Radiocarbon Dating of Late Iron Age Graves from Transylvania

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Abstract: In order to confirm and narrow down the relative chronology of the Late Iron Age in the Carpathian Basin, eleven samples from three Celtic cemeteries in Transylvania (Archiud-Hânsuri, Fântânele-Dealul Iușului / La Gâța and Fântânele-Dâmbul Popii) were submitted to radiocarbon dating using the AMS method. Based on the measurement of samples from human and animal bones and on additional 14C results from the Carpathian Basin, one could observe that the date ranges, often divided into numerous smaller or larger phases, cover a much wider period than the four Transylvanian Celtic horizons defined based on the typological changes of artefacts linked to historical events or socio-historical phenomena (La Tène B1/B2-C1 phases, 350/335-190/175 BC). The explanation of this circumstance raises further questions of physical and archaeological methodology, interpretation and research.

Key words: Late Iron Age, Celts, radiocarbon dating, Transylvania.

Archaeology is fundamentally based on the necessity of placing discovered artefacts in space and time. The most frequently applied method is the typological and technological succession of objects, sometimes correlated with the cultural order (Berecki 2008). The typo-chronological classification follows the evolution of the different archaeological categories. In the case of the Late Iron Age, processes such as the changes in taste for clothing and jewellery (fibulae, bracelets, belts, anklets, pendants, etc.), the evolution of weapons (swords, scabbards, sword-chains and chape-ends, spears, shields, helmets) according to developments in the military technique, the changes in food consumption customs and the technological accomplishments needed to achieve these changes, as well as their spatial transfer are the easiest to trace. Less spectacular are the changes occurred in tools (whetstones, shears, etc.) over time. Of the typo-chronological analyses in the Carpathian Basin the combinatorial and seriation examination of the grave goods from Pișcolt cemetery (Németi 1993) and the analysis of the pottery from Sajópetri (Szabó et al. 2007) are exemplary.

The second half of the last millennium B.C. is characterised by a high degree of demographic and ideological dynamism. Due to the mobility of communities, individuals, know-how and ideologies' changes and developments are also faster, yet differ regionally.

The evolution of objects in shape and aesthetics reveals not only the formal refinement or functional improvement of new technological achievements, but also the relationships between different communities. Besides the spread of new, 'culturally foreign' object types, these interactions often led to their local adaptation. However, interactions are not only perceptible at the level of objects, but also at the cultural and ideological level, observed primarily through regional specificities of rites and rituals.

In understanding these constantly changing societies, temporal classification is an important basis for social theory analysis. For example, the chronological classification of graves makes it possible to study

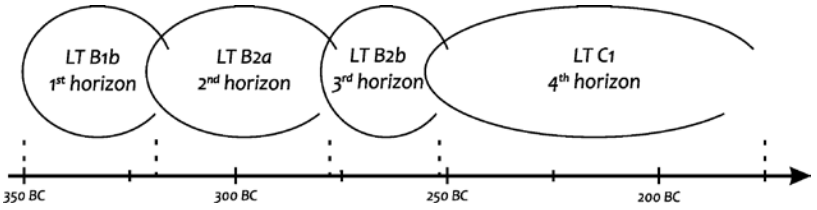

Fig. 1. Relative chronology of the Early and Middle La Tène in Transylvania

the location of such burials of the same period within a cemetery used over several horizons, and also to identify the combinations of grave goods within a given horizon, and to sketch the social structure of a period (usually one generation) through these analyses. Comparing successive horizons can also point out conscious and random social transformations. A pertinent example from the eastern part of the Carpathian Basin is the change in burial customs in the Pişcolt cemetery (Berecki 2021, 47-50) or the socio-historical factors involved in the spatial development of the cemetery in Fântânele (Rustoiu 2015, 22-23, fig. 18-19).

