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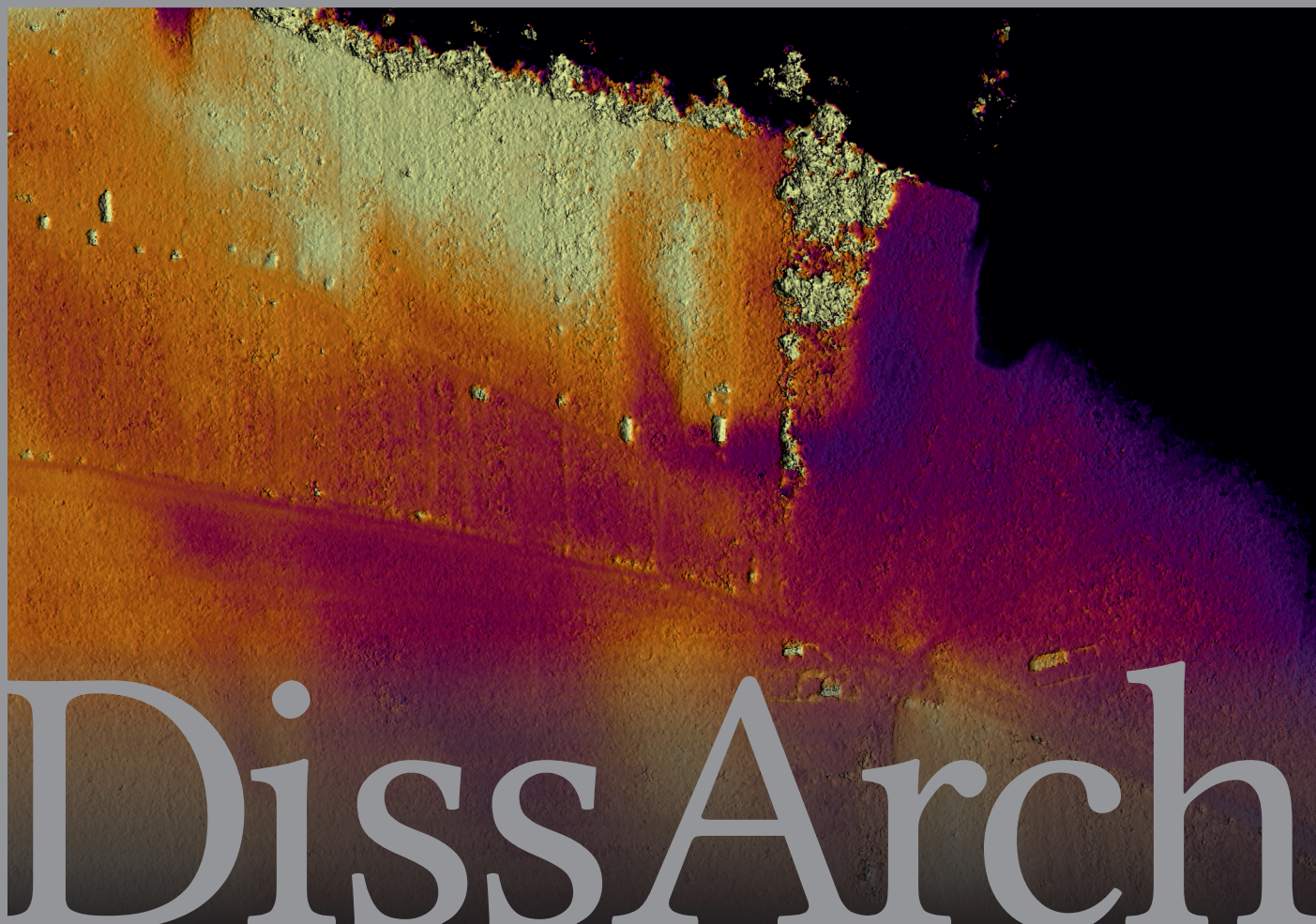

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Chronological problems of the 7th–10th-century AD Carpathian Basin in light of radiocarbon data

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Abstract: The study[1] presents the evaluation of a radiocarbon series, currently unparalleled in the research of the early medieval Carpathian Basin, which comprises data from the 7th to the 10th century AD. We provide a data set that, when combined with the radiocarbon data available in the related literature, covers the period in focus. The results of its analysis can be considered novel in several respects: 1) the radiocarbon data sequence and the relative chronological framework established for the Late Avar Period concord, 2) based on the radiocarbon sequence, the Middle Avar Period in certain large cemeteries (i.e., Tiszafüred-Majoros) started considerably earlier than it was assumed previously, based on 'Middle Avar Period' elite graves—and, interestingly, earlier even than the coin-dated 'Middle Avar' elite grave horizon, and 3) the data of the latest grave horizon in Avar cemeteries suggests a similar asynchronism between the related sites. The data set allows one to draw preliminary conclusions about the trends of the early medieval cultural and social transformations in the Carpathian Basin and outline 'innovative' groups which, by maintaining contacts with diverse regions outside the Carpathian Basin, played a central role in these processes.

Keywords: Early medieval archaeology, archaeology of the Middle Danube Basin, relative chronology, absolute chronology, radiocarbon dating, Avar Period, Hungarian Conquest Period

1. Introduction. Traditional chronological framework of the 7th–10th century AD in the Carpathian Basin

Until recently, radiocarbon dating had little effect on the chronological framework outlined for the Early Middle Ages. The anomalies in the calibration curve raised uncertainty, especially with regards to the 8th–10th centuries AD. Two trends can be highlighted in the practice of dating archaeological phenomena and finds in the second half of the 20th century. First, if dissimilarities between

1 The study has been implemented with the support provided by the Ministry of Innovation and Technology of Hungary from the National Research, Development and Innovation Fund, financed under the TKP2021-NKTA-24 funding scheme.

two sets of cultural phenomena could not originate from different ethnicity, they were invariably explained with a diverse chronological position, while resemblances with contemporaneity.[2] Second, researchers often worked on the hypothesis that historical events affect the archaeological record directly, i.e., that such events are precise chronological markers and that changes in the material culture may evidently be linked with them. Working upon these premises, an exceptionally detailed chronological framework had been established by the end of the 20th century for the period from the arrival of Avars in the Carpathian Basin in AD 567/568 to the Hungarian Conquest dated to AD 895. Uncertainty only emerged with regards to the closing date of the Avar period: while 20th-century research unequivocally accepted the Carolingian wars (AD 796–810) to be the closing act, today's convention settles for the last mention (in the *Annales Laurissenses*) of an Avar delegation which appeared in the imperial assembly in Frankfurt in AD 822.[3]

The internal division of the period in question was created using predominantly archaeological methods (Fig. 1). The distinction between the three main phases (Early, Middle, and Late Avar Period) relied on graves dated by coins up to the mid-7th century AD ('Middle Avar Period'),[4] while the remaining part (until the Carolingian invasion) was divided further mechanically, based mainly on stylistic traits of belt sets recovered from graves of men.

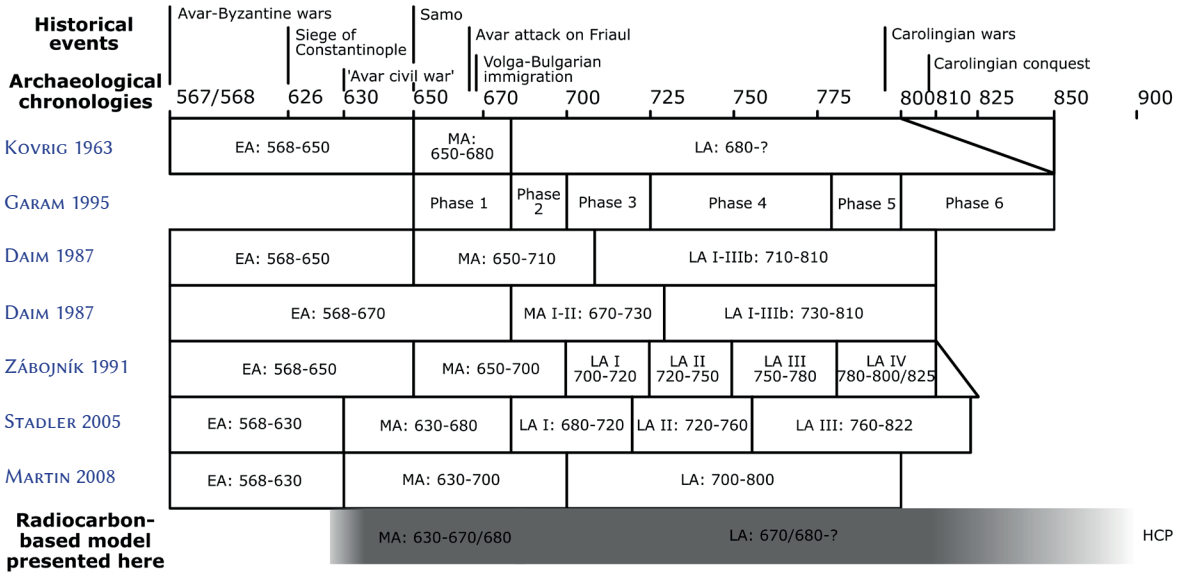

Fig. 1. Traditional chronological models of the Avar Period and the suggested radiocarbon-based chronology (after Faragó et al. 2022, Fig. 2)

Today, the Early and Middle Avar Periods, both significantly shorter than the late one, were divided into two, while the Late Avar Period into three (Falko Daim) or four (Jozef Zábojník), and, lately, integrating the conclusions deducted from statistical and cemetery analyses, five sub-phases,[5] four of which comprise the typo-chronological groups of Late Avar material culture (LA 1–4), while the last phase (LA 5) corresponds with the period of decay of Avar material culture (Leobersdorf Phase IIIb by Falko Daim[6] or Phase 6 of the Tiszafüred cemetery by Éva Garam[7]) This late phase

2 For a counter-example in early research, see Alföldi 1926, 15–16.

3 Pohl 2018, 389; Szőke 2019, 158–159.

4 Garam 1992; Somogyi 1997; Somogyi 2014.

5 To the relative chronology of Late Avar Period belt ornaments, see especially Daim 1987; Zábojník 1991; Garam 1995; Szenthe 2020, 45–67 and below.

6 Daim 1987, 47.

7 Phase 6, Garam 1995, 416–423.

comprises, e.g., incomplete belt sets and relative few Avar-type jewellery, completed with imported bead types—millefiori and segmented beads, as well as, in several cemeteries, simple wire jewellery types, like braid rings with S- or spiral-terminals. (As it is discussed below, a final, sixth phase has also been distinguished in some cemeteries, like Pilismarót and Tiszafüred, but it hardly contains artefacts with a good dating value.)

With a sociocultural approach, two major historical phases can be distinguished within the Avar Period. The first is the phase of nomadic rule, characterised by cultural heterogeneity, from the arrival of Avars in the Carpathian Basin to approximately the middle third of the 7th century AD. After that, the Avar culture underwent a fundamental transformation. The 'Middle Avar Period' is actually a transitional one when the socio-cultural structure of the previous period gradually vanished, giving room to the emerging Late Avar ways. As for its absolute dating, opinions vary, seemingly according to the main field or region of interest of the actual researcher, the most frequent dates being around AD 630,[8] 650, and 670. Hungarian research has focused primarily on the archaeological record of Avars settled on the Great Hungarian Plain and small elite burial grounds or find assemblages, complementing the body of data with mentions in coeval written sources, and has preferred the versions with younger dates[9]—which, albeit also incorporating historical arguments,[10] rely on coin-dated nomadic-style elite graves in the first place (e.g., Ozora, with a *solidus* issued by Constantin IV between AD 669 and 674).[11]

Initially, setting the start of the Middle Avar Period to around AD 650 was based on the analysis of a single cemetery;[12] however, the results of diverse typochronological assessments (of pottery[13] and some grave finds[14]) and statistical evaluations[15] have corroborated it since, and, by today, the work of researchers focusing primarily on the archaeological record of the era in Transdanubia and Western Hungary[16] has made it the most widely accepted version.

In summary, it is still a key problem with Avar cemeteries that the material record in itself does not provide sufficient information for an absolute dating of the Late Avar phases using exclusively traditional archaeological methods. All current hypotheses rely on historical data, linking phenomena in the archaeological record with historical events (e.g., the Carolingian and Bulgar conquests, the political and military events of the 9th century AD, as well as the Hungarian conquest in the late 9th century) or their aftermath. According to these models, the population behind the Avar cemeteries stepped off the world stage after a short agony due—allegedly—to diverse catastrophic events, including famine, drought, and a massive loss of life suffered in lasting military conflicts.[17] Thus, the Avar population was largely replaced in Transdanubia by the bearers of cultures of 'Danube

8 The earliest date, AD 630, was suggested by Max Martin based on the cross-dating of finds from the cemeteries of Linz-Zizlau (Austria), Környe (Transdanubia), and Alattyán-Tulát (Northern Hungarian Plain); see Martin 1990, 68–74.

9 See, for example, Garam 1979; Garam 1987, 191–200; Garam 1995.

10 The historical narrative only got into the foreground of interpretation after 1968 when Samu Szádeczky-Kardos published his famous study presenting a historical source that described the route taken by Prince Kuber to the Carpathian Basin (Szádeczky-Kardoss 1968). In the following decades, the historical narrative basically obscured all archaeological arguments, and the transition was linked to the arrival of Kuber around AD 671. See Bálint 2004, 36–38; Bálint 2008, 29–32.

11 Somogyi 1997, 71–72.

12 Alattyán-Tulát (Kovrig 1963, 188).

13 Vida 1999, 190–191.

14 Gyenesdiás (Müller 1989, 147).

15 Zábojník 1991.

16 The ones cited above and Daim 1987, 155–160; Daim – Lippert 1989, 91; Szenthe 2014.

17 See Preiser-Kapeller 2018, 317–320, from a critical perspective.

Region character' from the Carolingian borderland, by groups under Bulgarian rule in the Great Hungarian Plain, by Slavic communities in the mountain zone around the inner, plain regions of the Carpathian Basin, while some groups of Avar identity could only persist in the northern part of the Great Hungarian Plain. Another hypothesis, built obviously upon the faulty premise that any radical difference between the material cultures of the two groups is beyond doubt the result of their different chronological positions, but still widely accepted today—namely that in Transdanubia, the Carolingian-style find material is certainly younger than the Avar cemeteries—does not help with clarifying the picture either. After all, in the traditional narrative Hungarian conquerors, i.e., another 'people' with its own characteristic material culture, occupied a largely empty region and built a new political and economic system there with out local basis as the bulk of the population of the Carpathian Basin had diminished in the wars of the 9th century AD.

In summary, the current chronological frameworks for the 7th–10th centuries are based on premises which, doubtless, incorporate a grain of truth but are not sufficiently validated and are, unfoundedly, thought of as if they were set in stone. These premises are approximately:

- a) typological dissimilarities in the material record invariably reflect chronological differences;
- b) the material culture and funerary rite of Avars remained unchanged throughout the whole Avar Period (e.g., ornate belts were part of the mortuary costume in all phases);
- c) All cultural changes are omnipresent, i.e., they occur in every Avar community throughout the Carpathian Basin at the same time and in the same way;[18] and
- d) the reproduction and use of the elements of the Avar material culture ceases suddenly with the Carolingian conquest and the fall of the Avar Khaganate.

Several elements of this traditional model (and its methodological background) must be replaced by a new one, and a suitable set of radiocarbon data may contribute significantly to their creation.

2. The archaeological and historical background of the radiocarbon sampling and the evaluation of the data

The historical question behind our sampling strategy emerges from a contradiction between East-Central and Western European research regarding the historical and archaeological narratives of the Early Middle Ages. Western European scholarship described the history of Western and Central Europe between the 7th and the 11th centuries AD as a continuous process. Yet, the traditional historical (and, thus, archaeological) narrative of the events of this period in the Carpathian Basin has always been way more fragmented, describing the history of the period as characterised by the appearance and disappearance of parallel and consecutive cultures, geopolitical units, and peoples (Avars, Slavic, and Moravian peoples, and conquering Hungarians) which but do not add up to a continuous development. However, the high ethnic diversity and chequered history undoubtedly characterising the period in question in the Carpathian Basin only became leading themes in narratives in the 20th century, when many scholars were thinking in terms of nation-states in the first place. In contrast, several trends related to culture, economy, and the distribution and communication networks outlined in the archaeological record suggest that the development in the early medieval Carpathian Basin between the 7th and the 11th centuries AD was a continuous process.[19]

18 This phenomenon is actually an effect of the social, cultural, and distribution system integrating the whole territory of a single state-like construct, the Avar Khaganate, a focus of this research.

19 See especially Szenthe 2019; Szenthe 2021; Szenthe – Gáll 2021; Szenthe – Gáll 2022a; Szenthe – Gáll 2022b.

Our goal was to test these two historical conceptions. We started by compiling a radiocarbon series that covers all the find material assigned to the period in focus.

The scarcity of finds with an absolute dating value in the 8th–9th-century AD record of the Carpathian Basin, together with the anomalies of the calibration curve which make the samples from the period especially difficult to date, are the main problems one has to overcome when constructing an absolute chronological framework. To mitigate this risk factor, available radiocarbon data of 7th–10th-century AD coin-dated graves were integrated into the model. Luckily enough, these graves gave absolute dates for the start and the end of the period analysed, thus providing the sequence with a firm start and an end date.

The current analysis is based on samples taken from osteological remains of three cemeteries (Hortobágy-Árkus: 21 samples, Tiszafüred-Majoros: 43 samples, eight from horses, and Pilismarót-Basaharc: 14 samples), also incorporating published radiocarbon dates related to the Avar, the 9th-century AD Moravian, as well as all the Hungarian Conquest Period (HCP) record (Fig. 2).

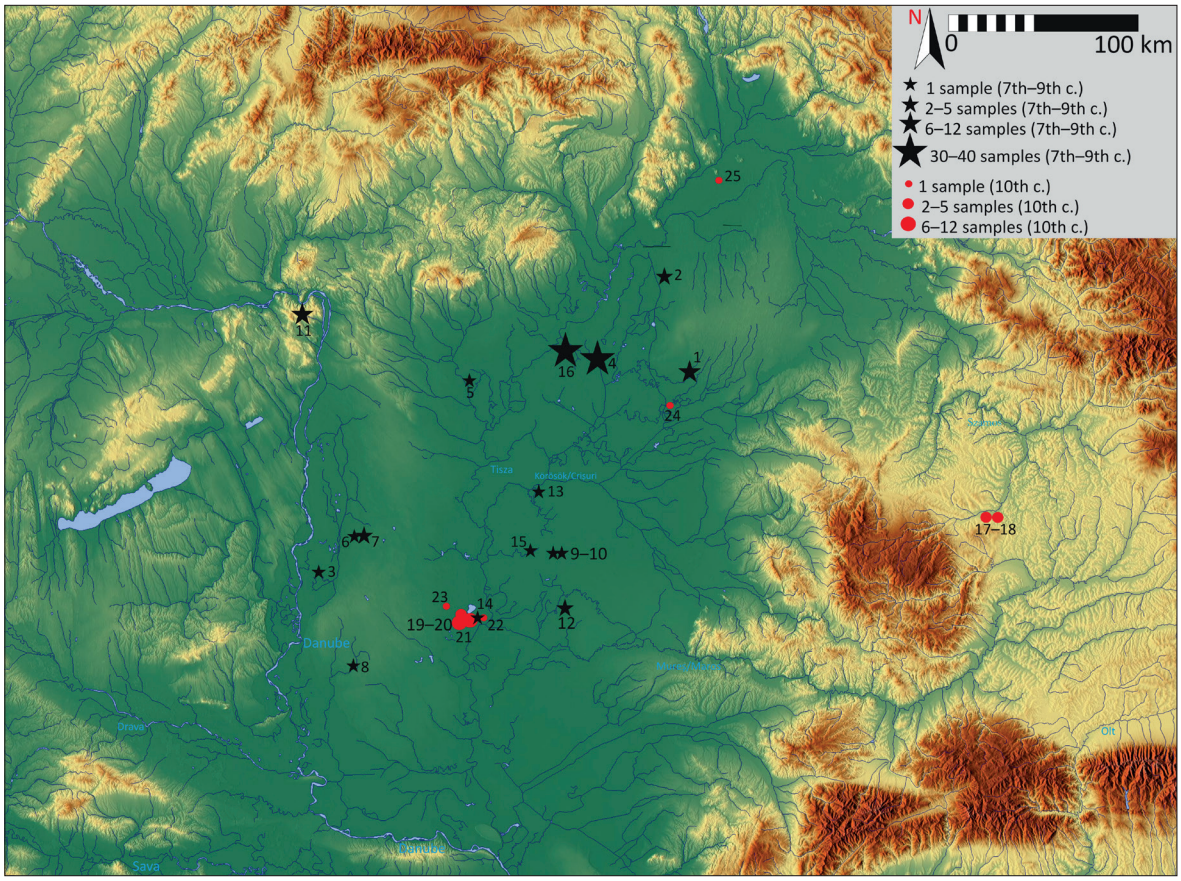

Fig. 2. Radiocarbon data series from the Middle and Late Avar and the Hungarian Conquest period in the Carpathian Basin. Spatial and quantitative distribution of the samples. 1 – Debrecen-Bellegelő (10 samples), 2 – Hajdúnánás-Fürj-halom-járás (2 samples), 3 – Homokmégy-Halom (1 sample), 4 – Hortobágy-Árkus (26 samples), 5 – Jánoshida-Tótkérpuszta (1 sample), 6 – Kiskőrös-Pohibuj, Mackó-dűlő (1 sample), 7 – Kiskőrös-Vágóhíd (2 samples), 8 – Madaras-Téglavető-dűlő (1 sample), 9 – Orosháza-Bónum-téglagyár (1 sample), 10 – Orosháza-Béke TSz-homokbánya (1 sample), 11 – Pilismarót-Basaharc (12 samples), 12 – Pitvaros-Víztározó (5 samples), 13 – Szarvas-Grexa-téglagyár (1 sample), 14 – Szeged-Makkoserdő (1 sample), 15 – Székkutas-Kápolnadűlő (1 sample), 16 – Tiszafüred-Majoros (49 samples), 17 – Cluj-Napoca-Plugarilor street (2 samples), 18 – Cluj-Napoca-Zápolya street (3 samples), 19 – Szeged-Öthalom V (7 samples), 20 – Szeged-Kiskundorozsma-Hosszúhát (8 samples), 21 – Szeged-Kiskundorozsma-Hosszúhát-halom, Grave 100 (2 samples), 22 – Szeged-Csongrádi út (1 sample), 23 – Zsombó-Ménesjárás-dűlő, Grave 1 (1 sample), 24 – Derecske-Nagymező-dűlő (1 sample), 25 – Karos-Eperjesszög F.s. III (1 sample)

