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ABSOLUTE CHRONOLOGY OF THE RAMPART OF THE EARLY IRON AGE HILLFORT IN CHOTYNIEC NEAR RADYMNO (SOUTHEASTERN POLAND) IN THE CONTEXT OF RADIOCARBON DATING

Sylwester Czopek[1] • Marek Krąpiec[2]* • Jacek Pawlyta[2] • Tomasz Tokarczyk[1]

[1]Institute of Archaeology, University of Rzeszów, Moniuszki 10, 35-015 Rzeszów, Poland
[2]Faculty of Geology, Geophysics and Environmental Protection, AGH University, Al. Mickiewicza 30, 30-059 Kraków, Poland

ABSTRACT. The Early Iron Age hillfort in Chotyniec (SE Poland) is the westernmost permanent settlement of the Scythian cultural circle. Recognizing the construction of the fortified settlement's ramparts and their chronology was considered one of the priorities of the systematic research conducted since 2016. Based on 18 radiocarbon dated samples from different parts of the rampart, a chronological model of its functioning was made. It indicates that the construction of this monumental fortifications protecting the settlement in Chotyniec should be dated to between 651–595 or 531–409 BC. This dating synchronizes well with the chronology of the most important ritual and ceremonial object within the Chotyniec settlement—the so-called *zolnik* and other Scythian settlements from the East European forest-steppe zone.

KEYWORDS: Scythians, early Iron Age, radiocarbon dating, SE Poland.

INTRODUCTION

The Early Iron Age hillfort in Chotyniec (SE Poland, GPS 49°56'53.323"N, 22°59'3.245"E) has been systematically investigated since 2016. So far, only 2% of its large area of more than 30 ha has been explored. The research has focused primarily on the ritual structure—the so-called *zolnik*—and its surroundings, as well as the hillfort's rampart. With respect to the *zolnik*, several papers have already been published on the most spectacular finds: a Greek wine amphora (Czopek et al. 2021), arrowheads (Burghardt 2020), and pins (Adamik-Proksa and Ocadryga-Tokarczyk 2021), and on its chronology (Czopek and Krąpiec 2020). Broader issues related to the Chotyniec hillfort and its surroundings, described as the Chotyniec agglomeration, have also been addressed in some papers (Czopek 2019, 2020; Czopek et al. 2020, 2022; Trybała-Zawiślak 2020a, 2020b). There is no doubt in linking the site to the forest-steppe zone of eastern Europe, associated with the Scythian cultural circle. At the end of the Bronze Age and at the beginning of the Early Iron Age, these areas were inhabited by sedentary communities of the Chernoles culture. Shortly after the arrival (or the crystallisation) of the Scythian ethnos on the eastern European steppes (8th century BC), the nomads began to push towards the forest-steppe, which eventually ended with the inclusion of this zone into Great Scythia. The fortified settlement in Chotyniec is of course part of these processes, but it has the added significance for being the westernmost permanent settlement of the Scythian cultural circle (Figure 1).

In prehistoric considerations concerning the Early Iron Age, chronology is of paramount importance, as the period spanning the 8th to 5th centuries BC saw highly dynamic processes of cultural, settlement, and even ethnic change. Some of these can even be linked to written sources, and synchronisation of archaeological material with written accounts requires a good