The subjectivity of the interpretation of typological sequences results in different relative chronological systems. The correlation of the relative chronologies of the European Late Iron Age indicates the trends of certain archaeological schools and the regional specificities of Late Iron Age cultural change (Berecki 2008, 50, fig. 1). The Late Iron Age typo-chronologies of the Carpathian Basin are based on I. Németi's seriation analysis applied on the Pişcolt cemetery in the Tisza region (Németi 1993), whose relative chronological system is based on J. Waldhauser's (1987, 35, Tab. 1) division of the Late Iron Age. With minor adaptations, mainly concerning the beginning of the Celtic colonisation and the end of the Celtic La Tène culture of Transylvania and the upper Tisza valley, this chronological system of Németi can also be applied to the classification of Early and Middle La Tène finds and sites in Transylvania (Berecki 2008; 2015, 30; Rustoiu 2015, 13) (**fig. 1**).

The absolute dates of the Celtic horizons and relative chronological systems in the Carpathian Basin have been linked either to historical events and social phenomena, or to generally accepted conventional labels. Thus, the appearance of the Celts in the Carpathian Basin can be linked to the delegation to Alexander the Great (335 BC), narrated by Ptolemy, while the end of the second horizon can be associated with the Balkan expeditions (280/279 BC), and the end of the Celtic presence in Transylvania and Tisza region is indirectly linked to the appearance of the Central European oppida (190/175 BC), absent in the eastern part of the Carpathian Basin. Based on different viewpoints, various scholars date the end of the first Transylvanian horizon and the beginning of the second between 320 and 300, while opinions are least consistent as to the date of the end of the third horizon and the beginning of the fourth (for the detailed discussion see: Berecki 2008, 53-54 and 58-59).

In 2014 eleven Iron Age samples collected from Transylvanian Celtic graves were sent for radiocarbon dating to the Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI), Debrecen, Hungary (regarding the laboratory and measuring equipment see: Molnár et al. 2013a; 2013b). Radiocarbon dating was meant to help investigate whether the relative chronological time intervals

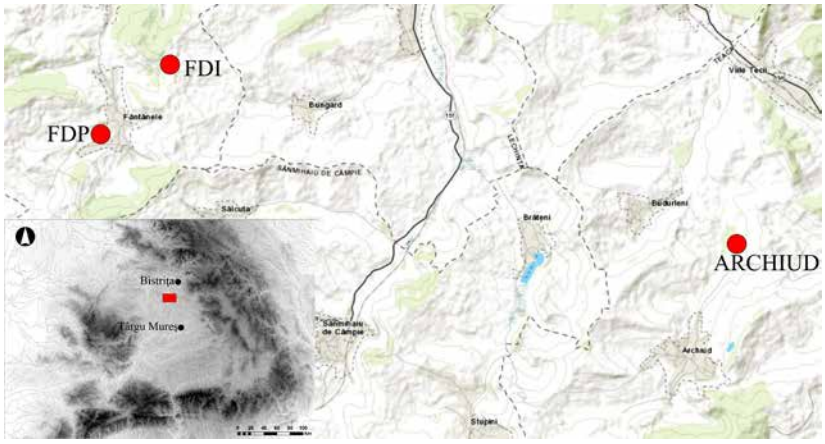

Fig. 2. Geographic location of the archaeological sites where the samples for 14C dating come from: Archiud; FDP = Fântânele-Dâmbu Popii; FDI = Fântânele-Dealul Iușului (base map: twcc.fr)

Fig. 3. Aerial view of the site Archiud-Hânsuri (photo: S. Berecki, November 2013)

previously used for Transylvania could be justified and possibly narrowed down by applying the physical method.

The samples came from three cemeteries in Bistrița-Năsăud County: Archiud-Hânsuri, Fântânele-Dealul Iușului / La Gâța and Fântânele-Dâmbul Popii (**fig. 2**). In terms of the results, it is important to mention that graves belonging to the Scythian horizon preceding the Celtic horizon were also found in all three sites.

