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BALTIC AMBER IN THE HUNGARIAN BRONZE AGE. NEW DATA AND CURRENT STAGE OF RESEARCH

ABSTRACT

Jaeger M., Kulcsár G., Melis E., Stróżyk M., Piszora P., Csányi M., Csuvár-Andrási R., Fischl K. P., Guba Sz., Pap E., Pásztor E., Patay R., Szathmári I., Szilas G., Čivilytė A., and Kiss V. 2023. Baltic amber in the Hungarian Bronze Age. New data and current stage of research. *Sprawozdania Archeologiczne* 75/2, 137-186.

Amber was one of the key raw materials distributed in Bronze Age Europe. One of its varieties – succinite – was exchanged over a vast area stretching from its sources on the southern shores of the Baltic Sea to the shores of the Mediterranean Sea. The chemical identification of Baltic amber significantly expands our knowledge of the dynamics and nature of the relationships connecting different regions of Europe in the first half of the second millennium BC. One of the most significant cultural-geographical areas reached by this amber was the Carpathian Basin. This text presents a summary of the current state of knowledge about the context, chronology, and the extent of amber occurrence in the Hungarian Bronze Age. At the same time, it supplements the catalogue of finds with artefacts acquired in recent years, providing new information regarding radiocarbon dating and spectral analysis of selected amber artifacts.

Keywords: Baltic amber, Carpathian Basin, Hungarian Bronze Age, prehistoric exchange, spectral analysis, absolute chronology

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1. INTRODUCTION

The distribution of amber and products made of it is a significant element of discussion within European Bronze Age archaeology (Czebreszuk 2003; 2011 with further references). From the very beginning of interest in this subject, the southern coast of the Baltic Sea was indicated as the most likely source of the origin of this raw material discovered in more and less distant parts of the continent, both in the Neolithic and in the Bronze and Iron Ages. Currently, the discussion on the provenance of particular fossil resins is developing in the direction of distinguishing its chemical varieties (*e.g.*, succinite, simetite or rumenite; Czebreszuk 2009, Plate I), and thus a more precise indication of the presence of Baltic amber – succinite, in archaeological contexts.

Succinite is a fossil resin that was formed in the Eocene (about 55-33 million years ago; Sawkiewicz 1970). During this period, in a vast area stretching from southern Scandinavia, through the territory of today's Poland, to central Ukraine, there was a shallow and warm sea surrounded by coniferous forests. It was there that large amounts of resin were produced, which, as part of long-term diagenetic processes and movement between the land and sea environment, transformed into amber (Kosmowska-Ceranowicz 2001). Geological deposits containing Baltic amber arose within river deltas that formed in the Eocene seas. The ones currently known are: the Sambia-Chłapowo delta (also known as Gdańsk Palaeogene delta), the Klesowska delta (in today's Ukraine) and the Parczewska delta in southeastern Poland. These areas are among the richest deposits of Baltic amber.

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Contemporary analytical possibilities, based on the method of infrared spectral analysis, proposed in the 1960s by C. W. Beck (Beck *et al.* 1964; Beck 1970), enable the identification of particular types of fossil resins. However, despite the development of chemical methods, it is still not possible to separate succinite into individual varieties that could in turn be linked to a specific source of origin. Due to the process of creating Baltic amber described briefly above, the origin of each piece of raw material discovered in archaeological context can potentially be associated with any region of the vast area of Northern and Eastern-Central Europe: from the southern coast of the North Sea in the west, through Jutland and the southern coast of the Baltic, until western Ukraine in the east (Czebreszuk 2009, Plate I). Consequently, in archaeological research on the origin of Baltic amber, apart from the indications from chemical analyses, it seems to be important to have contextual knowledge about the mechanisms of contact and exchange prevailing in certain areas of Bronze Age Europe.

2. AMBER IN THE CARPATHIAN BASIN – GENERAL REMARKS

According to the prevailing view on the dynamics of the spread of Baltic amber in Europe in the first half of the 2nd millennium BC, this process developed in two stages. In the older stage, amber is perceived as a key raw material controlled by the communities of the Únětice culture in Central Europe and a raw material known in the British Isles and in today's France and Spain. M. Ernée dates this phase to the classical phase of the Únětice culture (between 2050/2000 and 1750 BC), while H. Meller considers this period until 1600/1550 BC (Ernée 2016; Meller 2017). In the later stage, the presence of amber is recorded in a wider area, including – apart from the above-mentioned – also the Apennine and Aegean Peninsulas and, of key importance from our point of view, the Carpathian Basin (Meller 2019). The wider distribution area of amber is linked with the collapse of the classical Únětice culture in Bohemia, caused by the transformation of trade routes and the emergence of the Maďarovce-Věteřov cultural complex (Ernée 2012; 2016), or with the crisis and the disappearance of the Únětice culture, which formerly could have possibly created a complex system of military and political control of its region and of goods obtained from the north, including Baltic amber (Meller 2017, fig. 6; 2019, fig. 21). As a consequence, in the studied area of Hungary and in the neighbouring regions, today's Slovakia and Romania, amber finds should dominate after *i.e.*, 1750 or 1600 BC.

In the above context, the area of today's Hungary is most often discussed as an element of a larger cultural and geographical area, *i.e.*, the Carpathian Basin. In the frames of grand narratives concerning Bronze Age Europe, the Carpathian Basin is seen as a kind of transit area that connected two cultural zones – the Central European Bronze Age communities and the civilizations of the Mediterranean basin, especially the Mycenaean culture. Amber plays a significant role in this discussion. In the collection of nearly 300 amber finds from

the area of Mycenaean Greece, the vast majority (87%) were identified as succinite (Beck 1966; 1970; 1974). This fact has opened a wide discussion on the relations between the distant ends of the continent and the exchange mechanisms within which Baltic amber reached mainland Greece (Beck and Sprincz 1981; Sprincz 2003; Czebreszuk 2011; Kneisel and Müller 2011).

This discussion has long framed perceptions of the Carpathian Basin in this period and resulted in the attribution of a key role to local communities in the development of a complex network of far-reaching connections, implemented above all by warrior elites modelled on those known from Aegean sources (Kovács 1977; Sherratt 1982; Kristiansen 1999, 177; Kristiansen and Larsson 2005; Kristiansen and Suchowska-Ducke 2016). However, these statements are often based on sources (including Baltic amber), which are used selectively, without the necessary local contextualization and precise chronological considerations (Vulpe 2011; Jaeger 2014; Kienlin 2015; Jaeger *et al.* 2020).

Recent analytical results have raised a question concerning the origin of amber finds from the Carpathian Basin. Based on differences in the spectra of beads from Hungary the prehistoric use of not only succinite, but other fossil resin variants: ajkaite from the Balaton uplands or rumenite from the Romanian extra-Carpathian region has been hypothesized (Horváth 1999; Horváth *et al.* 2016).

3. MATERIALS AND RELATIVE CHRONOLOGY

According to the Bronze Age chronology in Hungary (Fischl *et al.* 2013; Kiss *et al.* 2019), the Early Bronze Age (EBA) can be dated to the period between 2600/2500 and 2000/1900 BC. The Middle Bronze Age (MBA) began around 2000/1900 BC and ends with the so-called Koszider period (MBA 3) dated to around 1500/1450 BC (Jaeger and Kulcsár 2013; Fischl *et al.* 2013, fig. 6; 2015, fig. 1b). From the last phase of the EBA (EBA 3, 2200/2100-2000/1900 BC) to the classical phase of the Middle Bronze Age in Hungary (MBA 1-2, 2000/1900-1700/1600 BC), the central part of the Carpathian Basin is characterized by a continuous development, best exemplified by the emergence of tell settlements. Therefore the sites, which cannot be dated more precisely within this period, are categorized as Middle Bronze Age. The Late Bronze Age (LBA), in turn, can be dated between 1500/1450 and 900/850 BC and includes both the period of the development of the Tumulus (*Hügelgräber*) and the Urnfield cultures, and contemporaneous Piliny and Kyjatice cultures (Kovács 1977, 18-20; Visy 2003, 476; V. Szabó 2019).

