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Trinca-*La Șanț* – A Large North Moldovan Trypillia Settlement

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Suppl. 1. Trinca-*La Șanț*. ^{14}C data with isotope values.
Suppl. 2. Trinca-*La Șanț*. Bayesian models of ^{14}C dates.
Suppl. 3. Trinca-*La Șanț*. Osteological report on the human bones.

Abstract

In the years 2022 and 2023, the Trypillia hilltop settlement of Trinca-*La Șanț* in northern Moldova was investigated and excavated by the CRC1266 in collaboration with the State University of Moldova. As a result, we unveiled the basic structures of the 25 ha fortified settlement, which, adapted to the topography, combines the principles of linear and concentric rows of houses. Based on the ^{14}C data available to date, it can be assumed that the settlement dates from 3950 to 3650 BCE. Of the 320 houses discovered, up to 100 existed simultaneously, which corresponds to a maximum number of inhabitants of 250–1000 people. $\delta^{13}C/\delta^{15}N$ isotope values of domestic animals indicate an extensive economy that corresponds to that of other, similarly large or mega-sites.

Research questions

As part of the CRC1266 investigations into transformation processes, we selected the northern Moldovan site of Trinca-*La Șanț* to investigate specific changes within the late Trypillian society. Several reasons prompted this decision, all of which tie back to three aspects.

1. The Trypillia settlement of Trinca is located on an elevated limestone promontory and overlooks the vast northern Moldovan karst landscape with its corresponding chernozem areas. Due to the special location, which is quite similar to the later C2 settlement of Gordinești (Sîrbu et al. 2019), located only 10 km to the south, and differs greatly from the large C1 settlement of Stolniceni, located ca. 20 km to the south, the following hypothesis was put forward: Hilltop settlements or elevated topographical locations are increasingly favoured at the end of C1. On the basis of ethnographic analogies it is assumed that this altitude is adopted due to a need for protection in uncertain circumstances, e. g. due to internal conflicts between settlements. Trinca might be an example of this.
2. The question was also raised as to whether the linear and concentric principles of the rows of houses visible in the archaeomagnetic survey of Trinca might mark two different phases. We assume that from an architectural-sociological point of view, a linear principle of gable-parallel houses marks a different political, social and cultural habitus than the concentric principle that we observe in numerous C1 large and mega-sites.
3. In comparison to the large settlement of Stolniceni, also excavated by the CRC1266 (Țerna et al. 2016; 2019; forthcoming), which is located only

20 km to the south but occupies a different ecological niche with its position on a flat slope and a less structured landscape, a more diverse economy is assumed for Trinca.

In order to verify these hypotheses, a settlement plan, the most precise possible absolute chronological dating of individual settlement areas as well as a reconstruction of the economic situation were aimed at.

Location and history of research

Trinca-*La Șanț* is located on the northern Moldovan plateau, which differs geologically from other areas of the Trypillia distribution due to its Sarmatian limestone formations and coral as well as seabed deposits (Fig. 1). These geological structures, referred locally to as 'toltre', exhibit a unique relief marked by massive rocky cliffs, high plateaus and dome-shaped formations. The site, located on a pronounced promontory, is surrounded to the west, north and north-east by the Draghișteștream and is connected to the south by a medium-sized plateau landscape (Figs. 2–3). While the stream valley is at an altitude of ca. 150 m above sea level, the promontory rises up to 250 m. In the north there is an about 100 m deep canyon with three known Palaeolithic cave sites. To the east, directly below the promontory, the present-day village of Trinca is located.

Today, the northern part of the promontory is used for grazing, while the southern part, where the promontory merges into a wider plateau area without steep slopes, provides arable land. The plateau was used for military operations during World War I, the zigzag trenches built for this

