Problems of the Late Neolithic Absolute Chronology in Eastern Croatia
Marcel Buric

Abstract
Although the first systematic excavation of a Neolithic site in Croatia was completed almost 120 years ago, we still lack a clear picture of its absolute chronology. The Late Neolithic phase of the whole Eastern Croatia shares the same destiny. As an attempt to clarify the issue, several already published and some more recent regional absolute dates are presented and discussed in this paper. Despite those dates, the Late Neolithic chronology of the given area — embedded in recently available archaeological data for the Balkans — remains fairly vague.

Introduction
The most extensively excavated area in Croatian prehistory, particularly the area dated to the Neolithic period, belongs to the eastern parts of the country and in a wider cultural frame, to the Balkan or Southeast European Neolithic. At a number of sites we witness a habitation layer of the Starcevo culture in the Early and Middle Neolithic periods, while the Late Neolithic is marked by the Sopot culture: its cultural expression is represented by a local technique of dark-burnished pottery. The origin of the Sopot culture is closely related to the Vinca culture. It is considered as a post-Starcevo culture production strongly influenced by Vinca pottery.1

The first archaeological surveys as well as the first excavations in Croatia were carried out at sites of the Sopot culture during the 19th century,2 yet only a few of them yielded data that can be used in a modern archaeological science. Despite modern dating approaches, in which the accuracy and availability of the radiocarbon methods have been significantly increased, Eastern Croatia as a part of technological and cultural trends of Southeast European Late Neolithic still reflects vague cognition. The main reason for this situation is the low number of systematic research in which radiocarbon analysis has performed as a standard procedure. It is worth stressing that Eastern Croatia represents one of the western fringes of the tell-settlement phenomenon (Fig. 1), where one can find stratigraphic accumulations of the late Middle Neolithic and the Late Neolithic sequences (roughly, on an axis running from Polgar-Csöszhalom in northern Hungary, through Sopot, Sarvaš and Bapska in Croatia, Gomja Tuzla in northeastern Bosnia, down to Okolište in Central Bosnia). Except for the type site of Sopot, Croatia still does not have a tell excavation, which would provide a significant number of stratified absolute dates. This is primarily due to the fact that radiocarbon dating was not immediately accepted as a method by the majority of the scholars in Southeast Europe.3 This includes S. Dimitrijević as the main figure in past research on the Neolithic Period in Croatia.4 Also, there are no precise absolute chronological intrasite analyses, which would shed some light in that direction as well. Consequently, there are no chronological schemes relying on Bayesian modelling or other models that might fill the void in the chronological framework of Late Neolithic tell settlements in Croatia. The lack of absolute dates, unfortunately, is not only present in the case of tell settlements: almost the identical situation is visible in the earlier Neolithic period, prior to the formation of tells. There, compared to the number of excavated sites, we can also witness a low number of radiocarbon data. In the past the chronology of the Neolithic Period in Croatia founded solely upon pottery typology, archaeological surveys, and finds from other parts of the Balkans.5

2 Victor 1870; Celestin 1897.
4 However, he was the first Croatian archaeologist to use the radiocarbon method (Dimitrijević 1968, 92).
mainly through the work of S. Dimitrijević. Based upon pottery typology and artistic development of the Sopot culture, his sequence for the Late Neolithic was made at several key sites: Klokčevik, Otok, Sopot and Bapska. Therefore, some aspects of their chronology will be discussed in this text.

Briefly, the fact is that it is hard to reach any serious scientific conclusions about the relations between the Late Neolithic sites and their absolute chronology in Eastern Croatia, that is, of course, within the framework of modern archaeological science. Fragmented and short-term test excavations, which were the main methodological approach in the last 50 years (and in many cases still are), are partly the reason for the above situation. However, since Croatia’s independence in early 1990s, especially during the last decade, many rescue excavations have taken place in continental Croatia. A substantial number of them dealt with sites of the Neolithic and Copper Age periods. The excavations were triggered mainly by the construction of new highways (in Đakovo and Osijek area). Yet, then again, we note with regret that within the framework of this research there is only a relatively small number of \(^{14}C\) analyses, and even fewer analyses have been published to the present day. Furthermore, the majority of the dates were obtained by conventional radiometric \(^{14}C\) analysis instead of the Accelerator Mass Spectrometry (AMS) method. As will become visible from the data presented in the text following below, the standard deviation for results around ±100 years or more yields a longer time span of dates, which is no longer acceptable for an accurate chronology according to the current methodological standards in archaeology. Considering the fact that a substantial number of these dates were published locally and/or in Croatian, we will use this opportunity to present all of them here, regardless of the radiocarbon method by which they were obtained.

Flat settlements and tell sites of the Late Neolithic in Croatia with \(^{14}C\)-dates

Sopot (tell settlement)

The type-site of the most important and most widespread Late Neolithic culture in the conti-

nectional part of Croatia is Sopot, located on the outskirts of the town of Vinkovci. In the past twelve years (1996–2008) the site was systematically excavated by the Vinkovci Town Museum, giving us the greatest number of radiocarbon data from any single site in the Croatian Neolithic. Based on the \(^{14}C\) data, the time span of the excavated part of the settlement (376 m², on the southwest plateau of the site) is between 5050 and 4040 calBC (Tab. 1–2). According to the director of excavations, the radiocarbon results from the Sopot tell can be divided into three major groups (excluding the one belonging to the Early Neolithic Starčević group):

Group 1: The oldest dates from the settlement. The house marked SU 23 (SU stands for ‘stratigraphic unit’) would be the oldest one belonging to the Sopot culture on this site (5212–4711 calBC). The collapsed walls of this house are dated to 5212–4703 calBC (charcoal samples).

Group 2: The middle phase of the excavated settlement is dated to 4322–3798 and 4337–3982 calBC (several house floors and ditch fills).

