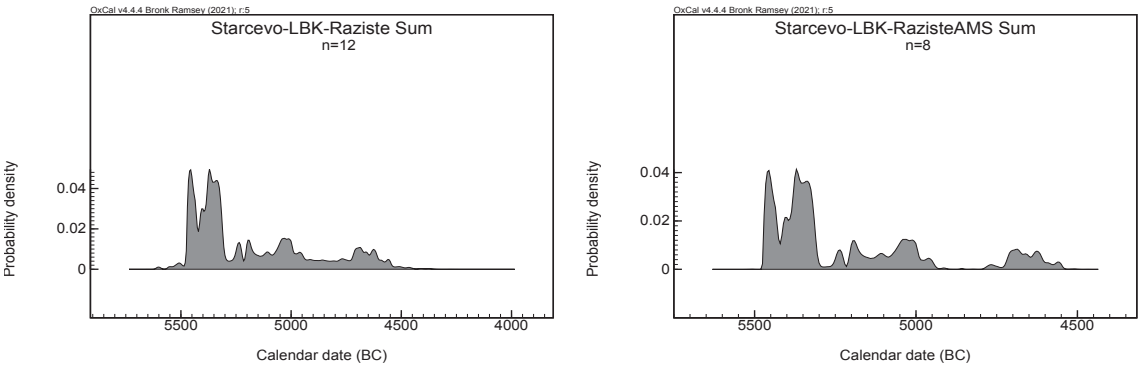

Figure 2. *Sums of radiocarbon dates for the Middle – Late Neolithic period in the eastern part of the central zone (left: all radiocarbon dates, right: AMS dates).*

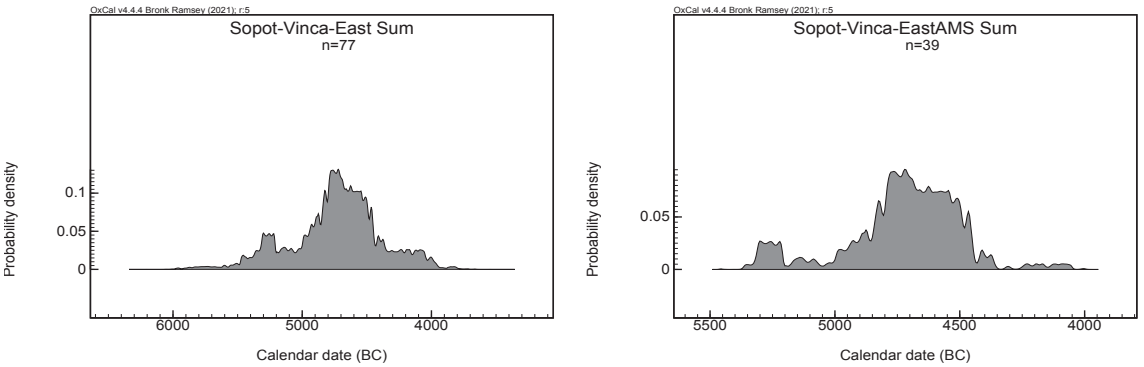

Figure 3. *Sums of radiocarbon dates for the Middle – Late Neolithic period in the east zone (left: all radiocarbon dates, right: AMS dates).*