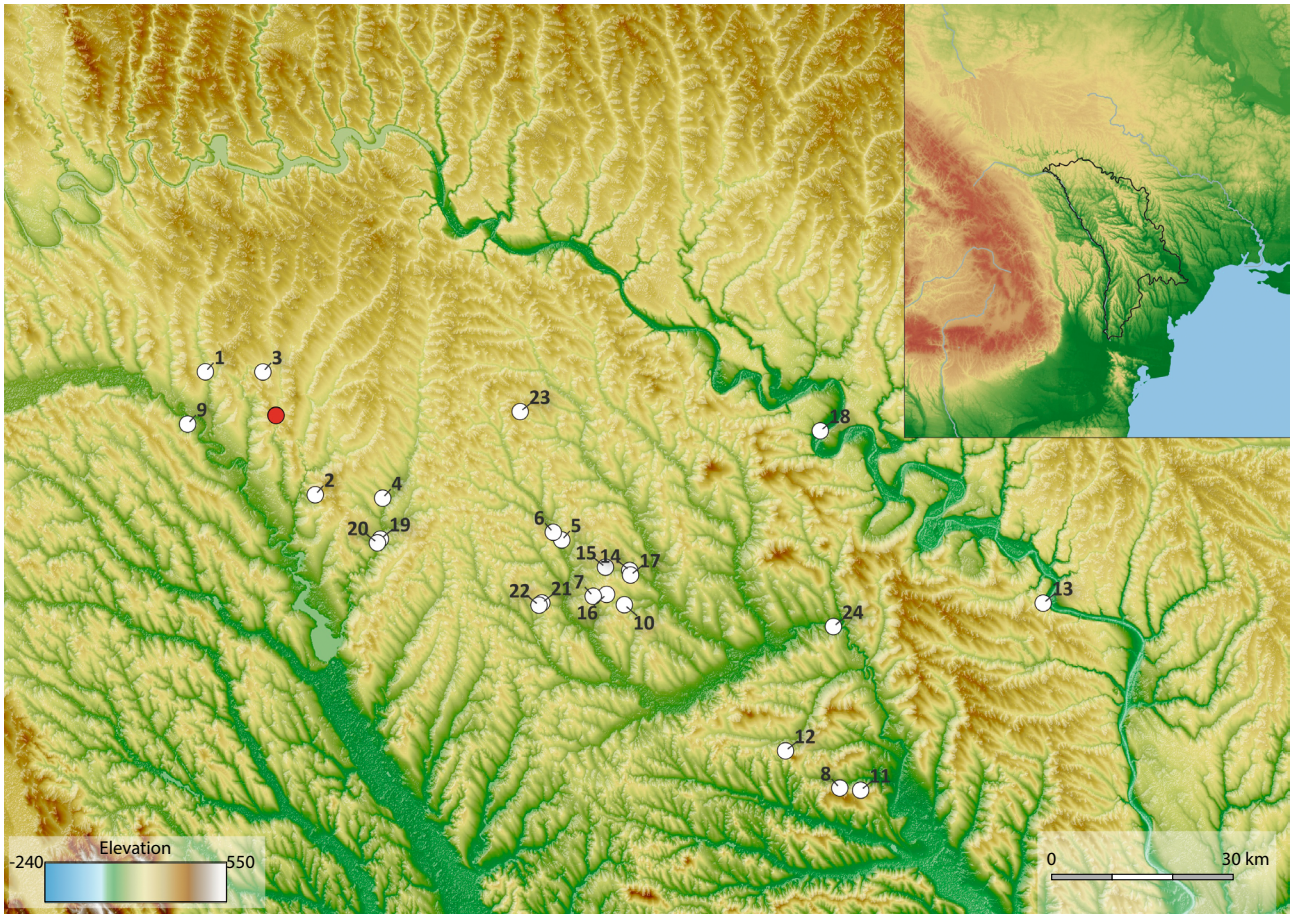

Fig. 1. Trinca-*La Șanț* (red dot) and the Cucuteni B1-Trypillia C1 settlements of northern Moldova: 1 Beleavinți I; 2 Brinzeni IV; 3 Cărăcușenii Vechi I; 4 Chiurt II; 5 Glăvan I; 6 Glăvan III; 7 Pelinia II; 8 Pepeni V; 9 Pererîta-Zamca; 10 Petreni; 11 Răzălăi VIII; 12 Sacarovca II; 13 Socola III; 14 Sofia-La Moină II; 15 Sofia II-La Găvan; 16 Sofia V; 17 Sofia VIII; 18 Soroca-Ozero; 19 Stolniceni I; 20 Stolniceni III; 21 Șumna I; 22 Șumna II; 23 Țaul II; 24 Vărvăreuca VIII (Graphics: A. Țerna, from Cereteu 1993; Guchin 1993; Manzura/Sava 1993; Roșca/Vâlcu 1993; Țerna/Vornicu-Țerna 2021).

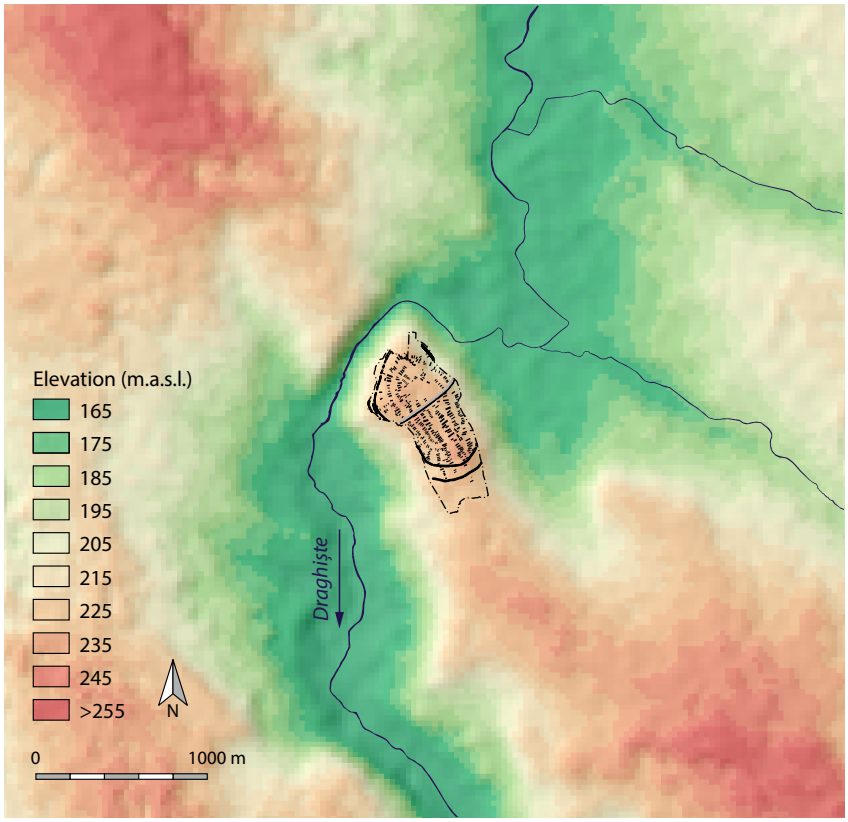

Fig. 2. Trinca-*La Șanț*. Local topography (Graphics: R. Hofmann).

Fig. 3. Trinca-*La Șanț*. View from the north (Photo: S. Heghea).

purpose being still visible in the northwestern part (Fig. 3). According to local tradition, there was a Romanian army camp from the period after World War I near the southern end.

Besides the already mentioned Palaeolithic cave sites, several settlements and necropoles from different periods, e. g. Copper Age, Bronze Age and Iron Age, are known in the Trinca micro-region. As concerns the Copper Age, there are four settlements within a 3 km radius of the site. Only one of them, Trinca-*Izvorul lui Luca*, was investigated by excavations and was dated to Horodiștea-Gordinești, a later period of the Copper Age (Leviţki et al. 2016).

The Trinca-*La Șanț* site was discovered in 1990 by O. Leviţki and T. Demchenko during the investigations of the Late Hallstatt necropolis of Trinca-*Drumul Feteștilor*, located approximately 1 km towards the south (Leviţki/Chitic 2006). It was due to the good visibility of the ditch and rampart that the site was believed to be an Iron Age fortification related to the necropolis. In order to test this hypothesis, a test trench was opened over the defensive system in 1999. The ditch, dug-out in the limestone, did not offer any dating materials. However, remains of a burnt daub structure and a pit, attributed to the Cucuteni B2-Trypillia C1 phase, were found below the rampart (Leviţki/Chitic 2006; Leiţki/Alaiba 2009). Still, the dating of the defensive system remained unclear, with three possibilities being considered: Cucuteni B2-Trypillia C1, Horodiștea-Gordinești or Late Hallstatt period (Leviţki/Chitic 2006). Therefore, the excavations were resumed in 2011, when a new trench was opened parallel to the old one. Similar to the previous excavations, several Trypillia features were discovered below the rampart: a burnt house (probably part of the one excavated in 1999), a pit house and ten pits. They were dated based on the pottery to the late Trypillia C2, the Brînzeni group (Leviţki et al. 2013). Though, once again, the ditch and rampart could not be dated, it became clearer that they were built much later, on top of the Trypillia site.

The first archaeomagnetic prospection was carried out in 2016 by G. Sîrbu, S. Țerna and R. Hofmann (Hofmann et al. forthcoming). The surveys were resumed later, in 2022, when the entire settlement plan of the 25 ha large Trypillia settlement was revealed (Fig. 4). Again, it was confirmed that the ditch-rampart system does not belong to the Trypillia site. Archaeomagnetic prospections on an area with scattered sherds outside the settlement (north of the canyon and southeast of the settlement boundary) revealed no archaeomagnetic features. Based on the documented archaeomagnetic findings, the settlement was included in the CRC1266 research programme. Accordingly, excavations were carried out in 2022 and 2023 with the aim of deciphering the development of the settlement. A team led by Wiebke Kirleis and Frank Schlütz carried out intensive archaeobotanical sampling accompanying the excavation activities. Archaeobotanical analyses are currently under way.

