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## TWO BRONZE AGE MINIATURE WAGON AND WHEEL BURIALS IN ENCS (NORTH-EASTERN HUNGARY)

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*Summary.* During an excavation of a Bronze Age, Füzesabony-culture cemetery at Encs (north-eastern Hungary), a clay wagon model with spoked wheels (grave 1290) and three miniature solid clay wheels were found (grave 1389). Miniature wagon and wheel models in burials began to appear in the Late Copper Age and lasted until the Iron Age in Central Europe. Their presence allows of several interpretations. These spoked wheels of grave 1290 provide early evidence about the appearance of such in the Carpathian Basin. Focussing on the two graves from Encs, this article reports AMS radiocarbon dates that suggest the spoked wheels belong to the early second millennium BC. The implications of these finds are interpreted through a comparative review of both wagon models from the Füzesabony culture and the evidence for early spoked wheels in the Carpathian Basin.

### INTRODUCTION

The invention of spoked wheels was a major advance in vehicle technology that led to lighter and faster wagons. The appearance of such is often connected to two-wheeled chariots, even though some elements of the chariot package, such as spoked wheels and cheek pieces for harnessing, could have originated from a number of locations (Maran 2020) and might have developed separately from chariots in response to functional or mobility needs (Piggott 1992, 48–9). The location where the first spoked wheels were invented is debated as this technology is known to have spread so rapidly among regions that the current dating methods are not capable of determining differences in so short a time span (Littauer and Crouwel 1996; Lindner 2020; Maran 2020; Grigoriev 2021; Metzner-Nebelsick 2021; Makarowicz *et al.* 2022). Currently, the first spoked wheels are known from a few significant territories, such as the steppe zone around the southern part of the Urals, Anatolia, the Middle East, and the Carpathian Basin. Communities dwelling between the Carpathian Basin and the Urals were all believed to have the ability to invent and manufacture the spoked wheel and a new bridle harness, making horses capable of pulling larger, four-wheeled wagons (Maran 2020, 512). Although actual, early wooden spoked wheels have not yet been found in the Carpathian Basin, small clay wheels and incised representations, dated between 2000–1500 BC, indicate their existence at this time (Bondár 2012b, 52). Spoked wheels likely first appeared around the early second millennium BC and diffused

quickly throughout the Steppe region, Central Asia, Mesopotamia and Mycenaean Greece (Metzner-Nebelsick 2021).

Miniature solid clay wheels and wagon boxes were first known around the middle of the fourth millennium BC in the Baden culture of the Carpathian Basin, as a symbolic version of actual life-sized wagons (Bondár 2012a, 26–7, 29). Earlier, scholars thought there might have been a hiatus in the production of miniature wagons and solid wheels between 2500–2000 BC, but new discoveries in the last decades have disproved this idea (Bondár 1990; Bondár and Székely 2011; Bondár 2016, 39). (However, it is important to note that their occurrence decreased during this period.) Today we know that wagon models were made continually from the Late Copper Age until the end of the Reinecke Bz B period (3500–1500/1450 BC) in the Carpathian Basin, but that their production flourished between 2000/1950–1500/1450 BC (Boroffka 2004; Balázs and Dani 2014, 12).

Rescue excavations accompanying the M30 motorway between Miskolc and Tornyosnémeti took place in north-eastern Hungary in 2018, coordinated by the Herman Ottó Museum of Miskolc and the Castle Headquarters. One segment of the work was excavation at the site of Encs-Mérmöki-teleptől délre (Fig. 1a,b), undertaken by Salisbury Archaeology and led by Áron Dávid and Zoltán Farkas. Here, part of a large Bronze Age cemetery belonging, in part, to the Füzesabony culture was unearthed (Mengyán and Dávid 2019, 159). At this site, one of the most remarkable finds was a wagon box with four spoked wheels made of clay, found in grave 1290. A second burial (grave 1389), without human remains, contained two and a half solid clay wheels. The model wagon is an exceptional find since both the wagon box and spoked wheels were found together in a well-documented context. This paper focuses on the analysis of graves 1290 and 1389, including their AMS radiocarbon dating, as well as additional grave goods and the human remains. To interpret these exceptional finds, the wagon models from the Füzesabony culture territory are comparatively reviewed alongside evidence for early spoked wheels in the Carpathian Basin.

#### THE FINDS FROM ENCS

The site is situated on the western fringes of Encs, in the Hornád/Hernád river valley (eastern Slovakia, north-eastern Hungary). This region is part of an important trade route that connects the Great Hungarian Plain and Lesser Poland and runs on further to the northern, Baltic regions (Fischl 2012).

During the excavation, 1413 features were observed, of which 1093 were identified as possible graves (Fig. 1b). Overall, 704 of these burials contained human remains, an additional 180 contained only pottery and/or bronze finds, and the remaining 209 features were empty but fit well within the cemetery structure so they could be interpreted as symbolic or looted burials. The proportion of robbed/disturbed graves occurring in a Füzesabony cemetery varies (Dani and Szabó 2004, 93–4, 101–3), but this phenomenon is relatively frequent here in the cemetery at Encs (Mengyán and Dávid 2019). The full anthropological analysis is not complete, but the burial rites associated with Füzesabony culture inhumation graves are routinely correlated with the biological sex of the deceased in a predictable manner (Fischl *et al.* 2020, 245; Jaeger *et al.* 2022, 3). According to the preliminary observations in this burial ground, it seems possible that men were buried on their right sides and oriented to the west/north-west, while women were placed on their left side and oriented to east/south-east. Therefore, both sexes were facing south, in a flexed position

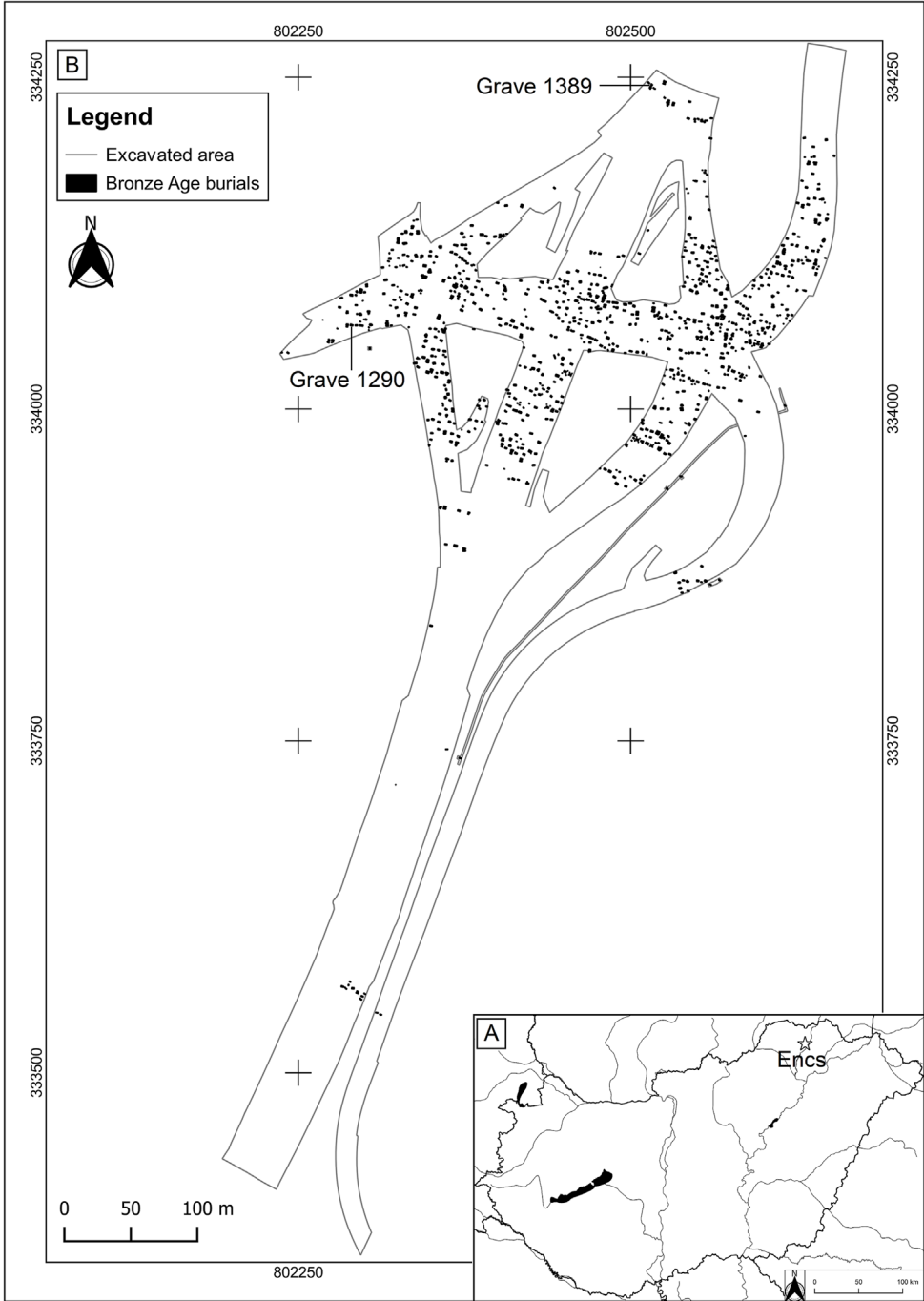


FIGURE 1

A: Position of Encs within Hungary; B: Map of the Bronze Age burial ground of Encs-Mérnöki-teleptől délre and the position of the analysed graves (made by Ákos Mengyán with QGIS 3.10 software).

with slightly pulled-up legs and the arms placed in front of the chest or face. On this basis, 184 graves could belong to males and 171 to females. Instances where multiple individuals were interred in a single grave were also encountered, most of which contained an adult and a child. A few cremation burials were also unearthed. Remains of wooden coffins were identified at the bottom of several grave pits, along with evidence for possible built mortuary structures, indicated by column-holes/post-holes at the outer corners of the graves (Mengyán and Dávid 2019, fig. 3). This phenomenon and the absence of cross-cutting burials suggests that the graves could have been marked on the surface to indicate the position of the burials, as is suggested too for the Bronze Age cemetery of Nižná Myšľa (Jaeger *et al.* 2022, 5). At Encs, the depth of the burial pits varies from 10–160 cm, but generally, the graves of children are shallower, while the depths of adult graves are more variable (Mengyán and Dávid 2019).