Despite the extensive excavations carried out at Archiud-Hânsuri in the 1970s (Marinescu / Gaiu 1983), very little and sometimes inaccurate information is available on the grave goods and the date of the objects (**fig. 3**). In addition to Late Iron Age graves, the site also contained burials from the Late Bronze Age (Noua culture) and the Migration Period (4th-5th and 6th-7th centuries AD). Some of the finds are stored in the Border Guards Museum in Năsăud, others in deposits of the Bistrița-Năsăud Museum Complex in Bistrița. The samples from Archiud were selected from graves 26 and 31, stored in the museum in Năsăud, with human bone from grave 26 and pig bone from the animal offering in grave 31. According to the plan of the cemetery (Marinescu / Gaiu 1983, fig. 1), grave 26 was a Late Iron Age skeletal burial, while grave 31 was indicated as Late Bronze Age. Contrary to this information, in the light of the 14C data, the person buried in grave 26 most probably lived before the Celtic settlement in

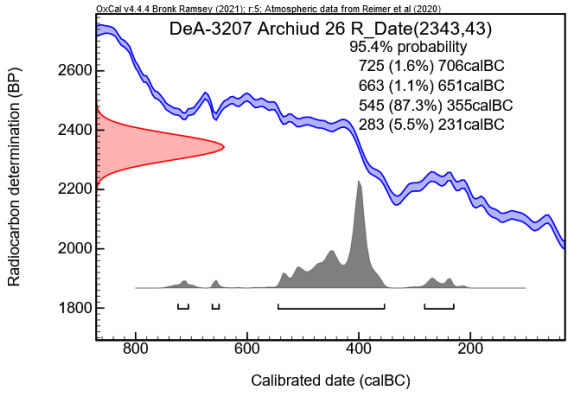

Fig. 4. Calibrated date of Archiud grave 26 (OxCal, version 4.4.4)

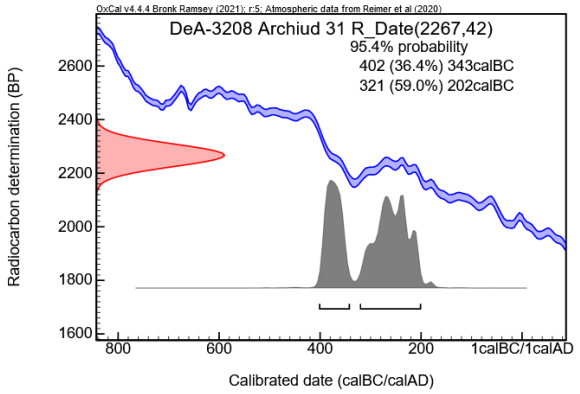

Fig. 5. Calibrated date of Archiud grave 31 (OxCal, version 4.4.4)

Fig. 6. Aerial view of the site Fântânele-Dâmbul Popii (photo: S. Berecki, September 2014)

Transylvania and was buried rather at the end of the Early Iron Age (2343±43 BP) (**fig. 4**), while the food remains of grave 31 can be dated without a doubt to the Late Iron Age (2267±42 BP) (**fig. 5**). It is true, however, that calBC data cover all four Transylvanian Celtic horizons in relative chronological terms.

The Fântânele-Dâmbul Popii site (**fig. 6**) also spans several periods: the earliest burials date to the end of the Early Iron Age, to the Ciumbrud culture identified with the Scythians. These are followed both in time and space by Late Iron Age Celtic burials, and the hillside was again used as a burial ground during the Migration Period. The Late Iron Age cemetery was in use during all four Transylvanian Celtic horizons. The spatial and temporal distribution of the graves in the cemetery also reveals the evolution of the community's social structure: the graves are clustered into three groups already starting from the first horizon. The three groups are probably associated with three families, but only one family burial site remains in use in the last period (Rustoiu 2015, 22-23; Berecki 2021, 50, fig. 21).