Group 3 yielded dates ranging from 4443–3824 calBC. Attention must be drawn to two dates that originate from the same excavation unit (SU 183a): samples Z-3868 (6295 ± 135 BP) and Beta-230033 (5760 ± 40 BP), both on charcoal. As Krznarić Škrivanovk already pointed out, both samples differ considerably in radiocarbon age: 6295 ± 135 and 5760 ± 40. The youngest house from the Sopot tell excavated so far is the one labelled SU 11, with the date 4443–3980 calBC (Z-2827, see Tab. 1–2 for details).

The majority of the radiocarbon data from Sopot originates from wood (charcoal) samples; therefore, we must take a relatively high percentage of ‘old wood effect’ into account. Only four (Late Neolithic) dates are from human teeth (Beta-251913, Beta-251912, Beta-251908, Beta-251907).
Dubovo-Košno (flat settlement)

During the year 2000, a rescue excavation was conducted some 18 kilometres south of Sopot at the flat Late Neolithic settlement Dubovo-Košno. An area of 8575 m² was excavated. According to the results presented by the director of the excavation, the site is dated to phase I-B and phase II of the Sopot culture chronology. 17 Papers published on this excavation dealt mainly with the aspects of architecture and focus less on chronological topics. 18 However, the ceramic finds revealed an obvious and strong influence from the cultural sphere of Linearbandkeramik pottery, deriving from areas mainly west of Dubovo-Košno. 19 The contact zone of these two cultural groups, Sopot and Linearbandkeramik, has been a matter of dispute ever since the 1970s. The area of more intensive contact and mutual influence is still considered to be westwards in the Požeža Valley. 20

Five radiocarbon dates (Tab. 3) were analyzed on charcoal exclusively. 21

Otok-Mandekov vinograd (tell settlement)

The site Mandekov vinograd is near the village of Otok, 17 km southeast of Vinkovci. It is an ellipsoidal settlement bounded by a trench, with the dimensions of 155 × 115 m and a height of 4 m. 22 Samples of charcoal and grains were collected from there during the 1957 and 1970 excavation campaigns, but were submitted to radiocarbon analysis only just recently. 23 The first archaeological excavation in Otok was carried out in 1957 by Dimitrijević as part of his extensive study of Neolithic sites in eastern Croatia. His objective was to establish a vertical stratigraphic sequence of the area, which would serve as a yardstick for relative chronology. Several sites in the vicinity were also incorporated within this project, namely three different locations in Vinkovci as well as Otok. 24 The second excavation at Mandekov vinograd covered a small area of 100 m². This settlement had one of the best preserved wooden houses remains discovered so far in Croatia, 25 whose dimensions reached 10 × 6 m. 26 At the moment of excavation a house from the early phase II of the Sopot culture, clearly showed that “walls were made of horizontally deposited and stacked oak

<table>
<thead>
<tr>
<th>Lab.-No.</th>
<th>Sample type/Context</th>
<th>BP</th>
<th>calBC (2σ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-2752</td>
<td>Charcoal, house floor, 1.05–1.25 m depth</td>
<td>5675 ± 120</td>
<td>4796–4271</td>
</tr>
<tr>
<td>Z-2753</td>
<td>Charcoal, house floor, 1.05–1.25 m depth</td>
<td>5790 ± 125</td>
<td>4934–4368</td>
</tr>
<tr>
<td>Z-2754</td>
<td>Charcoal from house floor SU 11</td>
<td>5360 ± 130</td>
<td>4644–3824</td>
</tr>
<tr>
<td>Z-2826</td>
<td>Charcoal from house floor SU 11</td>
<td>6339 ± 99</td>
<td>5485–5056</td>
</tr>
<tr>
<td>Z-2827</td>
<td>Charcoal, house SU 11, 2.11 m depth</td>
<td>5380 ± 100</td>
<td>4443–3980</td>
</tr>
<tr>
<td>Z-2909</td>
<td>Charcoal, house SU 20, 2.11 m depth</td>
<td>5220 ± 100</td>
<td>4322–3798</td>
</tr>
<tr>
<td>Z-2911</td>
<td>Charcoal, house SU 20, 3.54–3.67 m depth</td>
<td>5330 ± 90</td>
<td>4337–3982</td>
</tr>
<tr>
<td>Z-3139</td>
<td>Charcoal, house SU 23, 3.89–3.99 m depth</td>
<td>6020 ± 100</td>
<td>5212–4711</td>
</tr>
<tr>
<td>Z-3140</td>
<td>Charcoal, house SU 23, 2.74 m depth</td>
<td>6010 ± 100</td>
<td>5212–4703</td>
</tr>
<tr>
<td>Z-3141</td>
<td>Charcoal, house 23, context SU 6, 2.74 m depth</td>
<td>5960 ± 100</td>
<td>5206–4586</td>
</tr>
<tr>
<td>Z-3143</td>
<td>Charcoal, from SU 53 (levelling of the house SU 20), 3.58–3.99 m depth</td>
<td>5840 ± 100</td>
<td>4941–4646</td>
</tr>
<tr>
<td>Z-3866</td>
<td>Charcoal, burnt wooden beams, SU 332</td>
<td>5415 ± 195</td>
<td>4689–3800</td>
</tr>
<tr>
<td>Z-3867</td>
<td>Charcoal, house SU 55/53</td>
<td>5715 ± 155</td>
<td>4947–4260</td>
</tr>
<tr>
<td>Z-3868</td>
<td>Charcoal, house floor SU 183a</td>
<td>6295 ± 135</td>
<td>5521–4933</td>
</tr>
<tr>
<td>Z-3869</td>
<td>Charcoal, house floor SU 207</td>
<td>5900 ± 75</td>
<td>4960–4559</td>
</tr>
</tbody>
</table>

* Descriptions of the samples are given here as in the original publication.