2.1 Tiszafüred-Majoroshalom

The largest Avar cemetery east of the Danube was discovered by the middle course of the Tisza River (Fig. 3).[20] The fully excavated site comprised 1300 graves; the second and third largest cemeteries in the area are Tiszaderzs[21] with about a hundred burials, and Kisköre with 210 graves on the right bank of the river.[22] Save for Tiszafüred, cemeteries with more than a thousand graves of the Avar Period are all located west of the Danube. The archaeological record of Tiszafüred is characterised by a duality: while the basic characteristics, like the female attire,[23] some other traits of material culture,[24] and the funerary rite[25] link it closely with coeval sites in Southern Transdanubia, some attributes (including the 'Middle Avar'-style ornate belts with silver sheet fittings[26]) fit the local archaeological group in the Middle Tisza Region. Most graves of the cemetery could be classified into the Middle Avar Period (MA) and the first half of the Late Avar Period (LA) (based on ornate belts, MA Phase 1: 40 graves, MA Phase 2: 32 graves, LA Phase 1: 36 graves). After that, the number of men buried with ornate belts declines significantly: there are only 19 graves in LA Phase 2, seven graves in LA Phase 3, eight graves in LA Phase 4, and five graves in Phase 5 (incomplete sets of predominantly LA 3–4-phase ornament types).[27] Based on the number of the related graves of females, the difference is probably not the result of a change in funerary representation of men (i.e., that in the younger horizons, ornate belts would be less frequently buried with their owners). The number of the graves of females (counted according to Éva Garam's division[28]) plummeted in the last two horizons. While the cemetery gradually expanded southwards with time, its basic structure, that is, consisting of more-or-less separate grave clusters of families or kins(?), remained unchanged, which means graves of practically any horizon can be found anywhere. Conclusively, adding chronological value to the horizontal stratigraphical position of a grave and applying it as a chronological marker in the model can only be done very cautiously.

2.2 Hortobágy-Árkus

The comparative analysis of the coeval cemeteries at Tiszafüred-Majoroshalom and Hortobágy-Árkus is all the more important because they only lay twenty-five kilometres apart. Altogether, 52 graves were unearthed at the small burial ground situated at the fringes of the one-time flood plain east of Tiszafüred (Fig. 4) (originally, the cemetery could comprise about a hundred graves, a half of which was destroyed by a modern sand quarry).[29] The cemetery was used by a group with a characteristic find material markedly different from the one recovered from Tiszafüred. The high proportion of horse burials (over 20%), the presence of horse harnesses lavishly adorned with gilded copper alloy mounts, the ten gilded—or even gold plated—belt sets (out of the twelve ornate belts),

20 For a full archaeological assessment (albeit without anthropological and archaeozoological evaluation), see Garam 1995.

21 Kovrig 1975.

22 Garam 1979.

23 For direct analogies from Zamárdi to the earrings of women and the belt pendants, see Garam 2011. Similar types are also present in Pecica-Rovine Grave Ftr. 47 (Gáll – Mărginean 2021, 206–207).

24 Identical artefacts reflecting direct connections between Zamárdi, Kölked and Tiszafüred; see Szenthe 2012b.

25 For horse burials with the horse interred in a separate grave pit, see Garam 1987, 65–100.

26 Szenthe 2012a.

27 Based on the typological categories presented in Garam 1995, 187–263.

28 Garam 1995, Abb. 237, 239, 241, 243, 245, 247–249, 250. The large number of graves in Phase 4, in this case, results from the joining of Late Avar groups 1 and 2.

29 For a full publication, see Szenthe – Gáll 2022a.

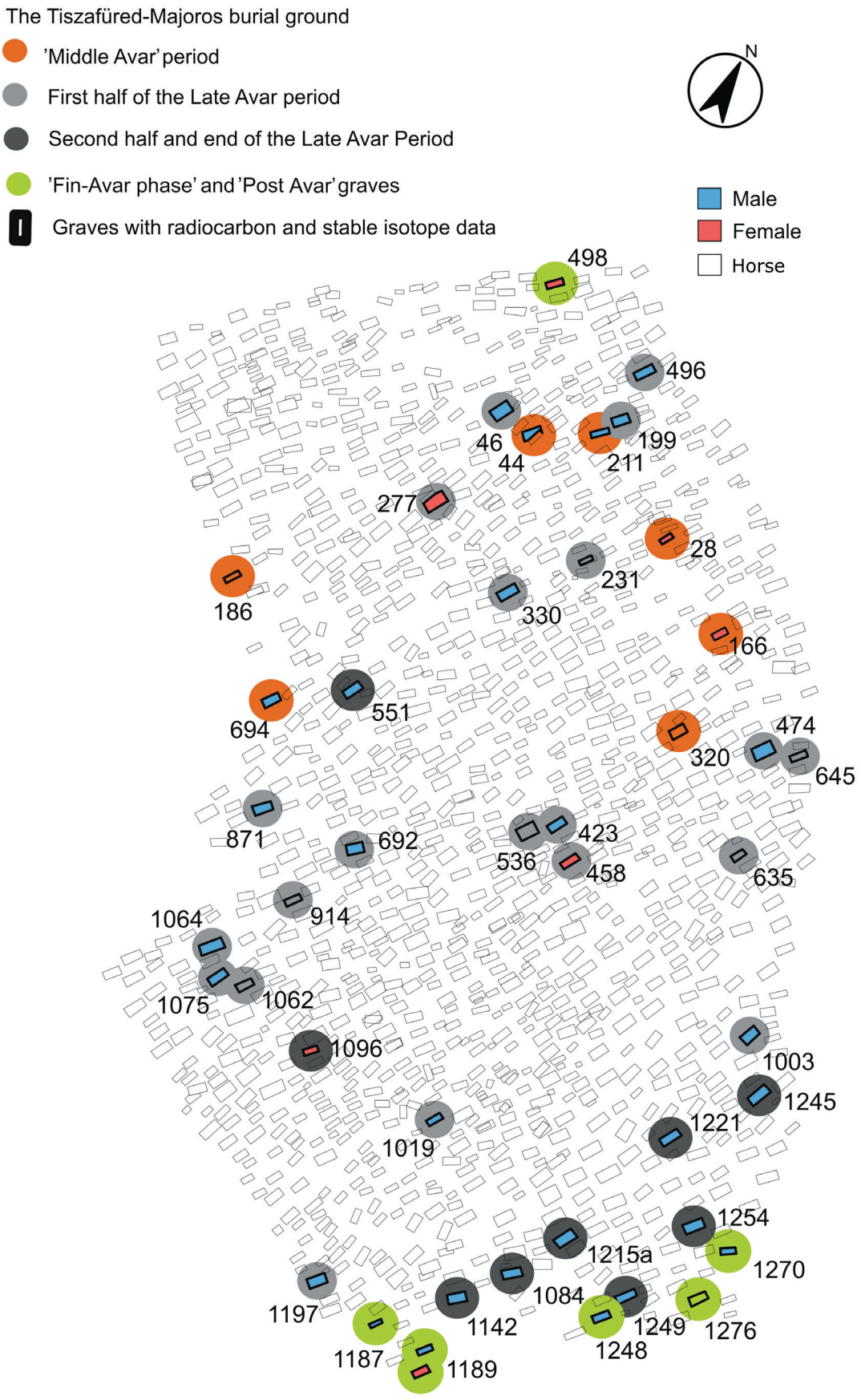

Fig. 3. Tiszafüred-Majoros. Survey map of the cemetery with the sampled graves and their chronological classification

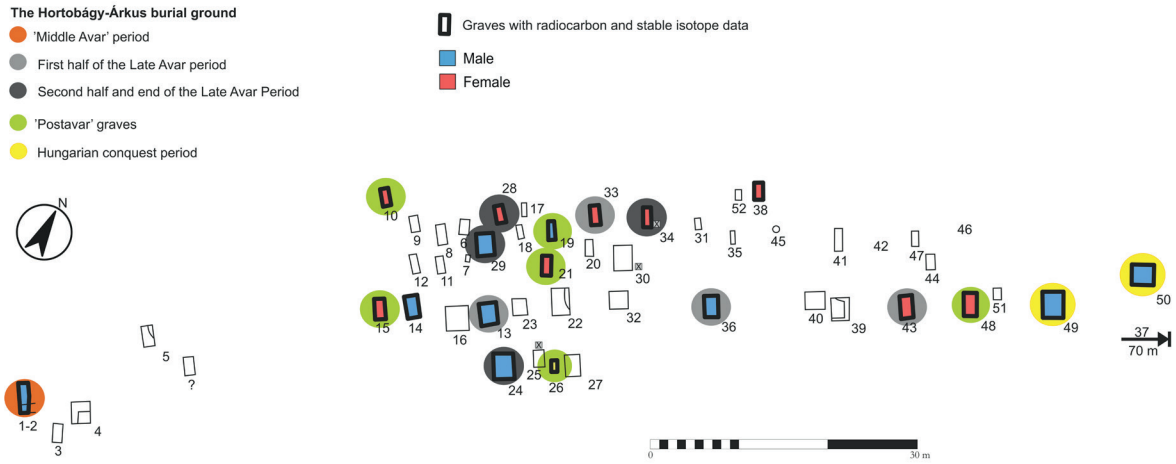

Fig. 4. Hortobágy-Árkus. Survey map of the cemetery with the sampled graves and their chronological classification

and the presence of precious metal items raise this site way above the average of the period. The find material reflects a particularly far-reaching connection network, indicating mobility and a military lifestyle having been central elements in the community's life.[30] Their diet was extremely rich in protein, indicating their distinct cultural and special social status.[31] Based on the above, not only the lifestyle but probably also the social status of the community behind the Hortobágy-Árkus cemetery differed from that of Tiszafüred-Majoroshalom, the former probably representing a high-prestige or elite group.[32]

2.3 Pilismarót-Basaharc

Almost 270 graves were discovered south of the Danube, on the two sides of Road 11 in the section west of the village Pilismarót (Figs 5–6); the graves in the path of the motorway have been destroyed. The earliest graves are not older than LA Phase 2. The area marked out by graves of men with ornate belts of the LA Phases 3 and 4 is surrounded by a number of burials which, based on the jewellery of women and girls and some distinctive pottery types, can undoubtedly be assigned to after Phase 4. Phase 5, characterised by incomplete belt sets, is also present on the site. Complex sets of jewellery (consisting of bead-pendant earrings, diverse types of bracelets, rings, disc-shaped agraffes, and long bead necklaces) are traits typical to the graves of females around the burials of men of Phases 4 and 5, whereas the graves surrounding these burials are characterised by a significant decline in the number of grave finds. The burials of men and boys in the peripheral areas of the cemetery contain almost no grave good or personal accessory, and the quantity and diversity of women's jewellery are radically decreased. In these burials, Avar-style head jewellery becomes replaced by spiral- or rolled-end rings, and burials of males only contain an occasional knife or iron buckle and pottery vessels, including ones with a potter's mark on the base. Grave 117, at the fringes of the cemetery, contained a bracelet twisted from two wires, while Grave 177 had a rolled-end ring and an S-terminalled lock ring.

30 Szenthe – Gáll 2022b.

31 Faragó et al. 2022.

32 For an analysis of horse and weapon burials, which research tends to link with the elite, see Szenthe 2019. The manuscript of the evaluation of the Hortobágy-Árkus cemetery includes a comprehensive evaluation of the phenomenon; the data presented here are based on the results of the analysis described there.

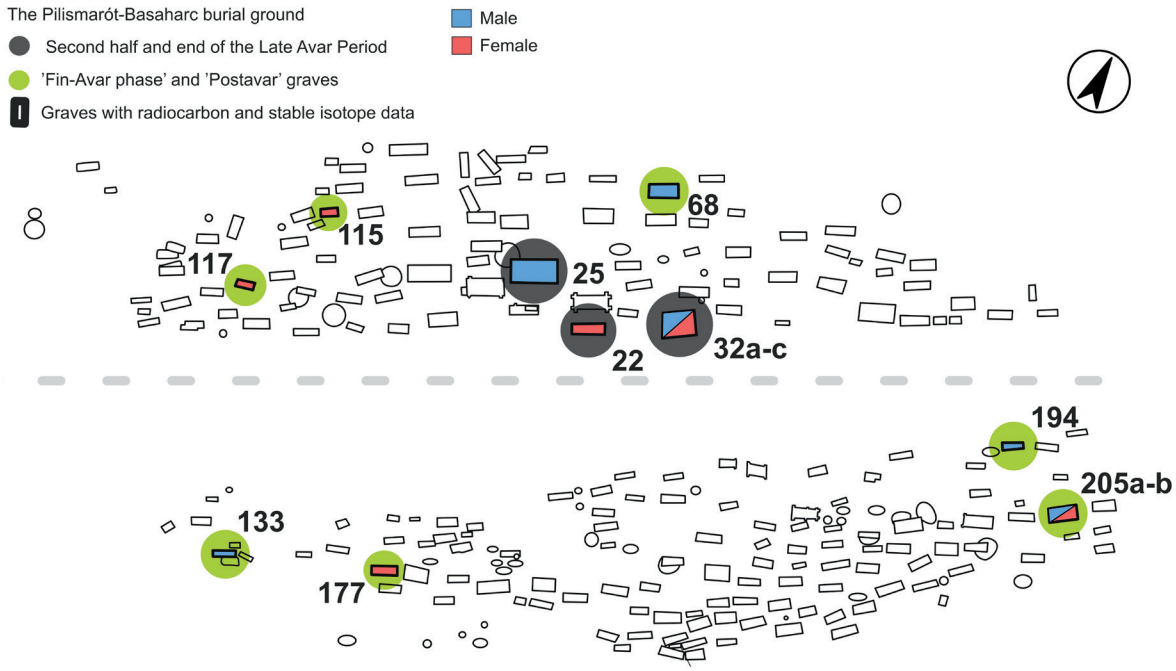

Fig. 5. Pilismarót-Basaharc. Survey map of the cemetery with the sampled graves and their chronological classification

3. Methods

In addition to radiocarbon data from Tiszafüred and Hortobágy,[33] Middle Avar data from Hajdúnánás,[34] and Hungarian Conquest Period dates,[35] fourteen new AMS measurements (Tab. 1; Figs 7–8) from human bones from the Pilismarót-Basaharc cemetery were utilised in this study. The samples were prepared and measured by the Hertelendy Laboratory of Environmental Studies (HEKAL) in Debrecen.[36] The uncalibrated radiocarbon data were calibrated using OxCal 4.4.4[37] and the IntCal20 calibration curve.[38]

The oldest calibrated date from the Pilismarót-Basaharc cemetery was the one from Grave 25, dated to about 650 (68.3%) 665 cal AD. The sample from Grave 205a proved to be the youngest, dating to 709 (68.2%) 870 cal AD. In the case of this double grave, the radiocarbon measurements provided significant additional information that contradicted field observations.[39] The two graves were supposed to be (and published as) contemporaneous, while Grave 205b proved to be much older than Grave 205a, dating to 687 (68.3%) 743 cal AD according to the new observations.

The situation with individuals A and B in Grave 32 is similar. Consistent with the field observations, Grave 32c proved to be the oldest, being the second oldest burial in the analysed series, dated to 661 (68.2%) 759 cal AD. However, radiocarbon dating raised some doubts about the contemporaneity of Graves 32a and 32b as the deceased in the latter was buried at the same time as or slightly after the

33 Faragó et al. 2022; Szenthe et al. 2022.
34 Rácz – Szenthe 2009.
35 Türk et al. 2015, 95; Gáll et al. 2020; Somogyi – Türk 2023.
36 Molnár et al. 2013a; Molnár et al. 2013b; Major et al. 2019a; Major et al. 2019b.
37 Bronk Ramsey 2009a.
38 Reimer et al. 2020.
39 Fettich 1965.

one in Grave 32c, who was interred around 667 (68.2%) 772 cal AD. The difference between the two uncalibrated dates is 16 years, which is on the border of the error margin of measurement (±14 and ±22 BP). Based on the differences of uncalibrated dates, Grave 32a was established only about 60 (calibrated) years later, around 689 (68.2%) 823 cal AD.

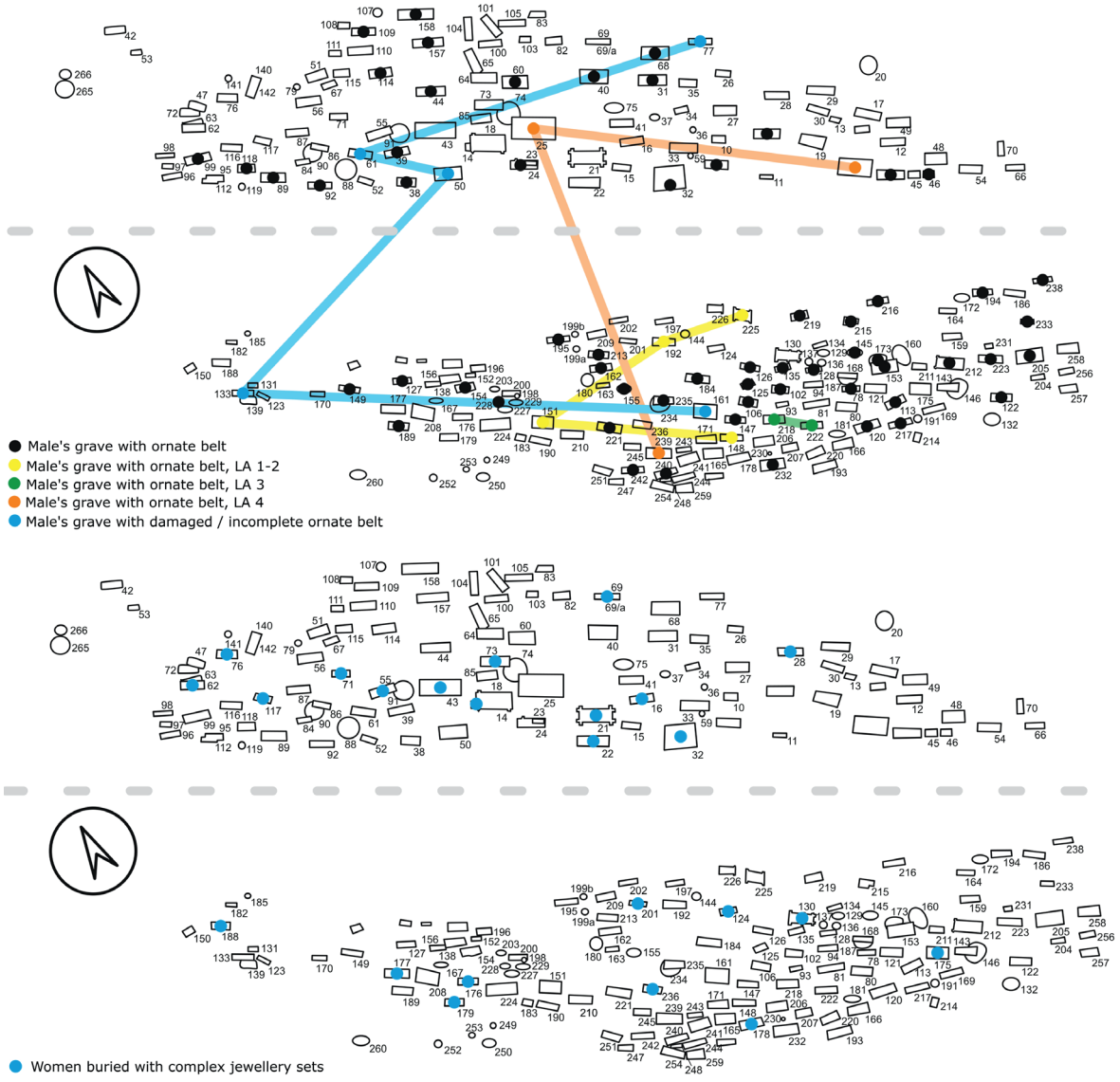

Fig. 6. Relative chronological phases of the Pilismarót-Basaharc cemetery based on ornate belts and the graves of females with jewellery sets

The aim of this analysis was to demonstrate and examine the chronological contradictions mentioned above using statistical methods and to place the Pilismarót data set in a broader chronological context. Therefore, first these results were inserted into a previously published series comprising data from Tiszafüred and Hortobágy,[40] as well as Middle Avar[41] and oldest Hungarian Conquest Period features.[42] The nine measurements from Grave 11 of the Karos III cemetery have already been the subject of a recent study.[43] However, we were forced to ignore these results, partly because

40 Faragó et al. 2022.

41 Rácz – Szenthe 2009.

42 Türk et al. 2015, Tab. 2.

43 Somogyi – Türk 2023.

the published models suggested that one of the measurements (DeA-15167, from a sheep) was an outlier, and the authors also excluded it from their analyses at a point; so we followed their logic. The more serious problem arose when evaluating together and incorporating into one model the data from Grave 11 of Karos III and Grave 52 of Karos II, as there was a difference of more than 20 years between the two burials with a probability of 95.4%, which contradicts genetic research results that the two individuals were siblings.[44]

The next step was about exploiting the potential of the OxCal software and Bayesian statistics.[45] As mentioned earlier, the find material and radiocarbon measurements from the 7th–10th-century AD Carpathian Basin were rendered into in a single historical process, without any attempt to assigning them to archaeological cultures or ethnic groups. Translated into the language of OxCal and statistics, these data have been arranged into a single-phase sequence without any further interpretation. To anchor our sequence to absolute dates, we relied on coin-dated graves that determined its start and end and, thus, the related chronological period. The burials utilised this way are Grave 12 of Hajdúnánás,[46] Graves 187 and 132 of Szeged-Öthalom, Graves 100 and 595 of Szeged-Kiskundorozsma, and Grave 1 of Szeged-Csongrád.[47]

These graves were incorporated into the model using the 'After()' function of OxCal based on the *terminus post quem* provided by the coins. For multiple measurements of samples from the same remains the 'R_Combine()' function was used, using which we also corrected the model published previously in the Hortobágy monograph.[48] Superpositions of double and triple graves were also built into the model (Graves 14 of Hortobágy-Árkus and Graves 32 and 205 of Pilismarót-Basaharc). Finally, the 'Combine()' function was used for combining the calibrated values of multiple measurements from the same grave but different samples (e.g., human and animal).