Based on the bronze fibula and bracelet found among the goods, cremation grave 78 excavated in 1973 can be dated to the earliest LT B1b horizon of the eastern burial group. The 2348±43 BP result of the animal offering's radiocarbon dating yielded significantly discon-

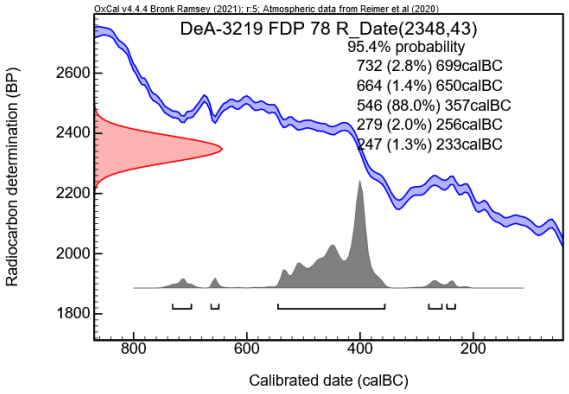

Fig. 7. Calibrated date of Fântânele-Dâmbul Popii grave 78 (OxCal, version 4.4.4)

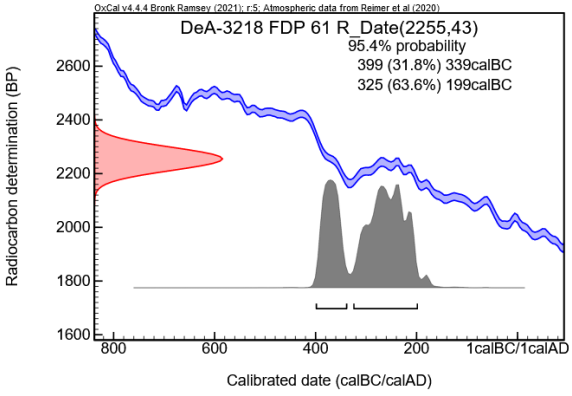

Fig. 8. Calibrated date of Fântânele-Dâmbul Popii grave 61 (OxCal, version 4.4.4)

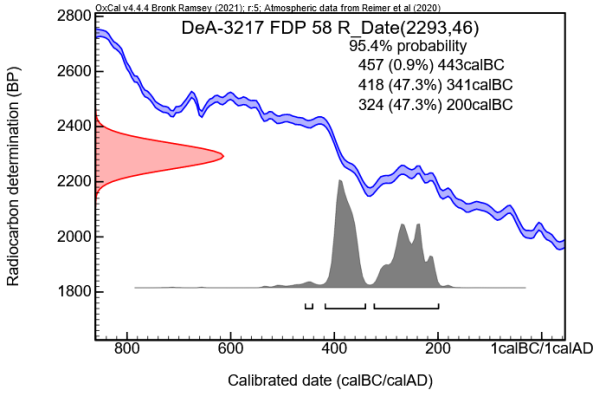

Fig. 9. Calibrated date of Fântânele-Dâmbul Popii grave 58 (OxCal, version 4.4.4)

tinuous calendar years, of which a probability of 88% dates the animal bones to the mid-6th – mid-4th century (**fig. 7**).

The cremation grave 61 of the middle group of graves was excavated in 1973, and its inventory also dates it to the first horizon, LT B1b. For radiocarbon dating, the samples were also taken from the animal bone placed as food offering. The result 2255±43 BP dates the grave with 95.4% probability between the beginning of the 4th century and the end of the 3rd BC, while the bulk of the probability density with 63.6% dates it between 325-199 cal BC (**fig. 8**). This covers the LT B2a-C1 period in relative chronological terms.

The bronze and iron fibulae and iron spearhead from warrior grave 58 of the middle group of graves date it to the third horizon, LT B2b. The grave was excavated in 1972. The sample for carbon isotope measurements was human bone. With a probability of 95.4%, 2293±46 BP can be dated between the middle of the 5th century (457 cal BC), or rather between its end (418 cal BC) and the end of the 3rd century (200 cal BC) (**fig. 9**). The 324-200 cal BC period of a 47.3% probability also represents the entire second to fourth horizon in relative chronological terms.

