

RESEARCH ARTICLE

Chronological modeling demonstrates short use of Middle Bronze Age cemetery in Transylvania

Colin P. Quinn¹  and Marius-Mihai Ciută²

¹University at Buffalo, Anthropology, 380 Academic Center, Buffalo NY, USA and ²Lucian Blaga University, Sibiu SB, Romania
Corresponding author: Colin P. Quinn; Email: cpquinn@buffalo.edu

Received: 15 March 2025; **Revised:** 09 July 2025; **Accepted:** 14 July 2025

Keywords: abandonment; cemetery; cremation; Middle Bronze Age; mortuary practices; Wietenberg culture

Abstract

The length of time that cemeteries were used provides important insights into the persistence of social identities and how communities situate themselves in the landscape. In Bronze Age Europe, the duration of use of cemeteries is an important line of evidence to assess the role of mortuary practices in a time of social change across the continent. This study presents new dates and a Bayesian model of cremation at a Middle Bronze Age (2000–1500 BCE) cemetery in Transylvania (Romania). The cemetery at Limba-Oarda de Jos-*Șesul Orzii* is the largest known cemetery associated with the Wietenberg culture in Transylvania during the Middle Bronze Age. Unlike Early Bronze Age cemeteries and other Middle Bronze Age cemeteries elsewhere in the Carpathian Basin where burial activity often continued for over 500 years, the duration of use of Limba-Oarda de Jos-*Șesul Orzii* was much briefer. The cemetery formed within 160 years; we argue closer to 50–100 years. This use life is similar to the nearby Wietenberg cremation cemetery at Sebeș and stands in contrast to mortuary practices in previous time periods and other contemporaneous regions. The short duration of burial activity, and subsequent abandonment of the site, has ramifications for understanding Middle Bronze Age settlement patterns, mortuary rituals, and the dynamics around emerging inequality in Transylvania and beyond.

Introduction

Cemeteries are places where people return to bury their dead. The length of time that a cemetery was in use reflects persistent engagement with place, ongoing renewal of community identity, and even social stability in times of sociopolitical change (see Duffy et al. 2019; Polányi 2022). In Transylvania, an upland plateau and mountainous region surrounded by the Carpathian Mountains and Carpathian Basin in Eastern Europe, the duration of cemetery use varied widely throughout the Bronze Age. In the Early Bronze Age, individual cemeteries, composed of single or multiple burial mounds that contained the remains of few individuals, were in use for nearly half a millennium (see Ciugudean et al. 2023, 2025). During the Middle Bronze Age, some cemeteries elsewhere in the Carpathian Basin have similarly long use lives (see Duffy et al. 2019). In the Middle Bronze Age, however, there is evidence to suggest that cemeteries associated with the Wietenberg culture were in use for a relatively short period of time compared with Early Bronze Age Transylvanian cemeteries and contemporaneous cemeteries in the Carpathian Basin (see Bălan et al. 2018).

The Wietenberg culture is an archaeological culture found in Transylvania during the Middle Bronze Age (2000–1500 BCE) (Andrițoiu 1992; Boroffka 1994; Chidioșan 1980; Horedt 1960, 1967; Quinn et al. 2020a). The material evidence for Wietenberg includes distinctive ceramic forms, decorations, and fabrics that became increasingly complex throughout the Middle Bronze Age, as well as the adoption of cremation as a dominant—though not the only—mortuary treatment (Boroffka 1994; Paul 1995). Settlement analyses have demonstrated the importance of controlling interregional trade and rich

agricultural land to the political economy of Wietenberg communities (Quinn 2024; Quinn and Ciugudean 2018).

The mortuary practices of Wietenberg communities provide important insights into their social lives (see Palincas 2014). Spatial analyses suggest that Wietenberg communities buried their dead in a wide range of contexts (Quinn et al. 2020b). Some Wietenberg cremations were placed in Early Bronze Age mounds, such as Ampoița-Dealul Doștiorului, Cetea, and Cheile Aiudului (Ciugudean 1996), and other contemporaneous inhumations were found in pits in settlements like at Micești-Cigașe (Bălan 2014a, 2014b). However, most burials were cremations placed in flat cemeteries near settlements (Quinn et al. 2020b). Cremation was an important mortuary rite in several Middle Bronze Age cultural groups across the Carpathian Basin and Transylvania (see Cavazzuti et al. 2022; Gavranović et al. 2025; Kapuran et al. 2020; Parditka and Duffy 2023; Polányi 2022).

The cremation cemetery at Limba-Oarda de Jos-Șesul Orzii is the largest known Wietenberg burial site (Ciută et al. 2021). A total of 74 funerary complexes have been excavated, while additional burials more likely remain in situ beyond the boundaries of the excavation. The second largest Wietenberg cemetery in Transylvania, also excavated as part of rescue excavations ahead of motorway construction, is Sebeș-Între Răstoace with a total of 63 funerary complexes (Bălan et al. 2018; Fântâneau et al. 2013, 2017).

In a previous study, we published a date from one burial—M.9—at this site that demonstrated that the body was cremated during the Middle Bronze Age (see Ciută et al. 2021). However, the duration of activity of the site remained uncertain. In this study we expand our sample to include 4 newly dated burials from Limba-Oarda de Jos-Șesul Orzii. We employ Bayesian modeling to evaluate whether the use life of this cemetery was relatively brief—more similar to the Wietenberg cemetery at Sebeș-Între Răstoace—or lasted for multiple centuries—more in line with Transylvanian cemeteries during the Early Bronze Age and other Middle Bronze Age cemeteries elsewhere in the Carpathian Basin. The expanded radiocarbon sample allows us to gain insight into the chronology of the cemetery. We also provide additional details on the archaeological context for the five burials that have now been dated.