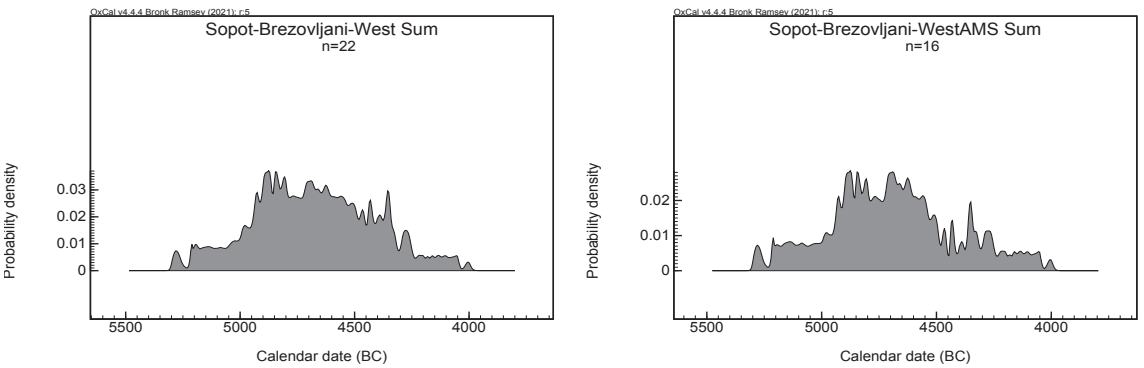

Figure 4. *Sums of radiocarbon dates for the Middle – Late Neolithic period in the central and west zones (left: all radiocarbon dates, right: AMS dates).*

In the eastern zone, the situation is more complicated. Most 77 dates (39 AMS) (Figure 3) date archaeological contexts after 5000 BC. However, several dates deviate from this average and are older (Table 5). Dates of the most recently excavated Vinkovci – Zablaće site (Figure 1: 7) come from contexts without any additional finds (Graves 1–3), or the context was not published (SU 69/70). The main settlement construction types are timber-framed longhouses without long pits and partly with narrow foundation channels along the longest sides (Krznarić Škrivanko 2020: 129, Fig. 2). Similar type of construction was discovered at Kruševica – Njivice site (Figure 1: 12) (Miklik-Lozuk 2014). This site was dated by a single radiocarbon date from the sample that was not collected from the timber-framed longhouses but from the large pit (Table 5). Except for four stone tools, no other context was provided for this site in general or for this radiocarbon date in particular. Such house constructions are different from those on tells, which are generally linked to the Vinča influence and appear in the eastern zone. However, house constructions of a similar type appear in the western LBK and later Lengyel traditions, and are present at settlements in the Baranya region, complemented by pottery styles and the rest of the assembly.

All six dates from Dubovo – Košno site (Figure 1: 11) are a more significant problem because the context which the samples came from is not known (it is impossible to verify the position and exact stratigraphic units) as detailed plan and/or description is missing (c.f. plan Marijan 2006: 44, Fig. 2). Sparse pottery finds published seem similar to Ražište style as defined for the area around Đakovo and not the classical Sopot style (Marijan 2006; Marković Botić 2008; Botić and Boras 2021). House constructions seem to follow the same timber framed pattern as the two previously mentioned sites (cf. Marijan 2006; 2007). More importantly, radiocarbon measurements were performed on charcoal samples, two of which were exposed to ground waters (Table 5). For the moment, Vinkovci – Zablaće and Kruševica – Njivice dates may still prove to be the missing link with the early Vinča B phase (Jakucs and Voicsek 2017) in the eastern zone, but we will have to wait for the detailed processing and publication of all the archaeological finds from these two sites. Dubovo – Košno dates have too high an error to be of further use (Table 5), and charcoal samples will have to be replaced by short-lived samples; new dates will have to be published with full details of the context if they will be further used for dating the beginning of the micro-regional Late Neolithic, especially the Sopot style in the Eastern Slavonia. One more date should be excluded from further dating of the Late Neolithic, from the Kneževi Vinogradi – Osnovna škola (Elementary School) site (Table 5). Not only is the error too high, but the human remains dated come from a mixed context (Šimić 2012: 212) and may well belong to the previous Early Neolithic Starčevo context.

Two dates from the eponym Sopot site (Figure 1: 8) also diverge from the rest. House SU 11 was dated to the Sopot III/IV phases by two radiocarbon dates and the context (Krznarić Škrivanko 2011; 2015; Botić 2017: 225), but sample Z-2826 yielded a much older date (Table 5). The second date has the same problem: house floor SU 183a is dated to the Sopot II phase by one AMS date (Beta 230033; Krznarić Škrivanko 2011: 214, Tab. 3; Botić 2017: 226) and the context, however, the sample Z-3868 yielded older result. Once again, results of radiocarbon measurements on charcoal samples exhibit too high errors for further use.