Tab. 1. Chart summarising the radiocarbon data of Pilismarót-Basaharc

AMS 14C measurement ID	HEKAL sample ID	Sample name	Sample type	Uncalibrated 14C age (year BP) (±1s)	Calibrated age (cal AD) (1s)
DeA-39794	I/3214/69	PilB115	human bone	1297 ± 20	AD 672–772
DeA-39795	I/3214/70	PilB117	human bone	1291 ± 18	AD 675–772
DeA-39796	I/3214/71	PilB133	human bone	1268 ± 18	AD 685–743
DeA-39797	I/3214/72	PilB177	human bone	1278 ± 18	AD 681–769
DeA-39798	I/3214/73	PilB194	human bone	1249 ± 17	AD 691–819
DeA-39799	I/3214/74	PilB205a	human bone	1228 ± 18	AD 709–870
DeA-39800	I/3214/75	PilB205b	human bone	1267 ± 17	AD 687–743
DeA-39801	I/3214/76	PilB22	human bone	1315 ± 18	AD 664–772
DeA-39802	I/3214/77	PilB25	human bone	1366 ± 17	AD 650–665
DeA-39803	I/3214/78	PilB32A	human bone	1247 ± 25	AD 689–823
DeA-39804	I/3214/79	PilB32B	human bone	1306 ± 21	AD 667–772
DeA-39833	I/3214/80	PilB32C	human bone	1322 ± 14	AD 661–759
DeA-39834	I/3214/81	PilB6	human bone	1251 ± 14	AD 702–797
DeA-39835	I/3214/82	PilB68	human bone	1250 ± 15	AD 702–817

44 Maróthi et al. 2022; Somogyi – Türk 2023, 303; Révész 2020, 21–23, 37.

45 Bronk Ramsey 2009a.

46 Rácz – Szenthe 2009.

47 Türk et al. 2015.

48 Szenthe – Gáll 2022a.

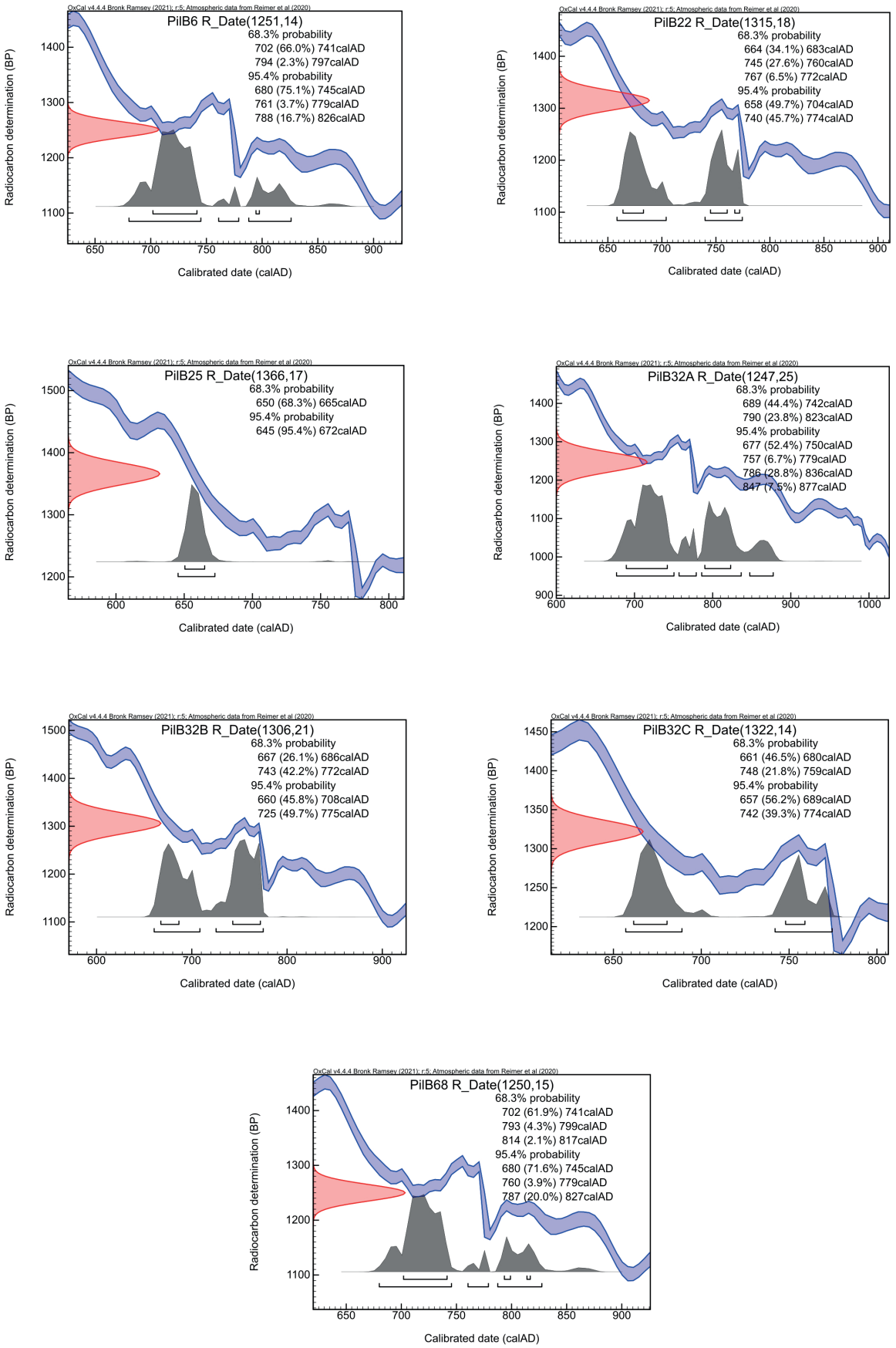

Fig. 7. Pilismarót-Basaharc. Calibrated radiocarbon dates 1

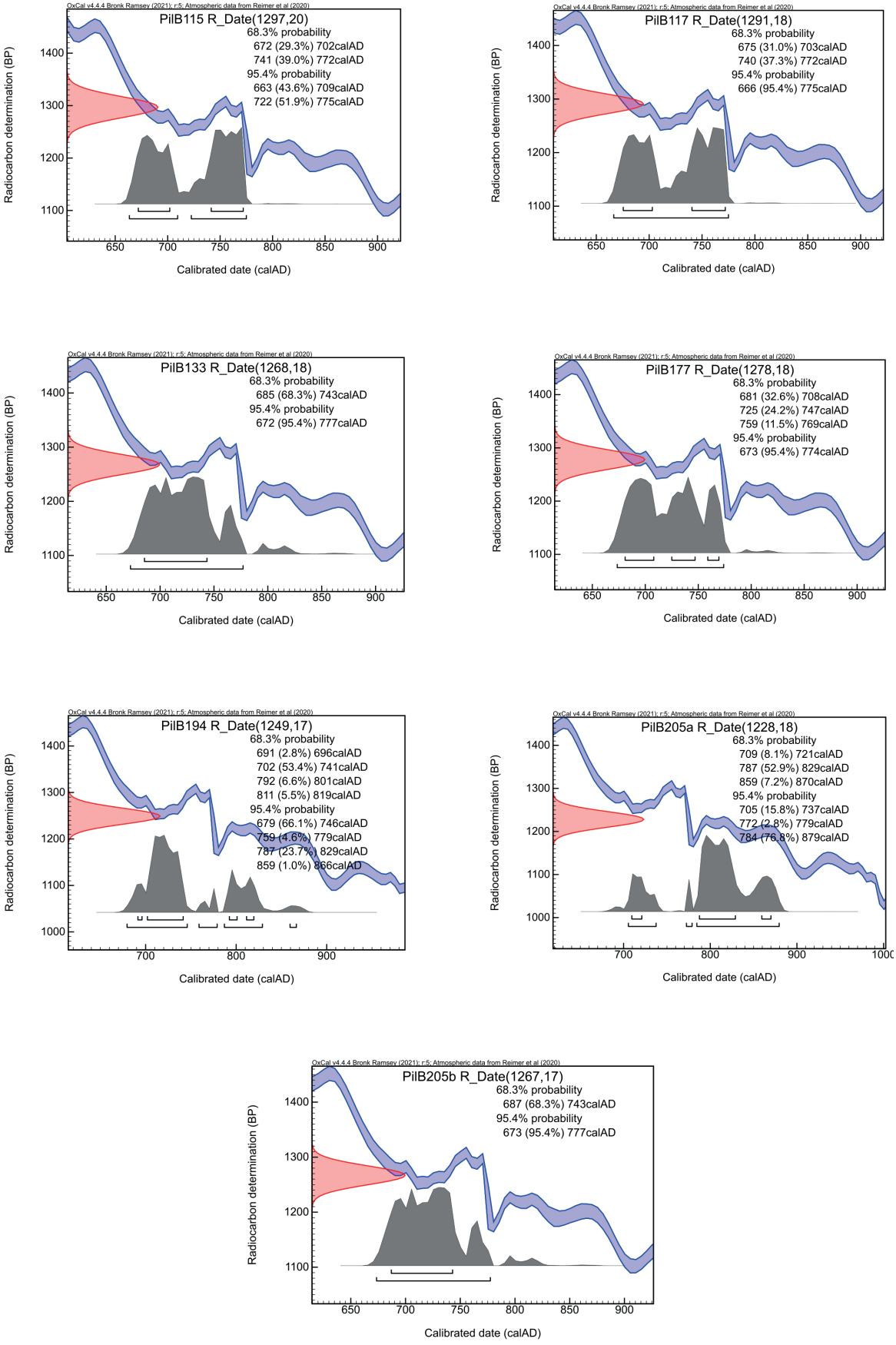

Fig. 8. Pilismarót-Basaharc. Calibrated radiocarbon dates 2

The model was developed in several steps as the agreement index of the first version comprising all data rendered into a single phase was 39%. As only a few measurements showed considerable discrepancy that marked them as outliers, we started omitting these from the model one by one, following a suggestion found in literature about statistics in general[49] in hope of obtaining a clearer picture about the original distribution and a more consistent model. The uncertainty of the dating of Grave 186 of Tiszafüred due to a significant dissimilarity of the two measurements of its sample by diverse laboratories has already been mentioned in a recent study;[50] therefore, the two measurements were combined before calibration and the null hypothesis of the corresponding chi-square test was rejected (with a 5% probability threshold, T=3.8). The situation is similar with Graves 21 and 49 of Hortobágy (with a 5% probability threshold, T=4.44 and T=4.377, respectively), both of which, together with the possible bias caused by the freshwater reservoir effect on this site, have been discussed several times.[51] Therefore, first all six measurements from all three graves were omitted from the series as it was not possible to decide at that point which of them can be considered more reliable.

Next, we had to exclude the data of the human in Grave 257 of Szeged-Öthalom (Poz-42786) for being by far the most obvious outlier in the series (A=8%). It is worth noting that the data of animal bones from the same grave (Poz-42792) had an outstanding agreement index (A=116.9%); accordingly, that date was not omitted. Having done that, the agreement of the model still did not reach the desired 60%, which meant more dates have to be excluded from the sequence. The next data point to be excluded was of the animal from Grave 100 of Szeged-Kiskundorozsma-Hosszúhát-halom (Poz-42741; A=28.5%). The grave and its radiocarbon data series have already raised a great deal of controversy and many questions in literature, and have practically become a cornerstone of heated debates on the applicability of radiocarbon dating in the Migration Period.[52] Although research has accepted the AMS measurements from this particular grave as valid, in our model they are not compatible either with the *terminus post quem* represented by the coin in the grave or with the AMS dates obtained from the human remains (VERA-2699). However, this does not contradict the Bayesian modelling of radiocarbon dates and does not mean that this particular data cannot be used in a model constructed according to a different logic.

Similarly, the date obtained from an animal skeleton in Grave 25 of Cluj-Napoca-Plugarilor Street (DeA-36423) proved to be inconsistent, with an agreement index of only 42.3%, and was omitted from the sequence. As the other date from the grave had an index above 60% (DeA-36416), it could be left in the model. Thus, the overall agreement index of the final model raised to A(model)=67.1%, which was considered good enough; therefore, there was no need to exclude more outliers from the data series (see below in detail) as the model was already generally acceptable (Fig. 16). Thus, the start of the single phase could be dated to 628 (68.2%) 642 cal AD, while the end to 954 (68.2%) 976 cal AD. There is still a burial, the aforementioned Grave 12 of Hajdúnánás, the probability range of which in the model is in poor agreement with the original (individual) calibrated values; however, being a coin burial, it has a key role in the model and was not omitted. Interestingly, its dating in the model, 660 (68.3%) 678 cal AD, has an agreement index of only A=50.7%, although the original calibrated value of 641 (68.3%) 671 cal AD, together with the issuance date of the coin (662 cal AD), allows for such a dating.

Next, we created a test for the model and for our preliminary assumption of the usefulness of the related data sequence by creating a second model that contains both typo-chronological data and radiocarbon dates. In this second model, the uncalibrated radiocarbon dates of the graves were arranged according to the typo-chronological classification of the related features (Middle Avar 1–2,

49 Bronk Ramsey 2009a; Bronk Ramsey 2009b; Shennan 1997, 46; Drennan 2009, 20.

50 Faragó et al. 2022.

51 Faragó et al. 2022; Szenthe et al. 2022a.

52 Türk et al. 2015, 95–96.

Late Avar 1–6, Hungarian Conquest Period) (Fig. 17). In doing that, the data from graves lacking diagnostic finds had to be excluded (e.g., Graves 10, 14a–b, 15, 21, 26, and 48of the Hortobágy-Árkus cemetery). The dating of these burials is uncertain due to modern disturbance, and there are not enough graves near them to allow for a specification based on their relative positions within the cemetery. In constructing this second model, the dates of Grave 186 of the Tiszafüred cemetery and Grave 49 of the Hortobágy cemetery were omitted again because of the inconsistency described above, and a constraint was applied which represents the classical conception of typo-chronology, namely that the phases follow each other without any gap or overlap.

First, the data of grave 32C from Pilismarót had to be excluded from this second model because its agreement index differed most from the original calibrated values (DeA-39833; A=17.1%), and thus the overall agreement index of the model remained way below the desired 60%. This single data point excluded, the agreement of the model raised to A(model)=64.2%; so that no further elements had to be omitted. However, following the above logic, it is also worth mentioning the graves which, although having a relatively low agreement index, were not relevant for the overall validity of the model, thus it was not necessary to exclude them. These are, in order, Grave 320 of Tiszafüred, a horse burial (DeA-22619, A=47.5%), Grave 22 of Pilismarót (DeA-39801, A=40.1%), Grave 1187 of Tiszafüred (DeA-22608 and Poz-132139 combined; A=22.5%), Grave 257 of Szeged-Öthalom (Poz-42786, A=16.9%), Grave 100 of Szeged-Kiskundorozsma (Poz-42741, A=24.8%), and Grave 25 of Plugarilor Street, Cluj-Napoca (DeA-36416 and DeA-36423 combined, A=38.6%).

The start of the series and, thus, the beginning of the Middle Avar Phases 1–2, could be dated to 627 (68.3%) 646 cal AD, and the end (i.e., the start of the Late Avar Phase 1) to 663 (68.3%) 672 cal AD. According sto the model, Late Avar Phases 2, 3 and 4 followed each other at very short intervals, with boundaries at 666 (68.3%) 672 cal AD, 670 (68.3%) 679 cal AD, and 682 (68.3%) 698 cal AD. The latest phase was relatively long, ending around 828 (68.3%) and 869 cal AD, which also marks the beginning of the Hungarian Conquest Period. The series ends at 963 (68.3%) 997 cal AD.

From the data series and the models points of view, it is worth underlining that three of the problematic Hungarian Conquest Period measurements were the result of the repeated sampling of the related features. As it was suggested previously, the inconsistency may be due to the freshwater reservoir effect,[53] a phenomenon recently identified in the record of Asian horse-dwelling nomadic peoples in various contexts and periods.[54] As mentioned at the discussion of the control measurements from Hortobágy-Árkus, this effect likely causes some distortion in Late Avar Period data as well.[55] However, in the case of two of the three Hungarian Conquest Period graves the measurement from the animal skeleton rather than the human bone was incompatible with the first model, which is a strong argument against the freshwater reservoir effect, hinting at other factors.

4. Evaluation

4.1 Context. Previous uses of radiocarbon dating in the research of the period and their place within the framework outlined by the phases of the Tiszafüred and Hortobágy cemeteries

Peter Stadler published the first extensive radiocarbon series from the period. The calibrated data of some published sites in this series[56]—Grave 100 of Mödling,[57] Grave 4 of Münchendorf, Graves

53 Türk et al. 2015, 97.

54 Ventresca Miller – Makarewicz 2018; Szeifert et al. 2022a; Szeifert et al. 2022b.

55 Faragó et al. 2022; Szenthe et al. 2022a.

56 Stadler 2005, 119–123, Texttabelle 43.

57 Stadler 2005, Abb. 55.

60, 61, and 195 of Sommerein, and Graves 11, 56, 78, and 152 of Leobersdorf[58]—augured that the Late Avar horizon of the material culture is younger than believed before and can be dated to the end of the 7th century AD (a hypothesis we could confirm based on the extended radiocarbon series in this paper). The boy resting in Grave 100 of Mödling, dated around AD 650–700, had a LA Phase I-style belt set akin to the first horizon of cast belt sets in Tiszafüred. Based on median values, Stadler suggested AD 630 and 680 for the start of the Middle and Late Avar Periods, respectively;[59] these values predate the periods in question at least by two decades compared to the traditional typochronological framework. It must be noted, though, that the published radiocarbon sequence contains graves assigned to the Middle Avar Period which are positioned within the 8th century AD (e.g., Grave 60 of Sommerein, Grave 152 of Leobersdorf), due possibly to the inaccuracy of conventional radiocarbon dating. Stadler built a Bayesian model from these data. In light of the calibration curve, this model is undeniably of good use for the 7th century AD, but its relevance in the case of younger dates may be questioned: as the model consolidates the calibrated data in the series in the shortest probable interval, 7th-century dates (varying in a narrow range) draw in problematic ones from the 8th and 9th centuries AD. As the dates on the 9th-century plateau of the curve may actually be anywhere within the century, the mathematical model presents distorted values even if they—accidentally—concur with the historical end date of the Avar Period at AD 800–810.