A total of 659 amber beads known from 22 Middle and Late Bronze Age sites from Hungary were classified into 17 formal groups by the first typological studies (Sprincz and Beck 1981). Later, further sites were added (Horváth 1999; 2013; Kiss 2012b); some of these, however, do not fall within the territory of today's Hungary. The latest summary contains altogether 28 Bronze Age sites (Stahl 2006). The Hungarian pieces examined

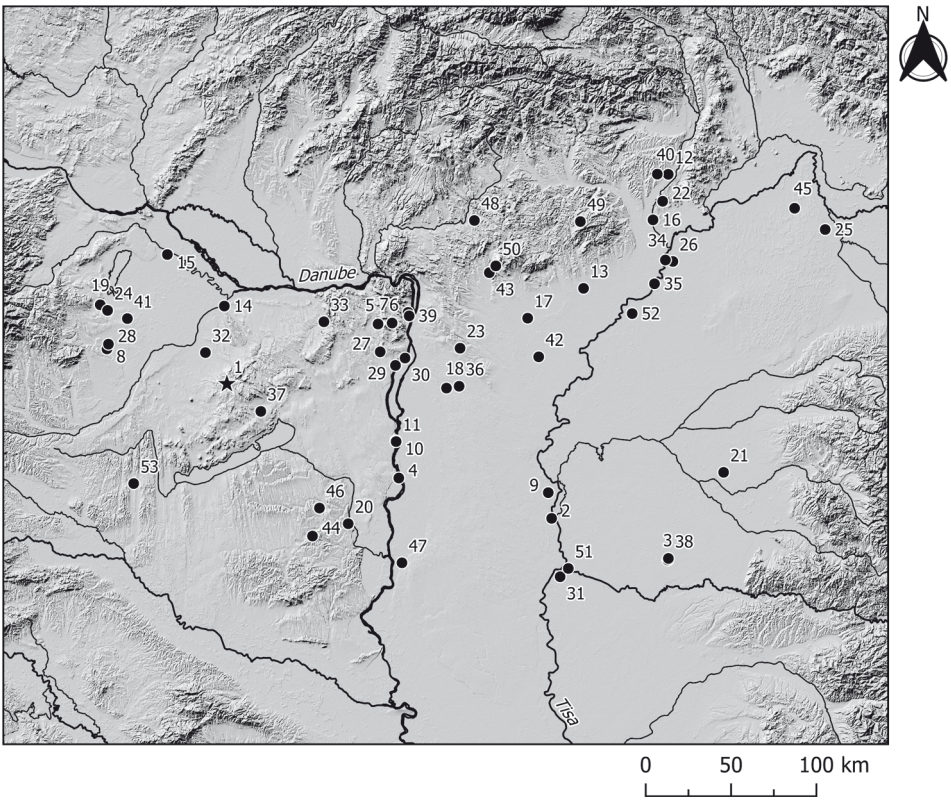

Fig. 1. Distribution of Bronze Age amber finds and ajkaite sample (paleontological site) in Hungary (key after Appendix 1)

from Móra Ferenc Museum in Szeged in the 1980s (nine beads from the Baks-Levelény hoard, Szőreg Grave 114, Tápé Graves 184 and 215; mentioning also the unpublished result of a sample taken from Battonya-Vörös Október Tsz, Grave 68) all proved to be succinite of Baltic origin (Beck and Sprincz 1981). Later analysis included further pieces from Százhalombatta (Horváth 1999), as well as Budakalász, Füzesabony, Hernádkak, Kötegyán, and Megyaszó (Horváth *et al.* 2016); from these, the pieces from Százhalombatta, Budakalász, Füzesabony and Kötegyán were interpreted as not originating from Baltic sources (Horváth 1999; 2017, fig. 13; Horváth *et al.* 2015, fig. 12).

Amber, mainly as an element of ornaments, was certainly used in greater quantities than is known today, as in many cases extremely small and fragile beads are only obtained through very meticulous excavation techniques (*e.g.*, sieving and flotation; see the case of the Kakucs-Turján settlement – Jaeger *et al.* 2018). Cremation also effects the presence of amber beads, as was demonstrated by the analysis of MBA finds from Hungary: in the case

Fig. 2. Szigetszentmiklós-Felső Ürgehegyi-dűlő, Grave 532, find no. 2 (Type IB amber bead)

of the vast cremation cemetery of Dunaújváros-Duna-dűlő (Vatya culture) 0.2% of the burials contained amber beads, while in the much smaller inhumation cemetery of Hernádkak (Füzesabony culture), 8.5% of the burials were equipped by amber ornaments (Jaeger 2016b, 208).

Currently, complimenting the former data of 28 sites, 52 Bronze Age Hungarian archaeological sites are now known, where altogether at least 1915 amber finds have been discovered from the Early Bronze Age until the Late Bronze Age (Fig. 1; Appendix 1). The minimal number of (complete) beads can be added because of the fragmentary condition of several amber find assemblages. It should be also noted that in the course of the work on the presented study, a hoard was discovered in Szécsény-Benczúrfalva. This deposit, in addition to bronze and gold objects, contained 770 amber beads (Guba and Tankó 2023). A full analysis of the hoard has not yet been completed so in this study the amber beads from Szécsény-Benczúrfalva are not included in the analytical sections on typology and absolute chronology.

In the text presented here, the available contextual and chronological information on the known amber finds was collected and their form (where possible to determine due to their state of preservation) was determined according to the typochronological scheme by E. Sprincz and C. W. Beck (Sprincz and Beck 1981; Stahl 2006) (see below). Within the framework of relative chronology, the presence of amber in the study area can be dated to the long period from the end of the 3rd millennium BC to the 2nd/1st millennium BC, Urnfields development period.

4. ABSOLUTE CHRONOLOGY

The chronology of the Hungarian Bronze Age, like that of the neighbouring areas of Slovakia and Romania, is still largely based on relatively few radiocarbon dates from well-recognized and described stratigraphic contexts. This observation applies to dating from settlements as well as cemeteries (Kiss *et al.* 2019; Staniuk 2021). The chronology of sites, including tells and multi-layered settlements, is determined primarily in terms of relative chronology, which is derived from typological studies most often referring to finds from cemeteries (Jaeger *et al.* 2018; Staniuk *et al.* 2020). In this context, it was difficult to determine the dynamics of the emergence and use of amber by local Bronze Age communities.

In this paper, next to new spectral analyses of amber finds, we publish radiocarbon dates from six archaeological sites, from different well-defined stratigraphic contexts, in general categories dated to Early, Middle and Late Bronze Age (Table 1; Appendix 1). The dataset collected in this study is supplemented by spectral analyses of amber pieces from Iharkút, a Late Cretaceous site in the Bakony Mountains, where palaeontological excavations were conducted. The amber from this particular study served as a reference point for identifying potential examples of a local variety of amber *(*ajkaite) among Bronze Age artefacts. In light of the new radiocarbon dates presented below, three distinct stages of amber use (deposition) in Bronze Age contexts can be identified.

The earliest dates for assemblages associated with the presence of amber products are from the burials of Bell Beaker culture at Szigetszentmiklós-Felső Ürgehegyi-dűlő (Grave nos 84, 162, 176, 532, 539 and 609; fig. 2) and at Budakalász-Csajerszke (Grave 1025). These are dated to the late 3rd millennium BC Early Bronze Age (EBA). Also dated to the end of the 3rd millennium BC is Grave no. 3 from the Csepreg site, the amber from which unfortunately could not be analysed in the presented study. Represented by the above-mentioned sites, the earliest stage of amber use can be dated to the period around 2560-2040 BC (Fig. 3; Table 1).