Two published dates for the central zone are older as well. One of the dates from Nova Gradiška – Slavča (Table 5), according to the principal investigator, dates the context (channel SU 37A) in the Brezovljani style (Mihaljević 2013: 78, 101, Fig. 16), while adjacent pit SU 37 was dated to the Sopot II/III phase (Z-3234) (cf. Mihaljević 2006: 33; 2013: 76–79, 101; transition phase Sopot II/III corresponds to the end of the Brezovljani style; after Dimitrijević 1979: 334). However, channel SU 37A is at least 400 y older according to this single date which may be the result of the sampling strategy. If the result of this radiocarbon measurement can be confirmed by short-lived samples in the future, this would be the oldest dated Brezovljani phase.

The second older date for the central zone is that from the Radovanci site (Figure 1: 21). At this site, archaeological material was collected after the illegal excavation of the house basement; pottery attributed to the Sopot style was reportedly found in the closed context with the skeleton (Balen and Potrebica 2006: 25) which was sampled for radiocarbon dating (Table 5). Published pottery finds have more in common with the Brezovljani style, i.e. material is closer to that which occurs west and north of this site (Gornji Brezovljani, Špišić Bukovica, Pepelana etc.) (Balen and Potrebica 2006: 24); it is also similar to that in the western Transdanubian Lengyel tradition (c.f. Barna 2017) although some elements of its decoration and technology of production may have some points in common with the Ražište style which appears on the sites geographically relatively close by somewhat earlier. It is quite clearly different from the classical Sopot pottery finds in the eastern zone. If the human remains dated come indeed from the same context as the pottery finds, this is the oldest dated Brezovljani context in the interfluve.

Site	Lab code	Material and context	14C age BP	Method	Literature
Dubovo – Košno	Z-3439	charcoal sample 221 (SU 318, sq. I/48); no other context	6870 ± 115		Obelić et al. 2011: 396
	Z-2973	charcoal sample 214 from pit-dwelling SU 148, sq. F-38, western part; no other context	6530 ± 100		Obelić et al. 2002: 620; 2004: 252, Tab. 1; Marijan 2001: 44, note 12; 2006: 48
	Z-3046	charcoal sample, SJU 308, sq. H-49d, PU 228; no other context	6380 ± 100		
	Z-2969	charcoal mixed with soil and exposed to the groundwater, PU 152, pit SU 160, sq. H-38; no other context	6270 ± 140		
	Z-3045	charcoal sample, SU 1804, sq. Z-43d, PU 339; no other context	6320 ± 100		Obelić et al. 2002: 620; 2004: 252, Tab. 1; Marijan 2001: 44, note 12; 2006: 48–49
	Z-2998	charcoal sample exposed to the groundwater from pit-dwelling SU 1144, sq. R-38/39; no other context	6220 ± 100		
Kneževi vinogradi – Osnovna škola (Elementary School)	Z-3386	human bone (femur); no direct finds, mixed Starčevo/Sopot context at the same depth in the rest of the pit	6350 ± 135		Obelić et al. 2011: 400; Šimić 2012: 212
Kruševica – Njivice	Z-3595	charcoal, sq. N24, SU 314, half pit-dwelling; no other context	6115 ± 60		Obelić et al. 2011: 400; Miklik-Lozuk 2014: 56
Nova Gradiška – Slavča	Beta 278784	charcoal, SU 37A, channel; pottery finds	6310 ± 40	AMS	Mihaljević 2013a: 78, 180, Tab. 31
Radovanci	OxA-23499	human bone; material collected, mixed context, Sopot pottery reported next to the skeleton	6229 ± 34	AMS	Perić 2012: 22; Balen and Potrebica 2006; Balen and Čataj 2014: 68
Vinkovci – Sopot	Z-2826	charcoal sample, fragment of a wooden construction / support of the house SU 11 wall, sq. I/6, depth 2.11 m	6340 ± 100		Obelić et al. 2002: 618; Krznarić Škrivanko 2011: 211, 220, Tab. 1
	Z-3868	charcoal sample, house floor SU 283a, sq. K/30/04	6295 ± 135		Krznarić Škrivanko 2011: 211, 220, Tab. 1
Vinkovci – Zablaće	DeA-11612	Grave 1, tooth (male 35–50 yr); Probe II, no other context	6299 ± 36	AMS	Krznarić Škrivanko 2020: Tab. 1
	DeA-11613	Grave 2, tooth (child 0–5 yr); Probe II, burial in the large wooden post hole, no other context	6310 ± 36	AMS	
	DeA-11614	Grave 3, tooth (female 35–50 yr); Probe II, no other context	6223 ± 33	AMS	
	DeA-23705	animal tooth; pit-dwelling SU 69/70, no other context	6248 ± 42	AMS	