Zsuzsanna Siklósi and Gábor Lőrinczy published a short radiocarbon sequence from the cemetery of Pitvaros;[60] almost every grave included in the Bayesian model of the site had multiple data measured by two laboratories (Debrecen and Poznań). While the radiocarbon dating of the Middle Avar features matched the traditional typochronology, the two Late Avar women in Graves 116 and 203—akin to the coeval burials of men and boys—could only be dated to a relatively broad interval within the 8th century AD. However, a major part of the radiocarbon sequence of the Pitvaros cemetery (save for the earliest dates) does not match either the relative or the absolute chronology of the period; moreover, the measurements of the two laboratories in most cases contradict. The inconsistency is particularly conspicuous in the case of Grave 51, a burial dated by its typochronological characteristics to the end of the Late Avar Period.[61] Nonetheless, the authors integrated both dates into the model.[62]

Sándor Gulyás and Csilla Balogh concluded from assessing the Early Avar Period cemetery in Makó that the radiocarbon method is unsuitable for specifying the chronology of the Avar Period[63]—while building a Bayesian model that incorporated historical data from written sources and preset dates marking the start and the end of relative chronological phases. However, one must be aware that the joint application of dates gleaned using historical, archaeological, and scientific methods points beyond the accepted methodological framework of radiocarbon dating.[64] Besides the studies mentioned above, only sporadic radiocarbon dates were published from the Avar Period. Rozália Bajkai and Barbara Kolosi presented a radiocarbon sequence built to help identify the youngest burials from Debrecen-Bellegelő, Bordás-tanya, a site assigned to the latest cemetery horizon of the Late Avar

58 Stadler 2005, Abb. 44.

59 Stadler 2005, 128.

60 Including both conventional and AMS data; see Lőrinczy – Siklósi 2017.

61 For more details, see Bende 1998.

62 In the case of Grave 51 of Pitvaros, the data presented by the Debrecen laboratory is congruent with the determined range of the end of the Late Avar Period in the Hortobágy and Tiszafüred series; therefore, as in general, the relative and radiocarbon chronologies match, one can only consider the data provided by Poznań an outlier.

63 Gulyás et al. 2018.

64 For a critique of the method by Gulyás et al. 2018, see Siklósi – Lőrinczy 2021.

Period.[65] Most calibrated dates ranged in the 7th–8th centuries AD and the slight probability of feature having been created in the 9th century AD only occurred in two cases (Graves 419 and 440). Typologically, the silver and gold-coloured bar-shaped beads[66] recovered from Grave 440 are amongst the youngest finds of the cemetery. Besides, some data are available in supplementary tables of recent archaeogenetical publications. Among the data published in Maróti et al.[67] only a few concerns the chronological spectrum of the present study (mid-7th to 10th centuries AD), even fewer come from published graves, and only a single sample was taken from each Avar cemetery. Therefore, the data in Maróti et al. could not be applied in the analysis of the present study.

As great uncertainty renders individually calibrated data unsuitable for further utilisation, one may only hope to succeed with radiocarbon dating 8th and 9th-century AD phenomena by incorporating them in larger sequences, while also keeping in mind that even Bayesian modelling cannot bring a breakthrough in this respect without available absolute chronological anchors (e.g., coin-dated graves or dendrochronological dates) or plenty of meticulously documented superpositions.

Archaeological dating of the Avar and Hungarian Conquest periods follows a fundamentally different methodology. They share the trait of relying on historical sources of questionable precision, since both periods were anchored to historical events (the Avar Period to AD 568 and AD 800, the '10th-century' period to a conventional date, AD 895 or 896). But the similarities end there: while the relative (and, thus, indirectly, part of the absolute) chronology of the Avar Period was built based mainly on seriations of finds, the research of the 10th century AD barely used this method (except for Jochen Giesler, who has become almost forgotten in the past two decades),[68] applying statistics only marginally, for building chronology for some cemeteries, find types, or microregions.[69] Consequently, the possibilities for cross-dating elements of the archaeological record were not exploited to such an extent either like in the attempts to build a chronological framework for the Avar Period.[70]

Because of that, the majority of the publications related to the chronology of the 10th-century AD Middle Danube Basin is a mere catalogue-like descriptive compilation of analogies, which do not venture beyond collecting all available analogies of a type and anchoring them in the chronological framework of the Carpathian Basin with the help of specimens recovered from coin-dated graves. As Hungarian research (but not exclusively that one) tends to think about the Carpathian Basin as a single homogenous cultural unit, the problem of the relevance and necessity of regional chronologies has rarely emerged. As a result, the details of the timescale of the Hungarian Conquest Period have yet to be clarified.

65 Bajkai – Kolosi 2017, 115.

66 Bajkai – Kolosi 2017, 12. t., radiocarbon data on 13. t.

67 See Supplementary table mmc6 in Maróti et al. 2022.

68 Giesler 1981, 3–181.

69 Bende – Lőrinczy 1997, Tab. 2; Gáll 2010, Fig. 20; Gáll 2013, 180–181, Fig. 47; Straub 1999, 409–422; Gáll – Lezsák 2018, Fig. 7; Gáll et al. 2010, Pl. 73. A renowned colleague from the Budapest school criticised at once the seriation method used in creating the typochronological framework. It must also be emphasised, though, that Péter Langó (Langó 2007, 217–222) only referred to the absolute chronological aspects of the results by Straub (which depend on the subjective decisions of the author) and not the relevance or precisity of seriation as a method. At the same time, the relative chronological order in the seriation by Straub mirrors reality faithfully, which has rendered Langó's objection irrelevant (Straub 1999, Tab. 1). For the same reason, seriation worked perfectly in the cases of the 10th and 11th-century cemeteries of Alba Iulia-Strada Brănduşei in the Transylvanian Basin, Romania, where the 11th-century AD coins in the record provided the absolute chronology with a perfect control (Gáll 2010, Fig. 20; Gáll 2013, 180–181, Fig. 47).

70 And that is why the chronological analyses, based on analogies and the numismatic record, by Károly Mesterházy (Mesterházy 1990) and László Révész (Révész 1996) must be reconsidered and reassessed. See also: Schulze-Dörrlamm 1988.

Another paradoxical (mis)conception rooted in the romantic ideas of the 19th century and deeply embedded in the research of the Hungarian Conquest Period states that the richly furnished graves of men discovered in the Upper Tisza Region represent 'the real conquering Hungarians' and, therefore, can be dated exclusively into a short period immediately after the conventional date of the Conquest (i.e., the early 10th century AD, which would made them very early), while the more modest graves containing less finds (especially in Transdanubia) must be younger. This hypothesis has fundamentally determined every assessment based on relative chronology up to this day.[71]

The radiocarbon method gained ground in the research of the Hungarian Conquest Period slower than even that of the Avar Period. Our aim was to collect all available AMS data from the Carpathian Basin. At the same time, their geographical distribution was also presented and has been illustrated on map too. At the same time, only a few sites of the era have been analysed until the 2000s[72] and only a single sample of these was dated to the 10th century AD (the rest were Árpád Age) (Fig. 13). The meticulous and professional publication of a lucky discovery, a grave from Gnadendorf, brought a fundamental change: as part of the evaluation of the archaeological record, Peter Stadler built a radiocarbon sequence of altogether seven samples from six graves of the period (Gnadendorf: human and animal bone, Karos-Eperjesszög II Grave 52, Orosháza-Görbics-tanya Grave 3, Bodroghalom-Éresztevényhomok Grave 24, Szakony-Kavicsbánya Grave 1, Kiskundorozsma-Hosszúhát-halom Grave 100).[73] As the dates obtained from the Gnadendorf samples partially contradicted the then-accepted absolute chronology (built upon analogies and coin finds), academia received with widespread scepticism both these results and, through them, the relevance of the radiocarbon method as a means to specify the established chronology of the era. It must be noted, however, that the excellent scholar who assessed the grave find assemblage from Gnadendorf must have overlooked a detail: besides the sabre with precious metal fittings (an artefact believed to represent the early phase), the belt with heavily worn mounts, and the coins, the grave also contained a small trapezoidal stirrup (weighing only 136 gr), which cross-dating with analogies in features dated by coins unambiguously placed to the mid or late 10th century AD.[74] This also means that Stadler's analysis of the radiocarbon results was correct, as the typochronological position of trapezoidal stirrups matches perfectly with the 1-sigma range of the combined radiocarbon date of the grave (980–1020 cal AD). It must also be added that the other radiocarbon dates presented by Stadler also reflected the correct absolute chronological position of the related features. While unfounded scepticism has not vanished, the number of radiocarbon analyses and AMS data gradually increased, especially after around 2010; nonetheless, only two of these (Szeged-Kiskundorozsma-hosszúhát, Szeged-Öthalom site V) include series extensive enough to be representative of a site.[75]

The distribution of the current radiocarbon data is far from covering the dwelling area marked out by 10th-century AD cemeteries. Of the 24 AMS-dated Hungarian Conquest Period graves, three (five samples) were discovered in the northern part of the Transylvanian Basin, one in the northern zone of the Great Hungarian Plain and the Upper Tisza Region, respectively, while the rest—24 samples from 19 graves—came from cemeteries and burial places in the area of Szeged. The *terra incognita* in this respect includes the northern regions of the Carpathian Basin, the Lesser Hungarian Plain, most of the Great Hungarian Plain, Transdanubia, and the southern part of the Transylvanian Basin.

71 E.g., Révész 2006, 154 dated Grave 52 of Cemetery II and Grave 11 of Cemetery III in Karos between AD 900 and 925. See also: Gáll 2019, with bibliography.

72 For a conventional date from Ópusztaszer, Grave 1, see Vályi 1994, 387–398.

73 Stadler 2006. See also: Révész 2006, 144, 149–154; Révész 2020, 21–23, 37; Bende et al. 2002.

74 A part of the measured trapezoid stirrups weighs 100–170 grams, akin to most pear-shaped stirrup variants (Gáll 2015, 379–380, Pl. 4). The discussed piece has been identified as Type 2a7. See also: Kovács 1986.

75 Türk et al. 2015, 15–23, 25–38, 95–100, Abb. 17–48, Abb. 66–135, Abb. 154–157.

Conclusively, one cannot draw general conclusions either for the Avar or the Hungarian Conquest Period at this point but only outline some tendencies to be qualified by forthcoming investigations.

4.2 Tiszafüred-Majoros: typochronology and radiocarbon chronology

The radiocarbon-dated Avar graves of Tiszafüred[76] arranged according to their relative chronological position, their order matches the calibrated radiocarbon sequence almost perfectly (Figs 9–10). In the following, the radiocarbon-dated graves will be presented according to their typological classification, describing first graves of males and then of females of high chronological value.

Some samples were measured by both laboratories involved (Debrecen and Poznań). We could sample both the human and the horse in related but separate graves in only two exceptional cases as the osteological record of the site is incomplete (the horse burial related to Grave 1075 was Grave 1062 and to Grave 474 Grave 645). Moreover, as the cemetery is extremely dense, in many cases, it cannot be decided with certainty which horse and human graves, often several metres apart, belong together.

4.2.1 Radiocarbon timeline of burials of men and horses

Middle Avar Period (MA)

Graves of males: no. 44 (AD 560–650 cal AD), 211, 694 (AD 570–660 cal AD), horse burial no. 186 (AD 560–650 cal AD)

The flagship finds of the group are pressed metal sheet belt mounts with imitation filigree and stone inlay decoration and Byzantine-style palmette motifs. The belt set in Grave 694 contained pressed metal sheet ornaments and ones cut out from a silver sheet with a plain smooth surface and U-shaped strap ends with two holes for rivets, which link the feature with the group in the Tisza Region. Based on the 1-sigma values of the related measurements, the three burials of males can probably be dated around 600–640 cal AD. The man in Grave 186 wore a belt adorned with simple silver mounts. The Debrecen laboratory dated its sample early (580–630 cal AD), while the Poznań laboratory, relatively late (650/670–770 cal AD). The value given by the former is undoubtedly faulty and, as an outlier, cannot be related to the radiocarbon data of other supposedly coeval burials.

Even if the measurement of the horse bone sample from Grave 186 is also an outlier (which it most probably is), the radiocarbon dates of burials of males indicate that the 'Middle Avar'-style material culture was present in Tiszafüred in the first half of the 7th century AD, i.e., almost fifty years before then it was assumed by relative chronology.

Late Avar Period (LA) Phase 1

Graves 1019, 1064 (AD 600/610–670/680 cal AD), 46, 330, 423, 692, 1075, 1197 (AD 630/640–770 cal AD) and (based on radiocarbon dates) horse burials no. 645.

Radiocarbon measurements dated Graves 1019 and 1064—each containing a belt set with pressed metal ornaments with gryphon-and-tendril pattern—to be the oldest (around 640–670 and 630–660 cal AD, respectively). These dates concur with their relative chronological position. Graves 46, 423, 692 and 1197 were also dated to the same period (650–690 cal AD). Stylistically, the belt sets in Graves 46 and 1197 are close to the ones in Graves 1019 and 1064, thus confirming their dating. Grave 871 is the youngest of the group with only a slightly different range (600–700 and 750–760 cal AD, of which the first one may be valid, dating the feature to the end of the 7th century AD). The stylistic

76 The AMS radiocarbon data from both laboratories were published in Faragó et al. 2022, supplementary table.

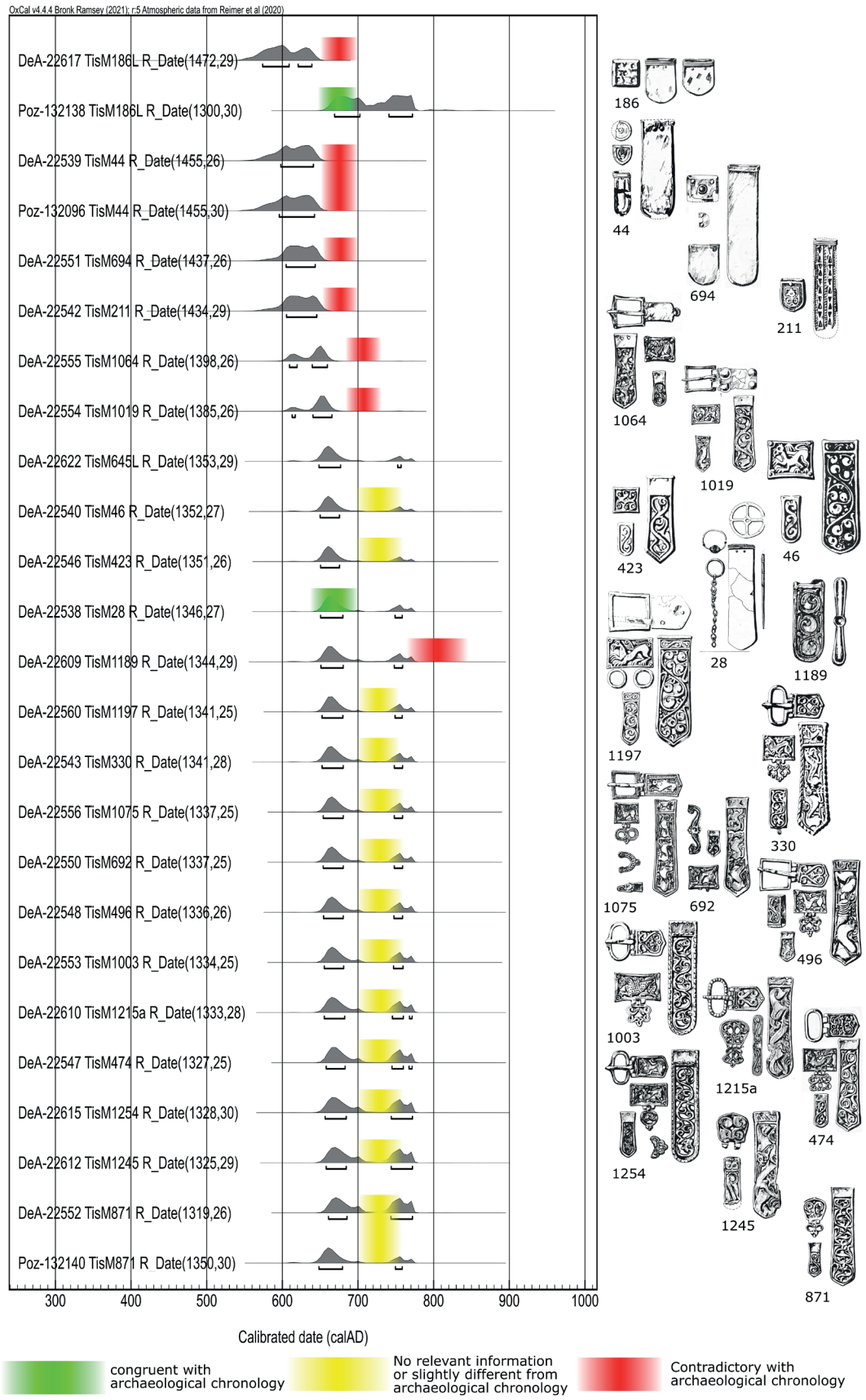

Fig. 9. Tiszafüred-Majoros. Radiocarbon sequence of the cemetery with the data arranged in increasing order of their uncalibrated values, the calibrated combined date of the sequence, and the relative chronological position and classification of the sampled graves, first part

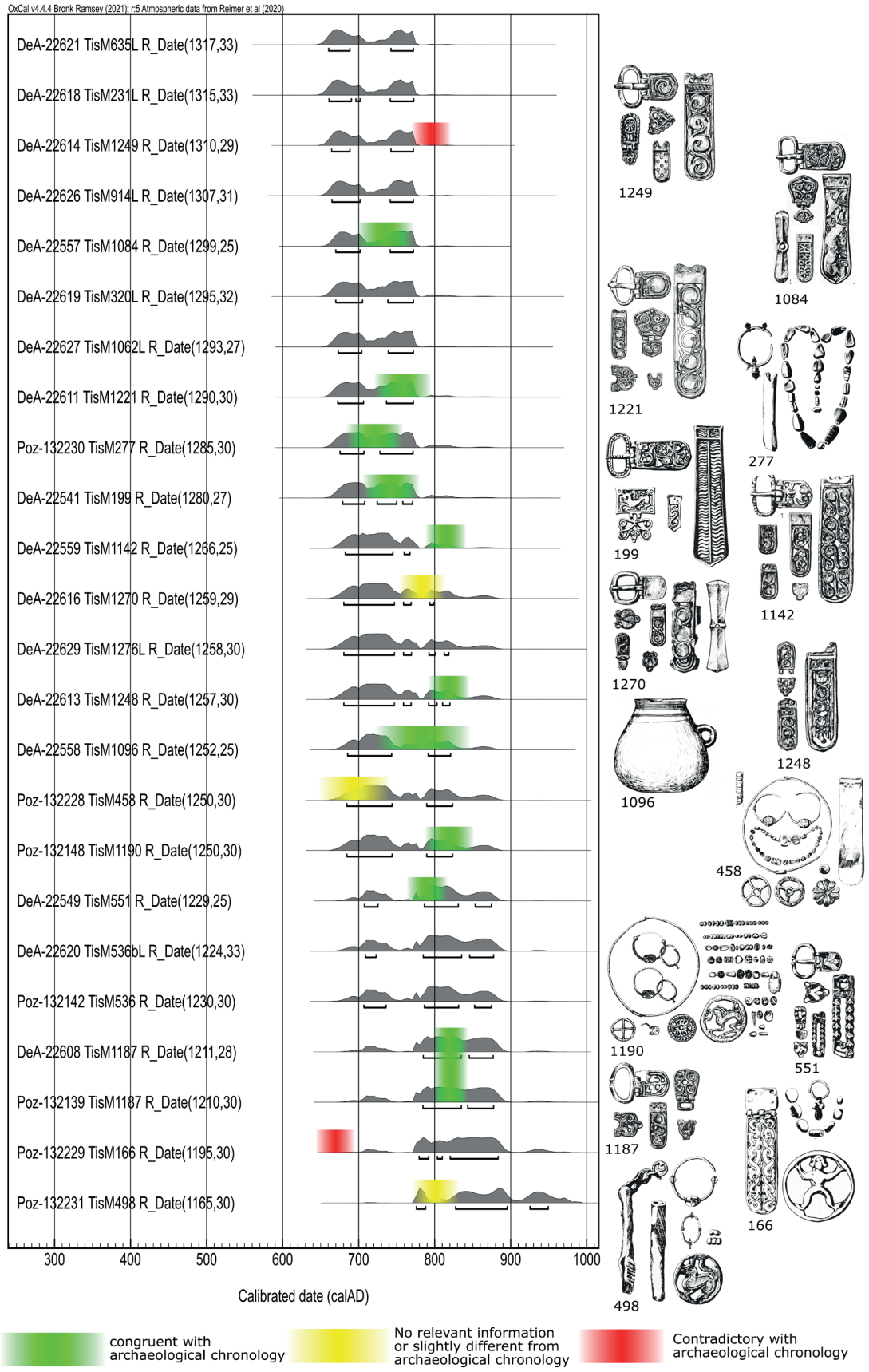

Fig. 10. Tiszafüred-Majoros. Radiocarbon sequence of the cemetery with the data arranged in increasing order of their uncalibrated values, the calibrated combined date of the sequence, and the relative chronological position and classification of the sampled graves, second part

traits corroborate this chronological position, as typologically, the wide shield-shaped and palmette-decorated cast mounts of the belt set are considered the youngest of the group.[77] According to the analogues of the belt set, Grave 1189 belongs to LA Phases 4–5.