*Corresponding author. Email: mkrapiec@agh.edu.pl

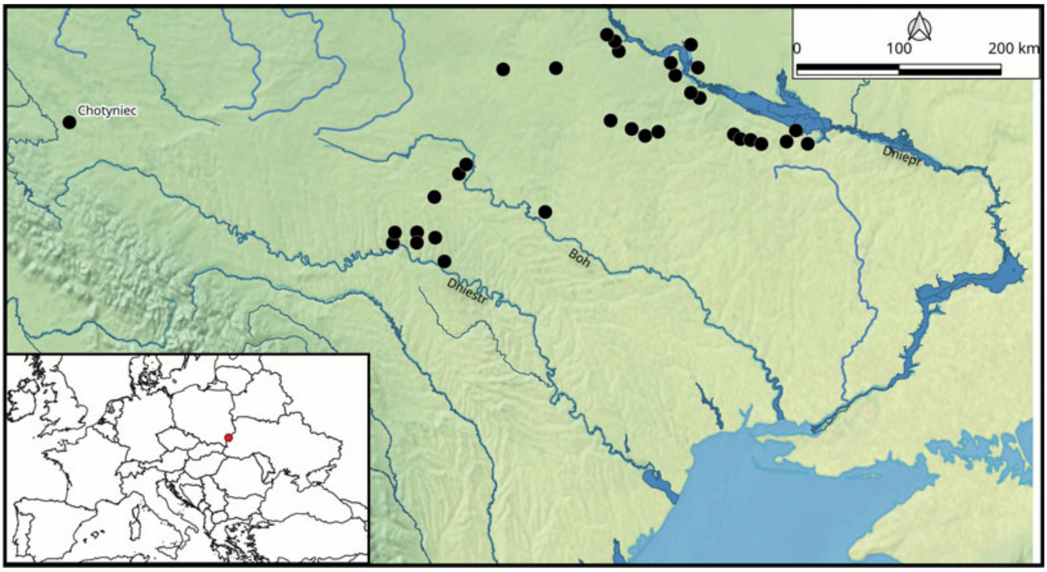

Figure 1 Location of the hillfort in Chotyniec in the context of other hillforts in the eastern European foreststeppe zone (data from Besonova and Skoryj 2001; Gretchko 2010).

source basis. The absolute dates published for the Chotyniec hillfort so far, albeit coming only from the *zolnik* (Czopek and Krąpiec 2020), suggested its functioning over a relatively long period, from the turn of the 7th/6th centuries to the turn of the 4th/3rd centuries BC. While the older dates, well correlated with the chronology of well-dated artifacts (Greek pottery: Czopek et al. 2021; arrowheads: Burghardt 2020), are not in doubt, the upper limit of *zolnik* use is open to debate (Grechko 2020; Czopek 2021). However, it should be noted that the state of preservation of the Chotyniec site is at the moment less than ideal due to extensive damage across the site caused by deep ploughing and many years of agricultural use. The upper layers have likely been destroyed, which was very clearly captured specifically on the *zolnik*.

This paper presents radiocarbon (^{14}C) age determinations obtained for 18 samples from the rampart of the Chotyniec hillfort.

ARCHAEOLOGICAL INVESTIGATION

Taking into account the construction and state of preservation of the fortifications, two zones can be distinguished. In the first, southeastern zone, the rampart is clearly visible in the field, and it is overgrown with vegetation (trees, bushes), so it is to some extent quite well preserved. In the second, much larger zone, the rampart has been destroyed but remains are clearly visible in the field as light discolouration of the eroded original earthworks (Figure 2). Aerial photographs (taken with a drone) clearly show the two parts of the fortification, preserved to various degrees, and they allow us to determine the approximate size of the entire hillfort, enclosed by a slightly oval rampart. The circumference of the entire fortification, measured along the probable, and partly confirmed, top of the rampart, is approximately 2000 m. Old maps from the 19th and early 20th centuries show the rampart not yet destroyed.

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Figure 2 Hillfort in Chotyniec—general view.

Studying the hillfort's rampart was identified as one of the priorities of the multiyear research program of 2016–2021. Two issues were of paramount importance here: the construction of the rampart along with its size parameters, and its chronology. This was dictated by the need to record the current state of preservation of the rampart and thus the size of the entire hillfort. It should be mentioned here that site 1 in Chotyniec is still in agricultural use (except for the better-preserved rampart in the southeastern part), so the damage caused by annual ploughing is continuing. Between 2016 and 2021, the rampart was examined at 12 places (Figure 3). Most of these were located within levelled and ploughed sectors in the northern and western parts and part of the southern. Only two trenches cut the rampart in its better-preserved SE section, where it was clearly elevated and overgrown with vegetation. In all excavations, similar structural elements were observed. The main conclusions can be summarised as follows:

1. The hillfort was established on a natural elevation, a promontory cutting into the vast valley of the Wisznia River (from the west). Wet depressions (perhaps even intentionally dug by the people building the hillfort) are still visible in the immediate vicinity of the rampart. Together with the rampart, they were part of the defensive system of the hillfort.
2. The rampart was erected from the local clayey-sandy and silty formations building up the Tarnogród Plateau, within which Chotyniec lies. The profiles recorded in the southeastern part clearly document the use of this raw material, virtually without any additional wooden or stone structures (Figure 4). Only a few minor pieces of charcoal were recorded. The excavations captured the horizontal span of the embankment in its bottom part, which ranged from 12 to 18 m. It is worth emphasising that layers associated with the rampart were fairly well-legible in all the trenches. The height of the rampart varied from a few cm to a few dozen cm in the eroded part, up to 1.6 m in the southeastern sector. Based on the slope angle in the lower part of the embankment, the original height of the rampart can be estimated to about 3–4 m (from zero floor level in its middle).