During the 2022 and 2023 excavations, the ditch-palisade systems of the Trypillia site (Fig. 5) and a house were excavated on the basis of the archaeomagnetic results (Fig. 6). In addition, seven smaller sondages were spread over the settlement (Fig. 4; 7). The aim was to use both the larger sections, which recorded features in their entirety, and the test sections to obtain find and feature material, especially datable material, in order to be able to sketch the chronological development of the settlement on the basis of the archaeomagnetic features.

Fig. 4. Trinca-*La Şanţ*. The results of the archaeomagnetic prospection with the location of the excavation trenches (Graphics: R. Hofmann).

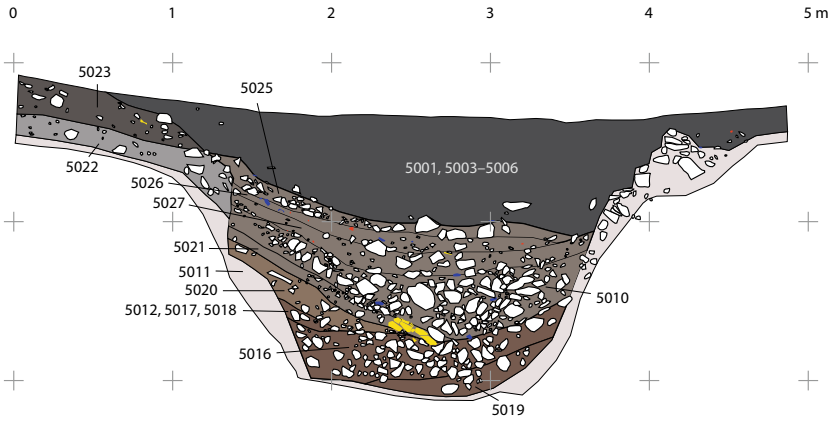

Fig. 5. Trinca-*La Şanţ*. Profile of ditch 1 (Graphics: R. Hofmann).

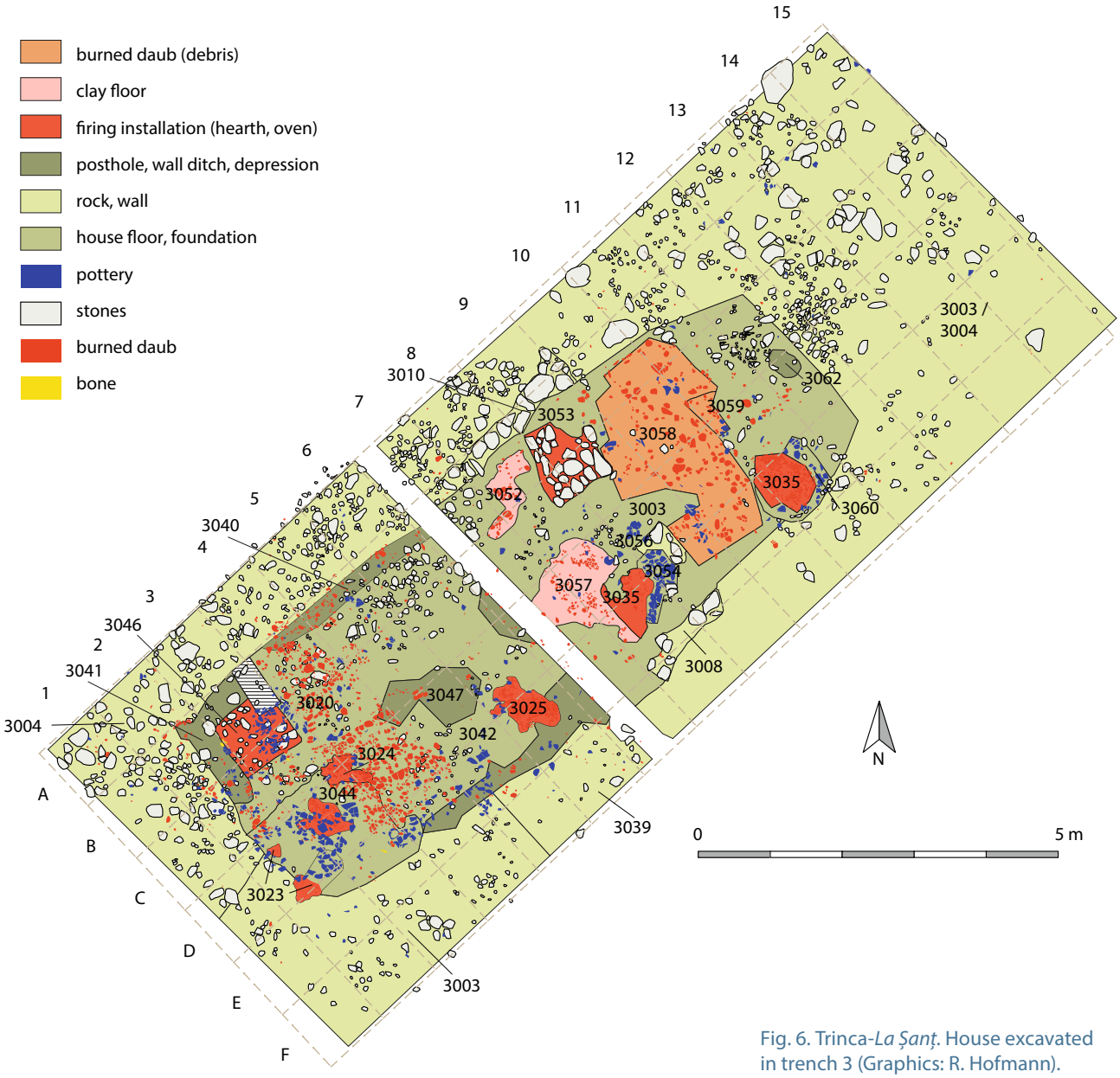

Fig. 6. Trinca-*La Șanț*. House excavated in trench 3 (Graphics: R. Hofmann).

Fig. 7. Trinca-*La Șanț*. Interpretation of the results of the archaeomagnetic prospection combined with a digital elevation model of the settlement area and the location of the excavation trenches (Graphics: R. Hofmann/ L. Shatilo).

Geophysical findings

The archaeomagnetic prospection revealed numerous features as houses, others as ditches or palisades (Figs. 4; 7). The southern edge of the settlement is formed by a ditch and palisade system with apparently five passages[1]. Ca. 70 m further north, there is a second ditch and palisade system, which can obviously be connected with ditch systems located to the north and together appear to form a rounded, long-oval enclosure.