Within the Middle Bronze Age (MBA), we have a small collection of radiocarbon dating amber finds from the Nagycenk cemetery (Grave 61; Table 1; Fig. 4: 11) (Gömöri *et al.* 2018) and the Kakucs-Turján settlement, where five bead fragments were discovered within layers associated with the Vatya culture settlement. In the last mentioned case, soil samples 122 and 125 were dated from two stratigraphic layers, where amber fragments were identified. These fragments were associated with Kakucs phases 9-11 (MBA 2-3). In light of the available absolute dates, this phase of habitation belongs to the period around 1750/1700-1650 BC. Soil sample no. 102 was taken from the 5th mechanical level. This part of the site's stratigraphy is associated with Kakucs Phase 8 (MBA 2), as are the other two samples, as manifested by the presence of the remains of a younger Vatya culture house (Jaeger *et al.* 2018). Available radiocarbon dating allows a preliminary determination of the framework for the formation, functioning and decline of the household during

Table 1. Radiocarbon dated archaeological contexts of amber finds. The dates were calibrated using the OxCalv4.4 software and the IntCal20 calibration curve (Reimer *et al*. 2020; https://c14.arch.ox.ac.uk/oxcal/OxCal.html)

Site	Context	Relative Chronology	Laboratory no.	BP date	cal BC (95.4%)	References
EBA (Bell Beaker)						
Szigetszentmiklós-Felső Ürgehegyi-dűlő	Grave No. 162	EBA 2 Bell Beaker c.	Poz-145195	3815 ± 30	2434-2142	unpubl.
Szigetszentmiklós-Felső Ürgehegyi-dűlő	Grave No. 176	EBA 2 Bell Beaker c.	DeA-8228	3837 ± 21	2451-2201	unpubl.
Szigetszentmiklós-Felső Ürgehegyi-dűlő	Grave No. 532	EBA 2 Bell Beaker c.	Poz-145120	3900 ± 35	2471-2236	unpubl.
Szigetszentmiklós-Felső Ürgehegyi-dűlő	Grave No. 539	EBA 2 Bell Beaker c.	DeA-7313	3967 ± 26	2573-2351	unpubl.
Szigetszentmiklós-Felső Ürgehegyi-dűlő	Grave No. 609	EBA 2 Bell Beaker c.	Poz-145121	3855 ± 35	2459-2204	unpubl.
MBA						
Nagycenk-Lapos-rét	Grave No. 61	MBA 1–2 Gáta–Wieselburg c.	DeA-10114	3489 ± 31	1894-1697	Gömöri *et al.* 2018, fig. 41.
Kakucs-Turján	KEX13-15: 70038 – floor, phase 8	MBA 2 Vatya c.	Poz-88387	3435 ± 35	1878-1626	Jaeger *et al.* 2018, Table 2, fig. 26.
Kakucs-Turján	KEX14-16: 50015 – oven, phase 8	MBA 2 Vatya c.	Poz-88392	3490 ± 30	1892-1699	Jaeger *et al.* 2018, Table 2, fig. 26.
Kakucs-Turján	KEX13-15: 50024 – debris, phase 9	MBA 2 Vatya c.	Poz-61647	3425 ± 30	1873-1625	Jaeger *et al.* 2018, Table 2, fig. 26.

Kakucs-Turján	KEX14-16: 60033 – collapsed wall, phase 9	MBA 2 Vatya c.	Poz-88382	3455 ± 30	1882-1687	Jaeger *et al.* 2018, Table 2, fig. 26.
Kakucs-Turján	KEX14-16: 60033 – collapsed wall, phase 9	MBA 2 Vatya c.	Poz-88383	3475 ± 35	1892-1690	Jaeger *et al.* 2018, Table 2, fig. 26
Kakucs-Turján	KEX13-15: 40008B – pit with debris concentration, phase 10	MBA 3 Vatya III–Koszider	Poz-61645	3425 ± 30	1873-1625	Jaeger *et al.* 2018, Table 2, fig. 26.
Kakucs-Turján	KEX14-16: 60016A – seed deposit, phase 10	MBA 3 Vatya III–Koszider	Poz-88389	3435 ± 35	1878-1626	Jaeger *et al.* 2018, Table 2, fig. 26.
Kakucs-Turján	KEX13-15: 50030 – hearth, phase 11	MBA 3 Vatya III–Koszider	Poz-61649	3365 ± 30	1741-1541	Jaeger *et al.* 2018, Table 2, fig. 26.
LBA (Tumulus culture)						
Jánoshida-Berek	Grave No. 113	LBA 1 Tumulus c.	DeA-7941	3167 ± 24	1500-1406	Csányi 2019, Table 1, fig. 4.
Jánoshida-Berek	Grave No. 140	LBA 1 Tumulus c.	DeA-7942	3157 ± 25	1499-1326	Csányi 2019, Table 1, fig. 4.
Sükösd-Árpás-dűlő V.	Grave No. 1	LBA 1 Tumulus c.	DeA-33514	3234 ± 26	1538-1434	Pásztor *et al.* 2022, 100.
Szurdokpüspöki-Hosszú-dűlő	Grave No. 1	LBA 1 Tumulus c.	Poz-145122	3225 ± 35	1601-1418	unpubl.

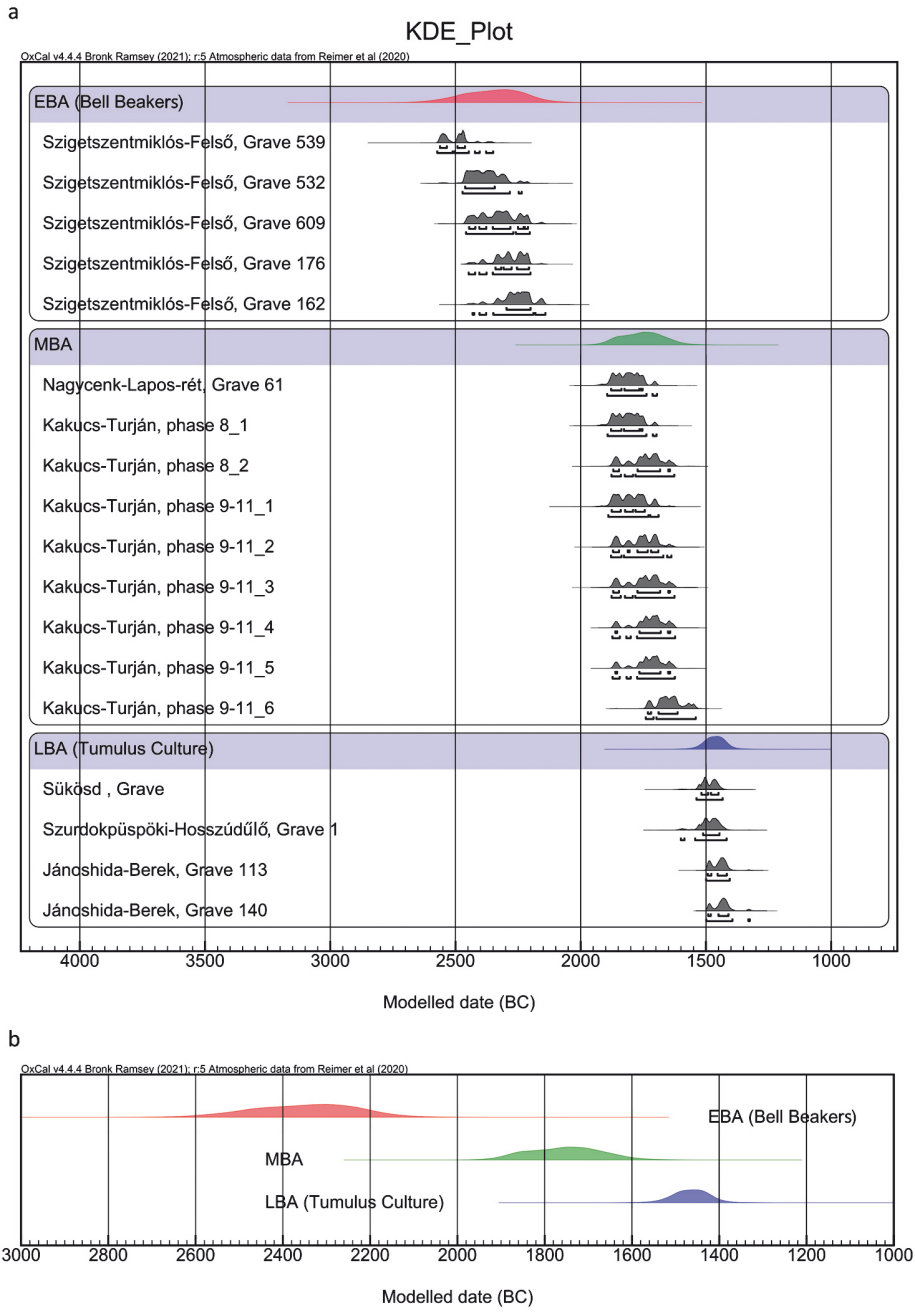

Fig. 3. KDE plot visualization of radiocarbon dated Bronze Age amber finds' contexts (a); KDE plot visualization of the overall distribution of particular Bronze Age phases (b)

Fig. 4. Amber beads from 1. Füzesabony-Öregdomb, 2. Hegyeshalom-Újlakótelep, Grave 5, 3. Hernádkak-Temető, 4-8. Jánoshida-Berek, Grave 113, 9. Kötegyán-Sarkadi út (Gyepespart), 10. Megyaszó, Grave 121, 11. Nagycenk-Lapos-rét, Grave 61, 12. Szurdokpüspöki-Hosszú-dűlő, Grave 1, 13. Jászdózsa-Kápolnahalom, Hoard no. 2

Fig. 5. Amber beads from Sükösd-Árpás-dűlő V.; hemispherical bead with a cross-shaped borehole (Type IB, V, XI, XII)

this period around 1800-1700 BC. The dates associated with the stage of amber use at the MBA sites mentioned above are in the 1900-1650 BC (Fig. 3; Table 1) period.