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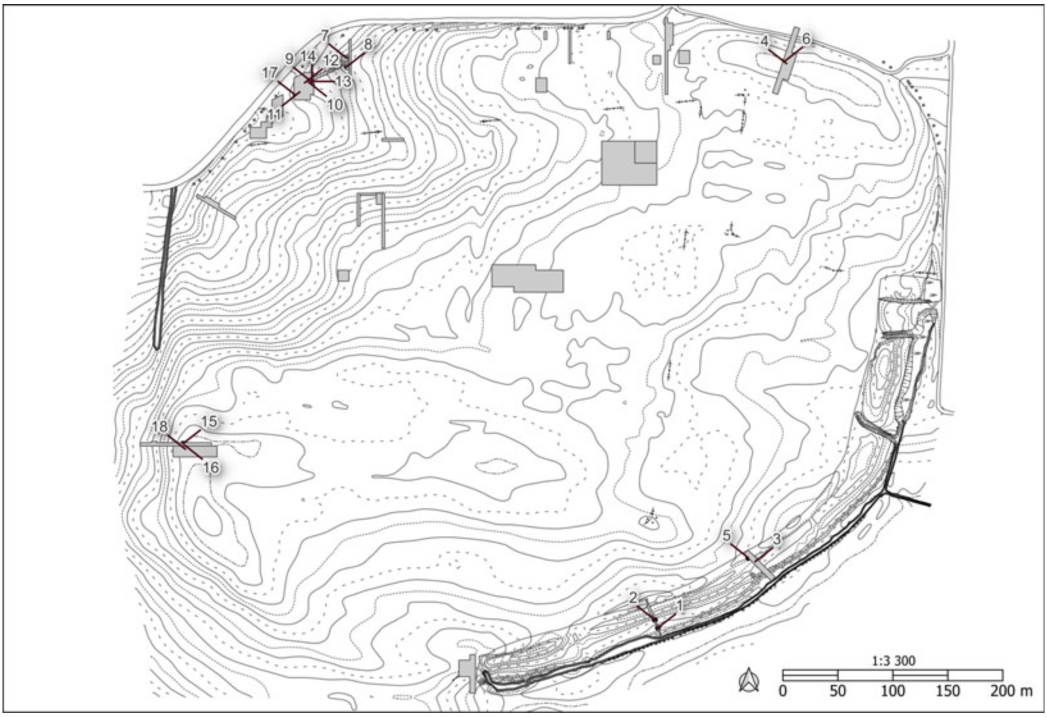

Figure 3 Plan of the hillfort showing archaeological trenches within the rampart, with locations of samples for ^{14}C dating (sample numbers as in Table 1).

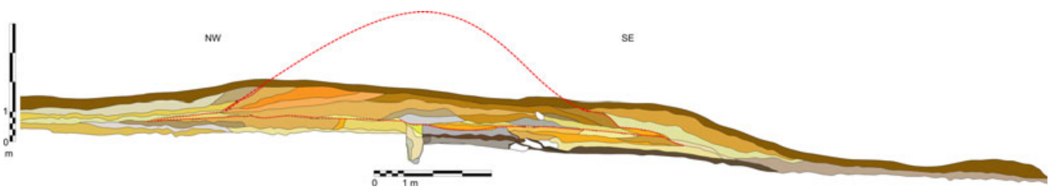

Figure 4 Profile of the rampart in its better-preserved part, with the original height and the base marked with red lines. Layers forming the embankment of the rampart (derived from the close vicinity of the settlement): brown and light brown: silty sediments; orange and yellowish-orange: clays; gray: loamy deposits; yellow and light yellow: sands, locally with clay.

3. One important finding was the recording in all trenches of a central ditch a few dozen centimetres wide (up to 0.5–0.7 m) and to 1.5 m deep from the base of the rampart. These were interpreted as relics of the oldest phase of the defensive structure. Where one was recorded, it marked the almost perfect center of the original embankment. The captured bottom part of the first rampart layer always covered the upper part of the ditch, which did not continue higher into the rampart and therefore did not likely play any significant role as a defensive element of the finished rampart. Alternatively, the ditch may have played an important role at the time of the rampart's construction, marking out its planned course. In the northwestern part, traces of round posts were recorded within the ditch. Thus, we are probably dealing with a palisade structure, although one which has not survived.