Late Avar Period (LA) Phase 2

Graves 474, 496, 871, 1003, 1215a, 1245, 1254 (AD 640/650–770 cal AD), 1084 (660–770 cal AD), and (based on radiocarbon dates) horse burials no. 231, 635, and 914 (AD 650–770 cal AD).

According to their radiocarbon dating, Graves 1003, and 1215a are the oldest (1-sigma value around 650–700 cal AD) among the graves classified into this phase on a typological basis. Based on a seriation of the related types, J. Zábojník considers some particular fittings (small strap ends in the shape of a wild boar head and socketed large strap ends with concave sides, pointy end, a band of strigil motifs, and a frieze with gryphons) into his following Phase II (SS IIa). The wide shield-shaped fittings with symmetrical tendril motifs from Grave 1215a are also amongst the flagship types of Phase II. Grave 1075 and horse grave no. 1062 probably belong together; their measurements yielded a 1-sigma 670–720, 750–760 cal AD range. According to the probability distribution of the individual calibrated dates, the horse is 'somewhat younger' than the man, their dates matching in the 670–690 cal AD range, which, again, is in accordance with the relative chronological position of the features.

Based on calibrated dates, Graves 474, 496, 1084, 1245, and 1254 are only slightly younger (individual 1-sigma values around 650–700 and 750–770, specified by the Bayesian model to 660–770 cal AD). Nonetheless, their find assemblages contain more than one piece (belt-hole guard mounts cut from a metal sheet), while not differing from the finds of the older graves of Phase 2 either (Graves 1084 and 1245). In Zábojník's classification,[78] the tendril-ornamented buckle from Grave 496 and the Vrap-type tendril patterns on the fittings in Graves 474 and 1084 belong in a younger category, *Spätstufe* IIb (a typochronological unit, i.e., phase or group); however, in Tiszafüred the IIa- and IIb-type (according to Zábojník's classification) finds appear intermingled. The single find may be linked with Zábojník's Group IIb is the thick large strap end with a complex openwork tendril pattern from Grave 1254,[79] a feature amongst the younger graves of LA Phase 2 based on radiocarbon dating. Grave 474 and feature no. 645, a horse burial, belonged together, with a corresponding dating around 650–680 cal AD (1-sigma values). The youngest feature in the sequence is Grave 199 (1-sigma value 680–770 cal AD but positioned considerably later, to the start of the last quarter in the uncalibrated data sequence); save for a unique buckle, the metal fittings in its find assemblage match the rest of the types in the phase.

The typological classification of the finds in their assemblages linked Graves 231, 320, 635, and 914, a horse grave, to Group IIb, and radiocarbon dating confirmed their contemporaneity (1-sigma values 670–720, 750–770 cal AD).

Late Avar Period (LA) Phase 3

Graves 199, 1142, 1121 (680–770 cal AD), and (based on radiocarbon dates) horse burials no. 320, 1062 (680–770 cal AD).

The radiocarbon dates of the two graves (1142 and 1221) are affected by the 9th-century plateau in the calibration curve, resulting in an exceptionally broad range (1-sigma value 680–780 cal AD). Typologically, the belt ornaments with abstract low-relief tendril patterns in their find assemblages

77 Zábojník 1991, 'Seriationsdiagram', see the Types 209, 230, 248.

78 Zábojník 1991, 298.

79 Garam 1995, Taf. 168.

assign them to Zábojník's Group III of the second half of the Late Avar Period. Grave 1142 contains both Group III and Group II-style metal fittings. The radiocarbon dating of the feature aligns with its relative chronological position (second half of the 8th century AD). According to typochronology, the finds from Grave 199 show mixed characteristics of LA 2 (strap-end, mounts) and 3 (buckle). In the light of the very restricted presence of LA 3 (and LA 4) garnitures (for the latter, see below), after LA 2, the community buried in Tiszafüred adapted the new trends only minimally.

Late Avar Period (LA) Phase 4

Graves 1189 (650–690 cal AD), 1270 (680–770 cal AD), 1248 (690–780 cal AD), 1249 (680–720, 750–770 cal AD), horse burial no. 1276 (680–770 cal AD)

The radiocarbon dates of the graves are affected by the 9th-century plateau in the calibration curve, resulting in an exceptionally broad range (1-sigma value 680–820/830 cal AD). The last stylistic group of Late Avar ornamented belts comprises fittings with punch-mark decoration and abstract floral patterns. The (1-sigma) 650–690 cal AD date of Grave 1189 may be faulty because the dating of Graves 1248, 1249, 1270, and 551, representing the closest analogies of the belt set in its assemblage, have an equally younger and tallying dating. However, the 8th- and 9th-century anomalies of the calibration curve result in relatively broad ranges for the calibrated dates (1-sigma value 680–880 cal AD), albeit the strong distortion effect of the 9th century AD plateau of the curve make their dating to that century more probable. The radiocarbon dates confirm the relative chronological position of the features, indicating, in the end, their dating to the first half of the 9th century AD, after LA Phase 3.

Late Avar Period (LA) Phase 5

Graves 1187 (720–740, 780–870 cal AD) and 551 (700–740, 780–880 cal AD), horse burials no. 536b (720–740, 780–870 cal AD) and 1276 (770–890 cal AD).

Due to the incomplete belt set comprising fragmentary mounts, Éva Garam classified Grave 1187 into the cemetery's latest, sixth grave horizon (in her interpretation, 'generation'). The grave was positioned south of the perimeter ditch of the cemetery, amongst the youngest burials. With a radiocarbon dating of around 700–950 cal AD (1-sigma value 780–890 cal AD), it is one of the youngest graves of the Tiszafüred cemetery. The Avar-rite burials without prestige items at the southern fringes of the cemetery include the horse grave 1276. As their BP dates fell on the 9th-century plateau of the calibration curve, the calibrated ranges are very wide.

In summary, the radiocarbon sequence of males' burials from Tiszafüred matches the relative chronological order, meaning that the radiocarbon dating in this case confirmed that the differences between typological categories (groups) in the Middle and Late Avar record represent consecutiveness. The match is emphasised by the fact that, besides shared general typological traits, several neighbouring graves in the radiocarbon sequence are directly linked by identical copies of artefacts (Graves 41 and 211, 1064, 1019, and 423, 46 and 1197, 692 and 496, 1003 and 1254, and 1245 and 1084.

4.2.2. Radiocarbon timeline of burials of women

The samples from all but one (Grave 28) burials of females were measured in Poznań; the calibrated data turned out to be significantly younger than expected based on typochronology.

Grave 28 contained artefact types characteristic to Éva Garam's Horizons 1 and 2 (belt pendant with long silver sheet strap ends, a spoon-headed hairpin, a simple, disc-shaped belt pendant and a brooch pair). However, according to its radiocarbon data (650–600 cal AD) it is half a century

younger than the graves of Horizons 1 and 2. The date measured for Grave 458 in Poznań was even younger (670–740, 770–810 cal AD), positioning the feature amongst male's burials of the latest phase (LA Phase 4), while its relative position within the cemetery links it with the graves at the turn of the Middle and Late Avar Periods. Surprising is the dating of Grave 166, a feature with Middle Avar-style artefacts. Both the grave finds and the relative position of the burial within the cemetery indicate that the radiocarbon date in this case is faulty, as the Late Avar Period dating of the grave is highly improbable.

The positions of Grave 277 in the typochronological and radiocarbon sequences are closely similar (first half of the Late Avar Period and between LA Phase 2 Grave 199 and LA Phase 3 Graves 1142 and 1221, respectively). The block of females' graves (1096, 1190, and 498) after that in the radiocarbon sequence is surrounded exclusively by burials of males dated to the end of the Late Avar Period (LA Phase 4: Graves 1270 and 551, Phase 5: Grave 1187). Grave 1096 contained a 'yellow pottery' vessel, a type characteristic of the Late Avar Period both in Tiszafüred and in general. Yellow pottery occurs in the youngest graves in other cemeteries, too;[80] this archaeological observation corresponds to the related radiocarbon dates. Graves 1190 and 498 are the youngest amongst the analysed graves of women according to both their radiocarbon dating and find assemblages. The types in its find assemblage date Grave 1190 (with a *millefiori* eye bead) without a doubt to the 9th century AD.[81] Grave 498, a feature dated to the second half of the Late Avar Period, is the last data point in the radiocarbon sequence; its probability curve extends even into the 10th century AD.

4.3 Hortobágy-Árkus

In contrast to the Tiszafüred radiocarbon series, the results of the measurements of the same sample from Hortobágy-Árkus by the Debrecen and Poznań laboratories (see Fig. 11)[82] often contradict, and the proportion of possible outliers is also significantly higher. The results of the stable isotope analyses suggested the diet (based probably on fish and extremely rich in protein) of the Hortobágy community as a probable cause behind the problem.[83]

Radiocarbon dating also confirmed the relative chronological order of the earliest graves in Hortobágy-Árkus; Graves 1 and 13 are amongst the oldest four based on their calibrated radiocarbon ages. Of the dates for Grave 1, the one measured in Debrecen—also the oldest date of the cemetery, from after the mid-7th century AD—fits better the assumed relative chronological position of the feature, also matching the radiocarbon age of technically and stylistically analogous belt sets with sheet mounts from Tiszafüred. The radiocarbon age given by the Debrecen laboratory for Grave 13, a burial comprising artefacts characteristic of the early phase of the Late Avar Period, is younger (in accordance with the relative chronological position of the feature), matching the calendar ages of the LA Phase 1 graves of men in Tiszafüred. The Poznań date of the same sample, albeit slightly younger, allows for a similar dating, dating the grave basically into the 8th century AD.

Generally, the remaining graves of men with prestige items were also dated to the 8th century AD. Their order roughly matches the typochronological, albeit any such a statement, in this case, must be taken with some salt due to low case number: only a few females' graves (33, 34, and 38), scarce in finds with a significant chronological value, complete the scanty series. The buckle in Grave 41 is

80 For example, Pilismarót-Basaharc, Grave 68 (Fettich 1965, 36), Szob-Homokok, Grave 79 (Kovrig 1975, Fig. 8), Kiskőrös-Szücsi-dűlő, Grave 5 (Török 1975, 317, Fig. 2), and Székkutas-Kápolnadűlő, Graves 89 and 90 (B. Nagy 2003, 38–39. kép).

81 Szőke 1992a, 877.

82 The radiocarbon AMS data were published in Faragó et al. 2022, supplementary table.

83 Faragó et al. 2022, 14–18.

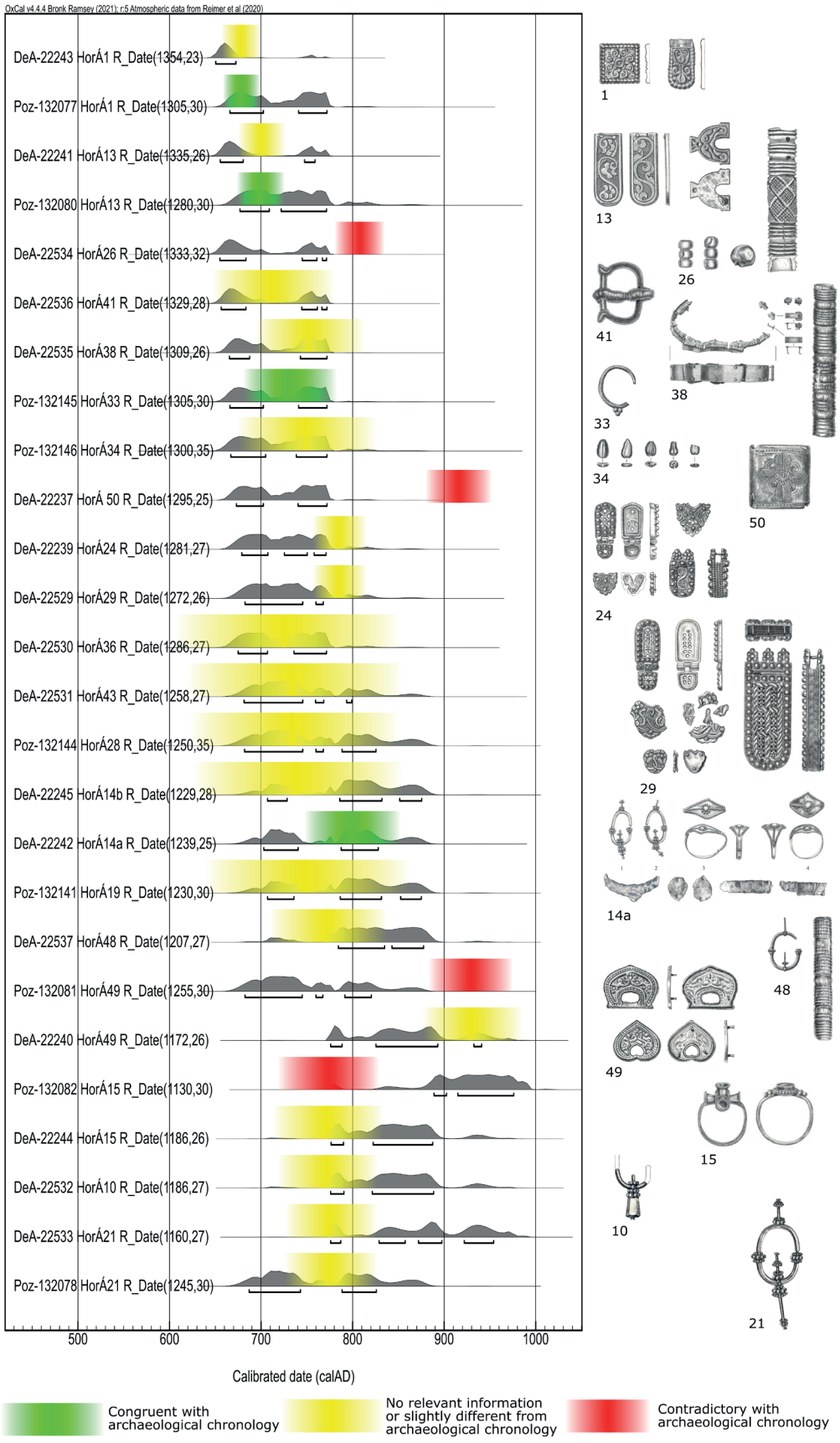

Fig. 11. Hortobágy-Árkus. Radiocarbon sequence of the cemetery with the data arranged in increasing order of their uncalibrated values, the calibrated combined date of the sequence, and the relative chronological position and classification of the sampled graves

characteristic of the end of the Middle–start of the Late Avar Period,[84] while the belt sets in Graves 24 and 29 date the two features to the end of the Late Avar Period.[85] Furthermore, there is one grave the radiocarbon age of which is considerably older than the relative chronological and, thus, impairs the reliability of the sequence (Grave 26, with a needle case with incised grid pattern and bar-shaped beads, a type characteristic of the latest grave horizons of Avar cemeteries).[86]

The lack of items with a chronological value in females' graves coeval with Late Avar Period males' burials, which are exceptionally representative in light of the record of the period, is conspicuous. Most sampled females' graves (10, 14a, 15, 21, 48) were positioned in the second half and the end of the calibrated sequence. These contained unusually precious and elaborate jewellery (gold in Graves 14a, 15, and 21, and silver in Grave 10). A precise analogy to the silver earrings from Grave 14a was found in a hoard at Donji Petrovci (Serbia) with Abbasid *dirham*s issued in AD 799/800.[87] Analogies to the rings with a diamond-shaped bezel of the woman in Grave 14a appear in the mid- and late-9th-century record in Moravia.[88] Conclusively, the tendency observed in Tiszafüred-Majoroshalom is also present in the cemetery of Hortobágy-Árkus: throughout the Avar Period, men were buried in a way to represent their social position, while women were interred with little or no items made of inorganic materials. In the final phase of the Avar culture, prestige items vanish from the graves of men but appear, in the form of jewellery sets and personal tools, in burials of women and girls. Females' burials keep following the Avar way of representation even in the decay phase.

Grave 49, at the eastern fringes of the cemetery, comprised Hungarian Conquest Period finds.[89] The radiocarbon age of Grave 49 fits smoothly the sequence of the Hortobágy cemetery, even placing it before the richly furnished burials of females. The position, grave type, and orientation of this grave following the cemetery order is a strong argument against a break in the use of the cemetery between the Avar and Hungarian Conquest Periods. The calibrated radiocarbon age of Grave 49 is in the last quarter of the sequence of the site, and overlaps considerably the radiocarbon ages of the latest 'Avar' and earliest Hungarian Conquest Period features (to be explicated in the chapter about chronological conclusions).

In summary, radiocarbon dating has revealed that the cemetery of Hortobágy-Árkus (akin to Tiszafüred-Majoroshalom) started earlier than it was believed based on typochronological considerations. Based on the related radiocarbon dates, Graves 13 (with a cast phalera) and 1 were dug at the end of the 7th century AD (Grave 13 perhaps around AD 700), and Late Avar Period burials in the 8th century AD. Several observations could be made of the features with dates affected by the 9th-century plateau of the calibration curve; a further interpretation of these in light of archaeological data and some the conclusions drawn from the radiocarbon dates of Tiszafüred are presented below.

4.4 Pilismarót-Basaharc

The oldest known burials of the cemetery are dated to the first half of the Late Avar Period (1st grave horizon). The site is relatively scarce in belt sets, several of which, dated to LA Phases 3–5, were recovered from graves in a well-defined cluster in the central zone of the cemetery (Figs 5–6). Females' graves in this cluster are also more generously furnished than in earlier ones. While females' graves in the older grave horizons (LA Phases 2 and 3) contained rather few and uncharacteristic items, in Phase 4 and later they were buried with complex jewellery sets comprising

84 Szenthe – Gáll 2022a, 326.

85 Szenthe – Gáll 2022a, 182–183 with literature.

86 Recently, Szenthe – Gáll 2022a, 212–214 with literature.

87 Bálint 2004, 585–588; Demo 2014, 62–63.

88 For the chronology of the 'Blučina-type' rings, see Szőke 1992a, 869.

89 For an assessment, see Gáll – Szenthe 2020.

earrings with bead pendants, disc-shaped agraffes, bead necklaces, diverse bracelets and rings. The high quantity of beads in these graves is conspicuous compared to the earlier ones.

Relatively many burials of males contained damaged or worn belt ornaments, as well as incomplete belt sets of mixed character, with ornament types characteristic of diverse periods. Based on their relative positions within the cemetery, these graves are younger than Phase 4, and can be linked with LA Phase 5, probably a 'post-Avar' horizon. Radiocarbon dating positioned Grave 43, a feature containing both earrings with large, drop-shaped bronze sheet pendants (a type characteristic to the second half of the 9th century AD)[90] and Avar-style jewellery,[91] amongst the features of Phase 5.