Table 1. Sopot, conventional radiometric dates (Obelić et al. 2004, 252; Krznarić-Škrivanko 2011, 211-212). All dates are calibrated according to OxCal v4.2.3 (Bronk Ramsey 2013) and are given in the 2σ-interval with 95.4% probability.

<table>
<thead>
<tr>
<th>Lab.-No.</th>
<th>Sample type/Context</th>
<th>BP</th>
<th>δ¹³C</th>
<th>calBC (2σ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta-230033</td>
<td>Charcoal, house floor SU 183a (compare with Z-3868)</td>
<td>5760 ± 40</td>
<td>5760 ± 40</td>
<td>4710–4505</td>
</tr>
<tr>
<td>Beta-230031</td>
<td>Charcoal, house floor SU 301, the same layer as 183a</td>
<td>5780 ± 40</td>
<td>5780 ± 40</td>
<td>4722–4534</td>
</tr>
<tr>
<td>Beta-251912</td>
<td>Tooth, house floor of SU 255</td>
<td>5860 ± 50</td>
<td>−19.9%</td>
<td>4843–4585</td>
</tr>
<tr>
<td>Beta-251908</td>
<td>Tooth, house floor of SU 403</td>
<td>5840 ± 50</td>
<td>−20.5%</td>
<td>4826–4552</td>
</tr>
<tr>
<td>Beta-251919</td>
<td>Pit-dwelling, tooth</td>
<td>7100 ± 50</td>
<td>−20.5%</td>
<td>6065–5886</td>
</tr>
</tbody>
</table>

Table 2. Sopot, AMS dates (Krznarić-Škrivanko 2011, 211–212).

<table>
<thead>
<tr>
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<th>BP</th>
<th>cal BC (2σ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-2969</td>
<td>Charcoal, sample no. 152 pit SU 160</td>
<td>6270 ± 140</td>
<td>5489–4851</td>
</tr>
<tr>
<td>Z-2973</td>
<td>Charcoal, sample no. 214 SU 148</td>
<td>6530 ± 100</td>
<td>5638–5314</td>
</tr>
<tr>
<td>Z-2998</td>
<td>Charcoal, sample no. SU 1144</td>
<td>6220 ± 100</td>
<td>5465–4911</td>
</tr>
<tr>
<td>Z-3045</td>
<td>Charcoal, SU 1804</td>
<td>6320 ± 100</td>
<td>5481–5046</td>
</tr>
<tr>
<td>Z-3046</td>
<td>Charcoal, SU 308</td>
<td>6380 ± 100</td>
<td>5533–5075</td>
</tr>
</tbody>
</table>

Table 3. Dubovo-Košno dates (Obelić et al. 2004, 252).
Table 4. Otok, Mandekov vinograd (Obelić et al. 2004, 252).

<table>
<thead>
<tr>
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<th>calBC (2σ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-2761</td>
<td>Grain from ceramic pot, 0.70–0.80 m depth (Sopot III phase)</td>
<td>5650 ± 120</td>
<td>4782–4265</td>
</tr>
<tr>
<td>Z-2762</td>
<td>Charcoal, depth 0.77 (Sopot III phase)</td>
<td>5330 ± 120</td>
<td>4447–3824</td>
</tr>
<tr>
<td>Z-2913</td>
<td>Grain (Triticum aestivum L. Thell. Sp. Vulgare Vill MK) from ceramic pot, 0.70–0.80 m depth (Sopot III phase)</td>
<td>5555 ± 120</td>
<td>4690–4071</td>
</tr>
</tbody>
</table>

Table 5. Privlaka-Gradina (Obelić et al. 2004, 252).

<table>
<thead>
<tr>
<th>Lab.-No.</th>
<th>Sample type/Context</th>
<th>BP</th>
<th>calBC (2σ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-727</td>
<td>Charcoal, burnt wooden beam from house floor</td>
<td>6030 ± 100</td>
<td>5214–4716</td>
</tr>
<tr>
<td>Z-728</td>
<td>Seeds, in layer, 1.7 m below floor of the burnt house</td>
<td>5700 ± 80</td>
<td>4713–4367</td>
</tr>
</tbody>
</table>

Table 6. Herrmannov vinograd (Obelić et al. 2004, 252).

<table>
<thead>
<tr>
<th>Lab.-No.</th>
<th>Sample type/Context</th>
<th>BP</th>
<th>calBC (2σ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-2830</td>
<td>Charcoal from fireplace, 1.80–2.00 m depth</td>
<td>5260 ± 120</td>
<td>4341–3800</td>
</tr>
<tr>
<td>Z-2831</td>
<td>Grave, human bone, 1.90 m depth (excavation 1998, Šimić 2006, 41)</td>
<td>5650 ± 100</td>
<td>4720–4331</td>
</tr>
</tbody>
</table>

Herrmannov vinograd (tell settlement)\(^{31}\)

One of the few sites in this region at which several excavations have been undertaken is Herrmannov vinograd, today the western part of the town of Osijek. In fact, this site was the first prehistoric site ever excavated in Croatia (1897). Publication of the finds followed in the same year (\(^{7}\)). Out of the site’s total area of approx. 12,018 m², about 800 m² were excavated during the first excavation campaign.\(^{32}\) A century later three more excavations followed in 1998, 2007 and 2012. Based on the observations of the finds from the late 19\(^{th}\) century diggings, some fifty years later Dimitrijević reconstructed two main building horizons on the site, which belonged in the middle (Sopot II) and late (Sopot III) phases of the culture.\(^{33}\)

More recent work was carried out by the Museum of Slavonia (Osijek) during two short rescue excavations.\(^{34}\) So far without published stratigraphic data, rescue excavations have revealed two building levels that correlate with the Sopot II and Sopot III horizons, confirming Dimitrijević’s previous works.\(^{35}\) The rescue excavations carried out in 1998 included the northeastern part of the settlement (90 × 7 m), but only a small part of finds have been processed and published so far.\(^{36}\)

In the 1998 campaign the grave of a female (25–30 years of age) in contracted position was discovered (at the relative depth of 1.9 metres). Samples were processed in Zagreb radiocarbon laboratory, dating it to the late fifth and early fourth millennium BC (sample Z-2830, see Table 6).\(^{37}\) No other details were presented about any other finds within or around this context, as well as the other stratigraphic or relative depth data.