The first graves of the Fântânele-Dealul Iușului / La Gâța site were discovered by chance in a sand quarry in 1999. Starting from 1999, systematic excavations conducted by D. L. Vaida on this site have brought to light an Early Iron Age and a Late Iron Age (LT B and LT C)

Fig. 10. Aerial view of the site Fântânele-Dealul Iuşului / La Gâţa (photo: S. Berecki, September 2014)

cemetery and several LT D pits (**fig. 10**). The remains of 43 persons from 41 graves have been excavated to this day (Vaida 2006a; 2006b; 2008; Berecki 2015, 118-127; Berecki 2021, 41, fig. 14).

Grave number 10 was inhumation, with a crouched skeleton of an 18-23 years old male, containing only two fragments of handmade pottery, which do not allow a relative chronological dating of the grave. Based on the samples from the long bone and tooth, the grave can be dated to 2230±41 BP, which gives a probability of 94.4% for the period between the beginning of the 4th century BC to the beginning of the 2nd century BC, i.e. the entire Early and Middle La Tène period (**fig. 11**).

Grave 18 was inhumation of a young woman, unearthed in 2005, its inventory including three bronze bracelets, two bronze fibulae, an iron fibula, three iron pendants, an iron loop, a tubular glass bead with a human mask, a clay bead, small fragments from an iron necklace and animal bones. The grave dates from the Early La Tène period, probably LT B2. Based on samples from the human long bone and tooth, the grave can be dated to 2256±45 BP, which confers a 95.4% probability of dating the grave to the 4th-3rd centuries BC (**fig. 12**).

Grave 22 was inhumation of a child, unearthed in 2006, containing two bronze bracelets and an iron object dating from the Early La Tène period. Based on the dating of the sample, also coming from the human long bone and tooth, the grave was dated to 2342±43 BP, which in absolute chronological terms resulted in uneven intervals between the 8th and 3rd centuries BC, with a probability of 86.9% between the mid-6th and the mid-4th century BC (**fig. 13**).

Grave 35 was inhumation, unearthed in 2011, with an inventory consisting of bronze earrings, three handmade vessels and animal offering. The relative chronological classification of the grave is not possible on the basis of the inventory. The dating of the human bone sample to 2319±45 BP dates the grave in absolute chronological values from the end of the 6th to the end of the 3rd century BC (**fig. 14**).

Grave 38, an inhumation one of an adult male, was unearthed in 2011, with an inventory consisting of a large iron fibula, a sword chain, a perforated bone object and two wheel made vessels. The grave is datable to the last Celtic horizon, the LT C1 period. The date of 2341±43 BP, based on the human long bone and tooth, resulted in a discontinu-

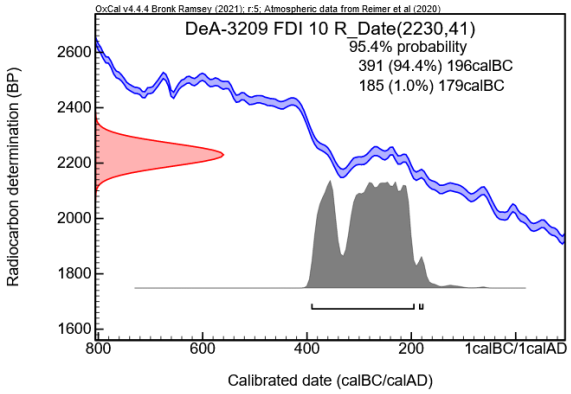

Fig. 11. Calibrated date of Fântânele-Dealul Iuşului / La Gâţa grave 10 (OxCal, version 4.4.4)