Materials and methods

Limba-Oarda de Jos-Șesul Orzii is located in the Mureș River valley southwest Transylvania (Figure 1). The site was discovered and partially excavated in 2016–2017 as part of the rescue excavations in advance of highway construction between Sebeș and Turda in Alba County, Romania. The excavations covered an area of 350 square meters and archaeologists documented 74 distinct burials and one rectangular burnt clay feature (1.40 × 0.60 m), which may be the remains of a pyre (Ciută et al. 2021, 76) (Figure 2). Each burial feature was bisected and then fully excavated to expose the funerary urn before removal. Despite these efforts, the pit cuts associated with the initial deposition of the burials were not identifiable in the field. The ceramic urns were fragmented and extremely friable. This poor preservation of the ceramics may be due to problems in the production of these urns or due to soil conditions, such as being a waterlogged or marshy in the past, as was the case for the Middle Bronze Age cremation cemetery at Sebeș-Între Răstoace (Fântâneau et al. 2017). The upper portions of the funerary urns were especially poorly preserved, but the lower portions were intact and contained significant quantities of cremated human bone. The burials that were selected for dating were among the better-preserved burials at the site. The cremains chosen were calcined cortical bone fragments from unidentified long bones, with preference for larger fragments that were intact in these five burials. The remaining urns also contain cremated human bone which hopefully can be dated in the future. There is evidence of some spatial clustering of burials (see Figure 2), which was also seen at Sebeș-Între Răstoace (Bălan et al. 2018; Fântâneau et al. 2013, 2017). We selected burials from across the site to account for any temporal differences between spatial locations of cremation burials (see Krečković-Gavrilović et al. 2025).

Five samples of cremated human remains were analyzed at the University of Georgia Center for Applied Isotope Studies. The bone was cleaned and washed in an ultrasonic bath then crushed into small

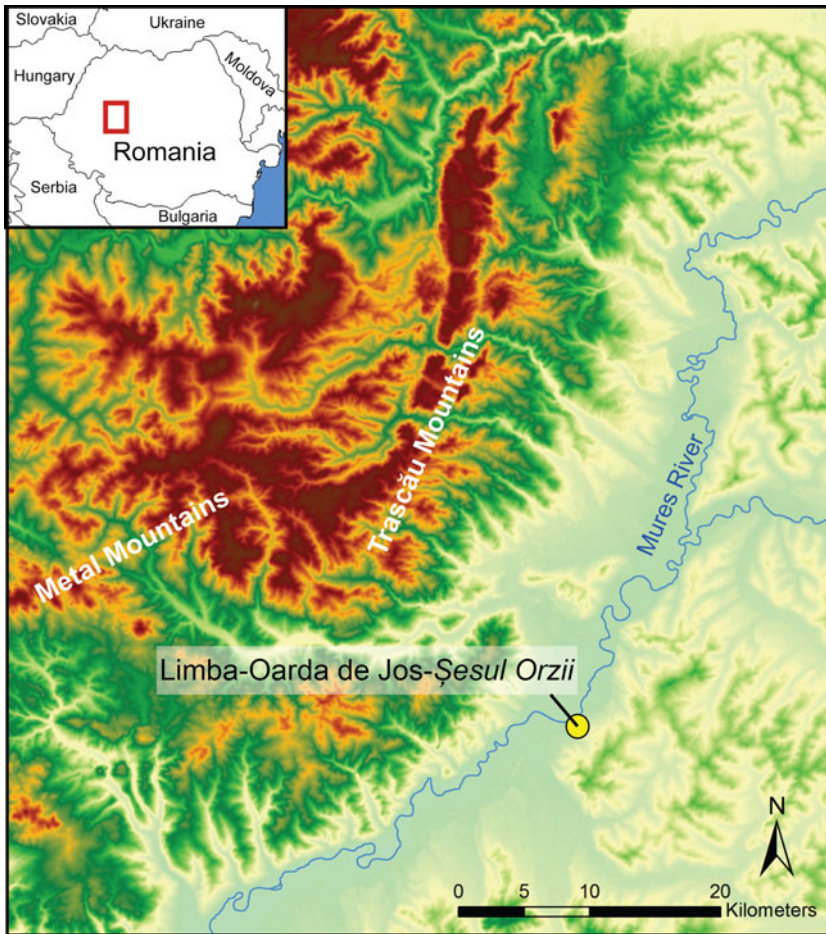


Figure 1. Regional map of southwest Transylvania with the location of Limba-Oarda de Jos-Şesul Orzii marked.

fragments. The crushed bone was treated and diluted with 1N acetic acid to remove potential contaminate carbonates. The sample was then treated with 100% phosphoric acid to dissolve the bone mineral and release the carbon dioxide from bioapatite. The carbon dioxide was converted to graphite using the methods of Vogel et al. (1984). Graphite $^{14}\text{C}/^{13}\text{C}$ ratios were measured using the CAIS 0.5 MeV accelerator mass spectrometer. The sample ratios were compared to the ratio measured Oxalic Acid I (NBS SRM 4990). The sample $^{13}\text{C}/^{12}\text{C}$ ratios ($\delta^{13}\text{C}$) were measured separately using a stable isotope ratio mass spectrometer. We constructed a Bayesian model using OxCal v. 4.4.4 modeling the dates as a single uniform phase and using the IntCal20 Northern Hemisphere radiocarbon age calibration curve (Bronk Ramsey 2009; Reimer et al. 2020) (Supplemental Material 1). All results are discussed following best practices as described by Hamilton and Krus (2018).