From the Late Bronze Age (LBA) period, radiocarbon datings of Tumulus culture burials from Jánoshida-Berek (Graves 113 and 140; Fig. 4. 4-8) (Csányi 2017; 2019, 1. táblázat), from Szurdokpüspöki (Grave 1; Fig. 4: 12) (Guba and Bácsmegi 2009) and from Sükösd (Grave 1; Fig. 5) (Pásztor *et al.* 2022, 100) are available. They allow dating the stage of amber use before the Urnfield development period to around 1540-1420 BC (Fig. 3; Table 1).

At this stage of research, it seems crucial to obtain more radiocarbon-dated contexts of the amber finds, especially in relation to the MBA. A relatively large number of these would make it possible to address the views put forward in the literature indicating that there was no influx of significant quantities of raw material into the area in question before 1750 BC or before 1600 BC (before the end of the Classical phase of the Únětice culture) (Ernée 2016; Meller 2017). The dating of the finds associated with the Gáta-Wieselburg style, as well as from the Vatya culture settlement from Kakucs-Turján and the information presented in other studies from the Maros/Mureş culture sites from Szőreg and Battonya (burials furnished with amber are not radiocarbon dated, but their chronology was determined to the Szőreg 2-3 phase, *i.e.*, to the period 2100-1800 BC) (Beck and Sprincz 1981; O'Shea *et al.* 2019, table 1-2, fig. 2), as well as the presence of Baltic amber in the earliest radiocarbon-dated graves at the Nižna Myšla cemetery in neighbouring eastern Slovakia (Jaeger *et al.* 2023), allow a cautious hypothesis about the availability of succinite before the crisis of the distribution system developed by the Únětice culture community.

5. FORM

The area of Hungary is distinguished from other regions of the Carpathian Basin by the availability of a typochronological scheme. The results show that during Middle Bronze Age flattened globular and disc beads were common, while during the Late Bronze Age more sophisticated types spread, like cylinder beads with sharp edges and truncated biconical beads (Fig. 6) (Sprincz and Beck 1981, fig. 6, fig. 9).

During the Late Bronze Age, however, other types can be observed based on recent evidence. From the burials of the Tumulus culture (from Jánoshida and Sükösd; fig. 7-8) triangular beads are also known (Csányi 2017; 2019; Pásztor *et al.* 2022, fig. 3.5). This new type, following the mentioned typological system (Sprincz and Beck 1981) can be ranked in Type XI (Fig. 6). Similar triangular beads were found in Tumulus culture burials in Hundersingen, Germany (Type 30 after Woltermann 2016, 168, Abb. 124.).

Another new type, a hemispherical bead (which can be ranked in Type XII) was found in Grave 1 of the Tumulus culture cemetery recently discovered at Sükösd (Fig. 5) (Pásztor *et al.* 2022, fig. 3.3), and in the Szilvásvárad-Kelemenszéke depot 1 (V. Szabó 2019, fig. 168), beside a truncated biconical bead (the last mentioned one is Type IXE; Sprincz and Beck 1981). The hemispherical bead from Sükösd is very interesting because of the cross-shaped borehole in it. A similar amber bead with a cross-shaped borehole is known from the mentioned Tumulus culture grave assemblage from Hundersingen, and from the sun symbol with bronze handle, discovered in an unknown site in Jutland (Denmark) (Kaul 2004, 66, 67; Pásztor *et al.* 2022)

Completing the typochronological scheme by Sprincz and Beck for Bronze Age amber beads in Hungary with new types (Fig. 6) we can demonstrate the diachronic transformation of amber bead fashion. During the early phase, before 1600 BC (sporadic finds from the Early Bronze Age and Middle Bronze Age 1-2 phases) cylinder, flattened globular and flat disc forms (typological Groups I, III, VII) are the most common (Appendix 1; Fig. 9).

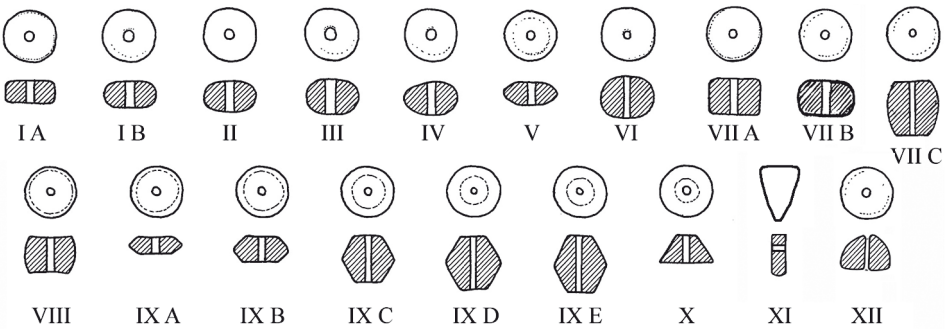

Fig. 6. Typochronological scheme of Bronze Age amber beads in Hungary (redrawn after Sprincz and Beck 1981, Fig. 6; supplemented by the authors)

Fig. 7. Jánoshida-Berek, Grave 113, amber beads (Type IA amber bead, Inv. no DJM 80.2.51)

Fig. 8. Triangular bead from Jánoshida-Berek, Grave 140 (Type XI; Inv. no DJM 80.2.76)

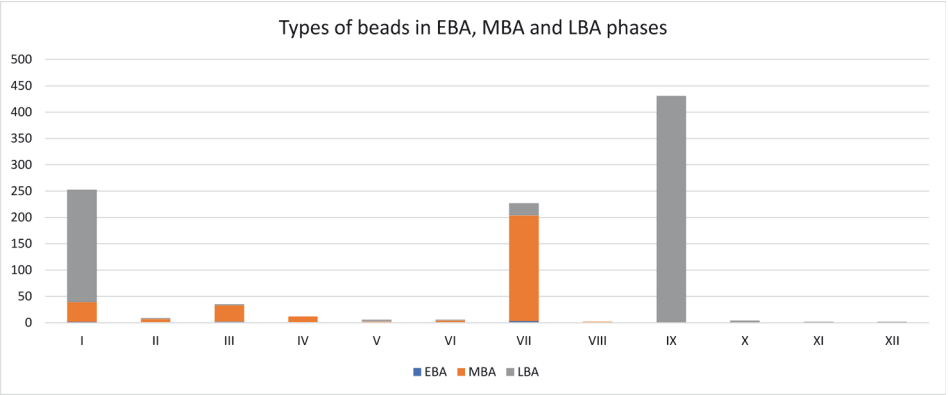

Fig. 9. Number of bead types in particular phases of the Bronze Age in Hungary

In the Koszider period (MBA 3) the same forms are still the most popular with a growing scale of flat disc and irregular round beads (typological Groups I, III, IV, VII). In the Late Bronze Age truncated biconical and flat disc beads (typological Groups I and IX) spread in the largest scale, beside the appearance of new types (Groups X-XII).

Table 2. Number of identified bead types in particular phases of the Bronze Age in Hungary

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
EBA	2	0	2	1	0	0	3	0	0	0	0	0
MBA	37	7	31	11	2	4	201	2	1	0	0	0
LBA	214	2	2	0	4	2	23	0	430	4	2	2

6. PROVENANCE OF RAW MATERIAL

Many analytical techniques are used in amber research, such as Fourier-transform infrared spectroscopy (FTIR), nuclear magnetic resonance (NMR) or gas chromatography-mass spectrometry (GC-MS). These methods are used individually or in various combinations, depending on the specificity of the analysed material and the analytical problem under consideration.

FTIR infrared spectroscopy has been repeatedly demonstrated by numerous research teams as the leading method of amber identification and classification. The specificity of the analysis, usually for small archaeological amber finds, imposes limitations that usually exclude the use of analytical techniques such as NMR (required amount 30-100 mg, destructive technique), GC-MS (required amount 1-3 g, destructive technique).