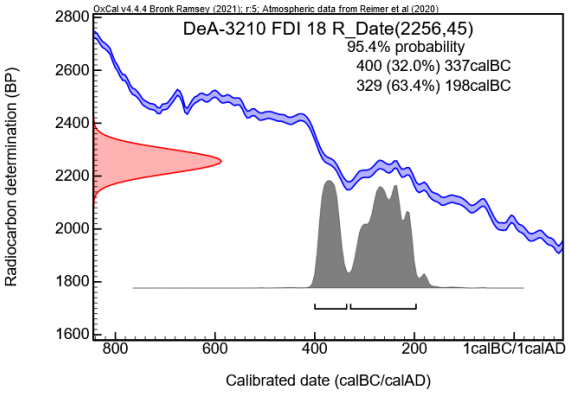

Fig. 12. Calibrated date of Fântânele-Dealul Iuşului / La Gâţa grave 18 (OxCal, version 4.4.4)

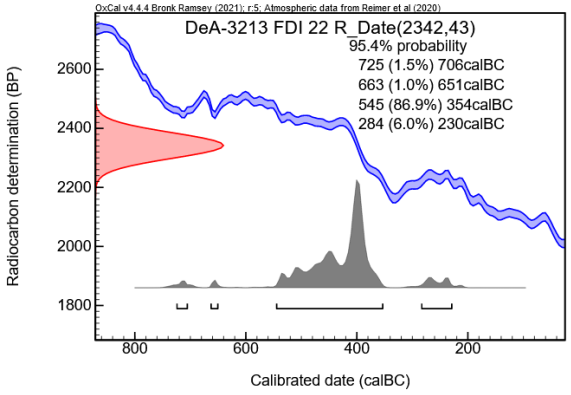

Fig. 13. Calibrated date of Fântânele-Dealul Iuşului / La Gâţa grave 22 (OxCal, version 4.4.4)

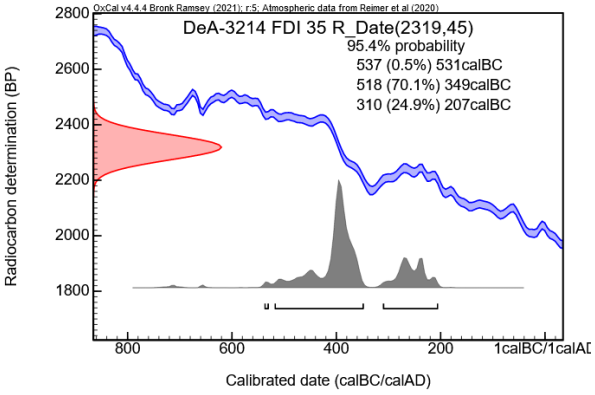

Fig. 14. Calibrated date of Fântânele-Dealul Iuşului / La Gâţa grave 35 (OxCal, version 4.4.4)

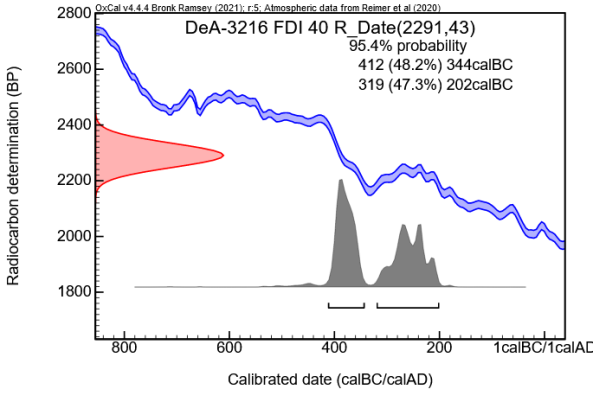

Fig. 15. Calibrated date of Fântânele-Dealul Iuşului / La Gâţa grave 38 (OxCal, version 4.4.4)

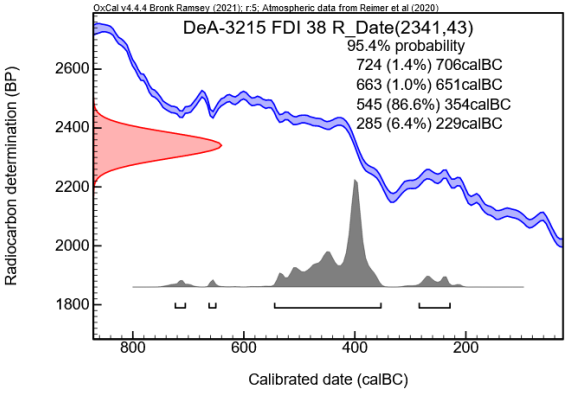

Fig. 16. Calibrated date of Fântânele-Dealul Iuşului / La Gâţa grave 40 (OxCal, version 4.4.4)

ous time interval, giving a probability of 86.6% that the grave can be dated between the mid-6th and mid-4th century BC (**fig. 15**).