East–west oriented, gable-parallel aligned houses, which form at least five linear, north–south running rows of houses at an average distance of 25 m, extend to the southern trench 1. Two rows of houses, also gable-parallel orientated, form bows both in the south and in the north, which are reminiscent of concentric house orientations known from other Trypillia settlements (Fig. 8). Obviously, there was an open space in the centre of the northern part of the settlement, unless this was caused by erosion or destruction by the military camp. The rounded rows of houses are only found in the centre of ditch system 2, but there are also houses with other orientations in the interior, e. g. in the westernmost part of the settlement.

[1] The two house features to the south of the area belong to a deposition site of World War II.

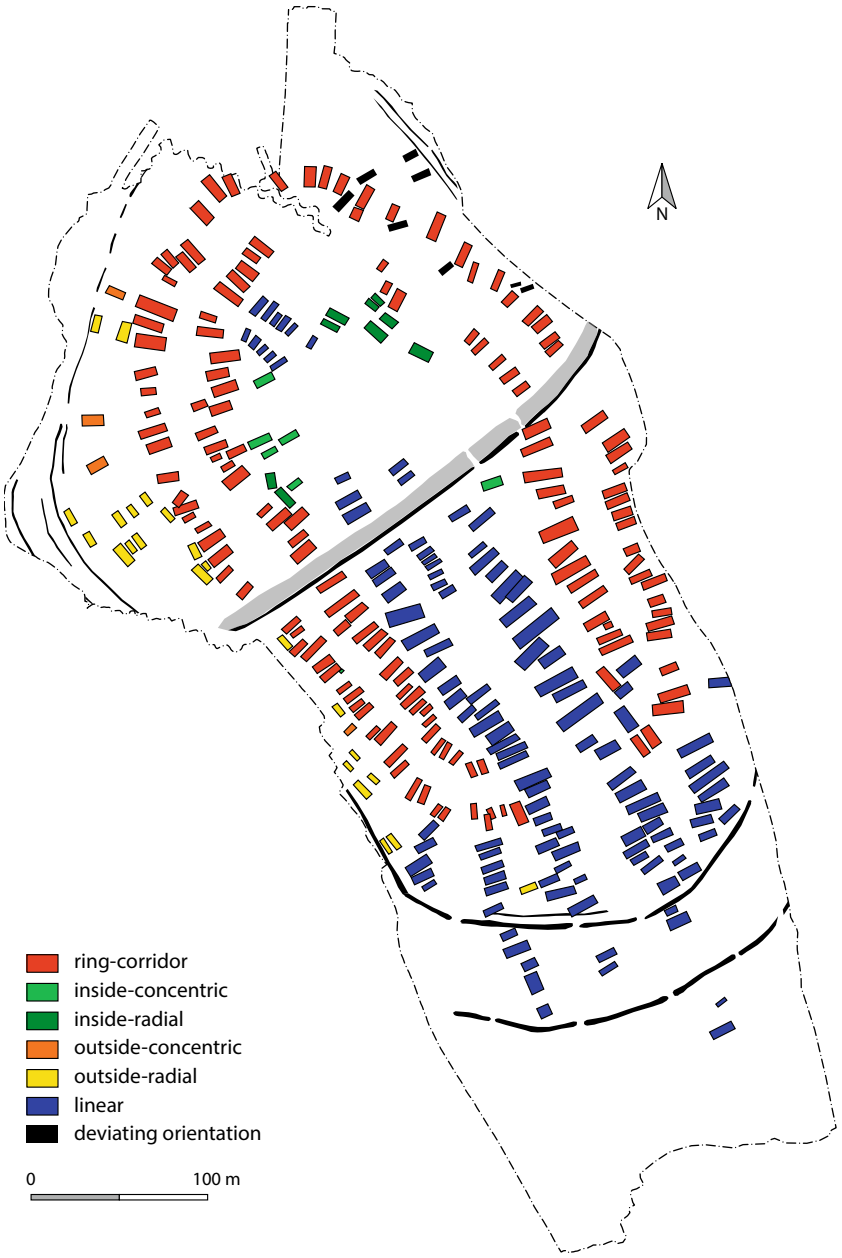

Fig. 8. Trinca-*La Şanţ*. Interpretation of the results of the archaeomagnetic prospection with a classification of the orientation of houses (Graphics: R. Hofmann/L. Shatilo).

Among the archaeomagnetic features, we recognise the rectangular army camp in the south and the defensive trenches typical for World War I in the north. The entire settlement is crossed by a probably Iron Age rampart ditch from east to west, for which, however, no datable material was found during the excavations in 1999 or 2011.

Chronology

Primarily from the excavation sections of the 2022 campaign, twelve ^{14}C dates are available, all but one of which are from cattle or caprine bones. The date from a bone of a domestic pig does not date conspicuously differently so that no particular dietary effect appears to compromise the date. This assumption is also supported by the $\delta^{13}C/\delta^{15}N$ values (Suppl. 1).

With the available data it is possible to date the outer ditch (500) and five houses (200, 600, 700, 800, 900). All median dates are between 3944

and 3715 cal BC (Figs. 9–10). Only one date from the uppermost layer above house 800 dates later: the median is 3210 cal BC. Since there is an interpretable vertical stratigraphic relation here and the date does not contradict the overall Bayesian calibration of the data, we consider the result to be an indication of C2 activities that took place at least 500 years after the actual large settlement. Basically, the dates fall within a period that is generally associated with Trypillia C1 – in the same time-frame as, for example, the aforementioned Stolniceni, which is only 20 km away, and earlier than the C2 settlements of Brînzeni and Gordineşti.