Table 5 *Radiocarbon dates that deviate from most Late Neolihic results.*

Regarding the end of the micro-regional Late Neolithic, it was pointed out (Burić 2015; Botić 2016a) that it overlaps with the beginning of the Eneolithic, namely Lasinja culture at the end of the 5th millennium BC. Period between 4300 and 4000/3900 BC was dated on several sites: Otok – Mandekov Vinograd (Z-2762, charcoal, 5330 ± 120 BP; Z-2913, burned seeds of Triticum aestivum L., 5555 ± 120 BP – Obelić et al. 2002: 611; 2004: 252, Tab. 1), Osijek – Hermanov vinograd (Z-2830, charcoal, 5260 ± 120 BP – Šimić 2000: 228; Obelić et al. 2002: 610; 2004: 252, Tab. 1), Čepin – Ovčara/Tursko groblje (Z-3263, charcoal, 5500 ± 90 BP – Šimić 2004: 59; Obelić et al. 2011: 396), Nova Gradiška – Slavča (Beta 278786, AMS, charcoal, 5290 ± 40 BP; Beta 303974, AMS, charcoal, 5430 ± 40 BP – Mihaljević 2013: 180, Tab. 3), and Vinkovci – Sopot (Z-2754, charcoal, 5360 ± 130 BP; Z-2909, charcoal, 5220 ± 100 BP; Z-2911, charcoal, 5330 ± 90 BP; Z-2827, charcoal, 5380 ± 98 BP – Obelić et al. 2002: 617–618; 2004: 252, Tab. 1; Z-3866, charcoal, 5415 ± 195 BP; Beta 230030, AMS, charcoal, 5300 ± 40 BP – Krznarić Škrivanko 2011: 214–215, Tab. 3). Most of these dates have too high an error to be considered for modelling but several AMS dates confirm the occupation of these sites well into the micro-regional Eneolithic. There is a fair amount of radiocarbon dates for a somewhat older period (4500–4300 BC) as well.

The settlement at the Bršadin site was recently dated by 11 AMS dates (Botić 2020b), with the youngest contexts dated before 4600 BC (Figure 5). However, this site underwent severe alterations in unknown period(s);; there are indications of tell mound levelling. Consequently, the topmost structures were damaged and were not dated. It is possible that the occupation of this site continued into the second half of the 5th millennium. The foundation of explored part of this settlement occurred after 4900 BC (Figure 5) (Botić 2020b). Another very recently excavated Late Neolithic settlement, at Ilok – Ađanski Kraj/Krstbajer position (Figure 1: 1), exhibits late Vič D period elements in pottery assembly, very similar to Vinča eponym site (cf. Borić 2015: 167, Fig. 5; Tasić et al. 2016a: 14, Fig. 10; Whittle et al. 2016: 5, Fig. 3). Both of these settlements were most probably founded at the same time as the settlement at Bapska although Bršadin dates are for the moment partially older (Figures 5–6) and there are no dates yet for the Ilok site.