Burial 1290 was found at the western part of the cemetery (Fig. 1b). The rectangular pit was oriented slightly south-west to north-east (length: 230 cm; width: 130 cm; depth: 90 cm). Traces of a rectangular wooden coffin (length: *c.*190 cm; width: 65 cm) were observed at the bottom, onto/within which the body and grave goods were likely all placed. The burial was robbed and the upper body of the deceased disturbed. Therefore, some parts of the human remains are missing and others were disarticulated and scattered about the bottom of the pit, only the lower legs and the surrounding grave goods remained untouched (Fig. 2). According to the position of the lower legs, the deceased

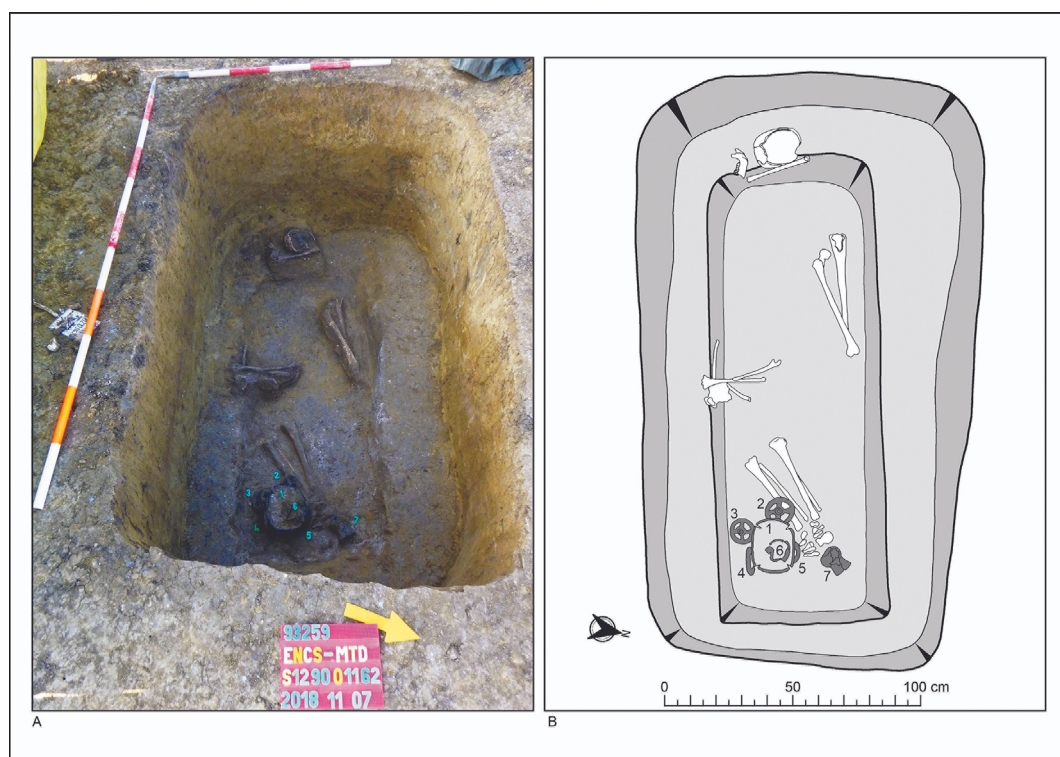


FIGURE 2

A: Photo of grave 1290 (taken by Márton Nagy, Salisbury Ltd.); B: Drawing of grave 1290.

could have lying on their right side, oriented to the west and facing south, which corresponds with the assumed male burials of the Encs Bronze Age cemetery. The contextually-estimated sex was supported by the anthropological analysis (see below). The clay wagon box and its wheels were found close to the front of the individual's feet (Fig. 2, nos. 1–5) along with two cups, one of which was placed in the wagon box (Fig. 2, no. 6) and the other that was located near the foot (Fig. 2, no. 7).

Burial 1389 is situated at the north-western part of the cemetery in a grave group (Fig. 1b), the pit of this grave was rectangular and east-west oriented (length: 95 cm, width: 60 cm, depth: 13 cm). Human remains were not observed. Grave goods were found in the western part of the pit and included two and a half solid clay wheels, two of which were stacked one on the other (Fig. 3b, nos. 3, 5), and all being situated next to a bowl and a cup. A second cup was discovered inside the bowl (Fig. 3b, no. 6).

METHOD AND RESULTS

Archaeological, anthropological, and radiocarbon analyses were carried out to determine the absolute and relative chronology of the analysed graves and the anthropological data of the individual in grave 1290. This section summarizes the finds and chronology attached to graves

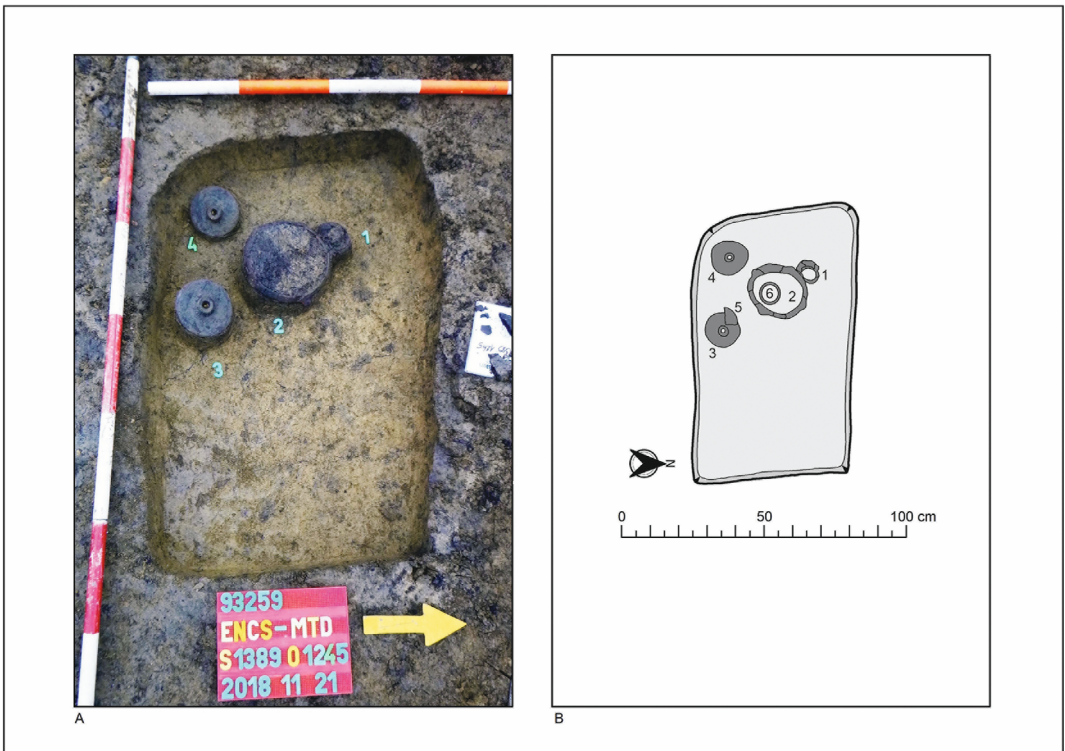


FIGURE 3

A: Photo of grave 1389 (taken by Mihály Ede Tóbis, Salisbury Ltd.); B: Drawing of grave 1389.

1290 and 1389 and places the data in context with the existing evidence for and interpretations of model wagons and wheels in the Füzesabony culture, as well as considering the presence of early spoked wheels of the Carpathian Basin.

### *Grave goods of burials 1290 and 1389*

The wagon box of Encs (Figs. 4 and 5) is brown in colour, undecorated; a handle is situated at the front part of the box (length: 13.5–19.5 cm; width: 8–17 cm; axles: 17 cm long; height: 14.5 cm; handle: 3 cm in length; diameter of the wheels: 10 cm, and width: 3 cm). The style of the 1290/6–7 cups (Fig. 6, nos. 1290/6 and 7) reflects the Hatvan ceramic assemblage tradition (Kalicz 1968, Taf. CXXIX/8b1, Taf. CXXIX/8n; 1984, Taf. LII/9; 1968, Taf. LII/24), but analogous pieces are also known from early and classical Füzesabony culture sites, dating to around 2000/1900–1700 BC (Bóna 1975, Taf. 160/13; Kovács 1984, Taf. LXV/12; Schalk 1992, Tafs. 2/6, 7/1 and 10/4). A fragment of a bronze spiral pendant (Fig. 6, no. 1290/8) was found in the looting pit; this pendant could have decorated the clothes of the deceased and was probably disturbed during the looting process. This type of pendant is relatively common in these contexts and was in use for a long period of time, approximately from Reinecke Bz A1–D (c.2200–1200 BC). Accordingly, it is not useful in bestowing an exact date to this feature (Grigoriev 2019, 229).