Results

Dating burial activity at Limba/Oarda de Jos-Şesul Orzii

The five samples come from burials across the cemetery (see Figure 2). In this section, we describe each burial and radiocarbon date in detail (Table 1).



Figure 2. Orthophotograph of Limba-Oarda de Jos-Şesul Orzii with the location of the five dated burials marked.

Table 1. Radiocarbon dates from Limba-Oarda de Jos-Şesul Orzii.

Sample ID	Context	Material	Date (BP)	$\delta^{13}\text{C}$
UGAMS-44053	M.9 (Cx. 138 H)	Human bone carbonate	3440 $\pm$ 25	–26.64
UGAMS-58795	M.42	Human bone carbonate	3520 $\pm$ 25	–23.18
UGAMS-58796	M.10 (Cx. 138 I)	Human bone carbonate	3510 $\pm$ 25	–22.25
UGAMS-58797	M.76	Human bone carbonate	3500 $\pm$ 25	–24.81
UGAMS-58798	M.29	Human bone carbonate	3430 $\pm$ 25	–23.59

M.9 (Cx. 138 H)

The cremation burial M.9 was positioned at the northern edge of the cemetery. The fragmented urn in this burial was approximately 26 cm in diameter and 20 cm in height, though the upper portion of the urn was damaged (Figure 3a). The uncalibrated age of M.9 is 3440 $\pm$ 25 years BP. The date was then calibrated using OxCal v. 4.4.4. The burning of the bone probably occurred between 1880 and 1630 *cal. BC* (95% confidence—2 sigma), but most likely between 1870 and 1690 *cal. BC* (68% confidence).

M.42

The cremation burial M.42 was positioned at the eastern edge of the cemetery. The fragmented urn in this burial was approximately 26 cm in diameter and 20 cm in height, though the upper portion of the urn was damaged (Figure 3b). The uncalibrated age of M.42 is 3520 $\pm$ 25 years BP. The date was then calibrated using OxCal v.4.4.4. The burning of the bone probably occurred between 1930 and 1750 *cal. BC* (95% confidence—2 sigma), but most likely between 1900 and 1770 *cal. BC* (68% confidence).

M.10 (Cx. 183 I)

The cremation burial M.10 was positioned at the northern edge of the cemetery, near M.9. The fragmented urn in this burial was approximately 28 cm in diameter and 23 cm in height, though the upper portion of the urn was damaged (Figure 3c). The uncalibrated age of M.10 is 3510 $\pm$ 25 years BP. The date was then calibrated using OxCal v.4.4.4. The burning of the bone probably occurred between 1920 and 1740 *cal. BC* (95% confidence—2 sigma), but most likely between 1890 and 1770 *cal. BC* (68% confidence).

M.76

The cremation burial M.76 was positioned at the southern edge of the cemetery. The fragmented urn in this burial was approximately 26 cm in diameter and 20 cm in height, though the upper portion of the urn was damaged (Figure 3d). The uncalibrated age of M.76 is 3500 $\pm$ 25 years BP. The date was then calibrated using OxCal v.4.4.4. The burning of the bone probably occurred between 1900 and 1740 *cal. BC* (95% confidence—2 sigma), but most likely between 1890 and 1770 *cal. BC* (68% confidence).

M.29

The cremation burial M.29 was positioned at the western edge of the excavated portion of the cemetery. The cemetery likely extends to the west of the excavated area. The fragmented urn in this burial was approximately 29 cm in diameter and 24 cm in height, though the upper portion of the urn was damaged (Figure 3e). The uncalibrated age of M.29 is 3430 $\pm$ 25 years BP. The date was then calibrated using OxCal v.4.4.4. The burning of the bone probably occurred between 1880 and 1630 *cal. BC* (95% confidence—2 sigma), but most likely between 1770 and 1680 *cal. BC* (63% confidence).