Large grave clusters were discovered outside these parts of the cemetery, mainly to the west and east and only in a narrow zone to the south and north. As the burials in these clusters do not contain ornate belts, their typochronological classification must rely on the find assemblages of females' graves. More of the ones amongst the graves of this cluster that lay near the LA Phase 4 burials contain Avar-style jewellery items (earrings and beads) worn as single (without pairs). Bar-shaped segmented beads, a type first appearing in Phase 4, are still present, and Avar-style bead pendant earrings are increasingly replaced by simple wire jewellery, rings ending in conical spirals or folded

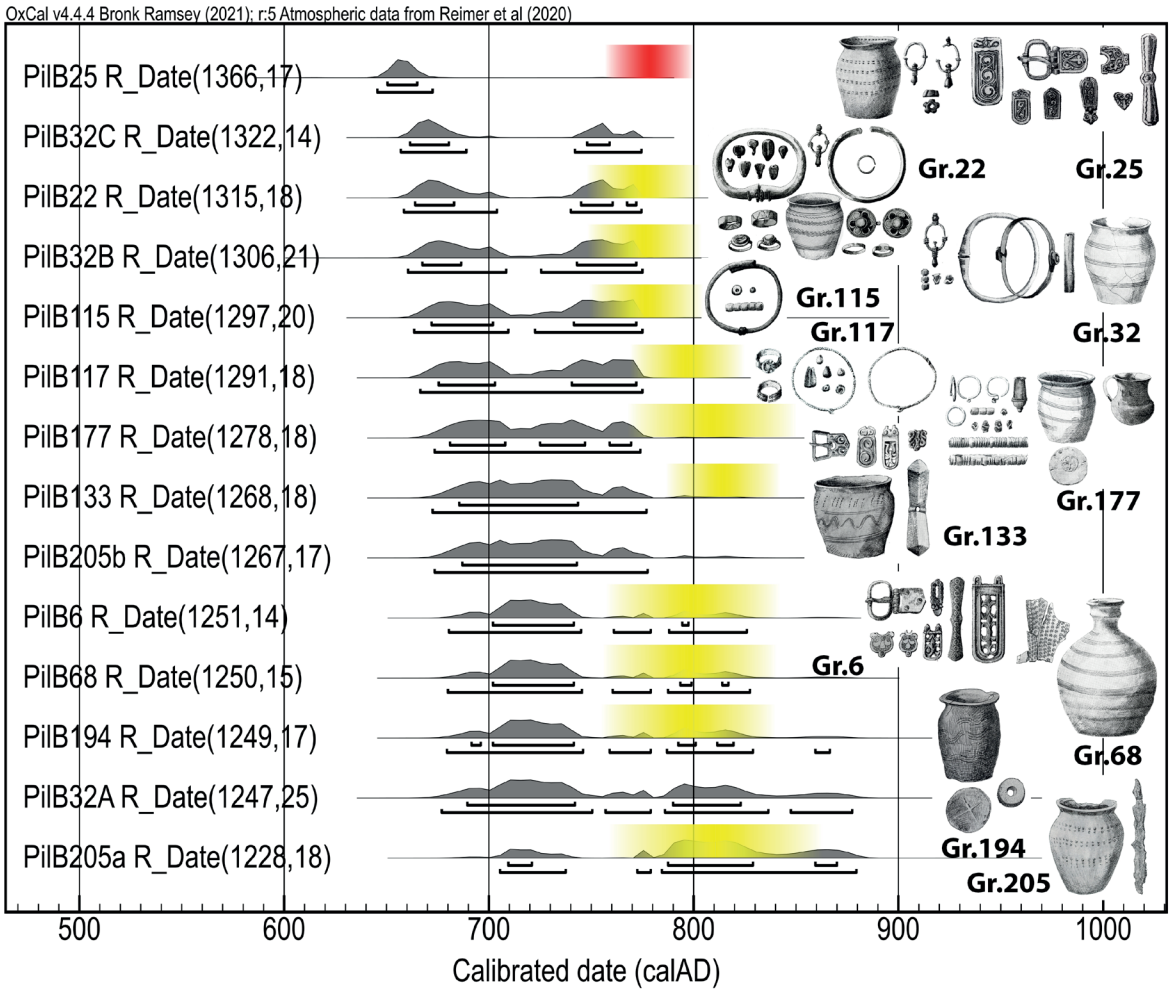

Fig. 12. Pilismarót-Basaharc. Radiocarbon sequence of the cemetery, with the data arranged in an increasing order of their uncalibrated values, the calibrated combined date of the sequence, and the relative chronological position and classification of the sampled graves

90 Szőke 1992b, 173.

91 Fettich 1965, 29–30.

into a multiple S-shape. Among these wire jewellery items a ring with a rolled-in and another with a simple S-shaped ending also occurred. Small pots with a potter's mark have been recovered exclusively from the graves in these clusters. Based on the find assemblages and the relative position of burials, at least two phases following Phase 5 (Phases 6 and, hypothetically, 7) could be distinguished in the cemetery of Pilismarót. Phase 6 is characterised by a persistence of Avar-style jewellery (earrings with bead pendants, beads) and the appearance of the first rings with tapered spiral endings. The graves of Phase 7 do not contain Avar-style jewellery anymore, and head jewellery comprises exclusively wire items with widening spiral ending and S-terminalled ring variants.

The relative chronological order of the graves from Pilismarót matches, in large, the radiocarbon series (Fig. 12). The youngest grave of a male (205a) in the sequence does not contain a belt set, while the radiocarbon date of the woman in the same feature positions it next to Grave 6. Graves 22 and 32b of women buried with complex jewellery sets are the oldest; the somewhat younger Grave 115 contains lesser jewellery items, including bracelets with beaded rings strung on them, characteristic of the final phase of the Late Avar Period.[92] Grave 177 with rolled-end and S-terminalled lock rings and Grave 117 with a twisted wire bracelet with hook-and-loop closure are even younger, the types being conventionally dated to the later 9th century AD.[93] The two vessels with a potter's mark could be placed into the second half of the data sequence.

The radiocarbon data of Grave 25 is likely an outlier, as both its relative position within the cemetery and the find assemblage—the belt set and a pair of oval earrings with prism-shaped pendant—place the feature to the second half of the Late Avar Period.

5. The radiocarbon sequence and some problems of the early medieval chronology of the Middle Danube Basin

The starting observation is that the uncalibrated order of the graves fit the relative chronology of the period, despite the anomalies of the calibration curve in the 8th and 9th centuries AD. This statement holds for both the longest radiocarbon sequence from Tiszafüred and that of the other two sites, allowing one to draw conclusions, based on the sequence and the Bayesian model (with its ends anchored by coin-dated graves), about the absolute chronological position of the typochronological phases.

The result is a chronological framework, its start and end defined by coin-dated graves from the 7th and the 9th century AD. The radiocarbon data set brought interesting new insights to the currently accepted chronology of the Early Middle Ages in the Danube Region, with respect to 1, the start of the Middle Avar Period and the pace of the Middle Avar transformation, 2, the absolute dating of the youngest grave horizons in Avar cemeteries, and 3, the timeline of the Hungarian Conquest Period. These topics are discussed in the following, while our suggestions, summarised in the conclusions of this paper, concern the entire chronology of the Avar Period.

5.1 The start of the Middle Avar Period and the problem of the asynchronous development of communities

The radiocarbon sequence of the Tiszafüred data series pushed back the start of the Middle Avar Period material culture into the second quarter of the 7th century AD (Fig. 9; Fig. 16). As the measurements of the samples from Tiszafüred by two independent laboratories yielded corresponding

92 Bracelets of this type appear in the youngest graves of several Late Avar cemeteries; the evaluation of the type is in progress.

93 Hair ring: Szőke 1992a, 846–847; János Győző Szabó dated similar bracelets in a Hungarian Conquest Period context to around AD 920–990 (Szabó 1979, 64–66).

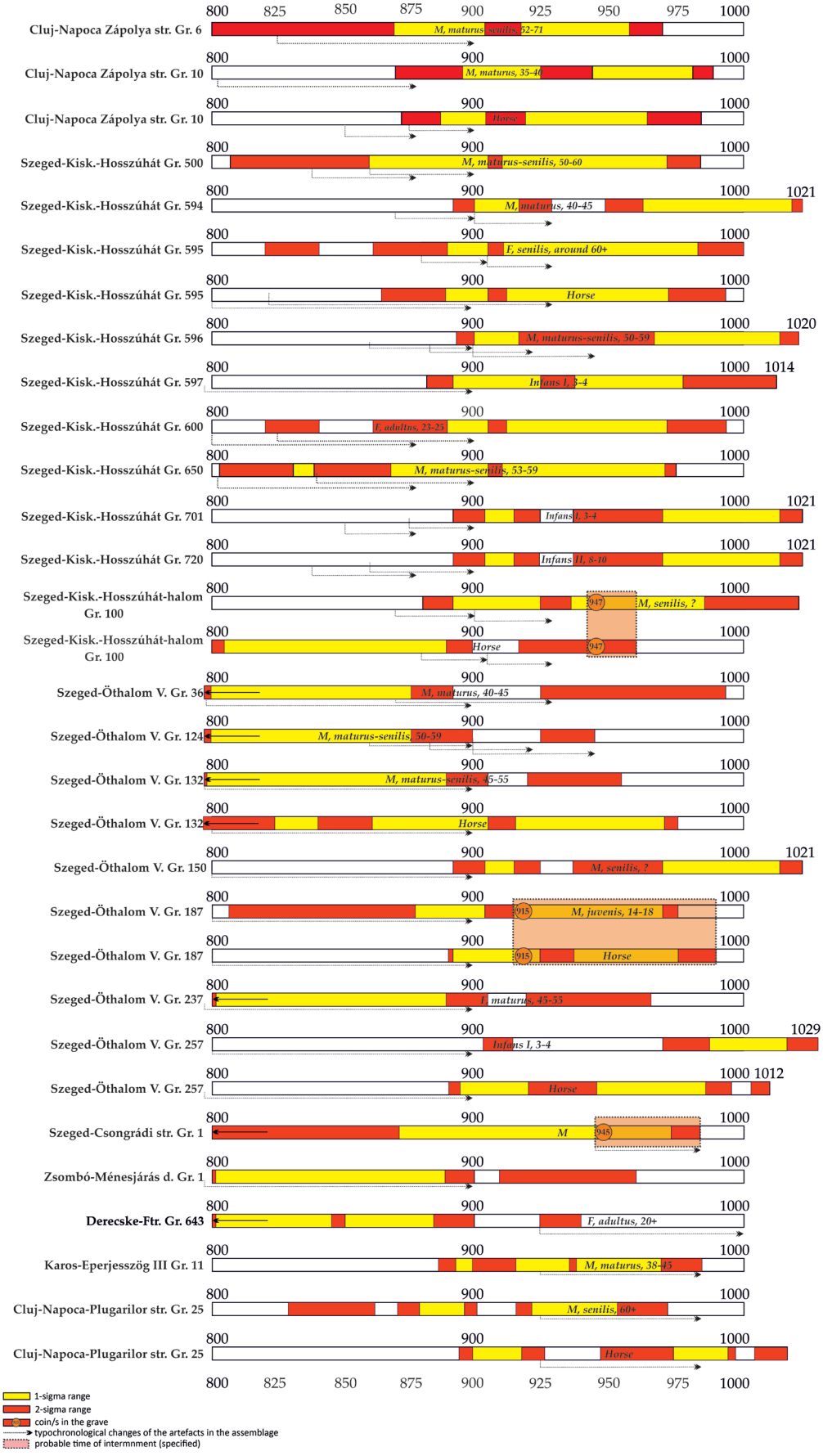

Fig. 13. Calendar ages of the analysed Hungarian Conquest Period features

dates, there is no reason for questioning the early dating of the related graves in Tiszafüred, and Hortobágy-Árkus. These results corroborate the similar conclusions by Peter Stadler.[94] At first sight, it seems challenging to harmonise this dating with coin-dated, mostly elite assemblages of the Middle Avar Period, dated occasionally also with radiocarbon data. The *solidus*, issued between AD 669 and 674, in the grave from Ozora,[95] the *solidus* from around AD 654–659 in a grave at Gyenesdiás,[96] the coin imitations from the end of the 7th century AD in Kiskőrös-Pohibuj, Mackó-dűlő, Grave 53,[97] the *solidus* issued by Heraclius–Heraclius Constantine in AD 662/663 in Grave 12 of Hajdúnánás-Fürj-halom-járás (a feature that also contained a silver belt set of the same type as the ones found in Tiszafüred), and the radiocarbon dates of Graves 12 and 19 of the same cemetery[98] date these elite assemblages unanimously to the last three decades of the 7th century AD.

Among the other assemblages, the ones from Hajdúnánás are of special significance for our analysis. The radiocarbon data of Grave 12 corroborates the dating suggested by the *solidus* issued by Heraclius Constantine in AD 662/663. Based on the radiocarbon date obtained, Grave 19 (also of a man with a silver belt set) in the same cemetery was younger (Fig. 12). At the same time, belts adorned with simple silver sheet mounts with glass inlay decoration appeared in Tiszafüred considerably earlier, in the second quarter of the 7th century AD, and the type already started fading from the material toolkit of social representation when the earlier grave (No. 12) was dug in Hajdúnánás. This suggests that the members of the community behind the Hajdúnánás cemetery still wore belts adorned with silver sheet mounts when men in Tiszafüred already sported the latest pressed sheet belt mounts and even Late Avar Period Phase 1-style cast belt sets. The same is true for the Ozora assemblage, one of the few archaeological features on which the definition and post-AD 670 chronology of the 'Middle Avar' Period was based.

As neither datings can be questioned, one must build a model accepting the possibility that typological and stylistic trends did not emerge in entirely simultaneous phases—not even in neighbouring communities. Seen in this light, the record of the Tiszafüred cemetery may be interpreted as reflecting a swiftly emerging community characterised by explosive development and an identity expressed, amongst others, by an innovative and dynamically changing material culture. People in Tiszafüred have already been wearing LA 1-style belts with cast fittings when their contemporaries in Hajdúnánás and Ozora were still interred with Middle Avar-style artefacts.

The belts with silver fittings from the burial place at Hajdúnánás may be interpreted as proof of the conservativeness of the group's material culture, probably a result of their distance from the hubs of the communication network integrating the territory of the Avar Khaganate. Distance in this context is structural rather than spatial, as the distance of the sites from the main roads is not the only determining factor but there are also the ecological niche in which the groups lived and the cultural characteristics of the probably nomadic-type communities who buried their dead in separate burial places, often established at the edge of flood plains, i.e., places ideal for large-scale stock breeding.[99]

The phenomenon is especially remarkable as it clearly shows that the internment of items of exceptional value and innovative material culture—two traits the joint presence of which is assumed to be a marker of the elite—do not meet. The burials at Hajdúnánás and, especially, at Ozora are traditionally—and probably rightly—regarded as belonging to the elite of the second half of the 7th century AD. The assemblage of Ozora reflects the characteristics of 7th-century Avar 'princely

94 Stadler 2005, 119–125, Abb. 52.

95 Constantin IV (Somogyi 1997, 71, Cat. no. 56).

96 Constans II and Constantin IV (Müller 1989, 147).

97 Somogyi 1997, 50, Cat. no. 35.

98 Rácz – Szenthe 2009, 328–329.

99 Szenthe – Gáll 2022a, 294–298.

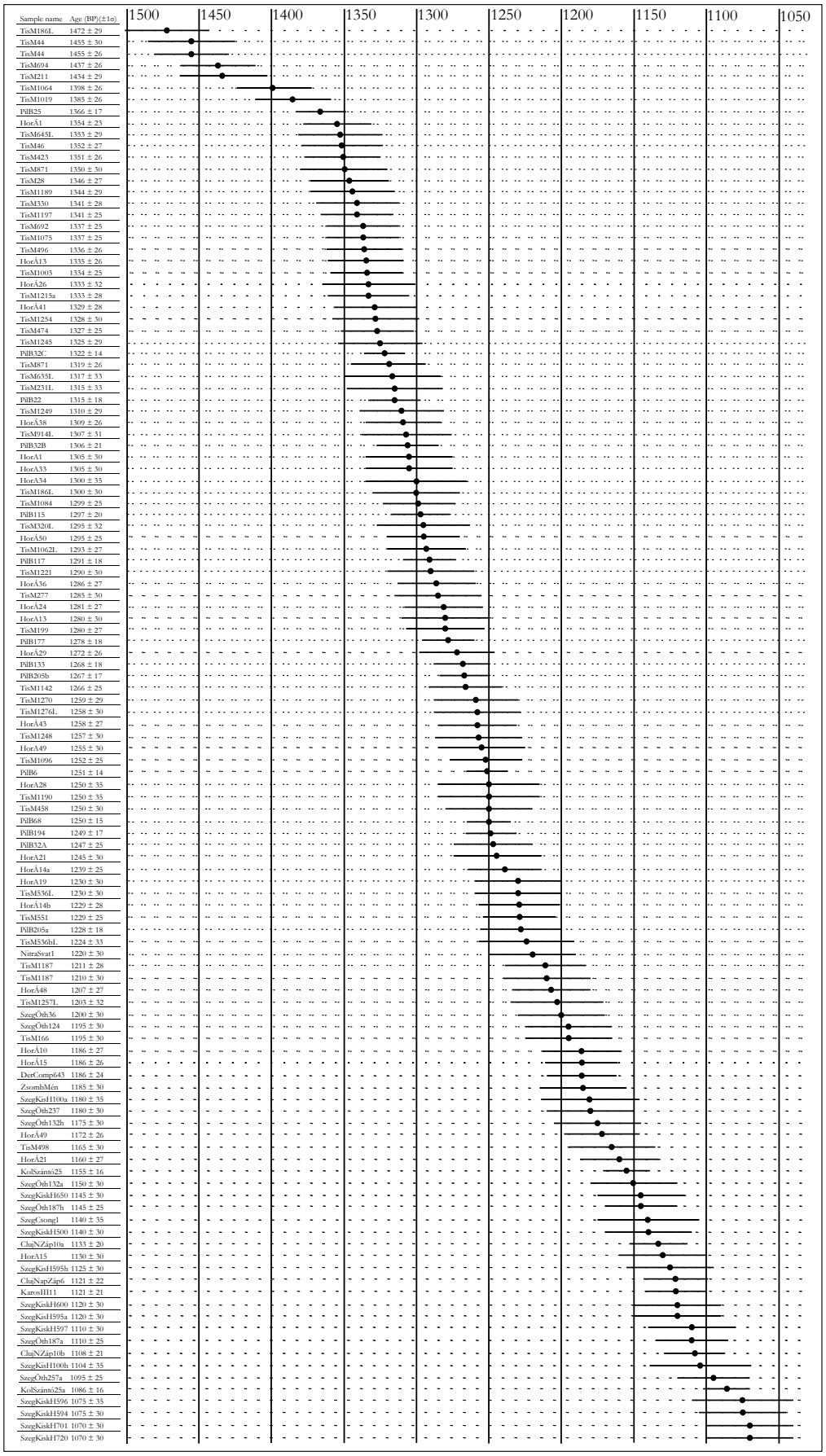

Fig. 14. Uncalibrated data sequence with the dates arranged in an increasing order

burials'.[100] That the members of the elite communities of Ozora and probably Hajdúnánás are furnished for the afterlife with items representing a highly traditional material culture may suggest that the Avar elite had no crucial role in the complex socioeconomic and cultural transformation which led to the emergence of the 'Late Avar' system.[101]

It is not yet clear whether the chronological primacy of the material culture in the Tiszafüred cemetery holds only in relation to the nomadic elite burial sites, and whether it is contemporaneous with other large, 'row cemeteries', or whether differences will be identified between the chronologies of the row cemeteries as well. The material culture of the Tiszafüred community having been innovative was probably due to that the community, having resided in an important communication hub at the crossroads of an east-west and a north-south road[102] and near a crossing of the Tisza River on the east-west road, had a decisive role in maintaining interregional contacts. Cultural anthropological case studies have proven that the material culture of communities residing along main communication routes is often innovative and characterised by an elevated representation of prestige, due to their higher communication potential, compared to other groups living far away from the main routes of traffic.[103] The strong connections of the Tiszafüred cemetery with central and southern Transdanubia, accepted in scholarly literature,[104] are also conspicuous, highlighting the communication potential reflected by the find material of the cemetery. Although we have still relatively few radiocarbon data, the available ones seem to corroborate the idea that some large row cemeteries similar to Tiszafüred (probably Mödling?),[105] which started with a Middle Avar grave horizon, were established earlier than assumed previously, in the first half of the 7th century AD, while their oldest Late Avar grave horizons can be dated to the end of the same century. One may formulate the working hypothesis that the relatively large communities behind these cemeteries supposedly formed an alternative connection network parallel with the Middle Avar elite, and the evolution of 'Late Avar' culture was determined by this network and the connections maintained with regions outside the Carpathian Basin. It cannot be accidental that the Late Avar ornamental style of cast belt fittings reflects trends arriving in the Carpathian Basin from the Mediterranean.[106] In light of these observations, one might hypothesise that the actual driving force behind the Middle Avar Period (and, in a wider sense, the early medieval transformation in the Carpathian Basin[107]) was these large communities, who buried their dead in certain row cemeteries of the era.[108]

Considering the geographical position of the Tiszafüred site and the close connections of its community with Transdanubia, one might also add that coeval groups in Transdanubia and communi-

100 Daim 2003, 482–484; To the horizon of elite graves of the Early Avar phase II and Middle Avar phase I see also Szenthe 2015.

101 The spatial and structural separation of the Late Avar elites is analysed in Szenthe – Gáll 2021, and Szenthe 2021.

102 Szenthe – Gáll 2022a, 294–298.

103 Based on the attire of Native Americans from the Orinoco area: Roe 1995.

104 Vida 2013, 318–319.

105 Stadler 2005, 119–123.

106 In general, Szenthe 2016; regarding the layers of communication influencing material culture, and, especially, ornament, see also Szenthe 2015.

107 Szenthe 2019.

108 One cannot leave out of account the fact that these data—and the model—fit well the 'Europe in between' model, analysing the paths of evolution of the Carpathian Basin by Jenő Szűcs (Szűcs 1983), confirming it in some sense and also finetuning it to some point. Amongst the top-down reforms started by the elite in the area, the Late Avar transformation (seeing the Middle and Late Avar Periods as a process) may be the only one which, breaking the trend, represents an organic economic, social, and cultural change passing off without interference by the 7th-century elite.

cation probably had a decisive influence on the formation of the new structures. This hypothesis is in unison with a previous observation,[109] namely that specialised crafting and the related systems of distribution spread from west towards east. Confirming these hypotheses, however, requires considerably more radiocarbon data and extended analyses.