Among the various configurations of the apparatus in IR spectroscopy, the attenuated total reflection (ATR) technique deserves attention as the most popular and non-destructive method of examining amber in infrared. ATR requires exposure to infrared radiation of the cleaned amber surface, moreover, it is recommended to repeat the measurement several times for different exposures in order to identify possible changes in the spectrum resulting from a chemically differentiated surface. Unfortunately, for very small lump the surface degradation is difficult to avoid and covers a significant fraction of the sample volume. Despite its obvious advantages when analyzing large amber objects, the ATR method does not work for archaeological objects of a few and sub-millimeters in size.

In the reported research, the previous analyses of artefacts were carried out using the FTIR method. This was due to, on the one hand, the conservation aspects (less invasiveness of historic material) and the fact that this method was widely used by other researchers of prehistoric amber, which made it possible to compare the obtained results between individual regional studies. FTIR infrared spectroscopy in the transmission mode requires only 1-2 mg of sample, which is why it is sometimes referred to as a low-invasive method (Angelini and Bellintani 2017). For measurements using the FTIR transmission method, the sample is prepared by grinding a small amount of amber, mixing it with potassium bromide (KBr) and pressing it into a tablet. The disadvantage of this method is the destruction of practically the entire sample. From it, we obtain a spectrum showing vibrations in the molecules of chemical compounds constituting amber, and not its surface changed due to the influence of the environment.

In all cases published here, it was decided to use the infrared spectroscopy (FTIR) method conducted in the Laboratory of Department of Materials Chemistry Faculty of Chemistry AMU, Poznań. The amber samples were crushed by hand using an agate mortar and pestle. 1.8 milligrams of powdered sample was dispersed into 200 mg of KBr and finally pressed into a pellet in a hydraulic press with a force of 10 tons. FTIR spectra were obtained with a resolution of 2 cm^{-1}, in the measuring range of 4000-400 cm^{-1}, using a Bruker IFS 66v/S FTIR spectrometer.

The spectra of all 22 analysed amber samples – with the exception of an amber lump from Iharkút (palaeontological site) show agreement with the succinite spectra known from the literature and with the standard spectra made for Baltic amber. This consistency is very high in the characteristic area of 1260-1100 cm^{-1} constituting a "fingerprint" of succinite, containing an almost horizontal area from ~ 1260 to 1200 cm^{-1}, resulting from the partial overlap of bands of almost equal intensity, followed by a maximum absorption at ~ 1156 cm^{-1}. This region called the "Baltic shoulder" is particularly useful in identifying succinite. In addition to the spectra features typical of succinite, changes were also noted in the literature spectra of archaeological amber related to the change in the content of carboxylic acids and the presence of salt (Angelini and Bellintani 2017), which, however, did not affect the possibility of identifying all the examined amber lumps as succinite. To sum up, in the light of the spectral analyses provided as part of the described research and the

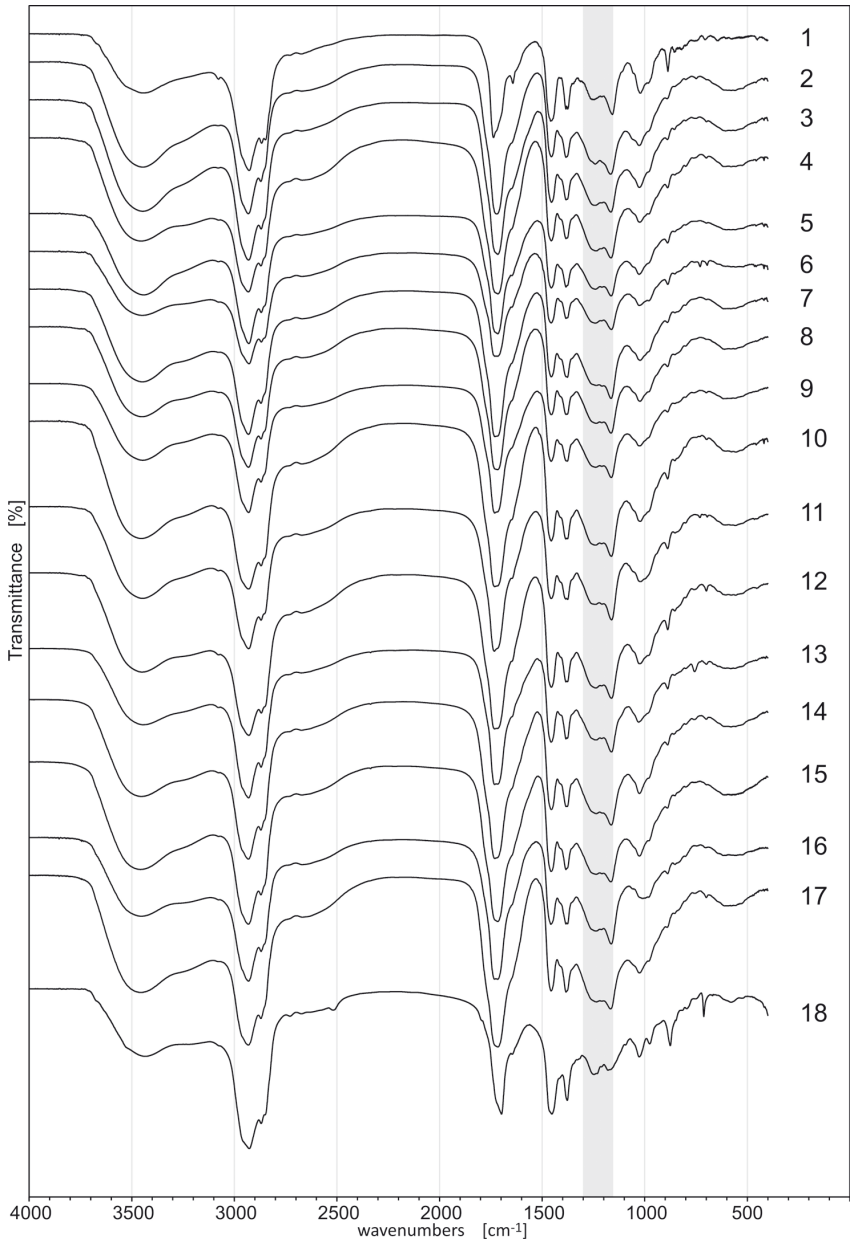

Fig. 10. Results of the FTIR analysis of amber samples: 1 – Baltic amber master sample; 2 – Hegyeshalom-Újlakótelep; 3 – Nagycenk-Lapos-rét; 4 – Hernádkak-Temető; 5 – Jászdózsa-Kápolnahalom; 6 – Jánoshida-Berek (dagger pendant); 7-9 – Megyaszó; 10-12 – Jánoshida-Berek; 13 – Budapest-II. Máriaremete (Nagykovácsi)-Remete Cave; 14-15 – Szurdokpüspöki-Hosszú-dűlő; 16 – Tiszakeszi-Szódadomb; 17 – Detek; 18 – Iharkút ajkaite master sample