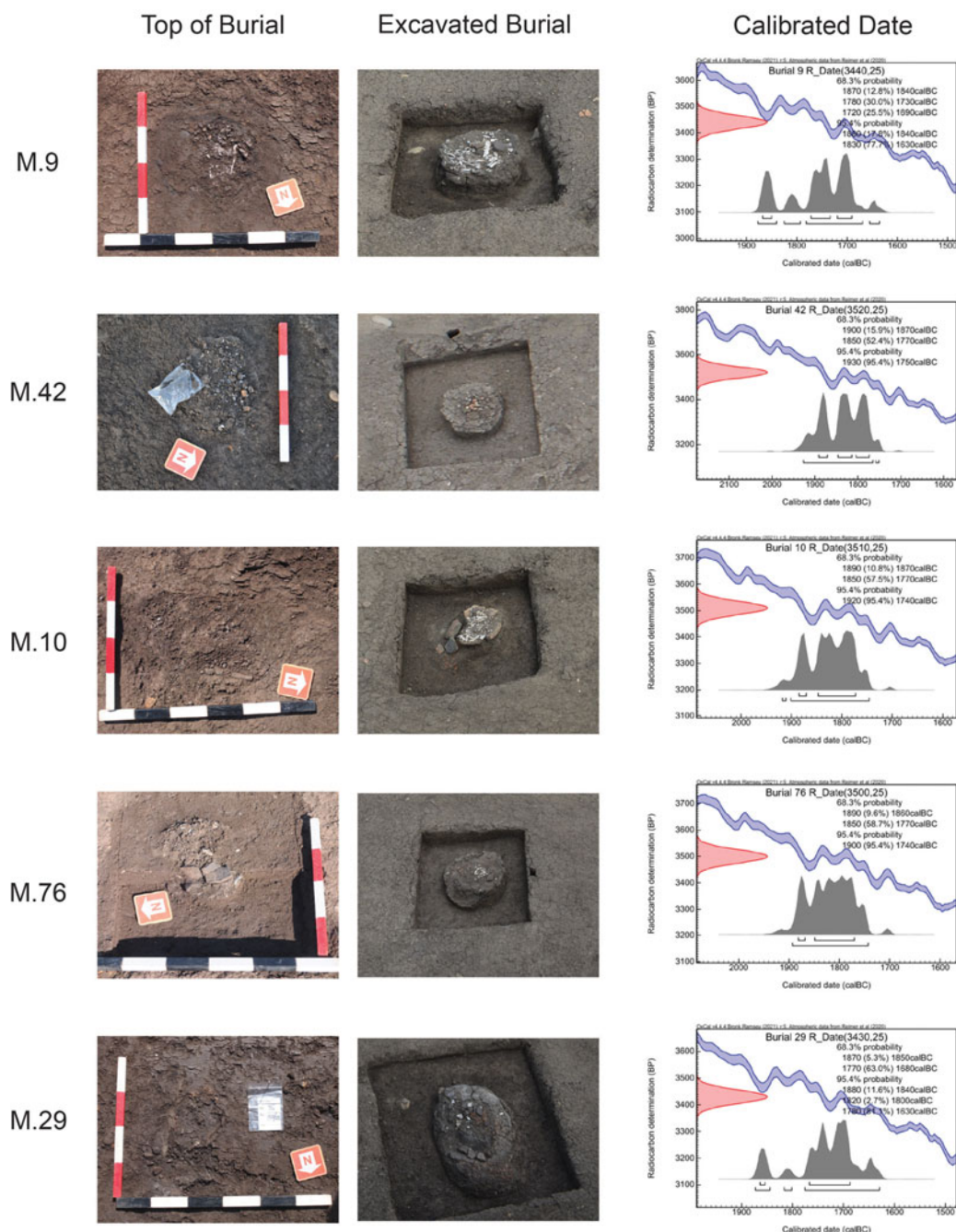


Figure 3. Detailed photographs and uncalibrated dates of the dated burials from Limba-Oarda de Jos-Şesul Orzii.

Bayesian modeling of mortuary activity at Limba-Oarda de Jos-Şesul Orzii

We modeled all dates as part of a single phase of activity at the site ($A_{\text{model}} = 90$) (Figure 4). The modeled start of burial activity at the cemetery is between 1990 and 1760 *cal. BC* (at 95% confidence), most likely between 1910 and 1800 *cal. BC* (at 68% confidence). The end of burial activity at Limba-

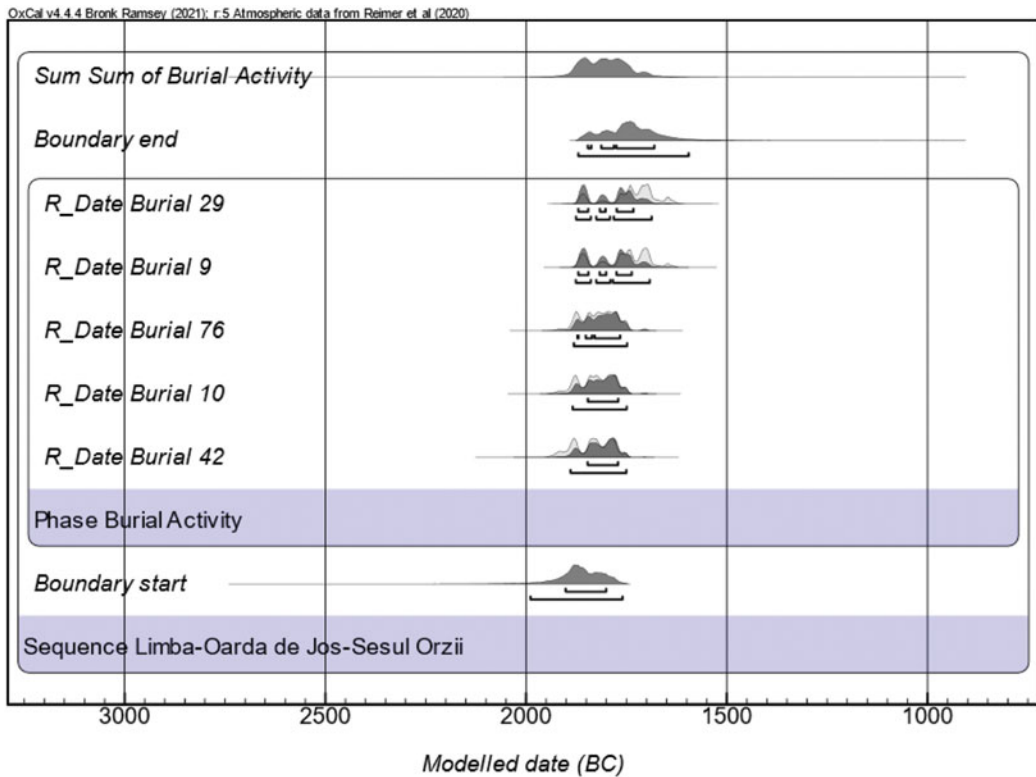


Figure 4. Bayesian model of cremations at Limba-Oarda de Jos-Şesul Orzii.