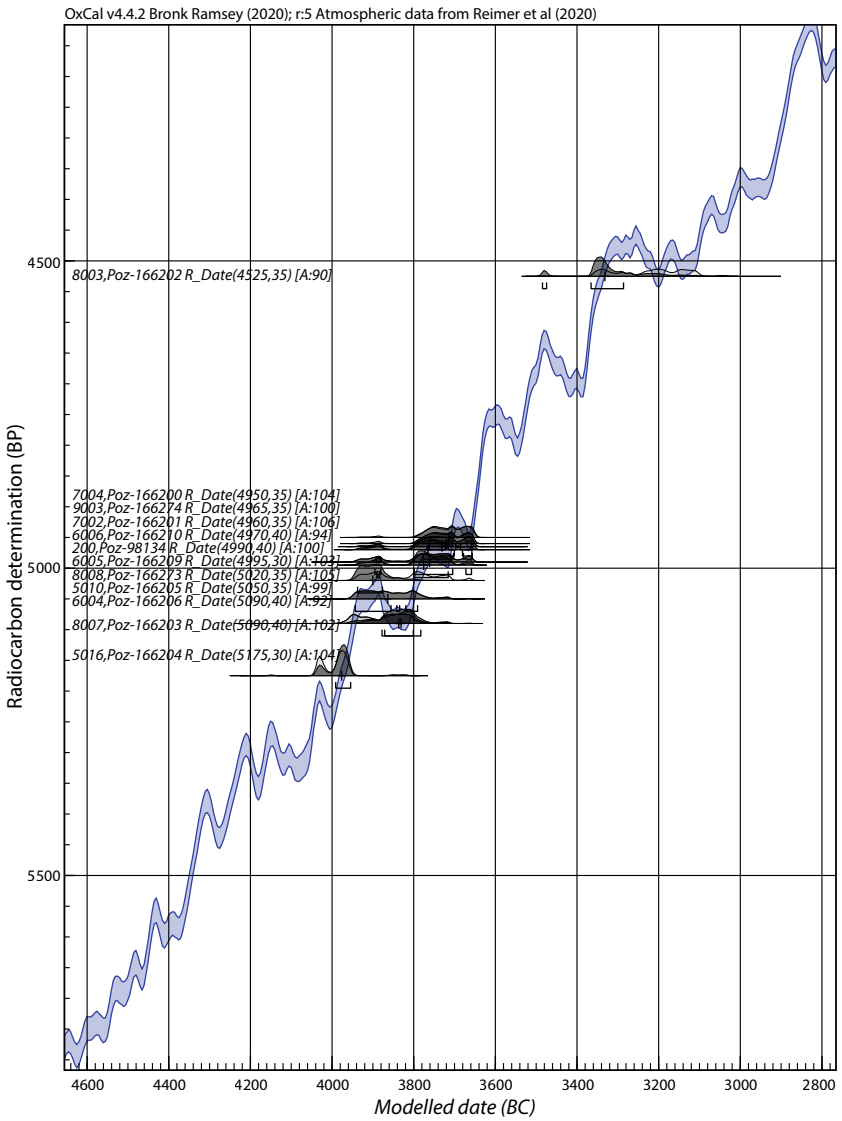

Fig. 9. Trinca-*La Şanţ*. The ^{14}C dates on the calibration curve (Calibration with OxCal 4.4: Bronk Ramsey 2009).

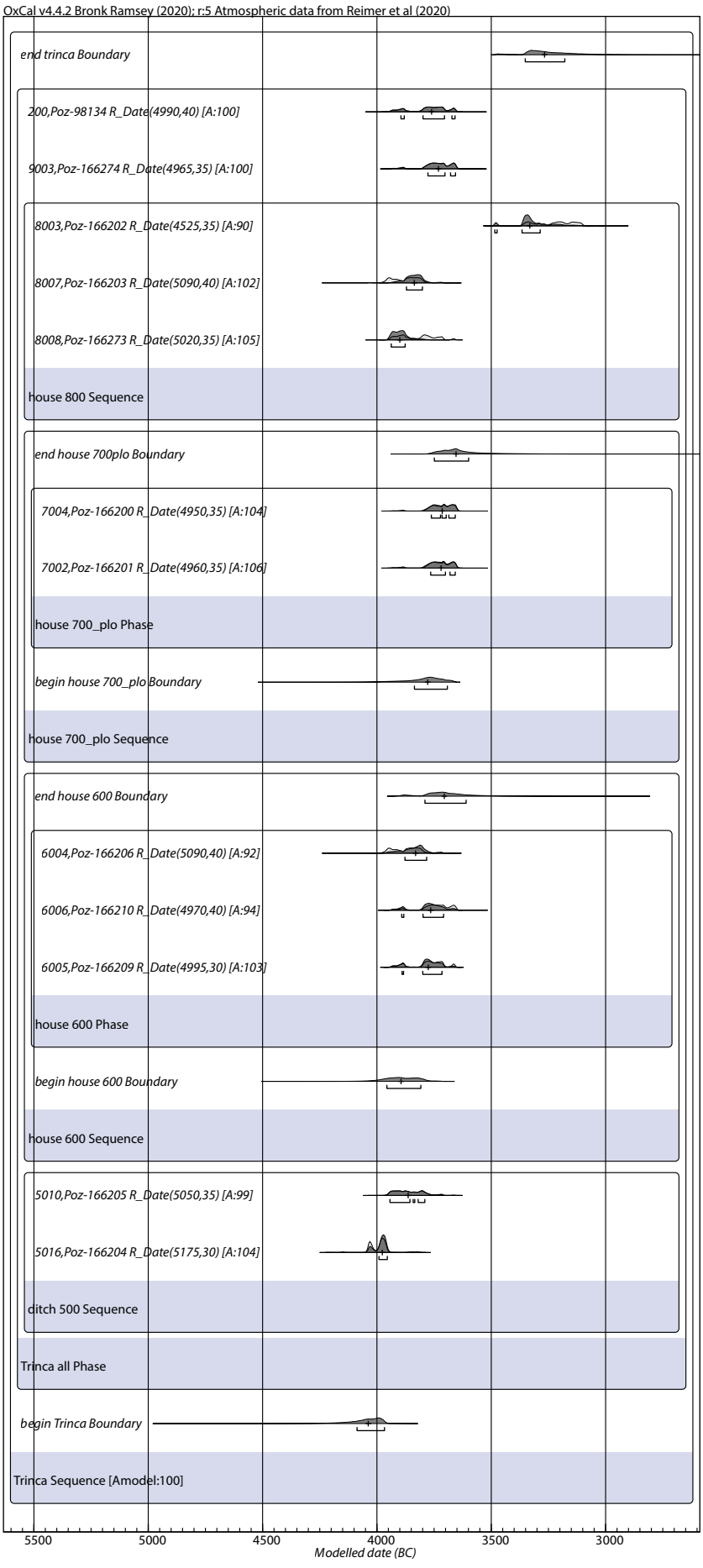

Fig. 10. Trinca-*La Şanţ*. Bayesian modelling of the ^{14}C dates with OxCal 4.4 (Bronk Ramsey 2009).

For Bayesian modelling, the vertical stratigraphic relationships could be used in addition to the other information:

Ditch 500: Poz-166205 comes from the lowest backfill layer (context 5016), Poz-166204 from the middle one (context 5010).

House *600*: Two of the dates come from the house platform *(plochadka)* (Poz-166210, context 6006; Poz-166209, context 6005) and one from the layer directly above the *plochadka* (Poz-166206, context 6004). Since the stratigraphically most recently deposited sample yielded the oldest date, we assume a relocation.

House *700*: Poz-166201 comes from the upper part of the burnt house (context 7002), Poz-166200 from a contemporaneous waste area.

House 800: The dates come from a stratigraphic sequence. Poz-166273 belongs to context 8008 from below the house and may itself belong to a superimposed, different house. Poz-166203 derives from the overlying fire clay horizon of house 800 (context) and Poz-166202 from the overlying cultural layer.

House 900: Poz-16624 comes from the layer directly above the *plochadka* (context 9003).

House 2: Poz-98134 was recovered in the 2016 excavation and is described as belonging to a house.