The shape and style of the cups no. 1 (Fig. 6, no. 1389/1) and no. 6 in grave 1389 (Fig. 6, no. 1389/6) are identical, with parallels (Bóna 1975, Taf. 179/1; Kemenczei 1979, Taf. II/2; Taf. XI/1; XI/6) in the classical and late phases of the Füzesabony ceramic assemblages at the end of the RBz A2 and RBz B1 (c.1700–1500 BC). The bowl (Fig. 7, no. 1389/2) is a common shape with a handle and four knobs on the belly line. This bowl-type is frequently found around the end of the RBz A2 and the RBz B1 periods (c.1700–1500 BC) with comparanda known in the classical and late Füzesabony cultural contexts (Kemenczei 1979, Taf. IX/1). Finally, the solid clay wheels at Encs are brown, 3 cm thick, with a diameter of 11–12.5 cm (Fig. 7, nos. 1389/3–5).

### *Anthropological analysis of human remains*

Human remains were only found in grave 1290; they were in an incomplete and fragmentary state. A large portion of the face and skull, including the entire mandible, are missing. The postcranial bones are fragmentary and most joints are missing post-mortem. The ribs, vertebrae, left pelvis, and sacrum are completely absent. The bones of the lower limbs are fairly well-preserved.

The sex was estimated using the methods outlined by Éry *et al.* (1963). The few sexually dimorphic anatomical features of the skull are slightly masculine, while the femora and pelvic bone features are more strongly masculine in expression. According to the method put forward by Éry *et al.* (1963), anatomical traits are scored and averaged, so that the resultant values lie between the extreme values of -2 and +2 that correspond to hyperfeminine and hypermasculine characters, respectively. The average value of the examined anatomical traits belonging to the individual in Grave 1290 was +0.625, indicating that the examined individual was probably a male.

Age-at-death was estimated by the obliteration of external cranial sutures (Meindl and Lovejoy 1985), the morphological changes of the auricular surface of the pelvis (Lovejoy *et al.* 1985), and the internal structure of the proximal end of the humerus and the femur (Nemeskéri



FIGURE 4  
The clay wagon model of Encs.

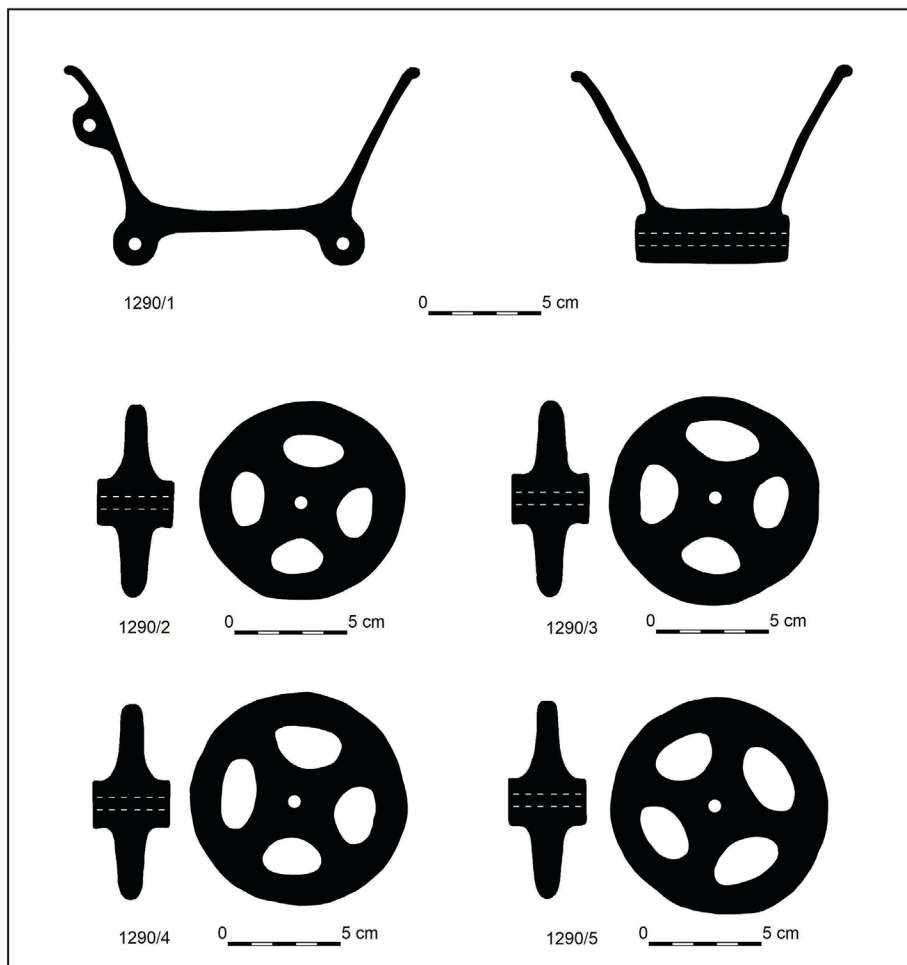


FIGURE 5  
Cross sections of the Encs wagon box and spoked wheels.

*et al.* 1960). Considering estimates derived from all these methods, age-at-death for this individual was estimated at 25–30 years.

Several palaeopathological alterations on the lower extremities were observed, most of which suggested considerable soft tissue involvement. In the distal third of the tibial shaft, bony changes related to osteomyelitis are present. In addition, signs of serious inflammation of the periosteum are visible on the medial, anterior, and posterior aspects of the tibia surface. Alterations related to periostitis are also apparent on the left tibia and both femora. The cortical surface of these bones was eroded due to post-mortem processes, which made assessment of the severity of the infection difficult.





FIGURE 6  
1290/6–8: grave goods from burial 1290; 1389/1, 6: grave goods from burial 1389.

### Dating

The typological analysis of the cups in the case of grave 1290 indicate that this burial belongs to the early phase of the Füzesabony culture (c.2000/1900–1800 BC), which corresponds to the first half of the Reinecke Bz A2 period in relative chronological terms. The absolute dating supports the relative chronology of the burial. AMS radiocarbon dating of the grave 1290 (DeA-27701) was performed in the Eötvös Loránd Research Network’s Institute for Nuclear Research

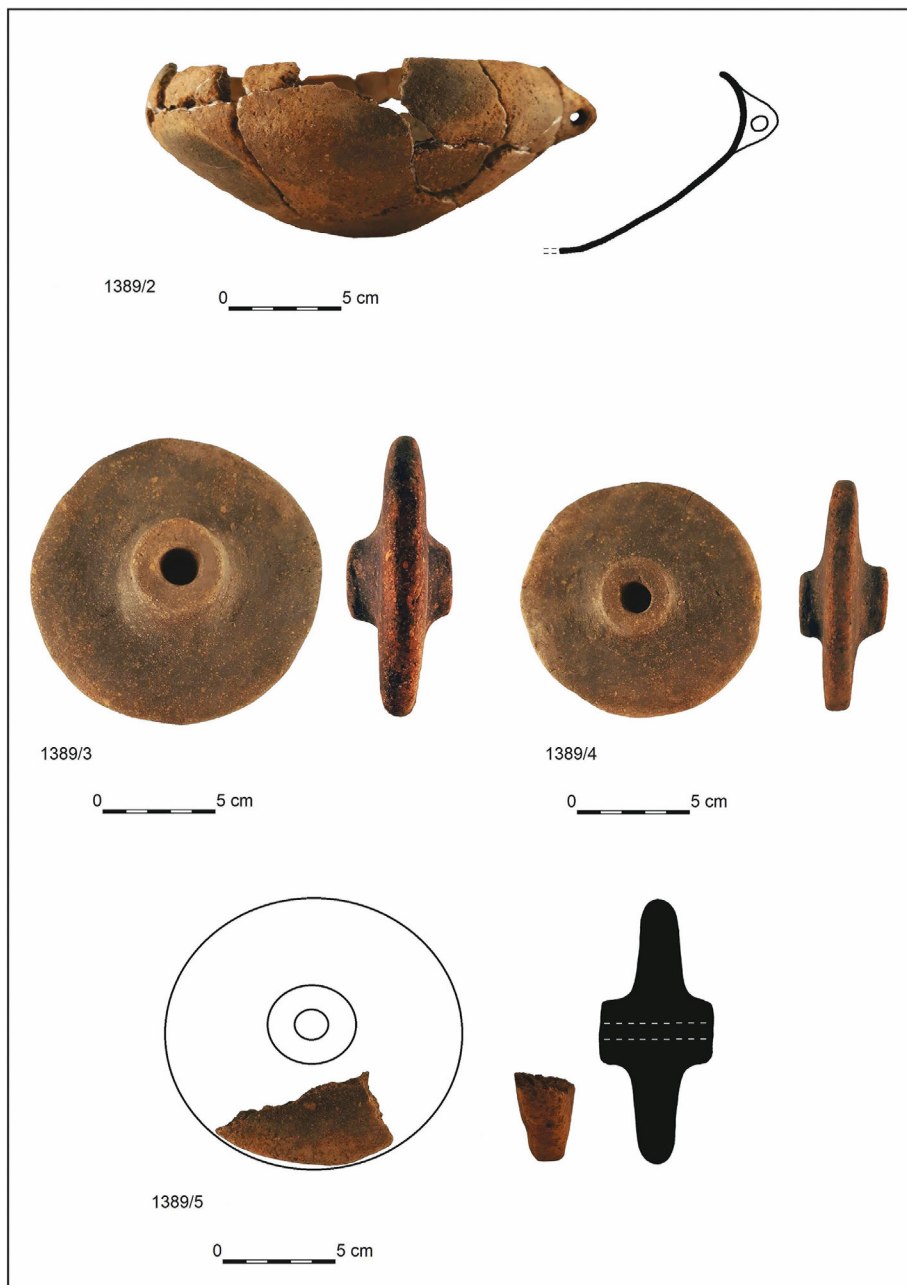


FIGURE 7  
1389/2–5: grave goods from burial 1389.