For the second sample (Z-2831, on charcoal) from the same excavations, there is a problem with the place of its origin. The excavator of the site (J. Šimić) published this sample as a piece of wood from a waste pit,\(^{38}\) while the sample under

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\(^{27}\) Dimitrijević 1959; Dimitrijević 1968; Dimitrijević 1979a.

\(^{28}\) English: ‘hillfort’.

\(^{29}\) Dimitrijević 1959; Dimitrijević 1968; Dimitrijević 1979a.

\(^{30}\) Obelić et al. 2004, 252; Dimitrijević 1979a.

\(^{31}\) Herrmannov vinograd (‘Herrmann’s vineyard’) is the old name of the site, which is used in the majority of published works, including the ones written by Dimitrijević. In recent reports the name ‘Filipovica’ has been used more frequently.

\(^{32}\) Celestin 1897.

\(^{33}\) Dimitrijević 1968, 27.

\(^{34}\) During the preparation of this text further rescue excavations at the site took place (the last excavations so far ended during late summer 2013). The results have not been published yet, but the excavation trenches were with only 50 m² again very limited in size (Rajković, in press). Several \(^{14}C\) dates from this site will be available soon.

\(^{35}\) Obelić et al. 2004, 251.


\(^{37}\) Šimić 2008, 7; Obelić et al. 2004, 252.

\(^{38}\) Šimić 2006, 41.
the same code number in a text published two years later was referred to as a part of a fire-
place. Again, dates were only given within a range.

Another rescue excavation took place in 2007. The dimensions of the trench were 115 × 1 me-
tres. Due to its specific dimensions, a number of different habitation features were discovered, but without a single closed context. Also no \(^{14}C\) data from 2007 and 2011 campaigns have been published. The authors of the 1998–2007 excavations date the settlement in Herrmannov vinograd “from the mid-5\(^{th}\) Millennium BCE to the first half of the 4\(^{th}\) Millennium BCE”. Despite several different excavations and the impor-
tance of Herrmannov vinograd, the material was not systematically published.

Čepin-Tursko groblje (tell settlement)
A site that was excavated in a rescue project that lasted for ten years is Čepin. Situated on a slightly elevated oval plateau, a few kilometres southwest of Osijek and Herrmannov vinograd, the site was damaged by a medieval building and the adjoining graveyard dated to the 11\(^{th}\) and 12\(^{th}\) century AD. Until recently the site was located exactly at the edge of a large swamp, a landscape that once surrounded many Neolithic tells in the area. The prehistoric layers con-
sisted of the Sopot culture starting from the “early to late phases”, each containing two Late Neolithic houses. The site is divided into two building horizons, but the classification was based on one pit, which was characterized by the author of the excavations as a “pit-dwelling”, and one rectangular house with a wood-
en floor. The only two dates from this site were obtained from charcoal (Tab. 7); they are related to features mentioned above. A sample from the younger floor was dated to 5500 ± 90 BP (Z-3263), while “from the older level of the site, a part of a big pit-dwelling with the remains of rounded (wooden) pillars were discovered […] The age of wooden charcoal from this level is 5900 ± 90 BP, Z-3264”. None of the houses at the site were excavated to its full extent.

<table>
<thead>
<tr>
<th>Lab.-No.</th>
<th>Sample type/Context</th>
<th>BP</th>
<th>calBC (2σ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-3263</td>
<td>Charcoal from house floor, younger level</td>
<td>5500 ± 90</td>
<td>4537–4070</td>
</tr>
<tr>
<td>Z-3264</td>
<td>“Pit-dwelling”, charcoal from a wooden pillar</td>
<td>5900 ± 90</td>
<td>4996–4547</td>
</tr>
</tbody>
</table>

Table 7. Čepin-Tursko groblje (Šimić 2006, 41).

Several finds place Čepin in a special category as far as the Croatian Neolithic is concerned. The first find is likely a hoard made up of 460 pieces of Spondylus and Dentalium shells. The majority of the finds were found placed in one large shell: it contained rectangular, round, oval and cylindrically shaped Spondylus artefacts (72 pieces) and more than four hundred small cyl-
drically artefacts of Dentalium. This is the largest number of worked Spondylus discovered so far in Croatia. However, there is no further data about this find, except that it originates “near the house from the younger phase of Sopot culture, in whose vicinity more bracelet fragments and one rectangular pendant were discovered too”. Further, a piece of copper was reportedly discovered at the site, but we did not manage to find it in the field documentation, nor in the official reports or in the museum’s depository. It is worth mentioning that metal finds were record-
ced at two other sites: Staro Valpovo, (north-west of Osijek) and Kneževi Vinogradi (northeast of Osijek). If they were stratigraphically cor-
text, this would be the oldest metal objects discovered in Croatia so far. The entire ensemble of metals has never been published; they were only mentioned in preliminary reports in as much as one sentence. Also none of the compositional analyses were performed nor is any other information on them available, except that all three finds were in a very bad condition.