5.2 Chronological issues of the second half of the Late Avar Period

Due to shape of the calibration curve in the 8th–9th centuries AD only very cautious conclusions can be drawn concerning the late horizons of Avar cemeteries. Please note (again) that the graves in the model have been arranged in an increasing order of their uncalibrated radiocarbon date, which largely concurs with the typochronological classification built from graves containing findings with a high typochronological value. In doing that, we were working upon the hypothesis that if the two chronologies generally match in the case of the measured grave assemblages, also relatively precisely dated tipochronologically based on belt mounts and jewellery, they shall also work for graves without findings of chronological value. Accordingly, the graves slotting in the sequence after the graves with belt sets are relatively younger than those and, if 'Avar' and 'Hungarian Conquest Period' data alternate in the series, that means their ages fall within the same period (this statement would remain valid even if all Avar data would be as early as possible and all HCP dates as late as possible within the measurement error margin, although the probability of that is negligible).

In fact, the data of the youngest, final grave horizon of the Late Avar cemeteries of Hortobágy and Tiszafüred appear in the radiocarbon model as a gradually thinning sequence intertwined with Hungarian Conquest Period data points.

As there is little connection between the archaeological phenomena and material culture of the Avar and early Hungarian cultural complexes, research has unanimously assumed a lack of contemporaneity, thus hypothesising them having appeared with a significant temporal gap in-between.[110] However, this assumed gap seems far less significant in light of the recent data set, as presented on Fig. 15 although it is true that one cannot draw far-reaching conclusions about the entire Avar settlement area based on only three sampled sites. At the same time, some observations can be made.

The overwhelming majority of the Tiszafüred graves could be dated to or before the middle phase of the Late Avar Period (LA 2). In the next phase, the number of graves started declining radically, resulting in a scarcity of related radiocarbon data. The cemetery seems to have remained in use for a long time—even if less intensively, as the lower grave count indicates—and the youngest Avar radiocarbon data in the series, appearing between Hungarian Conquest Period data in the model,

109 See Szenthe – Gáll 2021.

110 E.g., Bóna 1984, 351–352 ("90% of the Avar cemeteries were abandoned at the start of the 9th century AD"). It is common practice in Eastern Central Europe with regards to the record of the fringes of the Carolingian Empire (and, thus, Pannonia) to date find types which appear in western territories already in the 8th century AD to the first half of the 9th century AD (see, e.g., Szőke 1992b). Béla Miklós Szőke dates types already in use in Dalmatia, Istria, and the Eastern Alpine Region at the end of the 8th century AD in the record of Zalavár to after the AD 840s (recently: Szőke 2019, 187; Szőke 2023, 51), arguing that these could not be interred before the arrival of Priwina and the foundation of Mosaburg. Such argumentations, based on historical events, even if holding a grain of truth, are unacceptable from a methodological point of view. While traditionally, the diverse Avar jewellery types and those in the record of the Carolingian fringe area were regarded as representing consecutive periods of fashion, research today accepts more and more the possibility that they were in use at the same time, and Avar jewellery influenced Moravian production (Chorvátová 2022; Ungerman 2023, especially 59–62; Nowotny 2018). Macháček et al. 2019, especially 308–315, provide a summary of previous literature and a radiocarbon series to the chronology of Moravian jewellery types.

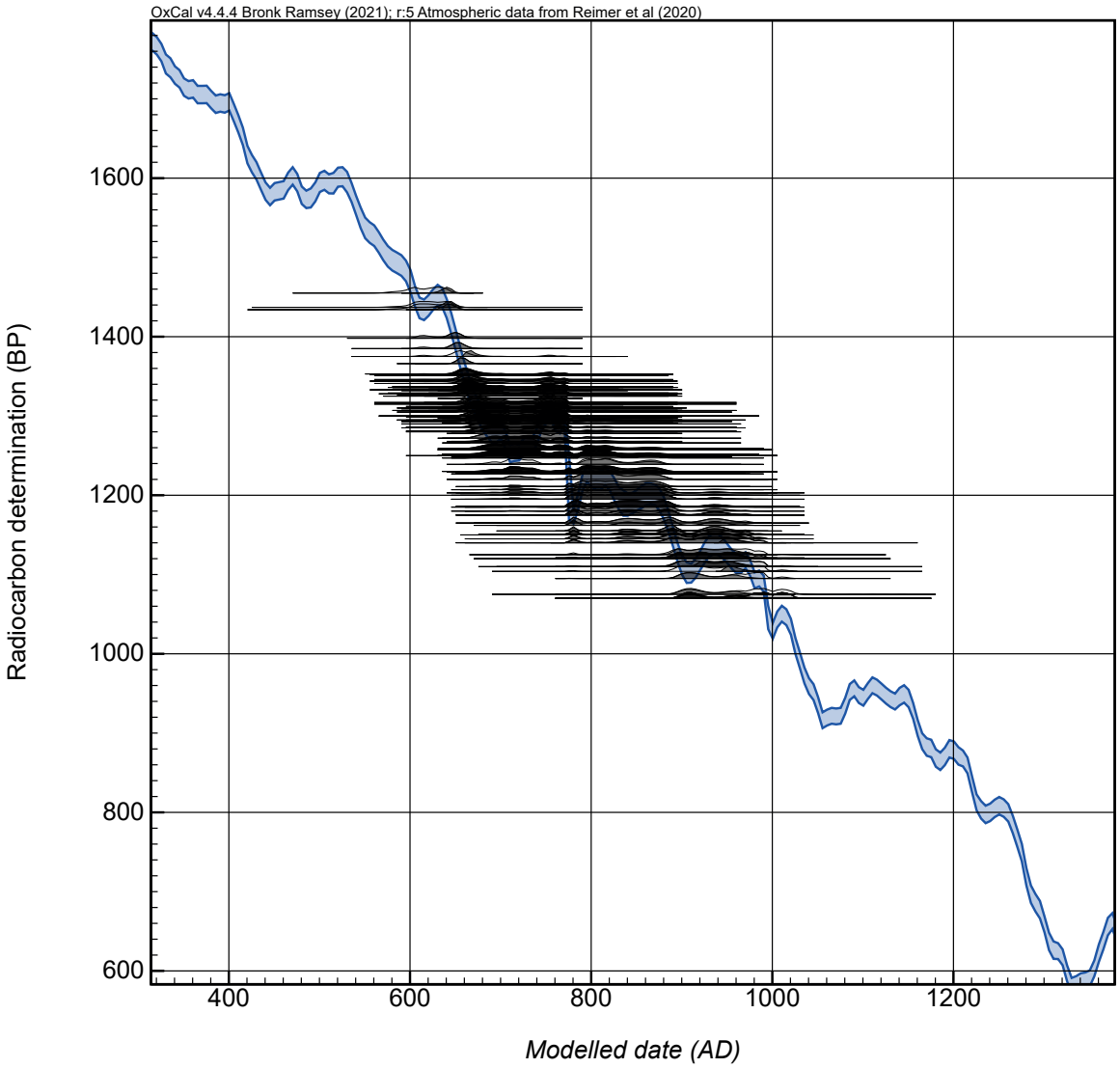

Fig. 15. Calibrated data sequence

also comes from this site. Taking a glimpse at the uncalibrated data sequence, it is conspicuous that the series from Pilismarót ends considerably earlier than those from Tiszafüred and Hortobágy, and does not meet the Hungarian Conquest Period sequence. According to the position of the uncalibrated data in the second model (where each is classified into a typochronological category), the Pilismarót cemetery ended earlier than the one at Tiszafüred. Moreover, its LA 4-phase graves appear in the radiocarbon sequence intermingled with LA 3-phase graves from Tiszafüred, which suggests that, at least in the latest Late Avar phases, Pilismarót was ahead of the trend, as akin to Tiszafüred in the MA and LA 1 phases.

The evidence at hand allows drawing some more general conclusions. The chronology of the two neighbouring sites in the northeastern part of the Hungarian Great Plain is very similar and, as their youngest data appear between those of Hungarian Conquest Period graves, probably both ended after the Hungarians' arrival. In contrast, radiocarbon data suggest that LA 4 in Pilismarót started earlier, and the cemetery was abandoned earlier than Hortobágy and Tiszafüred, and certainly before the period represented by the oldest Hungarian Conquest Period data in the sequence.

Clearly, one is limited in building an absolute chronology and phasing by the characteristics of the calibration curve. However, the relatively few archaeological reference points available for the

9th-century AD Carpathian Basin are enough for positioning with an acceptable accuracy the data on the 9th-century AD plateau of the calibration curve, even if the disappearance of artefacts with a high chronological value from the youngest graves of Avar cemeteries means one has very little evidence to rely on in this phase.

In social terms, the rural communities behind the row cemeteries started losing their significance already during the Avar Period,[111] which makes the cross-dating of their record with that representing the elite of the neighbouring territories and Pannonia rather difficult. The tendency to furnish the graves with precious items got a second wind only at the end of the Avar Period, marking the possible emergence of a new elite, linked with new burial places and, thus, communities.[112] The continuous impoverishment reflected by the record of Middle and Late Avar row cemeteries brings about, in the youngest grave horizons, an acute lack of imported finds (see, e.g., glass beads) and ones suitable for comparison with the representative material of the eastern fringes of the Carolingian Empire.[113] As in the new, 9th-century AD social representation the traditional Avar way does not prevail anymore, ornate belts cannot be used for cross-dating, leaving one to rely on jewellery types of females. However promising this work is,[114] it is still in an initial stage.

A few findings corroborate the absolute chronological conclusions. The Donji Petrovci hoard, comprising a granulated twisted wire torque, a genuine pearl pendant earring, and twelve Abbasid *dirham*s minted in AD 799/800, is one.[115] The hoard could not be interred before AD 800,[116] while the condition of the coins (heavily worn, some pierced) indicates that they had spent some time in circulation before internment. At the same time, the jewellery items do not seem to be worn (at least based on available information). In summary, the jewellery in the hoard is probably younger, and not older, than the coins, made in the first decades of the 9th century AD. Analogies (also in gold) to the gold earring were discovered in several graves dated to the early phase of the Moravian culture (Uherské Hradište V13)[117] and the late horizons of Late Avar Period cemeteries.[118] Grave 14a and 21 in Hortobágy-Árkus are among the youngest features of the cemetery, and their data fall on the 9th-century plateau of the calibration curve. This does not contradict the dating suggested by the Donji Petrovci hoard, corroborating a dating to the first decades of the 9th century.

The only known analogies of the light-blue, translucent beads in Grave 34 of Hortobágy are published by Šimon Ungerman[119] with earrings Type 7-19, dated by the publisher[120] and Elisabeth Nowotny[121] to the 9th century AD. In the radiocarbon sequence, Grave 34 appears among LA 3 phase graves.

An important issue for the chronology of the 9th century AD in the Danube Basin is the dating of Moravian jewellery. Lately, the oldest horizon of the 'Velihrad-type' jewellery was pushed back to the 8th century AD. However, this dating is based at least partly on the historical traditional chronological framework of the Avar material culture incorporating the assumption that the cemeteries

111 Based on a statistical evaluation of weapon-ornate belt-horse burial combinations, see Szenthe – Gáll 2022b.

112 Szenthe 2021, 435–436.

113 Collected in Szőke 1992a.

114 See Chorvátová 2023.

115 See Footnote 81 above.

116 End of the 8th century AD: Demo 2014, 62–63; Ungerman 2020, 283.

117 Galuška et al. 2018, 33–34.

118 In connection with Graves 14a and 21 of Hortobágy-Árkus, see Szenthe – Gáll 2022a and Szenthe 2021.

119 Dolní Vestonice Grave 381/55 (Ungerman 2023, 170–171).

120 Dolní Vestonice Grave 381/55 (Ungerman 2023, 170–171).

121 Thunau am Kamp (Nowotny 2018, 63).

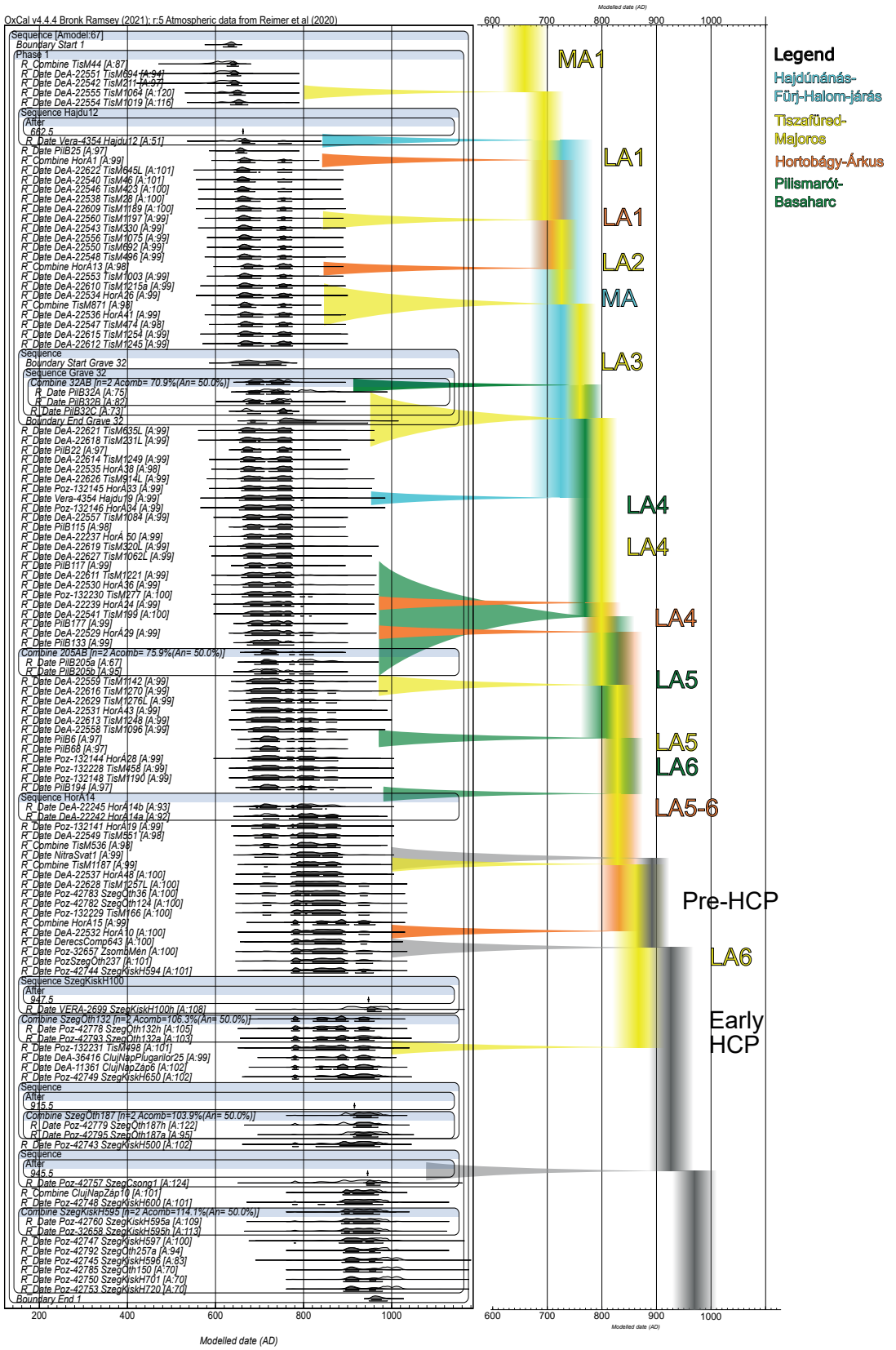

Fig. 16. Bayesian model of the Middle Danube Region from the Middle Avar to the Hungarian Conquest Period, based on available radiocarbon data and coin-dated graves, put in a single phase (MA – Middle Avar Period, LA – Late Avar Period, HCP – Hungarian Conquest Period). The suggested absolute chronology follows the most probably absolute chronology of Avar and Hungarian Conquest Period cemeteries, based on both the archaeological arguments mentioned in the text and the radiocarbon sequence

that started mainly in the late 7th century AD were abandoned right after the Carolingian invasion of the region, around AD 800.[122] It has yet to be decided whether the dating of some of the jewellery types dated to the 8th century AD on this ground can really pushed back that far, but we feel the need to emphasise that the dating of the types the appearance of which was pushed back to before AD 800 based primarily on Avar analogies is not necessarily correct, especially if it is a long-lived one that remained in use also in the second half of the Moravian period.

Some Phase 4 and 5 (LA 5 and LA 6) graves of the Pilismarót cemetery contained simple wire jewellery, identified by Š. Ungerman as the earliest but long-lived variants of the Velihrad type. According to B. M. Szőke, earrings with a wire hoop on the side and ones with a conical spiral pendant, types characteristic especially of the record of the Pilismarót cemetery, appeared first in the first decades of the 9th century AD, became widespread in the second and last thirds of the century, and remained in use also in the early 10th century AD. The drop-shaped sheet pendant earring from Grave 43 in Pilismarót could be dated well into the 9th century AD. Naturally, such a modification also affects the dating of other find types in the record of the site, depending on horizontal stratigraphy (e.g., rings with conical spiral ending, simple S-terminalled and rolled-end braid rings, twisted wire bracelets with hook-and-loop closing, and some finger ring types).[123]

The Moravian connection is a result of the position of the Pilismarót cemetery (by the north-western course of the Danube in the Carpathian Basin) may be related indirectly to a phenomenon observed in the radiocarbon series, namely that in the radiocarbon sequence, the end of the final Late Avar phases is before the corresponding measurements from features assigned to said phases on the other two sites. During this period, the main transport routes of the Khaganate may passed there, which would explain for both the presence of north-western artefact types and the early appearance of youngest trends of the Late Avar material culture in the cemetery. The probable existence of regional cultural trends may allow for greater or lesser phase displacements in local development. A possible phase shift between the Moravian and the Avar chronology could be tested and confirmed by an extensive radiocarbon series. Unfortunately, only a few radiocarbon data are available from Moravian graves, and most from a relatively young phase: AMS data from Praha-Staré Město, Graves 190/I, 1040/I—Klementinum (H1/2017, H31, H32a H33),[124] some from Přezletice,[125] and the most extensive radiocarbon sequence published by Macháček et al. from late and post-Moravian context.[126]

Conclusively, the occurrence of such artefact types in the latest grave horizons of Late Avar cemeteries is not so much proof of their conspicuously long life but rather of that several Avar cemeteries could have remained in use considerably longer in the 9th or even the early 10th century AD, as suggested by the appearance of the youngest 'Avar' dates between Hungarian Conquest Period dates in the sequence. Thus, the lack of connections between the archaeological records of the cemeteries in the Carpathian Basin and Moravia throughout the period under study stems not from a lack of temporal overlap but from regional differences in material culture and fashion. Obviously, regional cultural differences existed, the actual pattern having been shaped by local social networks, distribution systems, and production. However, in the case of the Late Avar Khaganate, a regional phenomenon, supra-regional links can also be detected. The great advantage of the radiocarbon chronology is that it allows investigating synchronisms between these regional groups.

122 See Ungerman 2023, especially 59–62.

123 Szőke 1992b, 173.

124 Havrda – Žďárská 2017, 124–127.

125 Košťová et al. 2022, 210–215.

126 Macháček et al. 2019.

5.3 Chronological problems of the Hungarian Conquest Period[127]

5.3.1 Observations and tendencies based on the radiocarbon model

1) Some graves undoubtedly connected with the Hungarian Conquest Period record of the Carpathian Basin are dated before the conventional AD 895 dating of the Hungarian Conquest. The radiocarbon date of Nitra-Svätoplukovo Grave 1, a burial possibly linked with the Hungarian Conquest Period record by the partial horse it contained,[128] is relatively early, partially on the 9th-century plateau of the calibration curve.[129] It forms a cluster with Grave 49 of Hortobágy-Árkus, radiocarbon dated to the 9th century AD and the final resting place of a man buried with a belt with Hungarian Conquest Period-style fittings.[130]

2) Radiocarbon dating provided compelling evidence of the dating of Graves 36, 124, and 237 of Szeged-Öthalom V and a grave unearthed at Zsombó-Ménesjárás in 2004 to the 9th century AD (1-sigma data, 68.3% probability).[131]

The time of death of the person in Grave 643 of Derecske falls on the 9th-century plateau; he was most probably buried before AD 895 (1-sigma value), but the 2-sigma value of the related radiocarbon data only covers the AD 925–940 period with very low probability.[132] Based on the related radiocarbon dates, the possibility that the feature was created in the 9th century AD is way more remote in the remaining cases. Their early dating suggests that these burials—e.g., Cluj-Napoca-Zápolya Street, Grave 6[133] and Szeged-Öthalom V, Grave 187[134]—represent the first generation of Hungarians who arrived in the Carpathian Basin from the east and whose life ended here in the 10th century AD.

3) The radiocarbon data specified the time when the cemeteries around Szeged (Szeged-Kiskundorozsma-Hosszúhát, Szeged-Kiskundorozsma-Hosszúhát-halom, Grave 1, Szeged-Öthalom V, and Szeged-Csongrádi út, Grave 1) became abandoned. Whether the dating of this horizon is also relevant for areas outside this microregion has yet to be investigated. While the burials concerned were only dated generally to 'the second half of the 10th century and the early 11th century AD', radiocarbon dating set the dating of several of them one to three decades before AD 1000 (e.g., Szeged-Kiskundorozsma-Hosszúhát; Fig. 13, Fig. 16). In other cases, numismatic evidence helps with dating. For example, based on radiocarbon dates and coins, the senile man in Grave 100 of Szeged-Kiskundorozsma-Hosszúhát was buried between AD 947 and 965, while the man interred in Grave 1 of Szeged-Csongrádi út died between AD 945 and 984 (most probably in 945–974), a dating also confirmed by the style of his sabre-hilted sword.