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4. Even in the zone where the rampart has only survived in its vestigial form, its state of preservation varies, depending on the physiography of the site's surface. In the northwestern part, located quite low and waterlogged, it was possible to record traces of the lower part of the rampart with a ditch in the center. Importantly, a line of postholes was recorded on the inner side of the central ditch, following the course of the rampart, parallel to the central ditch. A similar solution was also recorded in the southernmost excavation, right next to the better-preserved southeastern section of the rampart. None of these postholes provided any dateable material. They were only negatives of the original posts, and the state of preservation does not answer the question whether these posts originally ran the full depth of the embankment or even protruded above it as a palisade. The bottom layer in this section was very clearly distinguishable, and the negatives (remnants) of horizontally aligned timbers found there provided organic material for dating, which forms the bulk of the samples analyzed in this study.
5. In three trenches cutting across the rampart, in the northern, northwestern, and western parts, gaps were identified in the line of fortifications, and these were identified as gateways. These structures were clearly bounded by semi-circular embankments perpendicular to the line of the rampart. Interestingly, the distances between the gates do not vary much, at around 400 m. Clear traces of fire (with soil discolouration) were identified in gate 3 (western), including charred wood, from which three samples were taken. These will be analyzed later in the paper, along with samples taken from two features structurally related to gate 2 (northwestern) of the hillfort.

MATERIAL AND METHODS

The ^{14}C analysis encompassed 18 samples of charred wood collected during the excavations of the rampart area, including from the remains of charred timbers found in the bottom part of the rampart in its southeastern zone, from presumed gates, from the fill of the central ditch, and occasional charcoal fragments found in or near the bottom of the rampart (Table 1; Figure 3). The vast majority of these were very small, anatomically unidentifiable pieces of charcoal.

Charcoal samples were chemically pretreated using the acid-alkali-acid (AAA) method. Sixteen charcoal samples were combusted together with CuO and Ag in a pre-baked quartz ampoules. The ampoules containing the samples were evacuated to a pressure of 10^{-5} mbar, sealed and heated at 900ºC for 4 hr in a muffle oven. The resulting CO_2 was collected under vacuum and purified cryogenically. Carbon from CO^2 was converted to graphite using the Bosh reaction and an iron catalyst (e.g., Nadeau et al. 1998). The pretreatment and graphitization of all samples was performed in the laboratory at the AGH-UST in Kraków (Krąpiec et al. 2018). The mixture of graphite and Fe powder was pressed into a target holder and measured with the AMS system at the Center for Applied Isotope Studies at the University of Georgia, USA (Cherkinsky et al. 2010).

Two samples were dated using the conventional liquid scintillation spectrometry (LSC) ^{14}C dating technique at the Laboratory of Absolute Dating in Kraków, Poland. After the sample was dried, further procedures included a standard synthesis of benzene from carbonized samples (Skripkin and Kovalyukh 1998). Measurements were taken with a Hidex 300 SL spectrometer (Krąpiec and Walanus 2011).

All dates were calibrated using the OxCal 4.4 calibration program (Bronk Ramsey and Lee 2013) on the basis of the IntCal20 calibration curve (Reimer et al. 2020). The chronology of the rampart remnants was determined based on a model calculated using the OxCal procedures

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Table 1 The list of ^{14}C dates for samples from the rampart of the hillfort in Chotyniec (LSC dating: lab code MKL; AMS dating: lab code MKL_A).