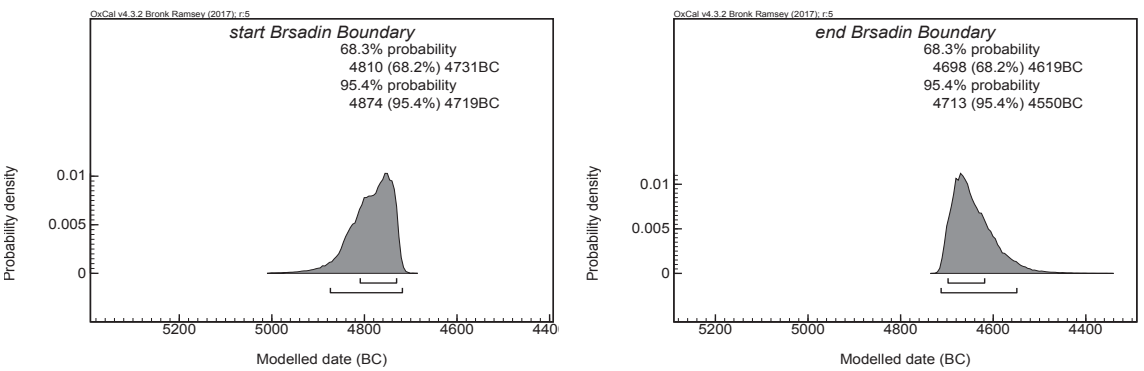

Figure 5. *Start and end boundary for the Bršadin – Pašnjak pod selom site (11 AMS dates).*

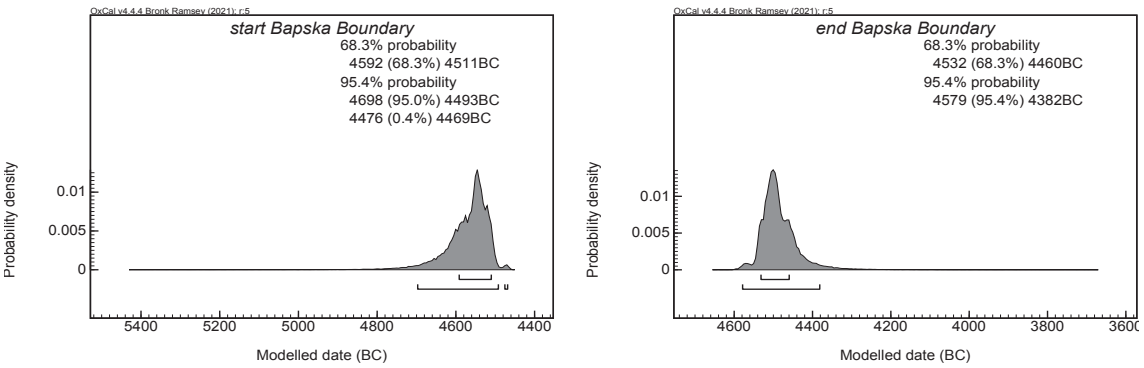

Figure 6. *Start and end boundary for the Bapska – Gradac site (5 AMS dates).*

Discussion

The complexity of the Middle and Late Neolithic in the Sava-Drava-Danube interfluve reflects a similar situation in adjacent regions north of the Drava River and in the Danube River basin. As already mentioned, sometime during the 54th century BC rapid changes seem to have occurred, which is reflected in appearance of diverse pottery styles and coexistence on various sites in the Sava-Drava-Danube interfluve central zone and in Baranya County (Jakucs et al. 2016). These styles (LBK, early Vinča, Ražište, and Korenovo) do not only differ in surface decoration, but the tempering, firing, surface treatment, and vessel forms have their own micro-regional or site-by-site variants; traditions transferred from the Early Neolithic Starčevo style vary as well.