Kneževi Vinogradi–Osnovna škola
(tell settlement)
Located just below the south slopes of Banovo brdo hill, on an elevated position in Croatian part of the Baranya County, is the present-day village

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40 Šimić 2008, 8, 18.
41 Šimić 2008, 19.
42 Another name used for this site in Croatian literature is ‘Ovčara/Tursko groblje’.
43 Šimić 2012, 92.
44 Šimić 2006, 41.
45 Šimić 2005, 7.
46 From its fill no data are available.
47 Šimić 2012, 98.
48 Šimić 2006, 41.
49 Šimić 2012, 98. Two more samples from Čepin were dated (Z-3750 and Z-3751), but they are not published yet.
50 Šimić 2012, 100.
52 Šimić 2007b, 10; Šimić 2012, 102.
53 For her great effort in searching we are grateful to D. Rajković, Museum of Slavonia in Osijek.
54 Šimić 2006, 42.
55 Kneževi Vinogradi: “A find of a few fragments of a very corroded copper items imply the existence of a very late Sopot culture life which stretches into the Early Copper Age of the area” (Šimić 2006, 42). Beliše, Staro Valpovo: “In one large pit, probably a pit-dwelling, a piece of heavily cor-
roded copper item was found. […] fragments of copper items were found during the 2003 rescue excavation in Kneževi Vinogradi, and also in Čepin” (Šimić 2007b, 10). The sentences above are all that was said about the first pieces of metal ever discovered in Croatia.
of Kneževi Vinogradi. In the village centre, right on the spot where the elementary school was built, a settlement belonging to middle and late phases of the Sopot culture was discovered. The first excavations took place between 1985 and 1987, but the finds and documentation were lost.\(^5\) They were probably completely destroyed during the recent war that followed the collapse of former Yugoslavia. In 2003 a rescue excavation covered the eastern and northeastern part of the Neolithic settlement. The investigated area showed a complete lack of any dwellings; only waste pits and the above-mentioned metal fragments were found. The finds have not been published until today.\(^5\) In a short introduction to this site published recently, it was stated that one grave of a male was excavated during that campaign. One radiocarbon sample was taken and analyzed, but no results have been published. It is only known that the "grave is dated between 5480 and 5200 calBC, thus belonging to an Early stage of the Sopot culture" (Tab. 8).\(^5\)

\(^5\) Only a very small group of finds is preserved in the Museum of Slavonia in Osijek (Šimić 2006, 42). The metal finds will be examined soon in Curt-Engelhorn-Zentrum Archäometrie gGmbH and the Archaeological Institute of the University in Tübingen.\(^5\) Šimić 2012, 212.

### Slavča (tell settlement)

A dominating hill in the small town of Nova Gradiska hides layers of several Neolithic and Eneolithic cultures, including the Sopot culture. Considering the fact that Slavča is a site settled in the area that covers the western part of the Sopot culture territory, it belongs to Dimitrijević’s regional Brezovljani type\(^6\) of its pottery production. A specificity of this site is a relatively higher number of red crusted pottery painting, which is a result of its close proximity to the Lengyel complex in Hungary.\(^6\) Nevertheless, it must be emphasized that red painting is a feature related to the late Sopot pottery in general (i.e. Sopot core area as well),\(^6\) and not only to the Brezovljani type. Moreover, red crusted decoration is also occurring in the latest levels of the Vinča culture at Belo Brdo.\(^6\)

The dates from the Beta-Analytic laboratory are AMS dates (Tab. 9).\(^6\)

### Krčavina-Nov Perkovci (flat settlement)

The settlement of Krčavina, situated six kilometres southwest of the town of Đakovo, falls into the group of recently excavated sites, although radiocarbon analysis did not reveal AMS dates. An area of over 18,000 m\(^2\) was investigated, but only two radiocarbon measurements were taken (Tab. 10). Among evidence of some later archaeological cultures, the site contained Starčevo and Sopot layers, just like in the case of Kneževi Vinogradi. The site is typologically dated in Sopot culture phases I-B–III according to Dimitrijević’s pottery typology.

### Ivandvor (flat settlement)

The site is located on an elevated position about 3.5 km west of the town of Đakovo. In the surrounding area more Sopot culture sites were discovered and processed in well performed and documented rescue digs. Based on radiocarbon dates, the time span for Ivandvor starts at 5195 and ends at 4353 calBC (Tab. 11); it is divided into two main chronological groups: the first at 5050–4780 calBC, and the second around 4730–4490 calBC. The groups may represent two separate settlements of the same culture, as also presumed for the recently excavated site Petrivente in Hungary. The pottery shows shapes...
that attest phases I-B and II according to Dimitrijević’s typology.⁶⁵

Ravnjaš (flat settlement)⁶⁶

The site of Ravnjaš, 20 km southwest of Slavča (Nova Gradiška), is also in an elevated position, about 165 m a.s.l. It has only been preliminarily excavated (2006–2008): Two test trenches were opened with sizes of 50 m² and 25 m². In the first trench was exposed a Late Neolithic house (SU 22), measuring 4 × 6 metres, with extensive house rubble, pottery shards and stone tools. From here stems the sample for date Beta-303976 at 5750 ± 40 BP. Right below this house in SU22 a pit came to light (SU 88, 89). A charcoal sample from it was also dated (Tab. 12). The two dates (Beta-303978 and Beta-303976) show that there is a possible continuity between pit and house around 4750–4650 calBC or a direct succession at c. 4700 calBC.