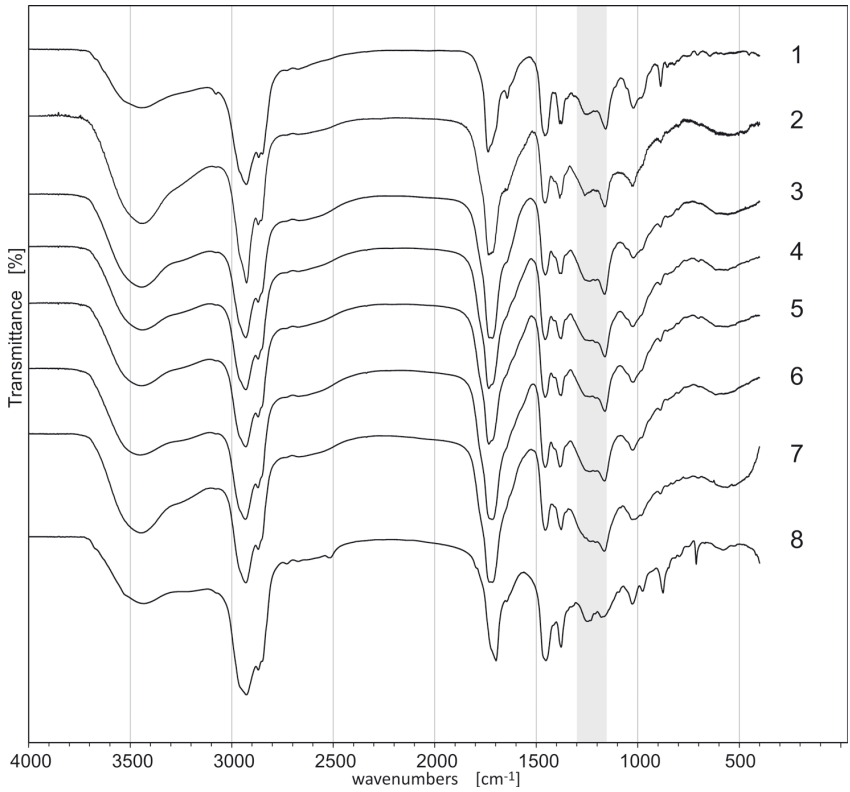

Fig. 11. Results of the FTIR analysis of amber fragments from: 1- Baltic amber master sample; 2-3 – Sükösd-Árpás-dűlő V.; 4-7 – Szigetszentmiklós-Felső Ürgehegyi-dűlő; 8 – Iharkút ajkaite master sample

analysis carried out earlier by the team of C. W. Beck, the vast majority of amber beads in the context of the Hungarian Bronze Age were identified as made of succinite.

7. CONTEXT

In the territory of today's Hungary, Bronze Age amber finds were most often deposited as grave goods and elements of (metal) hoards. The underestimation of settlement finds may result from the imperfection of excavation techniques that are not conducive to the identification of amber and its low resistance to post-depositional processes (Jaeger 2016b, 208).

As has been mentioned above, in total 52 Bronze Age sites are currently known from the research area, which provided amber finds. The collection includes 31 cemeteries (53

graves; the available publications in some cases lack accurate information about the number of graves furnished with amber objects), 15 hoards from 14 sites, and 7 (only MBA) settlements (Appendix 1; Fig. 1). The reconstructed number of amber objects (basically only beads of various forms or their fragments) was estimated at 1915. However it must be noted, that the number of finds could not be clearly determined. In the literature on the subject, in a few cases only numerical ranges were given, *e.g.*, 15-20 beads. In the presented study, it was decided to use the minimum number of items mentioned in the literature each

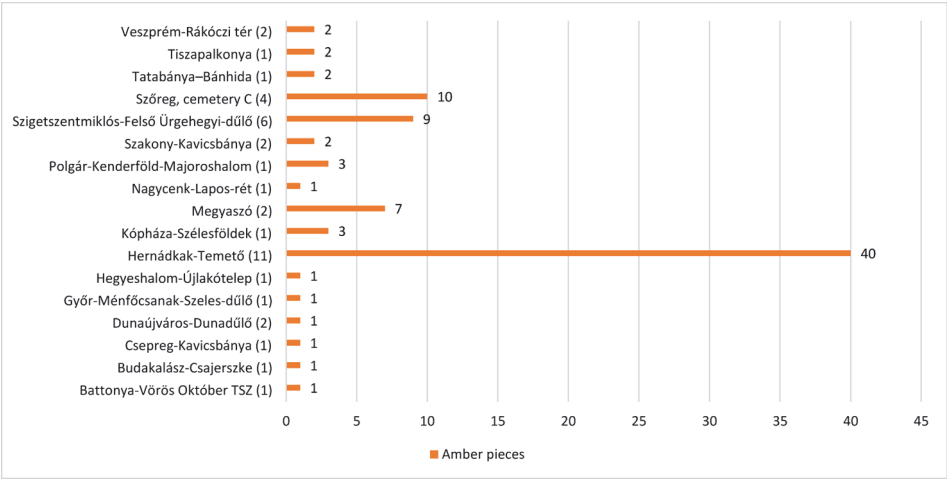

Fig. 12. Number of beads in EBA and MBA burials in Hungary. Number of burials furnished with amber in a particular cemetery given in brackets next to the site name

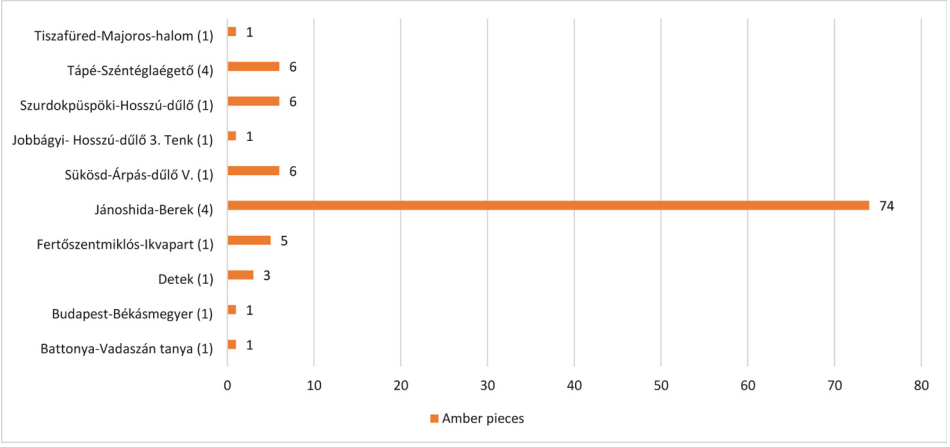

Fig. 13. Number of beads in LBA burials in Hungary. Number of burials furnished with amber in a particular cemetery given in brackets next to the site name

Fig. 14. Hoard no. 2 from Jászdózsa-Kápolnahalom tell settlement (photo: Péter Makrai)

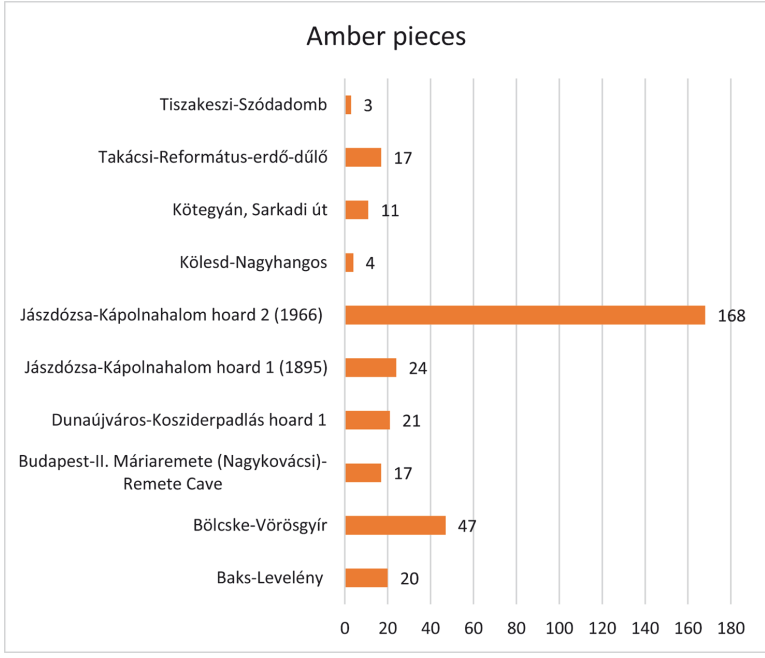

Fig. 15. Number of amber beads in MBA hoards in Hungary

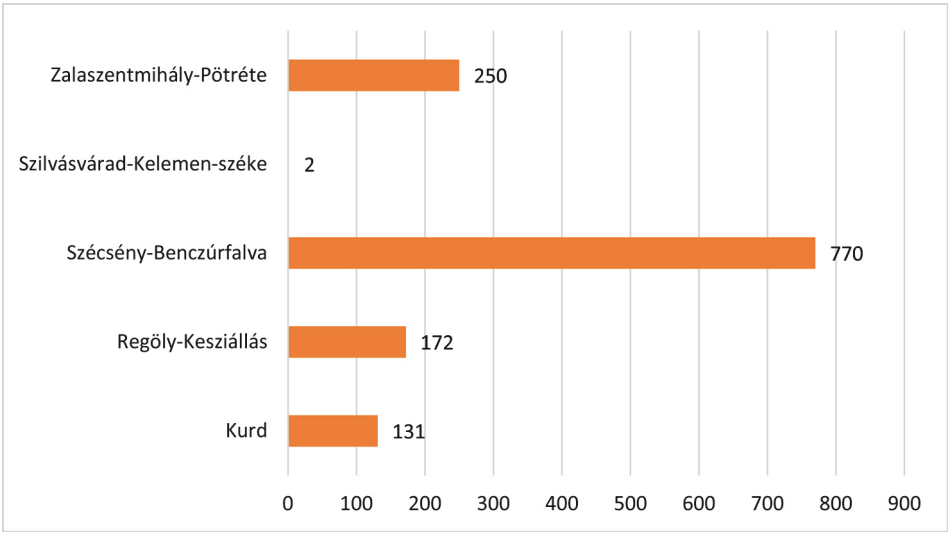

Fig. 16. Number of amber beads in LBA (Urnfield period) hoards in Hungary

time. Only those graves for which the number of amber finds was given in any number were taken into account.