Oarda de Jos-Şesul Orzii occurred between 1880 and 1590 *cal. BC* (at 95% confidence), and most likely between 1850 and 1680 *cal. BC* (at 68% confidence).

The burials likely took place within 160 years (68% probability), though this is likely an overestimation of the cemetery's duration. The peak probability, as seen in Figure 5, is approximately 50 to 100 years. It is therefore likely that the cemetery was used for several generations before being abandoned. This rate of burial is similar to the duration of occupation at most Wietenberg settlements (see Quinn 2017) as well as other well-dated cemeteries like Sebeş-Între Răstoace (see Bălan et al. 2018).

Discussion

The new Bayesian chronology from Limba-Oarda de Jos-Şesul Orzii makes several important contributions to our understanding of the Wietenberg Culture in Transylvania. First, the cemetery is positioned at an important point in the development of Wietenberg cultural identity. Burial activity at Limba-Oarda de Jos-Şesul Orzii commenced during the Formative Wietenberg (per Quinn et al. 2020a), which is roughly associated with Boroffka's (1994) Type A. Burial activity stretched into the early part of the Classical Wietenberg phase where ceramic decorations became increasingly ornate and stylistically complex. Recent radiocarbon dating at other Wietenberg cremation cemeteries at Sebeş-Între Răstoace (Bălan et al. 2018) and Țufalău-Alămenő I (Puskás 2020) underscore the importance of this period in the process of forming Wietenberg cultural identity. Future work at Limba-Oarda de Jos-Şesul Orzii may help reveal the role of mortuary practices in this transition.

Second, the short duration of activity at the site, under 160 years and likely closer to 50–100 years, suggests that cemeteries were intensively used by a community and then abandoned. There is no

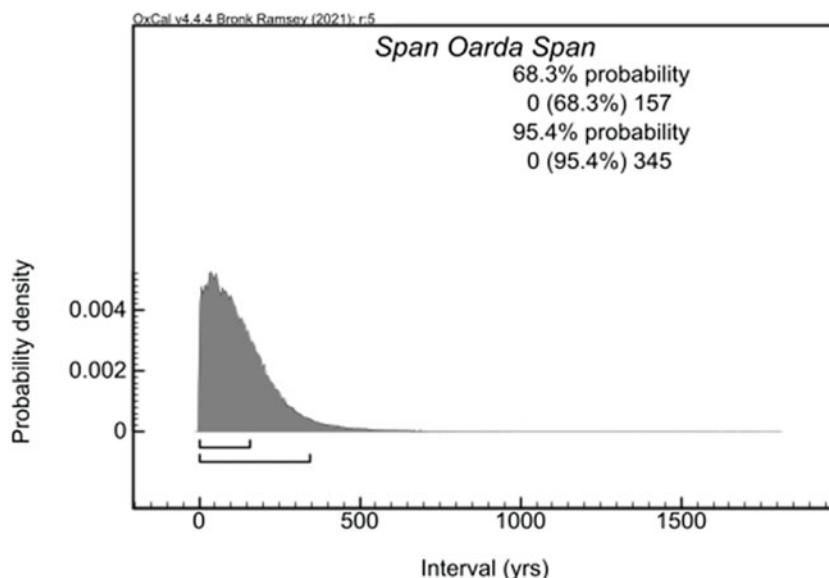


Figure 5. *Span of activity at Limba-Oarda de Jos-Şesul Orzii.*

evidence of returning to these cemeteries after their initial abandonment to bury the dead after a hiatus. While dates derived from bone apatite through cremations can be influenced by the “old wood” effect based on the wood fuel that was used to construct the pyre (see Cavazzuti et al. 2021; Dani et al. 2019; Major et al. 2019; Snoeck et al. 2015; Zazzo and Saliège 2011), this did not affect these samples. Either the pyres of the cremated individuals interred at Limba-Oarda de Jos-Şesul Orzii were constructed of relatively young fuel, or there was minimal carbon transference between the bone and wood fuel. The consistency in these dates adds to our confidence in the interpretation that the cemetery was used for a relatively short period of time. This stands in contrast to the long duration and lower frequency of burial activity at Early Bronze Age cemeteries. For example, at *Meteş-La Meteşel* burial activity took place over a longer span—approximately 500 years—but the tumuli contained a minimum number of individuals of 15 (Beck et al. 2020; Ciugudean et al. 2025). The higher quantity of cremation burials over a much shorter time suggests that Wietenberg mortuary activity was more intensive at Limba-Oarda de Jos-Şesul Orzii than at Early Bronze Age cemeteries in Transylvania.