(ATOMKI) laboratory on bone samples (Molnár *et al.* 2013; Major *et al.* 2019). The result was calibrated using the OxCal 4.4.2 software on the IntCal20 curve (Reimer *et al.* 2020). The result suggests the grave belongs to 1925–1770 cal BC with a 68.3% probability (Fig. 8).

The typological analysis of grave 1389's ceramic assemblage suggests that this burial could belong to the classical and late Füzesabony periods, around the second half of the Reinecke RBz A2 and B periods (*c.*1700–1500 BC). The absence of bone meant that radiocarbon dating was not possible for this grave.

*Bronze Age wagon boxes in the Carpathian Basin*

Wagon boxes and wheels made of clay are usually found east of the Danube, in the region of the Tisza river and in Transylvania, within the territories of the Hatvan, Füzesabony, Otomani (Ottomány), Várşand (Gyulavarsánd) and Wietenberg cultures (Boroffka 2004, Abb. 1; Balázs and Dani 2014, 12). In the northern Carpathian Basin, miniature clay wheels are known in large quantities from the Mad'arovce culture (Bóna 1960; 1975, map 10; Točík 1978; 1981), dated between *c.*1900–1600 BC (Kiss *et al.* 2015, 25). Moreover, two specimens are known from central Hungary: one is from the Nagyrév culture, dated around 2000 BC (Bondár 2012a, 58, table 1), and the second is a fragment of a wagon box belonging to the Vatyá culture, dated around 1750–1650 cal BC (Jaeger 2019). Wagon models are not known from Transdanubia, and to date

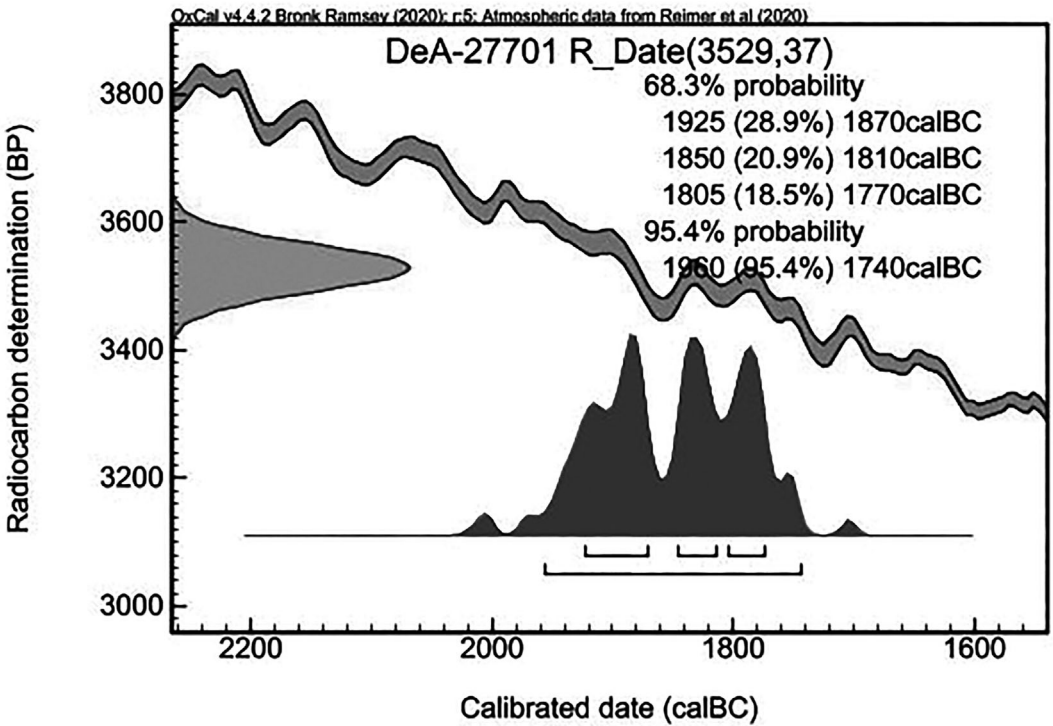


FIGURE 8  
The radiocarbon data of grave 1290.

TABLE 1  
Data of burials with clay wagon boxes and/or wheels from the Füzesabony culture territory

Site and grave no.	Sex, Age	Ceramics			Vessel	Bronze	Other	Date		Reference
		Wagon box	Wheels	Wagon box				Absolute (cal BC)	Relative (BC)	
Encs, 1290	male, 25–30	1	4 spoked	2 cups	spiral pendant	–	1960–1740	–	this study	
Encs, 1389	no human remains	–	3 solid	2 cups, 1 bowl	–	–	–	1700–1500	this study	
Nizná Mýšľa, 40	female, and child	1	–	1 cup, 1 bowl, 1 miniature vessel	4 Lockenrings, 1 pin	2 shell pendants	1865–1738	–	Olexa 1982, 391, Abb. 2	
Vatta, 35	no human remains	1	–	–	–	–	–	1700–1500	Fischl <i>et al.</i> 2019	
Vatta, 123	no human remains	1	–	1 pot	–	–	–	1700–1500	Fischl <i>et al.</i> 2019	

only one possible miniature solid wheel has been discovered from the first half of the second millennium BC in this region (Kiss 2009, 161, fig. 2, no. 1: Type E1; Szabó 2009, 48). Finally, a clay spoked wheel (Bátora 2018, fig. 114:4), perhaps influenced by the Mad'arovce culture, is also known from the Transdanubian Encrusted Pottery culture site of Iža, Slovakia (Kiss 2012, fig. 13) and dates to between 1900–1600 BC.

Besides Encs, eight clay wagon boxes are currently known from six different sites (Fig. 9, nos. 2–8) associated with the Füzesabony culture (Tables 1 and 2); three of these sites are known cemetery contexts (Table 1). One of these clay wagon boxes was found in the Nižná Myšľa cemetery. This box is oval-shaped, vessel-like and was placed immediately adjacent to the feet of the deceased (Olexa 1982; 1983, 126, Obr. 1.7; 1996; 2003; Nováček 2017, 77. Tab. 21–2.). Wheels were not found in this grave, but it is conceivable that this wagon once had wheels made of organic material (e.g. wood). According to radiocarbon dating, this burial could belong to the first phase of the cemetery, between 1865–1738 cal BC (Jaeger *et al.* 2022, 13, fig. 6). Two additional examples