On the basis of the available information, it can be concluded that amber was more often a part of female (11 cases) than male burials (6 cases). It should be emphasized that the number of anthropologically examined burials is relatively small. However, the trend of more frequent deposition of amber in female graves is also noticeable in the case of larger data collections, such as the cemeteries in Slovakia of Jelšovce and Nižna Myšľa (Bátora 2000; Jaeger *et al.* 2023). In general, the number of beads furnishing individual burials is relatively low, and only in exceptional cases (in all phases of the Bronze Age) were ornaments consisting of dozens of pieces discovered (Figs 12 and 13).

Amber beads appear in hoards during the MBA in Hungary, in the hoard no. 2 at Jászdózsa in outstandingly high number (Fig. 14), which can be dated to the MBA 1-2 period based on the stratigraphy of the tell settlement (Stanczik and Tárnoki 1992, 124, 125, Abb. 368. 2-10; Csányi *et al.* 2000, 154, Abb. 5.2).

At the end of the Middle Bronze Age, amber beads are a common element of the hoards (Fig. 15). At the same time, it should be noted that no hoard containing amber beads is known from the study area, which could be associated with the Tumulus culture. Another peak is represented by later hoards related to the Urnfield period. Although they represent a small group of finds, the vast majority contained several hundred amber beads (Fig. 16).

8. CONCLUSIONS

The new information presented above about Bronze Age amber finds in Hungary concerns the following aspects: 1) spatial distribution, 2) absolute chronology, 3) context of deposition of amber objects, 4) form of amber objects and 5) Baltic origin of the raw material.

The context of deposition of the earliest finds associated with the Early Bronze Age cannot be defined very precisely within the framework of absolute chronology. Although it should be noted that radiocarbon dating is known from some of the sites where amber finds have been discovered, which makes it possible to determine the chronological framework of their development: three sites can be dated to EBA 2: Budakalász, Csepreg, Szigetszentmiklós and four sites can be dated between EBA 3 – MBA 1-2: Hegyeshalom, Kópháza, Százhalombatta, Szőreg (see Appendix 1).

The distribution of amber artefacts in the area of present-day Hungary shows a certain dynamics over a long period from the Early Bronze Age (Bell Beaker), through the Middle Bronze Age, *i.e.*, the period of development of the so-called classical tell cultures, to the Late Bronze Age and slightly later period of the development of the Urnfield communities (Fig. 1).

Among them, however, the presence of radiocarbon-dated amber finds from the Bell Beaker cemetery at Szigetszentmiklós-Felső Ürgehegyi-dűlő should be highlighted. Indeed, the collection of discovered ornaments dating to the late 3rd millennium BC included both finds made of Baltic amber and simetite (Jaeger *et al.* forthcoming), a raw material present in the Chalcolithic of the Iberian Peninsula (Murillo-Barroso *et al.* 2018). Simetite may be connected to the mobility of Bell Beaker groups (Olalde *et al.* 2018; Dani and Kulcsár 2021, fig. 8). A much larger number of sites and amber finds in the analysed collection are dated to the first half of the 2nd millennium BC (2000/1900-1500/1450 BC; 29 sites from the Middle Bronze Age in Hungarian terminology, from which nine can be certainly dated to MBA 3; Appendix 1). However, it should be emphasized that their number and spatial distribution probably do not reflect the original knowledge and scale of amber use by local communities. Two important factors contribute to the incomplete picture of the phenomenon under study. The first is the cremation burial rite prevalent in most of the study area during this period. The second factor, on the other hand, is the imperfectness of the excavation techniques used in the study of settlements, especially those with complex stratigraphy (tells and multi-layered settlements). Sensitive to post-depositional factors and high temperature, amber, on the one hand, is rarely preserved in cremation graves, while, on the other hand, it is not easy to identify in sedimentary layers without special techniques, such as flotation.

In the Late Bronze Age (in Hungarian terminology; after 1500/1450 BC), the presence of amber finds in both burial furnishings and hoards (15 sites; Appendix 1) testifies to the availability of the raw material at a time when changes in the distribution of amber are

evident across Central Europe. Thus, communities in the study area acquired amber regardless of the observed transformations in the system of exchange routes for this raw material. The Late Bronze Age is notable for the relatively small number of hoards with amber, which, however, contained large quantities of amber beads. A similar situation can be seen in the period of development of Urnfields. After 1200 BC, only four hoards with amber are known from the study area, but they contained a very large number of beads.

The information on absolute chronology presented in this study, while still scarce, allows us to draw two basic and important conclusions. The first of these points unequivocally to the access and presence of amber in the study area over a long period reaching from the end of the 3rd millennium BC to the Urnfield period. The earliest finds (from EBA and MBA 1-2 phases according to Hungarian Bronze Age terminology) can be connected to the main trade routes along the Danube and the Tisza, as well as to the close relationship of the Únětice population with the Gáta-Wieselburg communities (living in the vicinity of the northwestern gateway of the Carpathian Basin; Krenn-Leeb 2011, 23, 24, fig. 21). We can assume that amber reached the area of present-day Hungary from regions located north of the Carpathians and the Alps, along with the steady development of complex exchange networks of the 2nd and late 2nd millennium BC centred around the acquisition of raw materials for metallurgical production (copper, tin, finished bronze and gold products). The Únětice and Maďarovce related pottery and metal finds in the northern part of western Hungary, and also the vessels and characteristic metal ornaments of the Transdanubian Encrusted Pottery culture in southwestern Slovakia, and also the strong connections of the Otomani/Füzesabony cultural complex with Únětice metallurgical zone prove these contacts (Kiss 2002; Czebreszuk 2009, pl. II. 1; Kiss 2011, fig. 3; Fischl and Kiss 2015, fig. 4). The direction of these connections can be clearly associated with the Slovakian copper ore sources, where Bronze Age mining in the Špania Dolina area is documented during the period of the Únětice culture (Žebrák 1995; Czajlik 2012; Modarressi-Tehrani *et al.* 2016; earlier use of this mine can be dated to the period of the Copper Age Ludanice culture; see also Siklósi *et al.* 2023) (Fig. 17).

The second conclusion relates to the relatively numerous group of amber sites and finds that date to the period before 1700/1600 BC. Based on the relative dating of the Early and Middle Bronze Age find assemblages and available radiocarbon dates, we can state that at least around 17 of the 50 Hungarian Bronze Age sites with amber finds (more than half of the amber related sites from the EBA-MBA period) can be dated before 1700/1600 BC. Based on the number of finds (280 pieces) these are more than 50% of the Early and Middle Bronze Age beads (486 pieces). This reflects the significant stages of using this raw material in the first half of the 2nd millennium BC before and during the apogee of dispersion of amber artefacts in Central Europe. The finds from Nagycenk, Hegyeshalom, Kópháza and Szakony are related to the Gáta-Wieselburg style, which can be treated to some extent as a peripheral phenomenon, culturally related to the tradition of Central European Únětice style. Transdanubian Encrusted Pottery, Vatya, Füzesabony