Meanwhile, in other nearby regions cemeteries have longer histories. Duffy et al. (2019) have demonstrated that the site of Békés 103 was used as a cremation cemetery starting in 2460–2200 cal. BC. This first phase of activity appears to match the duration of activity at Limba-Oarda de Jos-Şesul Orzii—at approximately 50 years. Unlike at Limba-Oarda de Jos-Şesul Orzii, however, Békés 103 was used as a cemetery again after a hiatus until 1880 cal. BC. From 1880 BC on, the cemetery was used continuously until approximately 1260–1010 cal. BC. All together, Békés 103 was used as a cemetery for a minimum of 600 years (Duffy et al. 2019). Dunaújváros-Duna-dűlő, one of the largest Middle Bronze Age cemeteries in Hungary, contains at least 1600 cremation graves and has been estimated to have been in use for 800 years, though radiocarbon dates from the burials themselves are not available for chronological modeling (see Cavazzuti et al. 2022; Laabs 2023). The inhumation cemetery at Mokrin in Serbia, which has 320 known burials, was in use for approximately 250–300 years between 2100–1800 BC (Krečković-Gavrilović et al. 2025). Similarly, the inhumation cemetery at Nižná Myšľa in Slovakia has 782 individuals and was in use for approximately 260 years from approximately 2073–1822 BC (Jaeger et al. 2023).

While the brief burial activity at Limba-Oarda de Jos-Şesul Orzii is unlike Early Bronze Age Transylvania and Middle Bronze Age cemeteries in the Carpathian Basin, there is a cemetery with a similar span: Sebeş-Între Răstoace. The 63 cremation burials at Sebeş-Între Răstoace were interred

within approximately 110 years (Bălan et al. 2018). In an earlier study, we demonstrated the relative contemporaneity of Sebeș-Între Răstoace and Limba-Oarda de Jos-Șesul Orzii (see Ciută et al. 2021). With the additional dates and Bayesian model presented in this study, we now know that the burial activity at both sites were similarly brief.

The short duration of Wietenberg cremation cemeteries may indicate that the associated settlements—which have not been identified at either Sebeș-Între Răstoace or Limba-Oarda de Jos-Șesul Orzii—may have also been occupied for only a few generations before they were abandoned. Previous dating at smaller settlements in southwest Transylvania, including at Geoagiu de Sus-Fântâna Mare, suggests that the lifespan of small residential communities was also brief, less than 125 years before sites were abandoned (see Ciugudean and Quinn 2015). We must also note that 50–100 years can hardly be considered a brief occupation for the people living at these sites. Multiple generations of families would have lived, died, and buried their dead in nearby cemeteries. Looking forward, we must develop new models for Wietenberg social, economic, political, and ideological institutions that account for both the short use life of cemeteries and variability in cemetery and settlement dynamics.

The chronology of the cemetery at Limba-Oarda de Jos-Șesul Orzii also contributes to broader discussions of social identity and inequality in Bronze Age Europe. Inequality, persistent ascribed differences in access to economic resources and other valued ends, is visible in the archaeological record through evidence of contemporaneous variation in access to resources, accumulation of material wealth, and ability to take action in the past (Beck and Quinn 2022). Assessments of contemporaneity are central to this endeavor (see Bailey 2007). Different areas of the cemetery at Limba-Oarda de Jos-Șesul Orzii were used contemporaneously. A recent Bayesian analysis of burials at the Early Bronze Age cemetery at Mokrin showed that all portions of the site were used relatively simultaneously (Krečković-Gavrilović et al. 2025). At Sebeș-Între Răstoace, burials in two distinctive spatial clusters were also shown to be contemporaneous (Bălan et al. 2018). The synchronous use of cemeteries by groups that maintain spatial affinity is indicative of multiple distinct social groups—likely household groups or lineages—maintaining that identity while also participating in building a communal identity among all social groups that used the cemetery. Despite multiple social units maintaining social difference, there is minimal evidence of inequality in these cremation cemeteries in Transylvania and the Carpathian Basin. Polányi (2022, 13–14) argued that homogeneity in cremation urns in EBA III/MBA I (ca. 2200–1800 BCE) cemeteries in the Carpathian Basin masked emerging socioeconomic differences that were made visible through increased quantities of metal grave goods associated with cremation burials. In Limba-Oarda de Jos-Șesul Orzii, as well as at other nearby cemeteries, the cremation urns are similar to each other, but there are few other grave goods. The relative contemporaneity of different spatial clusters and areas of Wietenberg cemeteries is evidence of the politics of mortuary practices that was an important part of Bronze Age Europe (Polányi 2022; Quinn et al. 2020b).

Conclusion

The site of Limba-Oarda de Jos-Șesul Orzii is the largest known Wietenberg cremation cemetery. This study has contributed four new radiocarbon dates, bringing the total for the site to five. As a result, the site is now the Wietenberg cemetery with the second-most dates in Transylvania. The new Bayesian chronology for the site presented here makes an important contribution to our understanding of both this site's history, but also the broader development of Wietenberg communities in Transylvania during the Middle Bronze Age.

The new chronology suggests that Limba-Oarda de Jos-Șesul Orzii was used intensively for a relatively short period of time. The use and abandonment of the cemetery may be linked to a more dynamic settlement system where small communities moved their settlements after a few generations. While Early Bronze Age cemeteries and Middle Bronze Age cemeteries elsewhere in the Carpathian Basin were persistent places that people returned to for hundreds of years, the dated Middle Bronze Age cemeteries in Transylvania were short lived places that did not entice reuse after abandonment.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/RDC.2025.10138>

Data availability statement. Data employed in this study is included in the text and as supplemental material. These materials are also available through the Digital Archaeological Record (<https://core.tdar.org/project/517364/supplemental-material-radiocarbon-chronological-modeling-demonstrates-short-use-of-middle-bronze-age-cemetery-in-transylvania-quinn-and-ciuta-2025>).

Acknowledgments. Funding for this analysis was provided by the Hamilton College Dean of Faculty. We would like to thank the team at the University of Georgia AMS Laboratory, particularly Alexander Cherkinsky, for processing the samples. This manuscript has benefitted from comments from two anonymous reviewers, though all errors and omissions remain the responsibility of the authors.