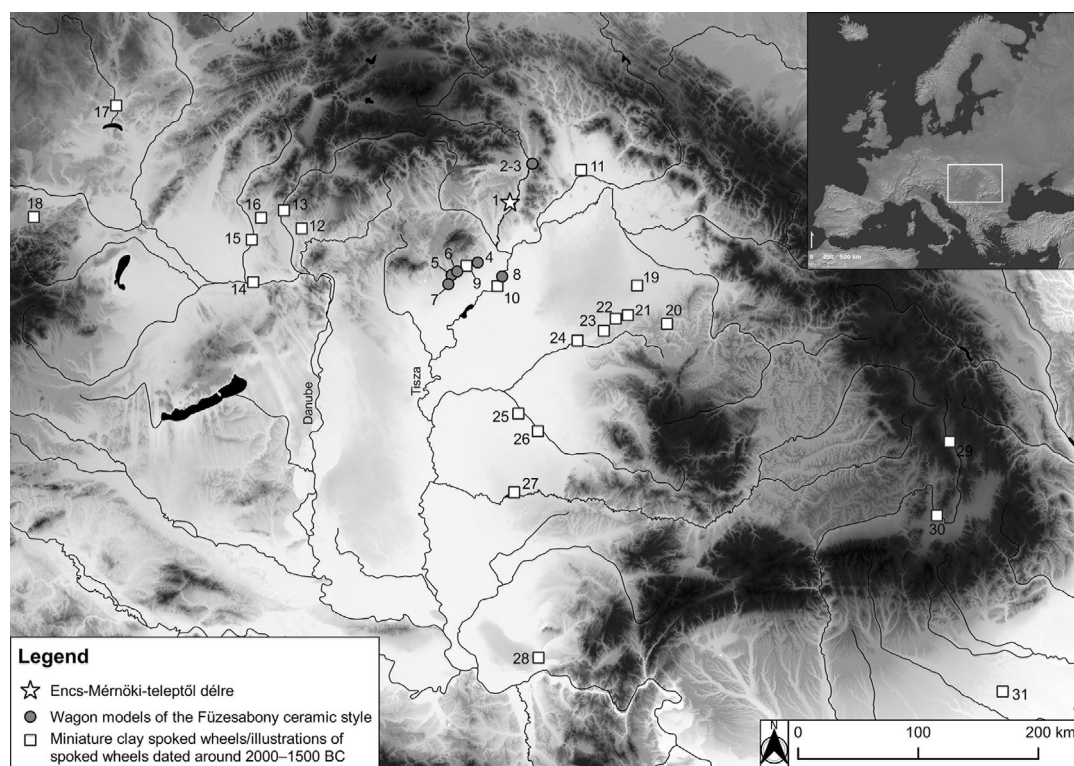


FIGURE 9

Map of the sites mentioned in text: 1: Encs-Mérnöki-teleptől délre, 2: Nižná Myšľa (cemetery), 3: Nižná Myšľa (settlement), 4: Vatta-Telek-oldal-dűlő, 5: Maklár-Baglyashalom, 6: Novaj-Földvár, 7: Füzesabony-Öregdomb, 8: Tiszakeszi-Szódadomb, 9: Tard-Tatárdomb, 10: Ároktő-Dongóhalom, 11: Velké Raškovce, 12: Santovka-Mad'arovce, 13: Rybník, 14: Iža, 15: Šurany-Nitriansky Hrádok, 16: Vráble, 17: Blučina, 18: Böhheimkirchen, 19: Carei-Bobald, 20: Derşida, 21: Pir, 22: Otomani (Ottomány), 23: Săcueni, 24: Pocsaj-Leányvár, 25: Békés-Várdomb, 26: Vărăşand-Movila dintre vii (Gyulavarsánd-Laposhalom), 27: Pecica, 28: Dupljaja, 29: Miercurea, 30: Feldioara, 31: Tei (made by Ákos Mengyán with QGIS 3.10 software).

TABLE 2  
Data of clay wagon boxes found in settlement contexts in the Füzesabony culture territory

Site	Context	Relative date (BC)	Reference
Füzesabony-Öregdomb	stray find	2000–1500/1450	Kovács 2006, Abb. 3
Maklár-Baglyashalom	stray find	2000–1500/1450	Mengyán 2019, fig. 9/1
Novaj-Földvár	stray find	2000–1500/1450	Bóna 1960, Taf. LXII/1–3
Nižná Myšľa	second phase of the site	1700–1500	Olexa 2003, fig. 11
Tiszakeszi-Szódadomb	stray find	2000–1500/1450	Balázs and Fischl 2013, figs. 2–3

were uncovered in the burial ground of Vatta-Telek-oldal-dűlő (Vatta site 3) and dated by relative chronology to around 1700–1500 BC (Fischl *et al.* 2019, 248; Fischl *et al.* 2020, 59). Similar to grave 1389 at Encs, neither of these features contained human remains: this fact could indicate the presence of similar symbolism among the sites (see below).

The remaining five wagon boxes were found in settlements (Table 2), but only one of these was recovered from a well-documented context, namely the wagon box of Nižná Myšľa. This find belongs to the second phase of the fortified settlement, dating to the classical and late periods of the Füzesabony culture, around 1700–1500 BC. The other wagon boxes were stray finds that can be broadly dated to the RBz A2–B periods, between 2000–1500/1450 BC (Kalicz 1968, 119; Szathmári 2011; Balázs and Fischl 2013, 27; Mengyán 2019).

### *Spoked and solid wheels in the Carpathian Basin around 2000–1500 BC*

Solid clay wheels were being made since the Late Copper Age in the Carpathian Basin. During the first half of the second millennium BC, such wheels occurred in large quantities in settlements but appeared also in cemeteries, specifically in the eastern and northern regions of the Carpathian Basin. Clay wheels usually appear in much larger numbers than wagon boxes, a fact that can be explained if wagon boxes were more often made of an organic material that has not survived, unlike the durable clay wheels. It was previously suggested that the solid clay wheels could have been spindle-whorls, however this explanation is refuted in two ways: firstly, miniature wheel presence regularly corresponds with clay wagons; and secondly, alternatively shaped, disc, conical, and biconical-shaped spindle-whorls are known from this period (Bóna 1960, 90). Generally, the diameter of clay wheels varies between 4 and 12 cm (Bóna 1960, 90), so indicating that the wheels of Encs represent some of the largest examples currently known.

The first presence of spoked wheels in the Carpathian Basin is evidenced by the appearance of miniature clay versions, as well as incised drawings made on solid clay wheels in which dotted/incised lines were used to imitate spokes (Table 3). Examples were found in relatively high quantities in the northern Carpathian Basin, specifically from the Füzesabony and Mad'arovec cultures (Fig. 9, nos. 9–10, 12–18). Moreover, it is important to mention the well-known chariot illustration on a funerary urn at Veľké Raškovce (Fig. 9, no. 11) in the north-eastern Carpathian Basin, dated to around 1500–1400 BC in the Suciú de Sus culture (Vizdal 1972, Vasic 2004). Illustrations are also known in large numbers from the territory of the Otomani (Ottomány) and Vărăsand (Gyulavarsánd) cultures from the eastern part of the Great Hungarian Plain (Fig. 9, nos. 19–27). Other significant examples are the Dupljaja (Fig. 9, no. 28) 'ceremonial' wagon models

TABLE 3

Sites where spoked wheel illustrations are documented in the Carpathian Basin, dating to between 2000–1500 BC

Position on Figure 9	Site name	Date		Cultural context	Reference
		Absolute (cal BC)	Relative (BC)		
9	Tard-Tatárdomb	–	2000–1500	Füzesabony	Fischl <i>et al.</i> 2014, Fig. 17
10	Ároktő-Dongóhalom	–	2000–1500	Füzesabony	Fischl 2006, fig. 345
11	Velké Raškovce	–	1500–1400	Suciu de Sus	Vizdal 1972
12	Santovka-Mad'arovec	–	1900–1600	Mad'arovec	Makarowicz <i>et al.</i> 2022, 12
13	Rybník	–	1900–1600	Mad'arovec	Makarowicz <i>et al.</i> 2022, 12
14	Iža	–	1900–1600	Encrusted Pottery or Mad'arovec	Bátora 2018, fig. 114:4
15	Šurany-Nitriansky Hrádok	–	1900–1600	Mad'arovec	Točík 1978; Tocik 1981; Bátora 2018, fig. 114:3, 5
16	Vráble	–	1900–1600	Mad'arovec	Makarowicz <i>et al.</i> 2022, 12
17	Blučina	–	1900–1600	Mad'arovec	Vladár 1973, fig. 62:5
18	Böheimkirchen	–	1900–1600	Veteřov	Neugebauer 1994, fig. 64:8
19	Carei-Bobald	1760–1530	–	Otomani (Ottomány)	Molnár and Katócz 2019, fig. 5:1–3, 5–6
20	Derşida	–	2000–1500	Otomani (Ottomány)	Chidioşan 1980, pl. 25/6, 10.
21	Pir	–	1600–1500	Otomani (Ottomány)	Bichir 1964
22	Otomani (Ottomány)	–	1600–1500	Otomani (Ottomány)	Bóna 1960, 94; Bichir 1964
23	Săcueni	–	2000–1500	Otomani (Ottomány)	Bader 1978, pl. XXX/12, 13
24	Pocsaj-Leányvár	–	2000–1500	Vărşand (Gyulvarsánd)	Mesterházy 1976, 2. fig
25	Békés-Várdomb	–	1600–1500	Vărşand (Gyulvarsánd)	Bóna 1960, 94
26	Vărşand-Movila dintre vii (Gyulavarsánd-Laposhalom)	–	1600–1500	Vărşand (Gyulvarsánd)	Bóna 1960, 94; Bóna 1975, Taf. 144/4
27	Pecica	–	2000–1500	Mureş (Maros)	Nicodemus 2014, 437
28	Dupljaja	–	ca. 1500	Žuto Brdo-Gârla Mare	Vasic 2004, fig. 2; Pare 1992, 179–81
29	Miercurea	–	2000–1500	Wietenberg	Boroffka 1994
30	Feldioara	–	2000–1500	Wietenberg	Boroffka 1994, Taf. 78/15.
31	Tei	–	2000–1500	Tei	Bichir 1964

dated around the middle of the second millennium BC (Pare 1989; 1992, 179–81). Additional examples are also known from the south-eastern Carpathian Basin and from the Wietenberg culture (2000–1500 BC) in Transylvania (Fig. 9, nos. 29–31).

DISCUSSION

The absolute date of the Encs spoked wheels from grave 1290 suggests it could be one of the earliest known specimens in the Carpathian Basin. According to the dates of early spoked wheels in this region (Table 3), this innovation first appeared around the early second millennium BC and spread rapidly through regions such as Anatolia, the Steppes, Central Asia, and the Near East.