At the same time, timber-framed longhouses appear both in the Drava and the Sava river valleys. From that time until the end of the Neolithic, micro-regional diversity continues. Classical Sopot style, as defined by S. Dimitrijević, occurs in the eastern zone. However, it is still not entirely clear when and where Vinča style appeared there, although newly excavated site Vinkovci – Zablaće may at least partially answer this question; radiocarbon dates point to the period of Vinča B (cf. Whittle et al. 2016) but older phase of the settlement can be expected as the child in the Grave 2 was buried in a hole left by a large wooden post, most probably the remain of a large longhouse (Krznarić Škrivanko 2020: 135, Fig. 8). Complex situation at this site is also demonstrated by the contents of one larger cylindrical pit with three whole vessels left at its bottom (Krznarić Škrivanko 2020: 133, Fig. 6). Description of these vessels was not published but we had the opportunity to examine them at the Vinkovci Town Museum; one of the vessels is biconical with incised arched motifs in the upper segment (similar to Ražište style), the other has a linear motif executed in double dashed lines, in a Stichbandkeramik tradition while the third was undecorated. Parallels for the Stichband decoration cannot be found in the close vicinity, only in the central Europe at the moment (see Zápotocká 2007: 203, Abb. 3, especially no. 13 as the closest parallel). Vinkovci – Zablaće vessel form suggests the early Stichbandkeramik phase. However, Zápotocká states that it only spreads in its 3rd phase. The exact position and orientation of this pit and its full context were not published. Both decorated vessels had dark, finely executed, unpolished surfaces. The third vessel was coarser. Earlier discovered Grave 3 from Vinkovci contained two early Vinča vessels (Burić and Težak-Gregl 2010); however, they do not match the early Vinča (Vinča A) vessels at Szederkény-Kukorica-dülö and other sites around it (cf. Jakucs et al. 2016; Jakucs and Voicsek 2016; Whittle et al. 2016). They match early Vinča assembly from Vinča – Belo Brdo site (Borić 2015; Tasić et al. 2016a), which is dated somewhat later than the Baranya County finds. They also point to the micro-regional classical Sopot development later on. The fact that these vessels were found in the same context as the late Starčevo pottery (Spiraloid B after Dimitrijević) is not surprising; as mentioned before, an amalgamation of pottery styles in the same contexts is quite common in that transition period from the Early to the Middle Neolithic. Unfortunately, this grave context was not radiocarbon dated.

The beginning of the Late Neolithic in the eastern zone with fully developed classical Sopot style can be dated to the period around 5000 BC and later. Already mentioned problems with uneven distribution of radiocarbon dates and lack of full contexts prevent the development of full chronology of this micro-region, but it can be observed that most of the dates span between 5000 and 4400 BC (Figure 7). Most dates diverging from that period, whether older or younger, should be re-examined or re-dated before considering them for further dating of the beginning or the end of the Late Neolithic. Regional absolute chronology based on these problematic dates was published by Obelić et al. in 2004. We advise taking the results from this study with caution.

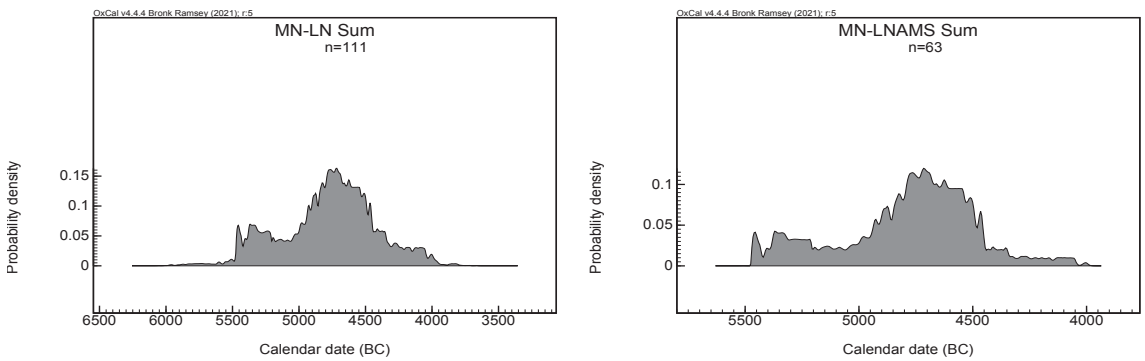

Figure 7. *Sums of radiocarbon dates for the Middle – Late Neolithic period in the Sava-Drava-Danube interfluve (northern Croatia) (left: all radiocarbon dates, right: AMS dates).*

Rašište style seems to first appear in the central zone (so far well attested in its northern and eastern part), followed by the Brezovljani style, while in the western zone, Brezovljani style succeeded the Korenovo style. This simplified relative chronology is not the best view on the problem: recent excavations around Nova Gradiška, Novska and Pakrac, i.e. central and western region border zone (namely its southern and south-western part), yielded mixed context finds (late Korenovo, Brezovljani, Ražište elements) that are primarily described as Sopot but may well represent a regional amalgamation of styles, as seen in the Drava River valley, and their transformation, especially from the 5000 BC onwards (e.g. Mihaljević 2010: 115; Nodilo 2013: 176; 2014: 60, 61, cat. nos. 154, 161–163; Ivanković 2013: 173; 2014: 58). Lack of radiocarbon dates and publication of pottery assembly for most of these contexts prevents building this micro-regional chronology for the moment.