Declaration of competing interest. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Andrițoiu I (1992) *Civilizația Tracilor din Sud-Vestul Transilvaniei în Epoca Bronzului*. Bucharest: Bibliotheca Thracologica Institutul Român de Tracologie.
- Bailey G (2007) Time perspectives, palimpsests, and the archaeology of time. *Journal of Anthropological Archaeology* **26**, 198–223.
- Bălan G (2014a) Așezarea Wietenberg de la Micești. *Terra Sebus* **6**, 25–86.
- Bălan G (2014b) Deviant Burials of Wietenberg Culture at Micești-Cigaș (Alba County, Romania). *Annales Universitatis Apulensis. Series Historica* **18**(2), 95–118.
- Bălan G, Quinn C, and Hodgins G (2018) The cultural and chronological context of the Bronze Age cemetery from Sebeș-Între Răstoace. In Németh R, Rezi B, and Berecki S (eds.) *Bronze Age Connectivity in the Carpathian Basin*. Târgu Mureș: Bibliotheca Mvsei Marisiensis, 183–216.
- Beck J, Ciugudean H, and Quinn C (2020) Bioarchaeology and mountain landscapes in Transylvania’s Golden Quadrangle. *Bioarchaeology International* **4**(2), 89–110.
- Beck J and Quinn C (2022) Balancing the scales: Archaeological approaches to social inequality. *World Archaeology* **54**, 572–583.
- Boroffka N (1994) *Die Wietenber-Kultur*. Bonn: Habelt.
- Bronk Ramsey C (2009) Bayesian analysis of radiocarbon dates. *Radiocarbon* **51**(1), 337–360.
- Cavazzuti C, Arena A, Cardarelli A, Fritzi M, Gavronović M, Hajdu T, Kiss V, Köhler K, Kulcsár G, Melis E, Rebay-Salisbury K, Szabo G, and Szeverényi V (2022) The first “urnfields” in the plains of the Danube and the Po. *Journal of World Prehistory* **35**, 45–86.
- Cavazzuti C, Hajdu T, Lugli F, Sperduti A, Vicze M, Horváth A, Major I, Molnár M, Palcsu L, and Kiss V (2021) Human mobility in a Bronze Age Vátya “urnfield” and the life history of a high-status woman. *PLoS ONE* **16**(7), e0254360.
- Chidioșan N (1980) *Contribuții la Istoria Tracilor din Nord-Vestul României: Așezarea Wietenberg de la Derșida*. Oradea: Muzeul Țării Crișurilor.
- Ciugudean H (1996) *Epoca Timpurie a Bronzului în Centrul și Sud-Vestul Transilvaniei*. Bucharest: Ministerul Învățământului.
- Ciugudean H and Quinn C (2015) The end of the Wietenberg culture in the light of new ¹⁴C dates and its chronological relation towards the Noua culture. In Németh R and Rezi B (ed) *Bronze Age Chronology in the Carpathian Basin*. Târgu Mureș: Editura Mega, 147–178.
- Ciugudean H, Quinn C, Uhnér C, and Beck J (2023) From east to west and west to east: Yamnaya migration and interactions with Copper Age Carpathian communities in Transylvania. In Preda Bălănică B, Ahola M, and Włodarczak P (eds) *Steppe Transmissions: The Yamnaya Impact on Prehistoric Europe*. Budapest: Archaeolingua, 204–245.
- Ciugudean H, Waterman A, Beck J, Quinn C, and Peate D (2025) The highlanders of western Transylvania and their neighbors: An interdisciplinary study of the Early Bronze Age Tumulus at Meteș, Romania. In Rezi B and Ciugudean H (eds) *Epoca bronzului la fruntariile Bazinului Carpatic: Volum omagial dedicate lui Caol Kacsó cu ocazia împlinirii a 80 de ani*. Baia Mare: Editura Mega, 39–101.
- Ciută M-M, Quinn C, and Totoianu R (2021) Radiocarbon data of funerary discoveries from Middle Bronze Age in the Mureș Valley: The Wietenberg Cemetery from Limba-Oarda de Jos (Alba County, Romania). *Journal of Ancient History and Archaeology* **8**(2), 75–83.
- Dani J, Köhler K, Kulcsár G, Major I, Melis E, Patay R, Szabó G, Hajdu T, Futó I, Huszánk, and Kiss V (2019) Case studies on the radiocarbon dating of Bronze Age cremation burials in Hungary. In Palincas N and Ponta C (eds) *Bridging Science and Heritage in the Balkans: Studies in archaeometry, cultural heritage restoration and conservation*. Oxford: Archaeopress, 29–37.
- Duffy P, Parditka G, Giblin J, and Paja L (2019) The problem with tells: lessons learned from the absolute dating of Bronze Age mortuary ceramics in Hungary. *Antiquity* **93**, 63–79.
- Fântâneau C, Bălan G, Popa S, and Tentiș D (2017). *Necropola din Epoca Bronzului de la Sebeș*. Alba Iulia: Editura Istros a Muzeului Brăilei “Carol I.”