Finally, inhumation grave 40 of a 60 years old male was found in 2012 and contained an iron awl with horn handle, which is not suitable for the dating of the grave. Samples were taken from human bone and tooth in this case as well, and the result was a date of 2291±43 BP, which in absolute chronological time represents the period from the end of the 5th to the end of the 3rd century BC (**fig. 16**).

Conclusions

In the case of radiocarbon dating of Late Iron Age graves from Transylvania, absolute chronological dates cover a much wider time interval than the relative chronological classifications determined by typo-chronological methods. In addition to the Archiud and Fântânele samples, the same can be said for the results obtained from the Teiuş (Alba County, Romania) dwarf elder seeds (2205±23 BP), which date the archaeological context between the mid-4th century and the first half of the second century BC (Ciută 2018, 49, fig. 2; Ciută 2019, 649). But a similarly wide time range was obtained from a child's cranium (400-210 cal BC) in an archaeological feature excavated at Süttő in the northern part of Transdanubia (Czajlik et al. 2019, 207), or from the charred peas (2190±35 BP = 95.4% probability 380-125 cal BC) dating from the end of the Early La Tène ("Vorpúchov-Stufe") of the Liptovská Mara II site in the northern part of the Carpathian Basin (Pieta et al. 2021, 135-139).

Unfortunately, the calendar intervals obtained by the 14C method are all split into at least two or three, and sometimes up to five, sequences, which is due to the unfortunate evolution of the calibration curve during that period. This is not a geographically specific phenomenon, and similarly broad and fragmented results have been obtained for measurements of Late Iron Age samples from Western Europe (Cahen-Delhaye 1994).

In some cases, the upper limit of cal BC years is much earlier than the conventional beginning period of the Late Iron Age from this region. Even in the case of high probability calBC results, the starting year often dates back to the mid-6th century BC, and in these cases the lower age limit does not exceed the middle of the 4th century BC (Archiud grave 26, Fântânele-Dâmbul Popii grave 78, Fântânele-Dealul Iuşului / La Gâţa graves 22, 35, 38), when Celtic settlement in the eastern part of the Carpathian Basin began according to relative chronological systems. At the same time, erroneous field or storage sampling and contamination of samples can be excluded in these cases, since the cal BC date of each sample partially overlaps, with greater or less probability percentage, the period of the conventional "Celtic Age".

The results of the research carried out on samples of animal bones from the Tisza area dating from the Scythian Age preceding the Celtic period also demonstrated that the initial period dates the objects well before the relative chronological classification (Czifra et al. 2017, 271, fig. 19).

But similarly early dates have resulted from the investigation of Late Iron Age samples. The starting date of structure 380 of the Sopron-Krautacker site dated to LT C (2385±50 BP = 95.4% probability 751-384 cal BC), or the data of multiple burial 118 dated to LT D (2095±35 = 95.4% probability 340 cal BC – cal AD 4, 90.5% probability 200-37 cal BC) (Jerem 2003, 545; 554) or the Late Iron Age LT D cremation cemetery at Westhampnett in Britain (Fitzpatrick et al. 2017, 369-371) have all been set too early. Since at least five of the eleven samples from Transylvania yielded a 732 cal BC start (and so did structure 380 at Sopron-Krautacker), the question arises whether the Early and Middle Late Iron Age can be classified as a "Hallstatt-plateau" phenomenon from the point of view of radiocarbon dating. Furthermore, although less likely, given that several samples stem from human bones, radiocarbon data of the early years of Late Iron

Age might be related to the freshwater reservoir effect (for FRE in radiocarbon dating see: Philippsen 2013). But in order to establish more precisely the exact nature and extent of this hypothesized effect, it is necessary to examine the currently poorly known Late Iron Age dietary diversity and food consumption customs of the communities and the proportion of resources from freshwater, marine and terrestrial systems at the micro- and macro-regional level.