Taking this information into account, a significant Bayesian model is achieved ($A_{model} = 100$; $A_{overall} = 99.2$) without one ^{14}C date contradicting the model (Model 1; Fig. 10; Suppl. 2). According to this, we can expect activities between 4039 and 3268 cal BC. However, a look at the detailed results shows that the main settlement process is much shorter. Since Poz-166202 is clearly a date of activity above house 800 that took place several centuries later, we have excluded this from further modelling (Model 2, cf. Suppl. 2). Since the probability for the main occupation phase is more constrained (3984–3685 cal BC), we also supplement the values calculated with this second model in the following (with the scheme Model 1/Model 2), despite its statistically poorer significance ($A_{model} = 89.1$; $A_{overall} = 82.9$). However, the deviations are within the 1σ probability of Model 1 in all cases.

Figure 11 shows the ^{14}C dated individual activities plotted on the settlment plan. The outer ditch 500 was created relatively early, so that the first sedimentation can already be detected around 3992/3955 cal BC (median: 3977/3965 cal BC). House 600 (from 3957/3809 cal BC [median: 3895/3850 cal BC] to 3791/3611 cal BC [median 3706/3753 cal BC]) and the oldest remains of houses under house 800 (3938/3877 cal BC; median: 3901/3888 cal BC) belong to the earliest documented houses.

Around 3944/3791 cal BC (median: 3864/3829 cal BC), ditch 500 is further filled with sediment while house 800 is occupied (3872/3802 cal BC; median: 3837/3827 cal BC). This is obviously followed by considerable building activity in the 38th century BCE, as the occupation of house 700 (3837/3693 cal BC; median: 3779/3777 cal BC), house 200 (3869/3659 cal BC; median: 3762/3772 cal BC) and house 900 (3778/3657 cal BC; median: 3732/3752 cal BC) is attested by the model and house 600 is also renewed and inhabited by 3791/3611 cal BC; median: 3706/3753 cal BC) at the latest.

The last occupation of the main phase extends to 3750/3600 cal BC (median: 3655/3726 cal BC) (house 700) and the subsequent use probably takes place after a hiatus of several hundred years with the house 800 (3485/3287 cal BC; median: 3332 cal BC).

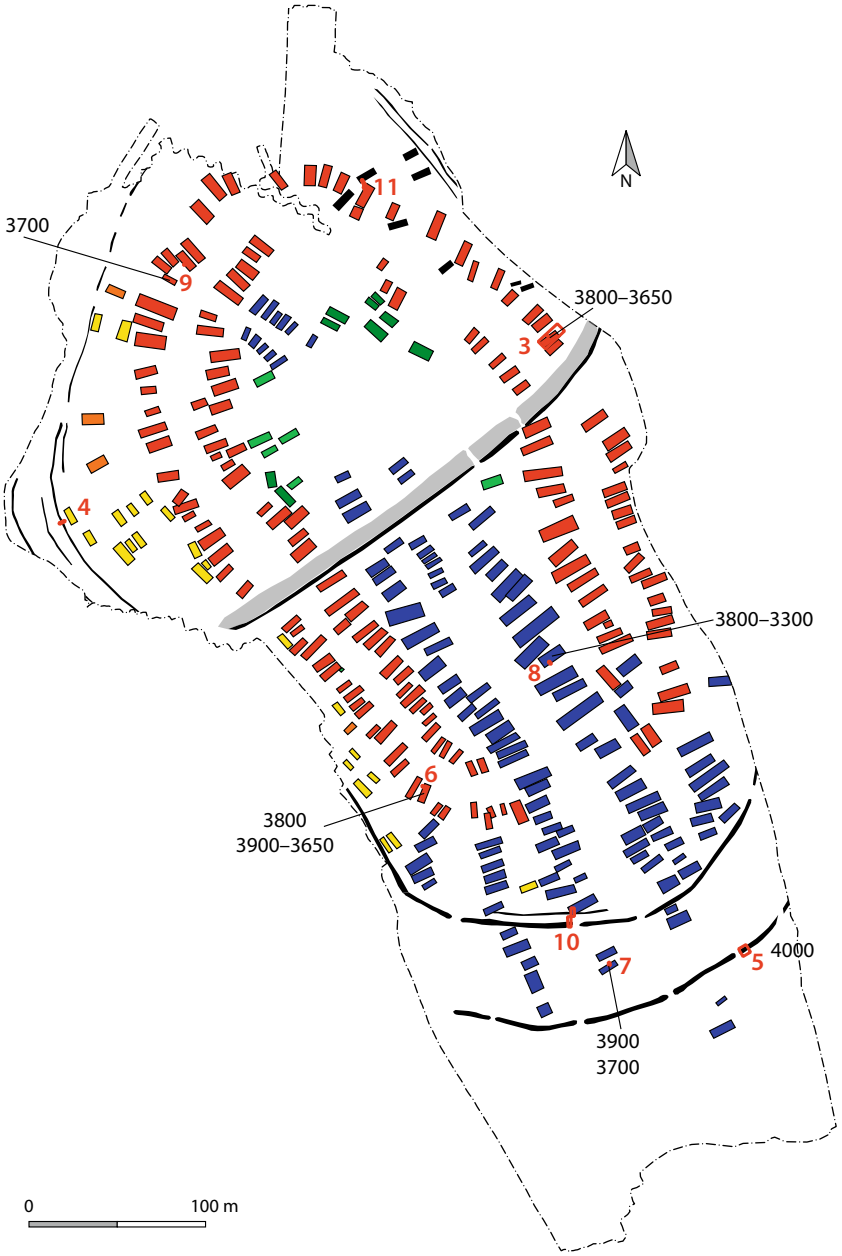

Fig. 11. Trinca-*La Șanț*. Mapping of the modelled ^{14}C dates on the settlement plan resulting from archaeomagnetic prospections (Graphics: R. Hofmann/ L. Shatilo).

To summarise, we can assume that ditch 1 was created in the middle of the 40th century BCE, thus demarcating the 25 ha settlement area from the rest of the promontory. There is evidence that two houses were built in the 39th century while ditch 1 seems to have slowly lost its significance. There is radiometric evidence of four houses in the 38th century and only one in the 37th century. The large settlement was abandoned by 3600 BCE at the latest.

Demography

There is geophysical and archaeological evidence of 320 houses in Trinca-*La Șanț*. Based on the temporal distribution of the houses over centuries obtained using Bayesian modelling, the total number of houses can be tentatively divided into three centuries of settlement. Depending on the assumed lifespan of a house, this results in the values shown in Table 1. Based on the occupation lengths for houses presented for Trypillia (Müller et al. forthcoming 2024), a house generation of 25–50 years must probably be

assumed. Accordingly, with 5–10 inhabitants per house, Trinca would have had no more than 250–1000 inhabitants during the period of densest settlement.