Regarding the spread and appearance of spoked wheels around the northern and north-eastern Carpathian Basin, the impact of the Füzesabony culture is a key factor, as emphasized by Makarowicz *et al.* (2022). According to Makarowicz *et al.* (2022, 12–13), the reason behind the early occurrence of innovations, such as horse harnesses and spoked wheels, in this territory and among these communities might be related to their reliance on long-distance trade routes to secure access to prestigious and raw materials like metals and amber. In the case of Encs, the importance of trade and the widespread network of the community are supported by the high number of (non-local) seashells (e.g. *Dentalium* shell) and amber beads found in the cemetery (Mengyán and Dávid 2019, 162).

Worthy of note here is the common technical characteristics of early spoked wheels in the Carpathian Basin, namely that most wheel examples show four spokes. Spoked wheels from Anatolia and Mycenae also show four (Littauer and Crowel 1979, fig. 29, 49–51; Metzner-Nebelsick 2021, 113), while early Syrian wheels have eight though the later ones, from 1600 BC on, also have four. Furthermore, wheels recovered from the Urals exhibit 6–12 spokes (Chechushkov and Epimahov 2018, 458). This pattern might suggest that specific technological variants (e.g. four-spoked or six-spoked) could have spread separately (Grigoriev 2021, 172–3.). The number of spokes could affect the durability of the wheel, and their number might reflect the function of the vehicle. For example, wheels with six or more spokes were probably more efficient for war chariots, while four-spoked wheels were sufficient for wagons used to transport loads or employed during rituals or ceremonies.

Clay wagon models were being offered as grave goods since the Late Copper Age, but actual (life-sized) ceremonial four-wheeled wagons with spoked wheels, and bronze vessel-carrying model wagons (*Kesselwagen*) have also been reported (Pare 1992, 177, 179; Honti and Jankovits 2022) from the Urnfield period (1300–750 BC) in Central Europe. In this period, a life-sized wagon was used to bear the dead body to the pyre, while smaller models carried cremated human remains (Pare 1992, 179). *Kesselwagen* often display a complex of symbols including wheel, waterbird and vessel (Pare 1992, 179): these artefacts might have first appeared in the Wietenberg culture (Pare 1989; 2004). Beyond their symbolic meaning, their inclusion in funerary rites suggests the prominent social status of the deceased. Currently, five burials are known from the territory of the Füzesabony culture that contain clay wagons and/or wheels, but of these, only two also yielded human remains. Both can be dated to the early phase of the Füzesabony culture by absolute chronology, that is between c.1900–1700 BC.

Aside from the Carpathian Basin, wagon models are also known from Mesopotamia, Greece, Italy, the Pontic steppe, India and China, where prehistoric civilizations thrived. The wagon models had a specific role and meaning in each culture's life and belief system (Bondár and Székely 2011, 546). Wagon and wheel models in funerary contexts could carry several meanings, including but not limited to the transportation of the dead to the netherworld, simple toys, symbol of the sun, prestige items symbolizing wealth, votive sacrifices and status rank markers (Boroffka 2004; Burmeister 2004; Pare 2004; Bondár 2012a, 98–100). Moreover, wagons with vessel-shaped boxes, such as the example from the Nižná Myšľa cemetery, might be connected to ritual or the symbolic function of certain liquids, such as alcoholic beverages (Pare 2004, 355). In the Carpathian Basin, vessel-shaped miniature wagons first occurred in the Late Copper Age (Pare 2004, 355) and continued to appear until at least the Iron Age (Gömöri 2006). The wagon model and the cup in grave 1290 from the Encs cemetery have an obvious connection to ceremonial liquids. Furthermore, wagon models in the first half of the second millennium BC can suggest special social rank and wealth, and from this perspective, might therefore be the predecessor of



the Urnfield wagon burials and vessel-carrying wagon models. Miniatures may have been used as substitutes because actual, life-sized wagons might have been too precious and big to bury with the dead in this period.

The clay wheels found in the 1389 burial at Encs could belong to a three- or four-wheeled model and might have been associated with a wagon box made of organic material that did not survive. Damage to the third wheel was probably caused by ploughing, and it is possible that had a fourth wheel been present, it might be missing for the same reason. However, three-wheeled models are known from the Carpathian Basin (Bošković 1959, pl. 24.13), and two clay wheels were found in an unpublished child grave of the Füzesabony culture cemetery at Tiszafüred-Majoroshalom (Kalicz 1984, 241). It is important to note that if an organic wagon box was placed in the pit, the box and the wheels were likely to have been disassembled because two wheels were stacked together. It is apparent that burials from the Füzesabony culture with wagons/wheels and without human remains belong to the classical and late periods around 1700–1500 BC, according to relative dating. The lack of human remains from the features can be explained by several reasons (Hegedűs 2021). While environmental factors may have played a role, the absence of remains may have been intentional. Firstly, the features may be the result of a ritual process or event and might be offerings. Secondly, the features could be symbolic burials connected to a specific person whose remains were not available for burial, leading the community to commemorate them in this alternative way (Hegedűs 2021, 6–7). Considering other burials from the Encs cemetery and similar features from Vatta (Fischl *et al.* 2019, 247; Fischl *et al.* 2020, 54), including grave size and structure, the first explanation might be the more probable. Therefore, this type of wagon/wheel burial might be not have directly to do with a specific person, but instead may represent a communal and/or ritual action of the community or a social group, that could include possible votive sacrifices and offerings.

#### CONCLUSIONS

The absolute date of the miniature clay wheels recovered from Encs, Hungary, argues that spoked wheels appeared in the early second millennium BC in the Carpathian Basin. This radiocarbon date also suggests that this could be one of the earliest known spoked wheels. As most of the early spoked wheels in the Aegean, Anatolia, the Carpathian Basin, and Central and Northern Europe show four spokes, the same number as at Encs, it could indicate that this technological variant spread through these regions. The wagon model recovered from grave 1290 suggests that wagons with four spoked wheels were used in the early second millennium BC. These life-sized wagons could have been used to transport loads and/or featured in ceremonies or ritual processions during which the wagon may have emphasized the status or rank of a particular person or social group.

The two graves presented in this paper may each symbolize a different function. The wagon and the cup in grave 1290 appear to be symbolically analogous to other vessel-shaped wagons and could therefore suggest the ritual or symbolic function of certain liquids that they held. Furthermore, this burial may indicate a special social standing for the 25–30 years old male individual, with the wagon implying wealth. It may thus be the predecessor of the Urnfield wagon burials. In contrast, grave 1389 might have not been related to a specific person, but instead could be explained as the result of a communal/ritual event and might be specifically interpreted as a votive offering.

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REFERENCES

- BADER, T. 1978: *Epoca bronzului în nord-vestul Transilvaniei. Cultura pretracică și tracică* (Bucharest).
- BALÁZS, Á. and DANI, J. 2014: Újabb bronzkori kocsimodellek a bihari Berettyóvölgyből, és egyéb a lótarással kapcsolatos tárgyak – New clay cart model discoveries from the Hungarian part of Berettyó Valley and other finds related to horse keeping. *A Bihari Múzeum Évkönyve* XVII–XIX, 1–17.
- BALÁZS, Á. and FISCHL, K. 2013: Újabb bronzkori kocsimodell Tiszakeszi-Szódadombról. *A Herman Ottó Múzeum Évkönyve* LII, 21–30.