Z. Marković determined Ražište as a variant of the Sopot culture in 1985; its relative chronology was linked to the Sopot I-B and later, after the excavations at Novi Perkovci – Krčavina site (Figure 1: 13), to the Sopot I phase (Marković 2012). After the new excavations and the first series of radiocarbon dates from Podgorač – Ražište, Golinci – Selište and Donji Miholjac – Vrancari sites (Botić 2021) south of the Drava River, and Szederkény-Kukorica-dülö, Szemely-Irtás and other sites north of the Drava River in the Baranya County, the chronology of Ražište style is quite different. North of the Drava River, this style appears along the early Vinča (A), early LBK and Korenovo styles, and it is predominant in the western part of the settlement in Szederkény-Kukorica-dülö, while in the eastern part of this settlement, with predominant Vinča (A) style, it appears along early Vinča, early LBK and Biňa-Bicske styles (Jakucs 2021: Fig. 16). The beginning of both eastern and western parts of this settlement was dated to the period following 5350 BC (Jakucs et al. 2016; Jakucs 2021). The end of both settlement parts at Szederkény is dated to the period predating 5150 BC. The continuity of Ražište style is dated at the Szemely-Irtás site into the 5th millennium BC (Vinča B2/C1 – Jakucs 2021: 138). The same situation is observed south of the Drava River, where the oldest dates and pottery finds appear almost at the same time as in Szederkény-Kukorica-dülö while the younger phase, after 5000 BC, is observed in the region around Đakovo and most probably further south. As mentioned before, sites with Ražište style appear around Đakovo along the sites where only classical Sopot-style material was reported and/or could be verified, which poses the question about their chronological relations. There are no Ražište style finds further east for the moment.

Such early dating of Ražište style, its decorative and technological elements, and its geographic distribution suggest its appearance as a local 'product' of the early LBK and early Vinča (A) contacts with limited Early Neolithic Starčevo technological traditions. Therefore, this style should not be considered a variant of the classical Sopot or even its earliest phase. Differences in vessel shapes, tempering, firing and surface treatment between these two styles are too great to be further considered tightly connected. Both, however, appear in the Late Neolithic (most of the 5th millennium BC) along several other styles and traditions which share some of the same elements, such as red-painted motifs, albeit with different intensity and technology. A recently published paper on Sopot chronology in the Sava-Drava-Danube interfluve by Šošić Klindžić et al. (2019) does not take into consideration this diversity of traditions between Ražište and classical Sopot styles. This paper should as well be taken with extreme caution when discussing the Late Neolithic chronology of the interfluve. The same problem occurs with some older papers (e.g. Sraka 2012). On the other hand, Transdanubian regional differences were already noted by Regenye in 2002; they are linked to the regional differences south of the Drava River, namely classical Sopot in eastern Slavonia and the Brezovljani style in the west. The map presented in this paper draws the separation line between these two Late Neolithic styles from Donji Miholjac in the Drava region, down the Požega Valley, to the area around Nova Gradiška. This is precisely where we see first the development of the Ražište style followed by the emergence of the Brezovljani style. Discussion about the Sopot variants in this paper should be disregarded. This paper also rightly connects the Brezovljani style with the Western Transdanubian Lengyel style, as they share most of the traits.