No.	Sample name	Lab no.	^{14}C age (BP)	Cal BC (1σ)	Archaeological context
1	2016/1/1	MKL-A3478	3383 ± 37	1688–1628	Layer outside the rampart, stratigraphically older
2	2016/1/2	MKL-A3477	2679 ± 35	896–877, 839–803	Bottom layer of the southern rampart
3	2019/4/2	MKL-4857	2330 ± 90	718–710, 660–654, 543–351, 291–209	South rampart layer
4	2019/1/2	MKL-A4564	3136 ± 25	1441–1395, 1333–1326	Rampart layers—loose, fine coals on secondary deposit
5	2019/1/1	MKL-A4563	2927 ± 24	1198–1172, 1164–1142, 1131–1106, 1099–1078, 1070–1055	
6	2019/1/17	MKL-A4565	2583 ± 24	797–776	Bottom of the northern rampart
7	2020/4/57	MKL-A5227	2491 ± 19	756–742, 692–680, 670–665, 647–607, 596–549	Gate No. 2
8	2020/4/56	MKL-A5226	2634 ± 20	810–796	
9	2020/4/6	MKL-A5229	2446 ± 19	737–695, 664–649, 547–477	Bottom of the northern rampart
10	2020/4/5	MKL-A5224	2484 ± 20	754–733, 697–681, 669–664, 650–609, 594–546	Between the negatives of the beams, bottom of the rampart
11	2020/4	MKL-A5872	2461 ± 24	750–685, 667–637, 588–579, 571–515, 496—491	Bottom of the northern rampart
12	2020/4	MKL-A5873	2466 ± 22	750–685, 667–636, 589–578, 573–539, 528–521	Bottom of the northern rampart
13	2020/4/X	MKL-A5223	2487 ± 19	756–735, 695–680, 670–664, 649–607, 596–546	Trench backfill
14	2020/4/11	MKL-A5225	2414 ± 19	515–496, 491–412	Bottom of the northern rampart
15	2020/6/1a	MKL-A5220	2496 ± 20	758–746, 690–678, 673–665, 644–551	Burnt layer at gate No. 3
16	2020/6/1b	MKL-A5219	2436 ± 19	720–708, 662–653, 543–462, 438–420	Burnt layer at gate No. 3
17	2020/4/21	MKL-A5228	2493 ± 19	757–744, 691–679, 671–665, 646–606, 597–550	Bottom of the northern rampart
18	2021/7/2	MKL-5601	2380 ± 90	749–687, 666–641, 568–383	Burnt layer at gate No. 3

(the Sequence command). Since all dated samples were charcoal, they were marked as outlier points when the model describing the phase was created in OxCal 4. The Outlier_Model("Charcoal",Exp(1,-10,0),U(0,3), "t") described by Bronk Ramsey (2009) was assigned to each sample with probability equal to 1. The beginning and end of the phase were determined using the Boundary Begin/Boundary End commands, and its duration was calculated using the Phase function (Figure 5).

RESULTS AND DISCUSSION

The absence of archaeological material (e.g., pottery or metal objects found in large numbers in the hillfort) within the construction layers of the rampart makes traditional relative dating impossible. In this situation, ^{14}C dating appears to be the best indicator of the time of construction of the fortifications.

The dating results obtained are presented in Table 1. They are spread over a considerable time span, and two sets of dates can be distinguished among them.

The early dates comprise one set: 3383 ± 37, 3136 ± 25, and 2927 ± 24 BP. The earliest of these comes from a sample associated with the base of the rampart within the slope section of the natural elevation (Czopek et al. 2017:Fig. 10) on which the rampart was built. The other two are from the lower embankment layers and are single, very small charcoal pieces that can be considered as a secondary deposit. They probably found their way to the layer accidentally during the construction of the embankment.

The second set is made up of samples coming from the lower layers of the southeastern and northern ramparts and from gates 2 and 3.

By comparing the samples coming from the period before the erection of the fortifications and those coming from the construction layers of the rampart and from the burnt wooden structures of the gates, a chronological model was developed assuming two chronological phases corresponding to these two sequences (Figure 5).

The chronological model indicates that the construction of the monumental fortifications protecting the settlement at Chotyniec should be dated to 651–595 or 531–409 BC (68.3% probability, Figure 5). One should not forget, however, that age estimations obtained from charcoal (especially from highly fragmented charcoal) tend to be older than the expected historical dating. The extent of this kind of "archaization" is difficult to determine though, and it varies highly from case to case.

Such dating is in good agreement with the chronology of the most important ritual and ceremonial feature within the Chotyniec settlement, the *zolnik* (Czopek and Krąpiec 2020). Although it is not possible to prove that the rampart pre-dates the oldest *zolnik* horizon (or vice versa), they certainly belong to one chronological horizon. The ^{14}C chronology does not provide a basis for drawing conclusions about the length of time it took to build the fortifications. Taking into account the reconstructed average size of the original embankment (perimeter: 2000 m, height: 3.5 m, width at the base: 15 m), the volume of this conical-sectioned earthen structure can be calculated as 52,500 m^3. In the reality of the Early Iron Age, such a huge undertaking must have taken several years to complete. If we add the initial phase covering the construction of a central ditch with a palisade, the period becomes even longer.