- BÁTORA, J. 2018: *Slovensko v Staršej Dobe Bronzovej* (Bratislava).
- BICHIR, G. 1964: Autour du problème des plus anciens modèles de chariots découverts en Roumanie. *Dacia* 8, 67–86.
- BÓNA, I. 1960: Clay models of Bronze Age wagons and wheels in the Middle Danube Basin. *Acta Archaeologica Academiae Scientiarum Hungariae* 12, 83–111.
- BÓNA, I. 1975: *Die mittlere Bronzezeit Ungarns und ihre südöstlichen Beziehungen* (Budapest, *Archaeologia Hungarica* 49).
- BONDÁR, M. 1990: Das frühbronzezeitliche Wagenmodell von Börzönce. *Communicationes Archaeologicae Hungariae* 1990, 77–91.
- BONDÁR, M. 2012a: *Prehistoric Wagon Models in the Carpathian Basin (3500–1500 BC)* (Budapest, *Archaeolingua Series Minor* 32).
- BONDÁR, M. 2012b: *Agyag kocsimodellek a Kárpát-medencéből (Kr. e. 3500–1500)* (Budapest, *Archaeolingua Series Minor* 32).
- BONDÁR, M. 2016: A new Bronze Age wagon model from Szombathely-Motel. *Ziridava Studia Archaeologica* 30, 27–41.
- BONDÁR, M. and V. SZÉKELY, GY. 2011: A new Early Bronze Age wagon model from the Carpathian Basin. *World Archeology* 43/4, 538–53. <https://doi.org/10.1080/00438243.2011.624701>
- BOROFFKA, N. 1994: *Die Wietenberg-Kultur. Ein Beitrag zur Erforschung der Bronzezeit in Südsteuropa* (Bonn, *Universitätsforschungen zur Prähistorischen Archäologie* 19)
- BOROFFKA, N. 2004: Bronzezeitliche Wagenmodelle im Karpatenbecken. In FANSA, M. and BURMEISTER, S. (eds.), *Rad und Wagen. Der Ursprung einer Innovation Wagen im Vorderen Orient und Europa* (Mainz am Rhein), 347–54.
- BOŠKOVIĆ, D. 1959: Quelques observations sur le char cultuel de Dupljalja. *Archaeologica Jugoslavia* 3, 41–5.
- BURMEISTER, S. 2004: Der Wagen im Neolithikum und in der Bronzezeit: Erfindung, Ausbreitung und Funktion der ersten Fahrzeuge. In FANSA, M. and BURMEISTER, S. (eds.), *Rad und Wagen. Der Ursprung einer Innovation Wagen im Vorderen Orient und Europa* (Mainz am Rhein), 13–40.
- CHECHUSHKOV, I.V. and EPIMAHOV, A.V. 2018: Eurasian steppe chariots and social complexity during the Bronze Age. *Journal of World Prehistory* 31, 435–83. <https://doi.org/10.1007/s10963-018-9124-0>
- CHIDIOȘAN, N. 1980: *Contribuții la istoria tracilor din nord-vestul României. Așezarea Wietenberg de la Derșida* (Oradea).
- DANI, J. and SZABÓ, G. 2004: Temetkezési szokások a Polgár határában feltárt középső bronzkori temetőben – Bestattungsgebräuche in den Friedhöfen aus der mittleren Bronzezeit freigelegt in der Feldmark von Polgár. In ILON, G. (ed.), *Momos III. – Óskoros Kutatók III. Összejövetelének konferenciakötete* (Szombathely), 91–119.
- ÉRY, K.K., KRALOVÁNSZKY, A. and NEMESKÉRI, J. 1963: Történeti népszerűségek rekonstrukciójának reprezentációja. – A representative reconstruction of historic populations. *Anthropológiai Közlemények* 7, 41–90.
- FISCHL, K. 2006: *Ároktő-Dongóhalom bronzkori tell telep* (Miskolc, Borsod-Abaúj-Zemplén megye régészeti emlékei 4).
- FISCHL, K. 2012: The role of the Hernád Valley in the settlement structure of the Füzesabony culture. In JAEGER, M., CZEBRESZUK, J. and P. FISCHL, K. (eds.), *Enclosed Space – Open Society, Contact and Exchange in the Context of Bronze Age Defensive Settlements in Central Europe* (Poznań, *Studien zur Archäologie in Ostmitteleuropa* 9), 39–51.
- FISCHL, K., KIENLIN, T., PUSZTAI, T., BRÜCKNER, H., KLUMPP, S., TUGYA, B. and LENGYEL, GY. 2014: Tard-Tatárdomb: An update on the intensive survey work on the multi-layer Hatvan and Füzesabony period settlement. In KIENLIN, T.L., VALDE-NOWAK, P., KORCZYŃSKA, M., CAPPENBERG, K. and OCIEPKA, J. (eds.), *Settlement, Communication and Exchange around the Western Carpathians: International Workshop Held at the Institute of Archaeology, Jagiellonian University, Kraków, October 27–28, 2012* (Oxford), 347–86. <https://doi.org/10.2307/j.ctvqmp120.25>
- FISCHL, K., KOÓS, J., MENGYÁN, Á. and SOMOGYI, K. 2019: Vatta-Testhalom – assembling the whole from its parts. In FISCHL, K. and KIENLIN, T. L. (eds.), *Beyond Divides – The Otomani-Füzesabony Phenomenon. Current Approaches to Settlement and Burial in the North-eastern Carpathian Basin and Adjacent Areas* (Bonn, *Universitätsforschungen zur prähistorischen Archäologie* 345), 345–54.
- FISCHL, K., KOÓS, J., MENGYÁN, Á. and SOMOGYI, K. 2020: Vatta-Testhalom – Részekből egész. *A Herman Ottó Múzeum Évkönyve LVIII–LIX*, 41–64.

- GÖMÖRI, J. 2006: Korai vaskori kultikus kocsiedény Fertőendréről. *Arrabona - Múzeumi közlemények* 44(1), 165–74.
- GRIGORIEV, S. 2019: Central European impulses in Eastern Europe in the early second millennium BC. *Slovenská Archeológia* LXVII(2), 225–39. <https://doi.org/10.31577/slovarch.2019.67.7>
- GRIGORIEV, S. 2021: The evolution of antler and bone cheekpieces from the Balkan-Carpathian region to Central Kazakhstan: chronology of “chariot” cultures and Mycenaean Greece. *Journal of Ancient History and Archaeology* 8(2), 148–89. <https://doi.org/10.14795/j.v8i2>
- HEGEDŰS, ZS. 2021: Burials without bodies. *Archaeologiai Értesítő* 146, 1–42. <https://doi.org/10.1556/0208.2021.00011>
- HONTI, SZ. and JANKOVITS, K. 2022: The warrior aristocracy of the Late Bronze Age Urnfield period in County Somogy, south-western Transdanubia. The Lengyeltóti V hoard (County Somogy/Hungary). *Acta Archaeologica Academiae Scientiarum Hungaricae* 7(2), 143–62. <https://doi.org/10.1556/072.2022.00012>
- JAEGER, M. 2019: Wagon model from the Vatya settlement in Kakucs-Turján. In SZMYT, M., CHACHLIKOWSKI, P., CZEBRESZUK, J., IGNACZAK, M. and MAKAROWICZ, P. (eds.), *Vir Bimaris: from Kujawy Cradle to Black Sea Steppes: Studies on the Prehistory of the Baltic-Pontic Between-the-Seas in Recognition of Professor Aleksander Koško* (Poznan, *Archaeologia Bimaris* 5), 875–81.
- JAEGER, M., STRÓZYK, M. and OLEXA, L. 2022: Society in transition: cultural change in the Early Bronze Age cemetery at Nižná Myšľa in the light of absolute chronology. *Radiocarbon*, 1–20. <https://doi.org/10.1017/RDC.2022.76>
- KALICZ, N. 1968: *Die Frühbronzezeit in Nordost-Ungarn* (Budapest).
- KALICZ, N. 1984: Die Hatvan-Kultur. In TASIĆ, N. (ed.), *Kulturen der Frühbronzezeit des Karpatenbeckens und Nordbalkans* (Beograd), 191–217.
- KEMENCZEL, T. 1979: *Das Mittelbronzezeitliche Gräberfeld von Gelej* (Budapest, *Régészeti Füzetek* II/20).
- KISS, V. 2009: A bronzkori kerámia-készlet változásairól (A mészbetétes kerámia kultúrája tipológiai vázlat) – Über die Veränderung der bronzezeitlichen Keramik- Inventare (Typologischer Abriß der Inkrustierten Keramik). *Tisicum* 19, 155–74.
- KISS, V. 2012: *Middle Bronze Age Encrusted Pottery in Western Hungary* (Budapest, *Varia Archaeologica Hungarica* 27).
- KISS, V., FÁBIÁN, SZ., HAJDU, T., KÖHLER, K., KULCSÁR, G., MAJOR, I. and SZABÓ, G. 2015: Contributions to the relative and absolute chronology of the Early and Middle Bronze Age in western Hungary based on Radiocarbon dating of human bones in Bronze Age chronology in the Carpathian Basin. In REZI, B. and NÉMETH, E.R. (eds.), *Proceedings of the International Colloquium from Târgu Mureş, 2–4 October 2014* (Târgu Mureş), 23–36.
- KOVÁCS, T. 1984: Die Füzesabony-Kultur. In TASIĆ, N. (ed.), *Kulturen der Frühbronzezeit des Karpatenbeckens und Nordbalkans* (Beograd), 235–56.
- KOVÁCS, T. 2006: Bisher unbekannte Kupfer- und Bronzezeitliche Wagenmodelle aus Ungarn. *Acta Archaeologica Academiae Scientiarum Hungaricae* 57, 35–45.
- LINDNER, S. 2020: Chariots in the Eurasian Steppe: a Bayesian approach to the emergence of horse-drawn transport in the early second millennium BC. *Antiquity* 94(374), 361–80. <https://doi.org/10.15184/aqy.2020.37>
- LITTAUER, M.A. and CROUWEL, J.H. 1979: *Wheeled Vehicles and Ridden Animals in the Ancient Near East* (Leiden).
- LITTAUER, M.A. and CROUWEL, J.H. 1996: The origins of the true chariot. *Antiquity* 70, 934–9. <https://doi.org/10.1017/S0003598X00084192>
- LOVEJOY, C.O., MEINDL, R.S., PRYZBECK, T.R. and MENSFORTH, R.P. 1985: Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of adult skeletal age at death. *American Journal of Physical Anthropology* 68(1), 15–28. <https://doi.org/10.1002/ajpa.1330680103>
- MAJOR, I., DANI, J., KISS, V., MELIS, E., PATAY, R., SZABÓ, G., HUBAY, K., TÚRI, M., FUTÓ, I., HUSZÁNK, R., JULL, A.J.T. and MOLNÁR, M. 2019: Adoption and evaluation of a sample pretreatment protocol for radiocarbon dating of cremated bones at HEKAL. *Radiocarbon* 61(1), 159–71. <https://doi.org/10.1017/RDC.2018.41>
- MAKAROWICZ, P., ILCHYSHYN, V., PASICKA, E. and MAKOWIECKI, D. 2022: An elite Bronze Age double-horse burial from western Ukraine and the chariot package dissemination. *Journal of Field Archaeology*, 1–17. <https://doi.org/10.1080/00934690.2022.2143630>