The second trench revealed one pit (SU 30) with diverse pottery types of very good quality, typologically dated to phase II by Dimitrijević.⁶⁹

Vidovci-Glogovi (flat settlement)⁶⁸

Situated some 30 km northeast of Slavča is another Sopot culture site, Vidovci-Glogovi.⁶⁹ It is in an elevated position above some modern, but presumably also old, water courses (Otinja River confluence). In 2009 a rescue excavation took place that covered an area of 8738 m². Most of the contexts belonged to pits dug into the virgin soil, so that heavy damage of the site is presumed. However, due to a very narrow trench, only 5 m wide, most of them were not completely excavated. The Sopot culture layers are dated to phases I and II of the Sopot culture chronology. All samples in Table 13 originate from the pits.⁷⁰

Bapska-Gradac (tell settlement)⁷¹

Bapska is a tell site positioned in the border area between the Sopot and the Vinča cultures, marking the most prominent known point of their contact zone. This fact puts the site into two special focal points: (1) as a place with continuous interaction between two very similar but different pottery styles (Sopot and Vinča), and (2) as an area that we consider to be the birthplace of the Sopot culture, taking into account its genetic origin in the Vinča culture.

The site lies on a natural loess elevation (188 m a.s.l.), which belongs to the first western slopes of Fruska Gora Mountain (Serbia). It occupies an area of approximately 35,000 m², but previous excavations in 1911, 1938 and 1964 included trenches not bigger than 5 × 5 metres each.⁷² A new excavation campaign started in 2007 and is still in progress. Cultural debris of ca. 5 m³ belongs mostly to the Sopot culture, while the upper two metres constitute the horizons of the late Vinča culture. The lowermost levels, according to V. Milošević, belong to the Starčevo culture.⁷⁴ however, in the 1964 excavation S. Dimitrijević denied any appearance of Starčevo shards.⁷⁵

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<table>
<thead>
<tr>
<th>Lab.-No.</th>
<th>Sample type/Context</th>
<th>BP</th>
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<th>calBC (2σ)</th>
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<tbody>
<tr>
<td>Beta-241649</td>
<td>tooth (SU 90)</td>
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<td>-25.2%</td>
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<td>charcoal (SU 30)</td>
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<td>charcoal (SU 88, 89)</td>
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<td>4669–4400</td>
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<td>charcoal (SU 51, 52)</td>
<td>6040 ± 40</td>
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<td>-24.3%</td>
<td>4837–4713</td>
</tr>
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<td>charcoal (SU 463, 464)</td>
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Today, a systematic excavation is focused on a 240-m² trench (B-G 06, B-G 11) situated in the northeastern corner of the tell. So far the depth reached is 1.8 metres in the south profile and only about one-half metre in the north profile. Two larger closed contexts have been discovered thus far, both houses. House 1, being directly in recent humus, has expectably been badly damaged; therefore only an approximate area where it was built was detected. Due to the destruction no clear features within the house were found.

House 2 was discovered along the west profile of the Trench B-G 06, belonging to the building horizon associated with the Vinča culture pottery. Two separate concentrations of burnt grain were found and dated (Beta-241657, Beta-333534), and one late Vinča C/D vessel was detected within the frame of the feature of Beta-333534 (Tab. 14). Also, two animal bones from the same building level (outside the houses) were dated (Beta-241659, OxA-23592). Several finds that are not typical for western Syrmia sites were found: one late Vinča type figurine, several fragments of Carpathian type obsidian (Prompt-gamma neutron activation analysis, or PGAA, forthcoming) and fragments of worked Spondylus shells, showing the upper layers of Bapska to be a typical Late Neolithic Tell Settlement.

Discussion

Judging by the still relatively modest amount of reliable absolute dates, we hold enough arguments to conclude that the time span of the Sopot culture in Croatia covers the end of the 6th millennium BC until the mid-5th millennium BC for the core area (eastern Slavonia, southern Baranya and western Syrmia). However, much has been written in literature about the synchronization of Dimitrijević’s pottery typology with radiocarbon data, but the attempts and arguments are still not firm or plausible. Dimitrijević’s model of the forming of the Sopot culture under the influence of Vinča is generally accepted, but it is highly questionable as to whether or not it is possible to synchronize his (or any) pottery typology with the sequence of the absolute dates.

One of the key elements for this unstable chronological picture is that the whole Sopot culture area was taken as a homogeneous space. Taking into account the aforementioned formation of the culture, which moved from the East (Serbia) towards the West (Croatia), Vinča influence therefore first appeared on the present eastern border of Croatia. That is where the first major Late Neolithic tell was settled (Bapska). The second important site is the still not excavated tell Bogdanovci, after which farther west Sopot was settled on the southern fringe of Vinkovci. The town of Vinkovci is of vital importance in defining the Sopot culture core area during its formative phase. Since the modern town lies practically on top of the tell settlement, from the numerous fragmented rescue excavations in last fifty years we are relatively familiar with its stratigraphy and cultural identity. However, the major-

76 Koznarč-Škrivančko 2011; Marijan 2007; Marković/Bollić 2008 (and others).
77 Dimitrijević 1968; Dimitrijević 1979a.
78 There were some rescue excavations carried out on a very small scale that have remained largely unpublished.
ity of the excavated material has so far remained unpublished.