- Fântâneanu C, Bălan G, and Tentiş D (2013) The Bronze Age Necropolis at Sebeş—Între Răstoace. In Sirbu V and Ştefănescu R (eds) *The Thracians and Their Neighbors in the Bronze and Iron Ages: Proceedings of the 12th International Congress of Thracology*. Braşov: Editura Cetatea de Scaun, 173–191.
- Gavranović M, Webster L, Kapuran A, Waltenberger L, Petschko I, Dević M, and Mittermair N (2025) Absolute dating of Bronze Age urn burials in the central Balkans: Cemeteries of copper-producing societies in eastern Serbia. *Radiocarbon*. <https://doi.org/10.1017/RDC.2025.8>
- Hamilton W, and Krus A (2018) The myths and realities of bayesian chronological modeling revealed. *American Antiquity* **83**(2), 187–203.
- Horedt K (1960) Die Wietenbergkultur. *Dacia* **4**, 107–137.
- Horedt K (1967) Problemele Ceramicii din Perioada Bronzului Evoluat în Transilvania. *Studii şi Comunicări Sibiu* **13**, 137–156.
- Jaeger M, Strózyk M, and Olexa L (2023) Society in transition: Cultural change in the Early Bronze Age cemetery at Nižná Myšľa in the light of absolute chronology. *Radiocarbon* **65**(1), 135–154.
- Kapuran A, Gavranović M, and Mehofer M (2020) Bronze age settlement and necropolis of Trnjane, near Bor: Revision and new research results. *Starinar* **70**, 51–84.
- Krečković-Gavrilović M, Radinović M, Porčić M, Pendić J, Milašinović L, and Stefanović S (2025) Absolute chronology and spatial organization of the Early Bronze Age necropolis in Mokrin. *Radiocarbon* **67**(2), 318–330.
- Laabs J (2023) Wealth consumption, sociopolitical organization, and change: A perspective from burial analysis on the Middle Bronze Age in the Carpathian Basin. *Open Archaeology* **9**, 20220281.
- Major I, Dani J, Kiss V, Melis E, Patay R, Szabó G, Hubay K, Túri M, Futó I, Huszánk R, Jull T, and Molnár M (2019) Adoption and evaluation of a sample pretreatment protocol for radiocarbon dating of cremated bones at HEKAL. *Radiocarbon* **61**(1), 159–171.
- Palincaş N (2014) Body and social order in Middle Bronze Age Transylvania (Central Romania, c. 1900–1450 BC). *European Journal of Archaeology* **17**(2), 301–328.
- Parditka G and Duffy P (2023) From the ashes of Bronze Age fires: A framework for comparison across body treatments. *Journal of Anthropological Archaeology* **71**, 101525.
- Paul I (1995) Die Wietenberg-Nekropole Und- Siedlung Von Sibişeni (Kreis Alba). In Paul I (ed) *Vorgeschichtliche Untersuchungen in Siebenbürgen*, Alba Iulia: *Bibliotheca Universitatis Apulensis*, 164–174.
- Polányi T (2022) The rise of *idiôtês*: Micro-politics of death and community reproduction in Bronze Age Hungary. *Journal of Anthropological Archaeology* **68**, 101445.
- Puskás J (2020) The Middle Bronze Age Cemetery at Țufalău/Cófalva–Alámenő I (Covasna County, Romania). *Marisia: Archaeologia, Historia, Patrimonium* **2**, 51–66.
- Quinn C (2017) The crucible of complexity: Community organization and social change in Bronze Age Transylvania 2700–1320 BC). PhD dissertation, University of Michigan, Department of Anthropology.
- Quinn, C (2024) Settlement ecology of bronze age transylvania. *Frontiers in Human Dynamics* **6**, 1360479.
- Quinn C and Ciugudean H (2018) Settlement placement and socio-economic priorities: Dynamic landscapes in Bronze Age Transylvania. *Journal of Archaeological Science: Reports* **19**, 936–948.
- Quinn C, Ciugudean H, Bălan G, and Hodgins G (2020a) Rethinking time, culture, and socioeconomic organisation in Bronze Age Transylvania. *Antiquity* **94**(373), 44–61.
- Quinn C, Ciugudean H, and Beck J (2020b) The politics of placing the dead in Bronze Age Transylvania. *Journal of Archaeological Science: Reports* **34A**: 102574.
- Reimer P, Austin W, Bard E, Bayliss A, Blackwell P, Bronk Ramsey C, Butzin M, Cheng H, Edwards R, Friedrich M, Grootes P, Guilderson T, Hajdas I, Heaton T, Hogg A, Hughen K, Kromer B, Manning S, Muscheler R, Palmer J, Pearson C, van der Plicht J, Reimer R, Richards D, Scott E, Southon J, Turney C, Wacker L, Adolphi F, Büntgen U, Capano M, Fahrni S, Fogtmann-Schulz A, Friedrich R, Köhler P, Kudsk S, Miyake F, Olsen J, Reinig F, Sakamoto M, Sookdeo A and Talamo S (2020) The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). *Radiocarbon* **62**(4), 725–757.
- Snoeck C, Lee-Thorp J, Schulting R, de Jong J, Debouge W, and Mattielli N (2015) Calcined bone provides a reliable substrate for strontium isotope ratios as shown by enrichment experiment. *Rapid Communications in Mass Spectrometry* **29**, 107–114.
- Vogel J, Southon, J, Nelson D, and Brown T (1984) Performance of catalytically condensed carbon for use in accelerator mass spectrometry. *Nuclear Instruments and Methods in Physics Research B* **5**, 289–293.
- Zazzo A and Saliège J (2011) Radiocarbon dating of biological apatites: A review. *Palaeogeography, Palaeoclimatology, Palaeoecology* **310**, 52–61.