- MARAN, J. 2020: The introduction of the horse-drawn light chariot – divergent responses to a technological invention in societies between the Carpathian Basin and the East Mediterranean. In MARAN, J., BAJENARU, R., AILINCĂI, S.-C., POPESCU, A.-D. and HANSEN, S. (eds.), *Objects, Ideas and Travelers Contact Between the Balkans, the Aegean and Western Anatolia During the Bronze and Iron Age. Volume to the Memory of Alexandru Vulpe. Proceedings of the Conference in Tulcea, 10–13 November 2017* (Bonn), 505–28.
- MEINDL, R.S. and LOVEJOY, C.O. 1985: Ectocranial suture closure: a revised method for the determination of skeletal age at death based on the lateral-anterior sutures. *American Journal of Physical Anthropology* 68(1), 57–66. <https://doi.org/10.1002/ajpa.1330680106>
- MENGYÁN, Á. 2019: Middle Bronze Age finds from the southern foothills of the Bükk Mountains (North-eastern Hungary). Case studies of Maklár-Baglyashalom, Novaj-Földvár and Szihalom-Árpád vár. In FISCHL, K. and KIENLIN, T.L. (eds.), *Beyond Divides – The Otomani-Füzesabony Phenomenon. Current Approaches to Settlement and Burial in the North-eastern Carpathian Basin and Adjacent Areas* (Bonn, *Universitätsforschungen zur prähistorischen Archäologie* 345), 277–94.
- MENGYÁN, Á. and DÁVID, Á. 2019: Preliminary report from a Middle Bronze Age cemetery at Encs (North-eastern Hungary). In FISCHL, K. and KIENLIN, T.L. (eds.), *Beyond Divides – The Otomani-Füzesabony Phenomenon. Current Approaches to Settlement and Burial in the North-eastern Carpathian Basin and Adjacent Areas* (Bonn, *Universitätsforschungen zur prähistorischen Archäologie* 345), 159–64.
- MESTERHÁZY, K. 1976: Agyag kocsimodell Pocsajról. – Clay cart model from Pocsaj. *Archaeologiai Értesítő* 103, 223–9.
- METZNER-NEBELSICK, C. 2021: Chariots and horses in the Carpathian lands during the Bronze Age. In BARAGLI, B., DIETZ, A., FÖLDI, Z.S.J., HEINDL, P., LOHMANN, P. and SCHLÜTER, S.P. (eds.), *Distant Worlds and Beyond. Special Issue Dedicated to the Graduate School Distant Worlds (2012–2021)* (Heidelberg: Propylaeum, *Distant Worlds Journal Special Issue* 3), 111–31. <https://doi.org/10.11588/propylaeum.886.c11954>
- MOLNÁR, ZS. and KATÓCZ, Z. 2019: Szekér- és kerékmodellek a középső bronzkori Nagykároly-Bobáld tellről. *Dolgozatok az Erdélyi Múzeum Érem- és Régiségtárából* 2015–2016, 5–50. <https://doi.org/10.57047/dolg-2015-01>
- MOLNÁR, M., JANOVICS, R., MAJOR, I., ORSOVSZKI, J., GÖNCZI, R., VERES, M., LEONARD, A.G., CASTLE, S.M., LANGE, T.E., WACKER, L., HAJDAS, I. and JULI, A.J.T. 2013: Status report of the new AMS C-14 preparation lab of the Hertelendi Laboratory of Environmental Studies, Debrecen. Hungary. *Radiocarbon* 55(2–3), 665–76. <https://doi.org/10.1017/S0033822200057829>
- NEMESKÉRI, J., HARSÁNYI, L. and ACSÁDI GY. 1960: Methoden zur Diagnose des Lebensalters von Skelettfunden. *Anthropologischer Anzeiger* 24(1), 70–95. <http://www.jstor.org/stable/29537394>
- NEUGEBAUER, J.W. 1994: *Bronzezeit in Ostösterreich* (St. Pölten-Wien).
- NICODEMUS, A. 2014: *Bronze Age Economies of the Carpathian Basin: Trade, Craft Production, and Agro-Pastoral Intensification* (Ph.D. thesis, University of Michigan).
- NOVÁČEK, T. 2017: *Vyhodnotenie Materiálu Pohrebiska Otomansko – Füzesabonyiského Kultúrneho Komplexu v Nižnej Myšli (Hroby 1-792)* (Ph.D. thesis, University of Brno).
- OLEXA, L. 1982: *Siedlungen und Gräberfelder aus der Bronzezeit von Nizná Myšľa in der Ostslowakei*. In HÄNSEL, B. (ed.), *Südosteuropa zwischen 1600 und 1000 v. Chr.* (Berlin, *Prähistorische Archäologie in Südosteuropa* 1), 387–97.
- OLEXA, L. 1983: *Sídliská a pohrebiská z doby bronzovej v Nižnej Myšľi. – Siedlungen und Gräberfeld aus der Bronzezeit in Nižná Myšľa. Archeologické Rozhledy* 35, 122–9.
- OLEXA, L. 1996: *Nižná Myšľa v dobe bronzovej. Nižná Myšľa Fundplatz Várhegy. Siedlungen und Gräberfeld aus der Bronzezeit. Ergebnisse der archäologischen Ausgrabungen 1977–1995* (Košice).
- OLEXA, L. 2003: *Nižná Myšľa. Osada a pohrebisko z doby bronzovej. – Nižná Myšľa. Siedlung und Gräberfeld aus der Bronzezeit* (Nitra-Košice, *Archeologické pamätníky Slovenská* 7).
- PARE, C. 1989: From Dupljaja to Delphi: the ceremonial use of the wagon in later prehistory. *Antiquity* 63, 80–100. <https://doi.org/10.1017/S0003598X00075608>
- PARE, C. 1992: *Wagons and Wagon-graves of the Early Iron Age in Central Europe* (Oxford, *University Committee for Archaeology, Monograph* 35).
- PARE, C. 2004: Die Wagen der Bronzezeit in Mitteleuropa. In FANSA, M. and BURMEISTER, S. (eds.), *Rad und Wagen. Der Ursprung einer Innovation Wagen im Vorderen Orient und Europa* (Mainz am Rhein), 355–72.
- PIGGOTT, S. 1992. *Wagon, Chariot, and Carriage: Symbol and Status in the History of Transport* (London).

- REIMER, P.J., AUSTIN, W.E.N., BARD, E., BAYLISS, A., BLACKWELL, P.G., BRONK RAMSEY, C., BUTZIN, M., CHENG, H., EDWARDS, L., HAJDAS, I., HEATON, T.J., HOGG, A.G., HUGHEN, K.A., KROMER, B., MANNING, S.W., MUSCHELER, R., PALMER, J.G., PEARSON, C., VAN DER PLICHT, J., REIMER, R.W., RICHARDS, D. A., SCOTT, E. M., SOUTHON, J.R., TURNER, C.S.M., WACKER, L., ADOLPHI, F., BÜNTGEN, U., CAPANO, M., FAHRNI, S.M., FOGTMANN-SCHULZ, A., FRIEDRICH, R., KÖHLER, P., KUDSK, S., MIYAKE, F., OLSEN, J., REINIG, F., SAKAMOTO, M., SOOKDEO, A. and TALAMO, S. 2020: The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 cal kBP). *Radiocarbon* 62(4), 725–57. <https://doi.org/10.1017/RDC.2020.41>
- SCHALK, E. 1992: Das Gräbelfelder von Hernádkak (Bonn, *Universitätsforschungen zur prähistorischen Archäologie* 9).
- SZABÓ, G. 2009: *Pannónia kincse. A mészbetétes edények népének bonyhádi temetője. – Schatz von Pannonien. Das Gräberfeld der inkrustierten Keramik von Bonyhád* (Szekszárd).
- SZATHMÁRI, I. 2011: Megjegyzések a füzesabonyi bronzkori tell telep időrendjéhez. [Remarks on the chronology of the Bronze-Age tell settlement at Füzesabony.] In TÓTH, E. and VIDA, I. (eds.), *Corolla Museologica Tibor Kovács dedicata* (Budapest, *Libelli Archaeologici* IV), 485–503.
- TOČIK, A. 1978: *Nitriansky Hrádok - Zámeček Nové Zámky. Bronzezeitliche befestigte Ansiedlung der Madarovce-Kultur* (Nitra).
- TOČIK, A. 1981: *Nitriansky Hrádok-Zámeček. Bronzezeitliche befestigte Ansiedlung der Madarovce-Kultur* (Nitra, *Materialia Archaeologica Slovaca* 3).
- VASIC, R. 2004: The Dupljaja cart again. In ROGOZEA, P. and CEDICĂ, V. (eds.), *Festschrift für Florin Medeleț. Zum 60. Geburtstag* (Timișoara, *Bibliotheca historica et archaeologica Banatica* 32), 155–62.
- VIZDAL, J. 1972: Erste bildliche Darstellung eines zweirädrigen Wagens vom Ende der mittleren Bronzezeit in der Slowakei. *Slovenská Archeológia* 20(1), 223–31.
- VLADÁR, J. 1973: Osteuropäische und Mediterrane Einflüsse im Gebiet der Slowakei Während der Bronzezeit. *Slovenská Archeológia* 21(2), 253–357.