127 The archaeological heritage of the 'conquering Hungarians' should not be regarded as ethnospecific but as belonging to a regional cultural 'conglomerate' characteristic of the 10th-century Carpathian Basin and, thus, the culture of the pastoral population inhabiting it in said period; see Gáll 2019, 21–26, 103–109.

128 Partial horse burials without harness are known, although their numbers are insignificant: Alba-Iulia-Stația de Salvare Trench No. XV Grave 42, Sládkovičovo-Újhelyi-dűlő Grave 2, Blandiana 'C', Himód-Káposztáskertek Grave 134 (Gáll 2013, Vol. I: 189; Horváth 2022, 29–30, 4–5. kép, 18. tábla; Točik 1992, 158–159, Obr. 102.2).

129 The data of the graves from Nitra, mentioned above, were also classified here; see Ruttkay 2018, 145–160.

130 Szenthe – Gáll 2022a, 88–89, 264–293, Fig. 42, Pl. 31.1–8, Pl. 39.13–19.

131 Türk et al. 2015, 112.

132 Berta et al. 2018, 10–17.

133 Gáll et al. 2019, 177–195.

134 Türk et al. 2015, Fig. 157.2–3.

4) The absolute chronology of the graves of women buried in mount-decorated overgarments in Szeged-Kiskundorozsma-Hosszúhát could also be outlined based on radiocarbon dates, setting the end of this fashion to before AD 1000 and corroborating the observation made on a typochronological basis that the most lavishly furnished graves of females in the second half of the 10th century AD concentrate in the area between Soroksár and Teremia Mare, i.e., the phenomenon is typical to the northern zone of the Great Hungarian Plain.

5) The eight graves of this period in Szeged-Öthalom V, a completely unearthed site, scatter over an area of 6.3 hectares rather than being arranged in a cemetery. Similar 'burial places' are also known (and documented by radiocarbon dates) from the Early Avar Period.

6) The radiocarbon dating of graves from the period from Cluj-Napoca made it clear that the new conquerors appeared in northern Transylvania already in the early 10th century AD; at the same time, the radiocarbon date obtained from Grave 25 (of a *senilis* male) of Cluj-Napoca-Plugarilor Street also proved that mount-decorated sabretaches did not evolve into ones with ornate plates in a linear process, and that sabretache plates did not replace the fashion of mount-decorated sabretaches but the two variants were in use simultaneously, at least for a while.

7) The time of death of the person (whose skeletal remains were way too poorly preserved for an anthropological analysis) in Derecske, Grave 643 fell on the 9th-century plateau of the calibration curve, meaning that he or she was most likely buried before AD 895 (1-sigma value, 93.5% probability), but the 2-sigma value of the related radiocarbon data also covers the AD 925–940 period. However, in this case, the probability of a 10th-century AD dating is pretty low. It must be noted, though, that the typochronological characteristics of the pressblech braid discs in the grave's find assemblage place it in the second half of the 10th century AD;[135] therefore, additional radiocarbon analyses and the radiocarbon dating of the skeletal remains from the other two graves of the cemetery may be needed for evidence conclusive of their age.[136]

5.3.2 Results in the chronology of the Hungarian Conquest Period

The radiocarbon dates of the two dozen graves analysed thus far allow for drawing the following conclusions:

1) The typochronological framework based on numismatical evidence and analogies developed for the 10th-century AD record is very limited. Based on radiocarbon analysis, Nitra-Svätoplukovo Grave 1, Hortobágy-Árkus Grave 49, as well as the lonely Graves 36, 124, 132, and 237 of Szeged-Öthalom V and the one unearthed at Zsombó-Ménesjárás-dűlő can be dated with high probability to the 9th century AD; this horizon may be named 'pre-Hungarian'. The timeline (Fig. 13, Fig. 16) indicated by these features also implies that the presence of Hungarian Conquest Period-style finds in the Carpathian Basin is not restricted to the 10th century AD.

2) While 'the first generation' is a widely used term in academia, neither traditional typochronology nor radiocarbon chronology could clearly outline the related finds and phenomena yet. Of the known individuals, maybe the 52–71-year-old man in Grave 6 of Cluj-Napoca, Zápolya Street and the senile man in Grave 150 of Szeged-Öthalom V were members of the first generation of Hungarians, ones who had been born in the East but died already in the Carpathian Basin.

3a) The radiocarbon dates of several features fell in later decades and mainly the second half of the 10th century AD. Based on the AD 915 *terminus post quem* of the coin in its find assemblage and the age at death of the individual (a juvenile boy), the person in Grave 187 of Szeged-Öthalom V

135 M. Lezsák et al. 2018, 143–168, Fig. 9.

136 The poor condition of the skeletal remains (also) makes a control measurement necessary (preferably in another laboratory).

was probably a member of the second or third generation, just like the mature individual in Cluj-Napoca-Zápolya Street, Grave 10 and the senile one in Cluj-Napoca-Plugarilor Street Grave 25. Their find assemblages do not represent a fundamental novelty compared to earlier graves of the sites; the difference only appears in the form of some new, previously unknown artefact types, including purse or bow hooks and the mount-decorated sabretache from Cluj-Napoca, an item with strong northern connections. Based on the horse harness with an owl's head-shaped rattle in Szeged-Öthalom V, Grave 257, of an infant, the child was buried at the end of the 10th century AD and, thus, could belong to the third, fourth, or even fifth biological generation of conquering Hungarians.

3b) Another notable result of the radiocarbon analysis concerns Grave 11 of the Karos III cemetery, the burial of a member of the first generation of Hungarians and one of the 'leaders' burials' in the Upper Tisza Region. According to the results of a joint archaeometric and radiocarbon analysis, the 38–45-year-old man was laid to rest in the mid-10th century AD, implying that he was a member of the second or third generation of Hungarians. This foreshadows the economic and political accumulation model of the period after the Hungarian Conquest, as accentuated by a historical analogy: while at the end of the first half of the Avar Period, a horizon of lavishly furnished graves appeared in the Great Hungarian Plain at the time when the Avar Khaganate faced a crisis,[137] in this case, a horizon of '*Prunkgräber*' is outlined in the mid-10th century AD.

In summary, even if the analysed two dozen burials do not provide a statistically representative series, they opened chronological and social-historical perspectives which were unreachable for traditional archaeological research. Additional radiocarbon analyses may specify the presented results in the future.

6. Conclusions

Considering the above and relying on both the AMS dates and the relative (typo-)chronology, we suggest the following absolute dates for the period in focus:

While radiocarbon analysis confirmed and strengthened the current relative chronology for the Late Avar Period, it has significantly modified our perception about the synchronicity of the archaeological phases between regions and even single sites, especially regarding the start and the end of the two main periods, the Middle Avar and the Late Avar Period.

The start of the Middle Avar Period in Tiszafüred shifted back to the first half of the 7th century AD, which is certainly in harmony with the dating of some row cemeteries (Mödling). Accordingly, the start of the Late Avar Period, marked by the appearance of cast belt sets, also shifted back to the AD 670s. At the same time, as attested by both radiocarbon and numismatic evidence, 'long chronology', i.e., the start of the Middle Avar Period somewhere between AD 650 and 670, remained valid, at least for small cemeteries and burial grounds of the elite. Radiocarbon chronology revealed that the Tiszafüred cemetery represents an innovative community: to test and expand this hypothesis, however, more radiocarbon measurements and archaeological comparative analyses are needed. Based on the cultural ties of the record of Tiszafüred, one might suspect that these communities probably occupied a central position in the distribution network of material and immaterial goods, both on interregional (within the Carpathian Basin) and supraregional level. In the archaeological record of the Tiszafüred cemetery, traits characterising the find material of Transdanubian cemeteries (discs, belt pendants, head jewellery)[138] and those of the Tisza Region (ornate belts with silver sheet

137 Gáll 2019, 133, Fig. 57; Türk et al. 2021, 54. For more about the '*Prunkgräber*' model, see Kossack 1974, 3–34; for its adaptation to the Avar Period, see Vida 2016, 259–260.

138 E. g., Garam 2011.

fittings for both men and women)[139] appear intermingled, while the cemetery also reflects cultural influences from Eastern Europe and the Balkans (earrings with star-shaped pendants and a 'Slavic brooch').[140] This find material is a trendsetter, foreshadowing the direction of the evolution of the local material culture and, thus, identifying Tiszafüred-Majoros as a centre of local social processes.

The radiocarbon data of LA Phases 2,3 and 4 in Tiszafüred basically cover the whole 8th century AD, while the belt sets of Phases 4 and 5 are difficult to date due to the 9th-century calibration plateau. Only a single feature could be dated likely to the 10th century AD, its uncalibrated date appearing amongst those of Hungarian Conquest Period graves. In the model, the MA and LA1–5 typochronological phases (Figs 16–17), became compressed to the very start of the possible period of the 8th and 9th centuries, i.e., to the turn of the 7th and 8th centuries AD, reflecting the anomaly in the 8th and 9th century part of the calibration curve. As a consequence, the absolute dates suggested by the model are not relevant. In contrast, the relative chronological positions of the dates in the various model versions (Model 1: with coin dated graves at the start and the end of the sequence, modelled in a single phase [Fig. 16], and Model 2: divided into phases [MA, LA1-6, PreHCP, Early HCP] according to the typochronology of the finds—mostly belt sets—of the sampled graves) are of good use for the analysis. Fig. 17 demonstrates that the archaeological phases really represent consecutive chronological phases. At the same time, the data comprise a continuous sequence without gaps (Figs 14–15). The gradually thinning sequence of Late Avar uncalibrated data—the later a phase is the fewer data belong to it—probably reflects a change in funerary customs: the graves of Phases 5 and 6 contain significantly fewer artefacts with a dating value and, therefore, were probably largely omitted from sampling (the structure of the cemetery alone is insufficient for determining which grave belongs clearly to late horizons).[141]

In Tiszafüred, graves of females have younger radiocarbon age compared to male's burials in the same typo-chronological group or phase. Most females' graves in Tiszafüred were radiocarbon dated to around and after the graves of males of Phases 3 and if correct, these dates may be interpreted as a significant difference between men and women in wearing style, indicating that women's attire was way more conservative than men's, and women may wore belt pendants with pressed silver sheet strap ends even in the Late Avar Period.[142]

The Pilismarót cemetery comprises graves from LA Phases 2–4 and especially the end of the Late Avar Period. Based on the relative chronological framework, LA Phases 4, 5, and 6 (the record of which could only be partially distinguished from the previous ones) started somewhat earlier here than in Tiszafüred. It must be kept in mind, however, that the sample number is way too low to be representative of the cemetery.

The find material of all three cemeteries reflects a change of trends in and after LA Phase 4, still characterised by burials of men with ornate belts: parallel with the vanishing of ornate belts from males' graves, burials of females became a field of social representation. The phenomenon is particularly conspicuous in Hortobágy-Árkus, where graves of females with precious metal jewellery concentrate in the last third of the sequence in the radiocarbon model, around the data of Grave 49, a male's burial with a belt set traditionally connected by research with the Hungarian Conquest Period. Part of the graves of females with relatively many finds in Tiszafüred are connected to

139 Szenthe 2012a; Garam 2011.

140 For Slavic 'brooches', see most recently Curta 2012.

141 In this regard, the trends in Tiszafüred and Zamárdi seem similar. Why a group, large, thriving, and (based on its archaeological record) maintaining an active network of interregional contacts in the 7th century AD has lost its significance later is a question for future research.

142 The difference between the burials of men and women seemingly cannot be the result of gender-based differences in their diet (for the analysis of the stable isotope results, see Faragó et al. 2022).

LA Phase 5 graves of men and horses, while another part was younger than those, both based on the horizontal structure of the cemetery and the relative position in the radiocarbon data series.

The dating of Grave 49 of Hortobágy-Árkus has interesting implications for the Hungarian Conquest Period find horizon. The related radiocarbon date, together with other graves with Hungarian Conquest Period-style finds (Szeged-Öthalom V. and Zsombó-Ménesjárás),[143] falls on the 9th-century plateau. The above shed a new light on the Hungarian Conquest, often seen as a single event. The features related to the earliest Hungarians may be the relics of groups who came to the West independent of the conquering Hungarians.[144] The 'real' conquering Hungarians, who arrived here probably with Árpád, established the first cemeteries, and most of their graves can indeed be dated to the 10th century AD. Thus, the radiocarbon sequence reflects that the conquering and occupation of the Carpathian Basin was a process with multiple phases, spreading from a core area towards the peripheries.[145] The find material of pre-Hungarians and the first generation to settle in the Carpathian Basin is remarkably more rich than that of the earliest generations of any previous peoples (the Huns or the Avars) to arrive there, due probably to a change in the cultural and economic position of the area of origin as Eastern Europe became an important transfer region of goods from the 9th century AD,[146] which also affected the material culture of the peoples residing there. The concentration of the find material of the pre-Conquest Hungarian elite and the Hungarian Conquest Period cemeteries in South Poland equally support this interpretation.[147]

Finally, the more numerous find material of the second and third generations may be identified as reflecting the beginning of acculturation and the emergence of a new power and its structures.

A remarkable result of the radiocarbon analysis confirms the suspicion of several researchers that the cease of the Avar material culture can be divided from the abandoning of Avar cemeteries, which occurred significantly later, as suggested by the presence of 'Avar data' among Hungarian Conquest Period samples in the data sequence.

The presents research has revealed minor and major phase shifts in the development of groups with seemingly uniform material culture, due fundamentally to location and the contact network maintained by the related communities. At the same time, there may have been significant differences in the material culture and beliefs of coeval, even neighbouring groups, which can be traced back to their different traditions and socio-cultural relationships. The lesson is that the position in the communication network (the localisation of the group), the cultural traditions and the networks of relationships that influenced cultural traits (some of which may have been determined by inherited—partly ethnic(?)—traditions), and changes in the location of the central space, taking shape on a supra-regional level, all had a simultaneous—and different—impact on the communities living in a micro-region. Thus, according to their social status, way of life (e.g., the settled or nomadic) and other characteristics, significant differences might have existed between neighbouring groups, such as the communities behind the cemeteries of Tiszafüred-Majoros, Hortobágy-Árkus, and Hajdúnánás-Fürj-halom-járás. As for said differences, an interesting aspect that could be grasped is that large communities, and ones positioned at communication hubs (i.e., the focal points of the road network) may have been ahead in picking up new cultural trends (think about the appearance of silver sheet belt sets in the Tisza Region), while elite groups, such as the one at Hajdúnánás, may borrowed certain characteristics from them with a delay.

143 Türk et al. 2015, 100, Tab. 2, Fig. 156.

144 See only the reports of Ammianus Marcellinus on the operations of Hunnic groups on Eastern-Roman territory: Ammianus Marcellinus *Historiae* Liber XXXI, Cap. 2, 3, 8, 16.

145 Gáll 2013, Vol. I: 821–824, 844–845, Vol. II: Pl. 335.

146 E.g., Duczko 2004; Goldina – Goldina 2010; Polgár 2019.

147 Gáll 2019, 221–227, 238–246, 247–249, Figs 118–122.

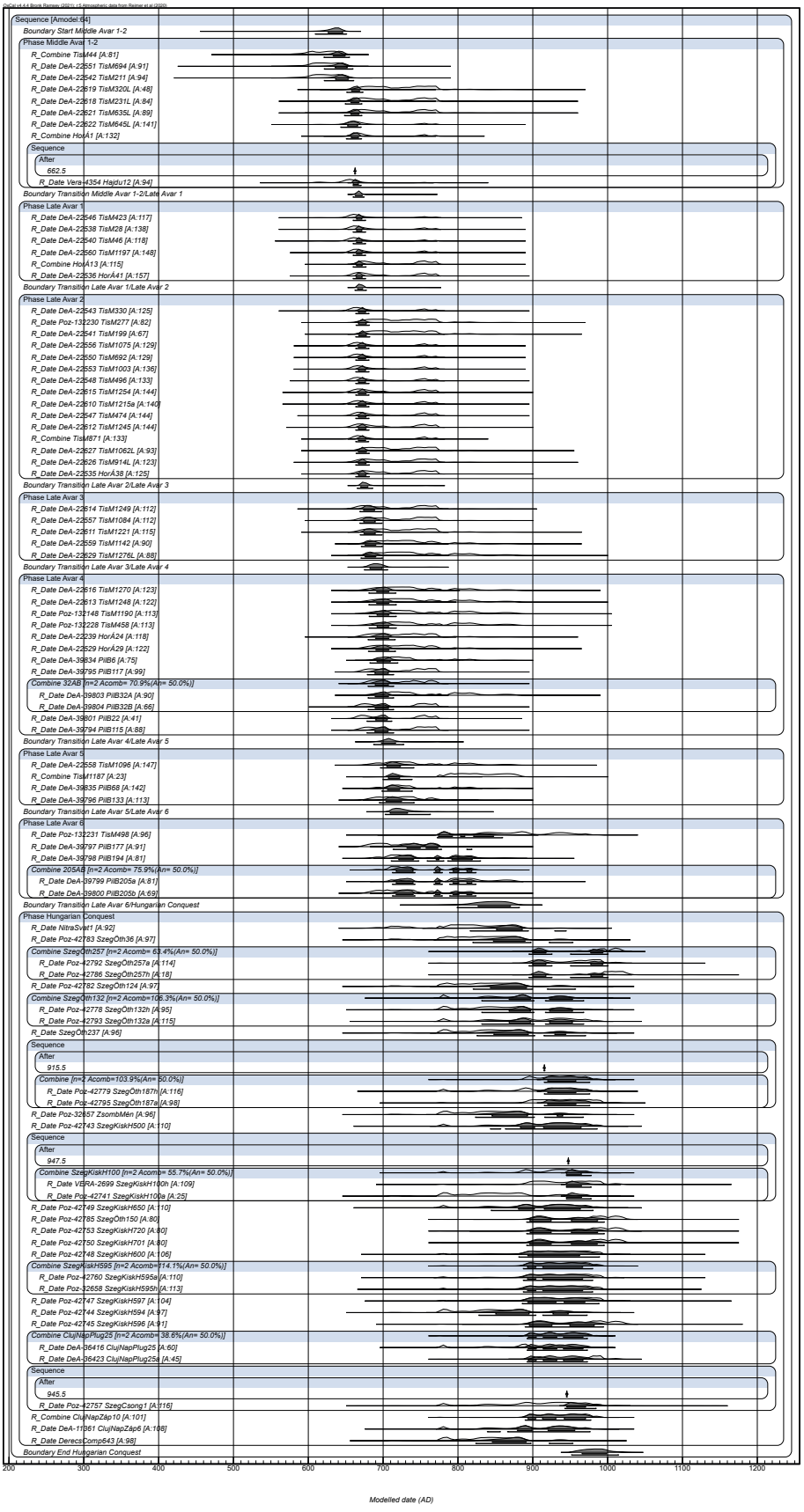

Fig. 17. Bayesian model of the Middle Danube Region from the Middle Avar to the Hungarian Conquest Period, based on available radiocarbon data and coin-dated graves, rendered into phases according to the archaeological relative chronology of the Avar and Hungarian Conquest Period

Meanwhile, it seems that the spectacular rise of Hortobágy-Árkus and Pilismarót-Basaharc took place in the middle and second half of the Late Avar Period, when the community behind the cemetery at Tiszafüred-Majoros suddenly started shrinking. All this shows that what at first sight appeared to be a static, simple and uniform Late Avar world at the time was undergoing a significant socio-economic transformation: after the complex transformation represented by the Middle Avar Period, another transition could be identified in the second half of the Late Avar Period, most probably between the LA3 and the LA4 phases, which, if not as far-reaching as the 'Middle Avar' transformation (that resulted in a general cultural homogenisation), was of economic and social significance.

Obviously, this periodisation has yet to be finetuned, verified, and expanded to encompass several more Avar cemeteries. Testing and clarifying the timeline full of question marks is a task for future research. Among other issues, there is the problem of when the Avar cemeteries were abandoned for good, which cannot be resolved based only on the radiocarbon series: the calibration curve gives no unambiguous answers, although a number of features suggest that the Avar cemeteries—at least the ones—were still in use for a long time during the 9th century AD, probably well after the arrival of the 'Conquering Hungarians'. At the same time, the two sampled Late Avar sites in the Great Hungarian Plain are out of the areas affected by the Carolingian invasion or the Bulgarian military campaigns, probably having profound effects on the population and social, economic and cultural structures of the territories impacted; synchronising the record with the timeline of Carolingian-type sites is also a task for future research. In conclusion, as large radiocarbon series as possible are needed from as many sites as possible to join the histories of the peoples residing in the Carpathian Basin in the 7th–10th centuries AD in a single narrative, outlining the cultural and social processes of the area and period in question.

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