Table 1. Trinca-*La Şanţ*. Demographic model of number of houses and inhabitants.

BCE	^{14}C model	Allocation of 320 identified houses	Contemporaneous houses (5 inhabitants per house)		
			25 yrs/house	50 yrs/house	75 yrs/house
3900–3800	2	92	23 (115)	46 (230)	69 (345)
3800–3700	4	184	46 (230)	92 (460)	138 (690)
3700–3600	1	92	23 (115)	46 (230)	69 (345)

Human remains

Two human bones were recovered during the excavation in 2022 (see full report Suppl. 3; Fig. 12), which represent two individuals, likely inhabitants of the Trinca settlement: a left mandible fragment of an older child (ca. 6–10 years) including three teeth and a completely preserved right femur of an adult, probably male (for estimation methods and further references, see Suppl. 3). These two single bones provide interesting information, such as a non-metric variation in the tooth positioning of the subadult as well as physiological overburden of the adult male probably due to malpositioning of the right femur.

Fig. 12. Trinca-*La Şanţ*. Human bone finds from the waste area and the ditch filling: 1–2 Mandible, child; 3–6 right femur, adult male (Photos: K. Fuchs).

Accompanied by animal bones and pottery refuse, the mandible was found in a waste zone associated with a house. It shows the typical features of postmortem damage of dry bone. The femur bone was recovered from the filling of the outer ditch, together with burnt clay, charcoal, animal bones (KIA-58106, Poz-166204: 3945–3709 cal BC [68.3 %]) and large stones. Dot-like imprints on its head could be due to animal gnawing, which indicate that the primary deposition of this bone – and perhaps the rest of the individual's remains – was not deeply buried in the ground. The fracture morphology of the diaphysis is typical for a green bone fracture (spiral-wedge shape). This means that either the individual experienced a serious fracture of the femur shortly before death. Or a strong spiral and bending-force impacted the bone in a taphonomic (or ritual) process before it was completely dry. Altogether, the context and preservation of these bone finds speak against careful burial treatment but rather for careless handling of human remains at Trinca-*La Şanţ*.

Economy and exploitation of the environment

Although the detailed archaeozoological and archaeobotanical analyses are still pending, we can already make some statements based on the isotopy of the ^{14}C dated values (Suppl. 1; Fig. 13). Compared to the values from Stolniceni, the $\delta^{13}C$ values have a somewhat more negative tendency. This may indicate the exploitation of forested areas for both cattle and caprines. On the other hand, the spread of the data is so broad that a wide variety of ecotopes in the immediate vicinity were probably frequented. The $\delta^{15}N$ values of 7.0–10.0, especially for the cattle and caprines represented here, suggest feeding on e. g. crop by-products fertilised with animal faeces, as is also assumed for contemporaneous mega-sites (Schlütz et al. 2023; Kirleis et al. 2023). Interestingly, the sample of the large herbivore, which dates to around 3210 BCE, yielded a significantly lower $\delta^{15}N$ value. This could indicate a decline in the practice of field fertilisation as observed elsewhere.

In summary, the isotope values indicate a broad, mosaic-like exploitation of the immediate surroundings of Trinca, as can be seen, for example, from the isotope values of Stolniceni.

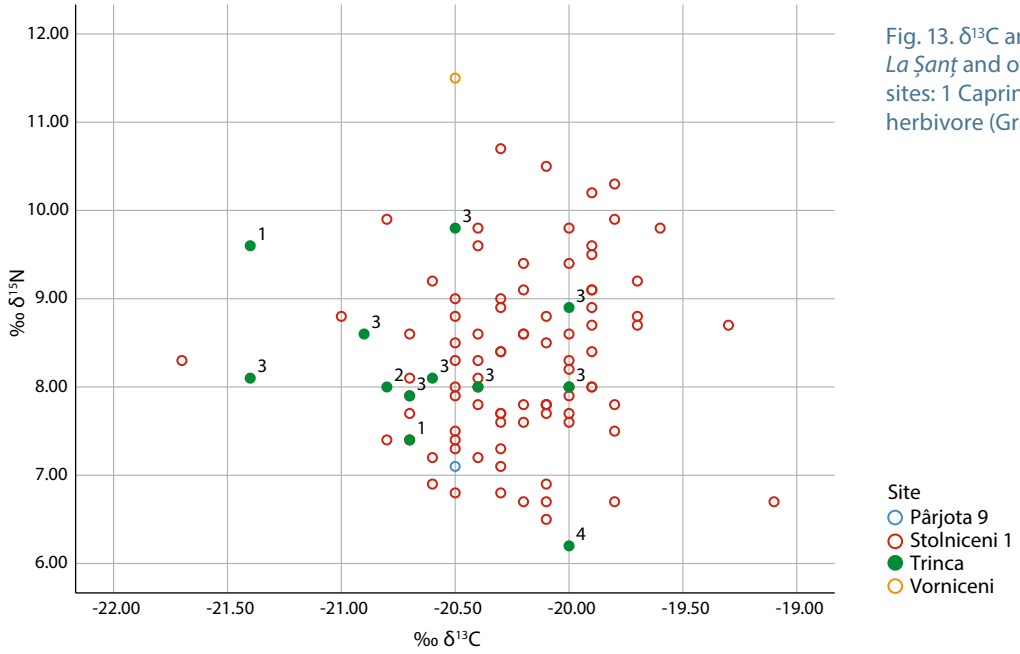

Fig. 13. $\delta^{13}C$ and $\delta^{15}N$ values from Trinca-*La Şanţ* and other Moldovan Trypillia sites: 1 Caprines; 2 pig; 3 cattle; 4 large herbivore (Graphics: J. Müller).

Pottery and small finds

Like other large Trypillia settlements in Moldova, the features excavated in Trinca contained a rich inventory of pottery and small finds. Currently, the processing of the finds is underway, so only preliminary observations are available at this stage. Within the pottery assemblage it is evident that the vast majority of sherds belong to the fine ware. The range of ceramic shapes includes typical vessels from Trypillia C1 such as conical bowls (Fig. 14,4.6.9.10), goblets (Fig. 14,1.5), lids (Fig. 14,3), amphorae and sphero-conical vessels (Fig. 14,8) as well as less common ones, such as the small vessel with rounded belly and handles placed at the base of the neck (Fig. 14,2). Although the preservation of the paint often poses challenges, we managed to identify[2] the use of *cross-shaped* (Fig. 14,4) and *figure eight* (Fig. 14,6.10) schemes for decorating the conical bowls. Additionally, we recognised the use of *tangent* (Fig. 14,2) and *Tangentenkreisband* (Fig. 14,8) on different types of vessels. What appears to be particular for Trinca in comparison to sites of the Petreni-Stolniceni type and still requires validation through quantitative data is the preference for monochrome black paint and consequently a relatively limited use of red paint.