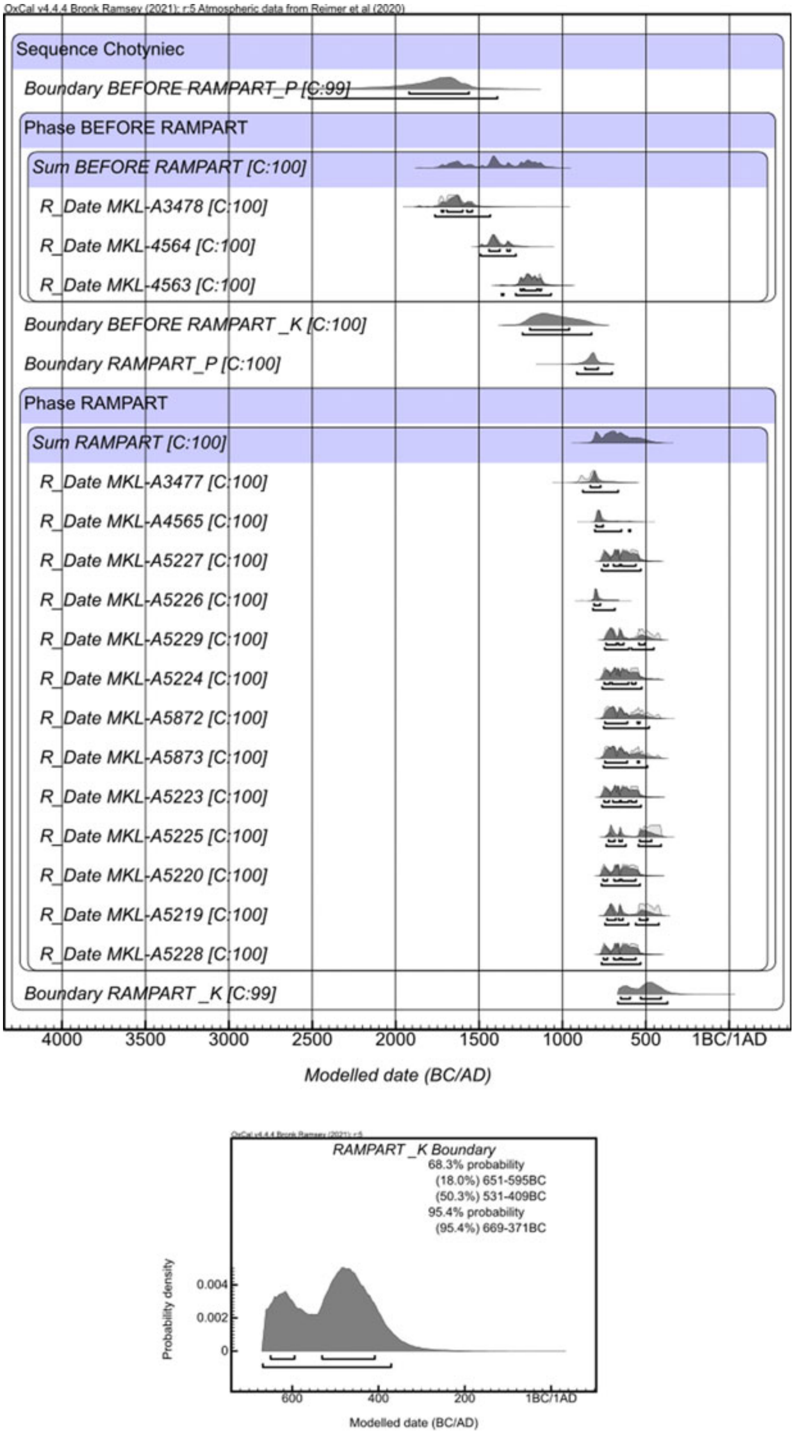

Figure 5 Modeled calendar age BC placements of the ^{14}C-dated charcoal samples from the hillfort in Chotyniec. Probability distribution for calendar year values for the phases of construction of the rampart (below). The ^{14}C dates are listed in Table 1.

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^{14}C dating of the rampart, falling most likely between the second half of the 7th and the first half of the 6th century BC, does not give a precise answer as to the moment when the rampart was erected, which should be taken as the beginning of the hillfort's functioning. When compared with other Scythian fortified settlements from the eastern European forest-steppe zone, we cannot find any differences (Czopek 2021:382). These hillforts, like Severynivka (Ignaczak et al. 2016), Motronin (Bessonova and Skoryi 2001), or Chotiva (Kravchenko 2017), were established by the end of the 7th century. The earliest dated hillfort is Nemirov, whose beginnings can be traced back as early as the first phase of the Early Scythian period, i.e. the end of the 8th century BC (Smirnova et al. 2018). The fact that Chotyniec occupies the same chronological position as hillforts from right-bank Ukraine allows for the general conclusion that the Chotyniec fortifications of interest to us here attest to the same genetic process (as to time and form) behind all sites of this type.

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