During the 1977/1978 excavations at Vinkovci-Hotel, a child’s grave with early Vinča pottery was discovered in a site, at which Vinča or Sopot ceramics were completely absent. It is a position inhabited already by the late Starčevo population (Starčevo IV or Starčevo spiraloid phases), followed by Copper Age and Early Bronze Age layers. When considering the late Starčevo culture and its transition to the Sopot culture in the territory of Croatia, based on the “traditional method” of pottery typology, several aspects concerning vessel shapes are discernable: (1) modification of mainly widely used globular, early Neolithic shapes into biconical ones, typical for early Vinča; and (2) vessels were modelled into new shapes, but were still painted, tempered and burned in the traditional way.\(^{79}\) The aforementioned transition from local polychrome, we might even say “baroque” painted globular pottery\(^{80}\) to dark-polished, biconical shapes (attributable to the Vinča influences), was exceptionally documented at the site itself. The mentioned child burial, that is, closed and containing deposition inside the grave was highly expressive: Early Vinča vessels were placed one into another and carefully laid right next to the deceased’s head. Their special meaning was emphasized by the fact that they were completely preserved, while the finest Starčevo pottery was shattered into pieces and scattered under the skeleton.\(^{81}\) Unfortunately, apart from a few painted Starčevo fragments, one field drawing of the grave and the Vinča culture pottery (now displayed in the Vinkovci Museum), nothing else originating from this grave is preserved, including the bones, leaving no possibility to conduct radiocarbon dating. Nevertheless, similar “scenes” in graves have already been observed in several locations in Vinkovci (Pjeskana, Erevnica, Ulica Prvog maja):\(^{82}\) the spherical receptacles slowly transform to carinated forms. The Vinča vessels discovered in the centre of Vinkovci indicate that the bearers of the oldest Vinča culture pottery production reached this area first; the surrounding with the tells of Otok, Privlaka and Sopot on the other hand can be considered as subsequent well stratified early Sopot sites. The exchange between late Starčevo and early Vinča, reflected in the Vinkovci-Hotel grave no. 3, led to the formation of Sopot pottery. The same stratified early Sopot pottery is also found in Bapska, allowing the conclusion that the formative space of the Sopot culture, i.e. its core area, should be considered within the circle bordered by Bapska in the East and Vinkovci area in the West. The northern and southern points are to be located towards southern Hungary in the North and in eastern Bosanska Posavina in the South. The indication for an extended northerly direction is an early \(^{14}C\) date of the grave discovered in Kneževi Vinograd/Osnovna Škola (Tab. 8). However, as the Kneževi Vinograd excavation was very limited, resulting in one single \(^{14}C\) date, we will keep this issue open until further excavations are conducted at the site. Hence, for the time being, due to a lack of reliable data, the precise range of northern and southern extension of the core area is only poorly understood (Fig. 2). At least, this is what we may conclude from the published material.

Both sites with the latest Starčevo shapes in the Symnia region, Kudoš-Šašinci and Golokut-Vizić, are located near the modern Croatian-Serbian border and in the closest vicinity of Tell Bapska. Two radiocarbon dates derive therefrom, ranging roughly between 5600 and 5400 BC. These dates fit well to the general view for the end of the Starčevo culture,\(^{84}\) which just “reach” the earliest dates of the Vinča culture around 5400/5300 BC.\(^{85}\) Taking into account the above-mentioned dates collected from numerous sites, primarily from Serbian territory, the results from Dubovo-Košno (Tab. 3) raise founded suspicion. Here, the date Z-2973 is with 6530 ± 99 BP extre-

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\(^{79}\) Dimitrijević 1968, 54, 55.

\(^{80}\) Dimitrijević 1979a, PI. XII, 5.

\(^{81}\) Burić/Težak-Gregl 2010.

\(^{82}\) For the description of the circumstances during the find, we must thank to T. Težak-Gregl and A. Dumjan, who were at the site during the discovery.

\(^{83}\) It is important to stress that the various sites in Vinkovci are scattered locations but concentrated on a single tell.

\(^{84}\) Whittle et al. 2002, 2; Sekelj-Ivančan/Balen 2006, 24; Minichreiter/Krajcar-Bronić 2007, 12, 14.

\(^{85}\) Burić 2009, 203; 231; 233; 236.
When speaking about the Sopot culture chronology in general and of the phase Sopot I-A in particular, it must be stressed that it is known from only one or two sites, both excavated by Dimitrijević. Otok (Vinkovci area) and Klokočevik (in the vicinity of Slavonski Brod). 31 To be precise, in his monograph “Sopotoško-landelska kultura” Dimitrijević states that for the determination of the phase I-A he used the materials from two sites: Klokočevik (around 100 km from Bapska) and the “prehistoric humus” from the site Otok near Vinkovci. 32 Eleven years later, in “Pařistorija jugoslavenskih zemalja”, he emphasized that he used “solely Klokočevik site”—materials for the definition of the same phase. 33 Therefore, if we accept the opinion that dark-burnished pottery in Croatia originates from the influence of the Vintča culture, how could it be possible for the earliest phase of the Sopot culture to appear one hundred kilometres away from the westernmost Vintča site(s) even earlier?

The uncertainty in the chronological positioning of the earliest phase of the Late Neolithic in eastern Croatia is repeated in the developed stages, too. In modern research in Croatia, as we already pointed out, there is a crucial lack of absolute dates, especially those originating from closed contexts, as well as those from short-lived samples. There is only a minimum of stratified 14C sequences, which can be modelled in order to establish the chronology of Late Neolithic tells. It is therefore obvious that research on this particular period is right at the beginning, especially when combining complementary archaeological methods. Considering the above stated, at the moment there are no strong arguments that allow us to support Dimitrijević’s separation of the early stage of the Sopot culture in two sub-phases (I-A and I-B). The site(s) used for this separation are incompletely published, and they do not contain radiocarbon dates. The field documentation and drawings in the case of Klokočevik have been lost, 34 but it is known that excavation was carried out in one test trench of 5 x 1 m, reaching the depth of 2.8 m. 35 In recent publications Klokočevik is labelled as “tell-like site”, 36 but such limited excavation does not give us firm grounds for such a classification. The fact is that the pottery excavated in Klokočevik might originate from any phase of the Sopot culture, because the finds generally belong to the category of everyday use. Moreover, sites of the Sopot culture located in the relative vicinity of Klokočevik (Slavča, Ravnjaš, Vidovci) show pottery shapes that stretch through all three major

The oldest absolute dates from Belo Brdo gave results that are not older than 5450 calBC, which would be the oldest date also for many important sites of the Vintča culture (Belo Brdo, Divostin, Pločnik, Belovode etc.). 37 An attempt to synchronise the absolute dates with the pottery typology of the Sopot culture 38 resulted in the following scheme:

- Sopot phase I-A: ?
- Sopot phase I-B: 5480–5070 calBC
- Sopot phase II-A: 5030–4770 calBC
- Sopot phase II-B: 4800–4250 calBC
- Sopot phase III: 4340–3790 calBC

We would strongly disagree with the presented chronological scheme, especially concerning the early phases and absolute chronological positioning of the Sopot III phase.