At Trinca, the majority of implements both for the domestic and hunting/war equipment were made of chipped stones (Fig. 15,9–13). In addition, animal bones were mostly used for manufacturing awls and projectile points (Fig. 15,3), while polished stone was used for axes (Fig. 15,7.8). Textile production at the site is attested by the discovery of a clay loom weight (Fig. 15,6). As with other sites from this period, there are few adornments, the most common of which are pendants made from animal teeth (Fig. 15,5). The clay miniatures are best represented by tokens (Fig. 15,4), small balls and anthropomorphic figurines (Fig. 15,1.2).

Conclusions

With the data we have so far, we have been able to falsify rather than verify the initial hypotheses. The ^{14}C datings show that Trinca was founded at the same time as other large settlements in Moldova, such as Stolniceni or Petreni, but also at the same time as the mega-sites in the central Ukrainian Sinyukha Basin. Consequently, there is no chronological separation between lowland and hilltop settlements. Accordingly, the hypothesis of turbulent times, which would have been decisive for the selection of this settlement site, no longer applies. A chronological differentiation between linear and concentric principles is also not possible based on the data available to date. Instead, Trinca-*La Şanţ* evidently represents a settlement concept that combines both principles, adapted to the topographical conditions of the promontory. The third hypothesis of a more diverse economy compared to other settlements can also be falsified on the basis of the admittedly limited data yet available. At Trinca-*La Şanţ,* apparently the same subsistence pattern common to other contemporaneous large settlements was present, with the primacy of animal husbandry for fertilisation and the cultivation of protein-rich food (Schlütz et al. 2023). The isotopic values also correspond to those known from other C1 settlements (Fig. 13).

All this presents to us a picture of a complex hilltop settlement that according to the complex settlement plan appears to have existed as a town-like settlement for up to 300 years. The number of inhabitants will not have exceeded 1 000, and the settlement was probably always demarcated by a labour-intensive ditch system. In fact, the outer ditch with its four entries, which was obviously built before the actual settlement, is reminiscent of a causewayed enclosure as discussed for other C1 Trypillia settlements.

[2] In the terminology for the decorative schemes we follow Ryzhov 2012.

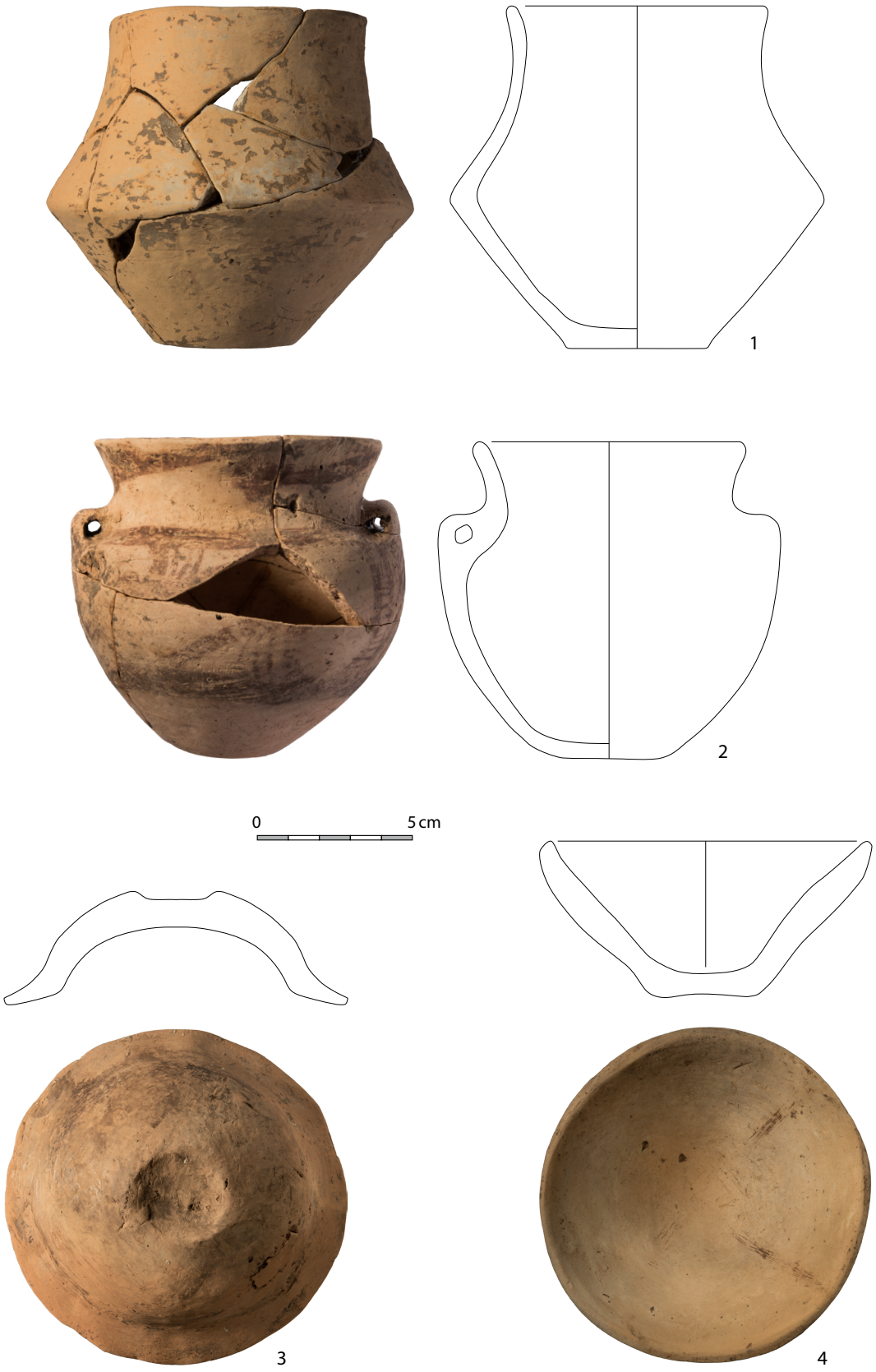

Fig. 14. Trinca-*La Şanţ*. Selection of pottery: 1 Goblet; 2 small vessel; 3 lid; 4 conical bowl (Graphics: A. Heitmann/CAU).

Fig. 14, continued. Trinca-*La Şanţ*. Selection of pottery: 5 Goblet; 7 small vessel; 6.9.10 conical bowls; 8 sphero-conical vessel (Graphics: A. Heitmann/CAU).

Fig. 15. Trinca-*La Șanț*. Selection of small finds: 1.2 Anthropomorphic figurines; 3 bone projectile point; 4 clay token; 5 tooth pendant; 6 clay loom weight; 7.8 stone axes; 9–13 chipped stone tools. 1–5.9–13 M. 1 : 1; 6–8 M. 2 : 3 (Photos: A. Heitmann/CAU).

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