From a methodological point of view, it can be observed that the calendar years are equally spaced for both animal and human bone samples, although the results from animal bones for the Archiud 31 and Fântânele-Dâmbul Popii 61 graves yielded a slightly narrower time interval (4th-3rd c. BC).

Although the eleven sample measurements did not yield relevant results in comparing and corroborating the relative and absolute chronology, formulated as the working hypothesis, conclusions can still be drawn for the chronology of the eastern part of the Carpathian Basin. For example, in the case of graves with a relative chronological classification that can be well determined by typo-chronological means, it seems that the first horizon may date slightly earlier than the mid-4th century BC, while the last horizon may not even cross into the second century BC. Further research on dietary customs may support or refute the role of the freshwater reservoir effect in early dating.

Furthermore, while the material culture of the Early and Middle La Tène periods in the eastern part of the Carpathian Basin is relatively well separable from the one specific for the subsequent final period of the Late Iron Age, in the Middle Danube region, however, radiocarbon dating is suitable for the separation of the LT A-C and LT D periods. Last but not least, in the case of multi-layered sites (e.g. cemeteries with burials from several chronologically successive periods), radiocarbon dating is the most suitable for the chronological classification of objects for which the inventory does not provide sufficiently precise information for dating.

AMS Lab code	context of the sample	sample type	radiocarbon age BP	calibrated Age BC 2 sigma (95.4% probability) (OxCal v.4.4.4)
DeA-3207	Archiud-Hânsuri, grave 26	human long bones	2343±43	725-231
DeA-3208	Archiud-Hânsuri, grave 31	pig long bones and teeth	2267±42	402-202
DeA-3209	Fântânele-Dealul Iușului, grave 10	human long bones and tooth	2230±41	391-179
DeA-3210	Fântânele-Dealul Iușului, grave 18	human long bones and tooth	2256±45	400-198
DeA-3213	Fântânele-Dealul Iușului, grave 22	human long bones and teeth	2342±43	725-230
DeA-3214	Fântânele-Dealul Iușului, grave 35	human bone	2319±45	537-207
DeA-3215	Fântânele-Dealul Iușului, grave 38	human long bones and teeth	2341±43	724-229
DeA-3216	Fântânele-Dealul Iușului, grave 40	human long bone and tooth	2291±43	412-202
DeA-3217	Fântânele-Dâmbul Popii, grave 58	human bones	2293±46	457-200
DeA-3218	Fântânele-Dâmbul Popii, grave 61	animal bone	2255±43	399-199
DeA-3219	Fântânele-Dâmbul Popii, grave 78	animal bones and teeth	2348±43	732-233

Fig. 17. Radiocarbon dates from Late Iron Age samples in the eastern part of the Carpathian Basin.

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Радиовъглеродно датиране на гробове от късножелезния период в Трансилвания

Шандор БЕРЕКИ

(резюме)

Единадесет проби от келтски некрополи в Трансилвания (Archiud-Hânsuri, Fântânele-Dealul Iuşului / La Gâţa and Fântânele-Dâmbul Popii) са датирани чрез радиовъглеродния метод. Целта е да се потвърди и уточни относителната хронология на късножелезния период в Карпатския басейн. Пробите са взети от животински и човешки кости. В статията са използвани и други 14C датировки от Карпатската област. Оказва се, че така наречения „келтски хоризонт“ в Трансилвания покрива много по-голям период, отколкото общоприетия, определен по формално-типологичен анализ на артефакти, свързани с исторически събития или със социално-икономически явления (La Tène B1/B2-C1, фази 350/335-190/175 BC). Този извод повдига въпроса за археологическите методи на изследване.

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