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84 Balen et al. 2009, 34.
86 Obelić et al. 2004, 256 Fig. 6.
87 Schier 1996, Table 1; Borlić 2009, 234 Table 7.
89 Dimitrijević 1968, 31.
90 Dimitrijević 1979a, 274.
92 Dimitrijević 1968, 29.
93 Link 2008, 164.
chronological horizons of the Sopot culture.\textsuperscript{97} Looking at the late Sopot phases, Sopot III ends shortly after 4500 BC in the core area, along with the Vinča culture in the East. The Sopot communities continued West of the core area (that is, west of the Sopot tell) within the frame of the phase Sopot IV. But Sopot phase IV is, according to Marković,\textsuperscript{98} more or less integrated within the local early Copper Age groups.\textsuperscript{99} The tell in Bapska describes this chronological picture in detail; after Sopot III/Vinča D the site came under the control of the Baden culture population.\textsuperscript{100}

Therefore, let us go back to the problem of the core area. Whilst we know where its beginning in the East is, the western frontier remains less firm, but we may presume that it is situated in the wider Vinkovci area (Fig. 2). If we consider that the eastern part of Croatia shared the same destiny as northwestern Serbia, regarding the collapse of Late Neolithic societies, one or two very uncertain presumptions can be proposed. Bapska is a site which basically belongs to the Sopot culture. According to Schmidt, Milojičić and Dimitrijević, the tell includes in its cultural debris almost the complete sequence.\textsuperscript{101} By the end of the Sopot culture, and the Vinča culture as well, the site witnessed a substantial influx of Vinča population, which changed the site’s pottery tradition in the upper layers to Vinča types. The date of that influx must have been before 4500 BC, because radiocarbon dates show that at that precise time late Vinča (D2 phase) pottery was already in use in Bapska.\textsuperscript{102} Therefore, the transition in Bapska from the Sopot to the Vinča site at the time of late Vinča C/early Vinča D phase of Milojičić’s classification can also be understood as a result of rapid social changes that took place in the Middle Danube area at the time and which resulted with a collapse of local Neolithic phases. This moment in time would also probably mark the end of the phase Sopot III on the site. Numerous, if not all, Sopot culture sites west of Sopot, including Sopot itself, continued until sometime after 4400 BC. Keeping in mind the dates well after 4500 BC, the core area of the Sopot culture must be defined within an approximate circle starting from Bapska in the East to the Sopot type site in the West (Fig. 4).

What can we conclude about the chronology and the initial area of the Sopot culture development? The earliest Sopot culture dates, as seen in the proposed scheme by Obelić et al., cannot be completely taken as a chronological framework for the entire Sopot culture, both from an absolute chronological point of view as well as from the point of view of relative phases. Since the distinction in pottery typology between Sopot phases III and IV is still very unclear, presuming that there is any difference between them at all, the end of the Sopot culture west of the core area is also unclear. The Sopot site in its upper levels gives younger dates that would fit to phase IV (Z-2754, Z-2826, Z-2911). Also, pottery from the mentioned levels in Sopot records a shift towards more sand and finely crushed stone in the clay-body, typical for the Early Copper Age, while contemporary architectural structures (SU 11 and SU 20) show a shift in orientation when compared with earlier building phases.\textsuperscript{103} These are clear hints that some substantial changes occurred in the type-site, too. It is important that this fact can be taken as an argument that the core area of the Sopot culture in the West really ends with the Sopot tell. Overlapping of the \textsuperscript{14}C results of the upper Sopot tell horizons with the Lasinja group and/or phase Sopot IV (also keeping in mind the aforementioned change in clay preparation) has already been emphasized;\textsuperscript{104} therefore, we might suppose that Copper Age communities already

\textsuperscript{97} Mihaljević 2013, 118 Table 11.
\textsuperscript{98} Marković 1985, 12; 22; 1994, 85–86.
\textsuperscript{100} Dimitrijević 1968, 13; 14; Burić/Težak-Gregl 2009, 87–89.
\textsuperscript{101} Dimitrijević 1968, 12–20; 1968, 13–14; 1979a, 267–268.
\textsuperscript{102} At the moment the new excavations in Bapska are still in the upper layers containing pottery of the Vinča culture; therefore, we still do not know what is “happening” in middle and lower levels of the site.
\textsuperscript{103} Burić 2009, Fig. 47.
\textsuperscript{104} Balen et al., 2011, 20.
reached the Sopot tell, introducing new social and technical innovations.\textsuperscript{106} The sites west of the Sopot tell show Copper Age types of the Sopot-IV-phase (namely Slavča etc.) (Fig. 5).

On the other side of the core area, Bapska’s cultural deposition ends with the Sopot III and the Vinča D phases, showing that eastern part of the core area does not contain features of Sopot phase IV. Naturally, further excavations in Bapska and any other stratified site between Sopot and Bapska will prove or override this hypothesis. However, it is crucial to stress once again that the majority of firm (AMS) absolute dates from a number of Late Neolithic sites in Croatia originate from charcoal, which, due to the nature of the reuse of wood in house constructions, must be taken into account.\textsuperscript{107} A step forward in solving this problem is dating the short-lived samples from the well stratified sites and modelling the results where possible. Again we would like to stress that when this paper was presented (2012) some new publications with absolute dates were being prepared. Certainly they will enlarge our knowledge on this topic.

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