The Late Neolithic settlement foundation in the Danube River valley seems to have occurred at the beginning of the 5th millennium for a specific reason. Some indications that the environmental conditions may have played a role in this can be seen at the Bršadin site, where the settlement was founded on a very low Vuka River bank (tell Sopot was also founded on a low Bosut River bank at a very similar time, cf. Krznarić Škrivanko 2015). Radiocarbon sequence and most distinct finds were used to create the first preliminary composite chronology of the site (Botić 2020). The importance of building site-by-site chronolo-

gies before attempting to create a regional one and the methodology were described by Marić et al. (2021) and Diaconescu et al. (2020).

Other sites, such as Bapska – Gradac and Ilok – Ađanski Kraj/Krstbajer, appear in the Western Syrmia on elevated positions and are most probably contemporaneous with the Bršadin settlement. For the moment, Bršadin and Bapska sites are dated to Sopot III–IV/Vinča C–D/D periods (c. 4800–4500 BC). However, the difficulty in attributing finds to the Sopot or Vinča assembly is preventing us from drawing precise conclusions. Whittle et al. (2016) demonstrated difficulties in building and comparing regional chronologies of the Vinča culture. With some certainty, we can partially attribute some of the pottery finds from Bršadin to the short Milojčić's phase Vinča C–D and early Vinča D phase as described and dated by Borić (2015) and Tasić et al. (2016a; 2016b). Other pottery finds from the Ilok site can be similarly attributed, although some differences between these two sites exist.

Conclusions

The traditional approach to the Middle and Late Neolithic micro-regional chronology consisted of a short publication of the archaeological contexts with a list of radiocarbon dates. Despite a significant number of radiocarbon measurements performed in the last 20 years, there have been almost no attempts to build a site-by-site and, consequently, a local chronology through combining Bayesian modelling of radiocarbon dates with full statistical seriation of finds from individual sites. Although the beginning of the Neolithic in the Sava-Drava-Danube interfluve at the very beginning of the 6th millennium BC is fairly known (Botić 2016b), the transformation that occurred in the period following 5400 BC is only beginning to be understood, both south and north of the Drava River (Marković 1994; 2012; Horváth 2006; Jakucs and Voicsek 2016; 2017; Jakucs et al. 2016; 2018; Botić 2018; 2020a). This is a period of pottery styles diversification in the interfluve: early Vinča (A), early LBK and Ražište styles in the central zone (Podgorač – Ražište, Golinci – Selište, Donji Miholjac – Vrancari), and in the Baranya County (Szemely-Irtás, Szederkény-Kukorica-dülö, Versend-Gilencsa, Villány-Villányvirágos) where Korenovo elements appear in some of the same contexts; local LBK Korenovo style (Dimitrijević 1979; Težak-Gregl 1993) in the Moslavina-Bilogora region followed by Brezovljani style (Dimitrijević 1978; 1979), and classical Sopot style in the eastern zone with significant Vinča influence (Dimitrijević 1979; Burić 2011). The diversity between eastern and western zones is also seen in the house dimensions and structure; timber-framed longhouses appear in both the Drava and Sava River basins (Virovitica – Brekinja, Donji Miholjac – Vrancari, Kruševica – Njivice, Dubovo – Košno) with only one known site from the central area of the eastern zone (Vinkovci – Zablaće). In the eastern zone, on the other hand, tell settlements appear in the Late Neolithic with houses of smaller dimensions and very often with clay floors in wattle and daub house constructions. Flat settlements in the same zone follow the timber-framed longhouse model but are of smaller dimensions.

Regarding the absolute dating of these changes, over 100 radiocarbon dates have been collected from publications of the last 20 years. However, large majority were published without clear context or a full study. Not enough of these measurements were performed on short-lived samples. Further, there were attempts in the past to justify and date old typo-chronology periods (Obelić et al. 2004) or to use all available radiocarbon dates without taking into consideration micro-regional and temporal diversity, problems with samples and/or contexts listed here (Šošić Klindžić et al. 2019; Sraka 2012). At present, robust Middle and Late Neolithic chronology is still missing. However, there are indications about certain temporal occurrences, such as the beginning of the Middle Neolithic transformation in the Drava River valley, the appearance of the Late Neolithic along the Danube and the transformative period at the end of the 5th millennium BC. Building complete chronologies of several key sites and incorporating them into the micro-regional chronology would be a good start.

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