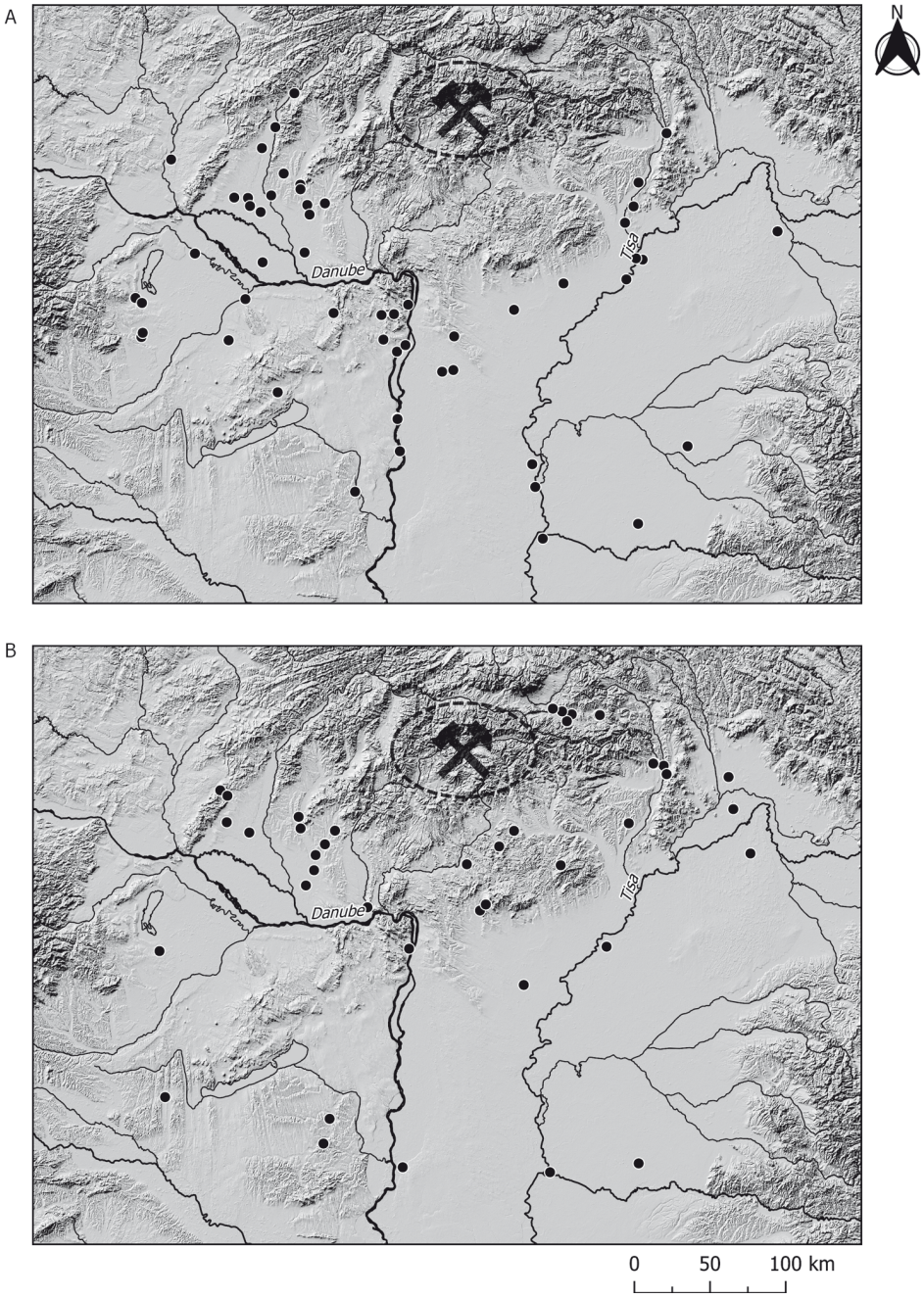

Fig. 17. Distribution of amber finds from the EBA and MBA (map A) and from the LBA (map B) in relation to the copper-bearing areas of today's Slovakia

and Maros culture amber finds, however, can be connected to a wider trade activity. The accumulated information seems to cast doubt on the proposed model of a kind of monopoly of the Únětice culture, which, thanks to its complex political and military structure, would have had the ability to fully control the flow of Baltic amber and block its penetration into the Carpathian Basin (Meller 2017). On the one hand, this is contradicted by finds from both Hungary and Slovakia, which can be dated to the period of the Classical Únětice culture (Jaeger *et al.* 2023). On the other hand, what draws attention is a very numerous group of finds in the form of imports of bronze objects, and stylistic inspirations in ceramics testifying to the bidirectional relations of the areas of the Únětice culture and the Carpathian Basin. A special case in this context appears to be the Vatya culture's multilayered site at Kakucs-Turján in Central Hungary, where pottery forms representing imitations and imports of neighbouring styles were discovered within one of the huts, including a cup alluding to the stylistics of the classic Únětice cup (Jaeger 2018; Staniuk *et al.* 2022, 8, fig. 4, 30). Significantly, bronze, copper, gold and Baltic amber objects were also discovered at the same site. These provide strong evidence of very extensive (in terms of cultural and geographic distance) relationships being built by local Bronze Age communities in the territory of present-day Hungary (Sherratt 1993; Kiss 2011, fig. 6; Czebreszuk 2013, fig. 5; Fischl and Kiss 2015, fig. 4).

As in other areas of Central Europe, amber was most often discovered in burial equipment (Jaeger *et al.* 2023). Less frequently, the raw material was part of hoards of metal

Fig. 18. Finds from Tiszakeszi-Szódadomb hoard (after Fischl 2014)

objects. It should be noted, however, that in the latter, amber is relatively often present in the form of necklaces consisting of a very large number of beads. On the other hand, single beads dominated in the equipment of burials, being elements of ornaments combined with beads/pendants made of other raw materials. In this context, the area of present-day Hungary does not differ from that of neighbouring Slovakia, where amber was most often combined with pendants made of animal teeth or boar tusks, faience and small metal elements such as bronze spirals. Such examples are known from hoards in Jászdózsa (Fig. 14) and Tiszakeszi (Fig. 18) (Csányi *et al.* 2000; Fischl 2014; Jaeger *et al.* 2023). In both Slovakia and Hungary, amber was primarily used to furnish female burials, although in the case of the latter area it should be noted the very small number of anthropological analyses available. There is also insufficient information to conclusively determine the relationship linking the presence of amber to a specific age group of the deceased or their status during life. In Battonya, Hegyeshalom, Polgár, Sükösd, Szakony, Szőreg and Tiszafüred amber beads were discovered beside female individuals, however, in Budakalász, Csepreg and Nagycenk burials with amber grave goods belong to male individuals (see Appendix 1).

In the collection of amber finds from present-day Hungary, we are dealing primarily with beads. The vast majority of Middle Bronze Age beads were flattened globular and disc beads known from other areas of Central Europe (Czebreszuk 2011; Jaeger *et al.* 2023). However, it is important to note the change that occurred in the Late Bronze Age. In the later finds of the analysed collection there appeared not only examples of unique shapes (Jánoshida and Sükösd), but also new types of beads (truncated biconical and flat disc beads), which were not produced in earlier periods (Fig. 6). There are only two cases with irregular pieces of amber lumps among the finds (in burials from Csepreg and Tiszafüred) that could be considered as raw material prepared for processing (semi-finished product). From the study area we do not have information on a site within which remains of amber bead production were discovered. Such finds are still rare and for the time being allow us to assume that amber reached most areas of Central Europe in the form of finished products (beads). Ernée (2016, 94) mentions pieces of amber raw material for bead processing from Hosty (South-Bohemia), from where a typical cup of the Transdanubian Encrusted Pottery is also known (Kiss 2012b, fig. 42, fig. 43.7), as signal of contacts between South Bohemian Únětice groups and the western part of the Carpathian Basin.

Formerly known and the spectral analyses published here from 12 sites performed for some of the finds allow us to unequivocally state that the basic raw material in the research area was Baltic amber. Thus, the information presented confirms the results of research already performed earlier (Beck and Sprincz 1981). As mentioned in the introduction, the precise origin of succinite known from many different natural sources cannot be clearly indicated on the map using spectral methods. However, it seems most likely that the amber used by local Bronze Age communities came from areas of Western Pomerania and/or the Scandinavian coast. In the collection of finds from present-day Hungary from the Middle Bronze Age, the relatively large number of beads discovered as elements of metal

hoards draws special attention. Amber was found in deposits of the types characteristic for the area and the Middle Bronze Age: Tolnanémedi, Hajdúsámson-Apa and Koszider. The latter may be one of the additional arguments in the discussion on the northern (Baltic) provenance of amber. Hoards of the Koszider type, with a specific composition, containing both Carpathian and Nordic imports, are known from Western Pomerania in Poland. They should be interpreted as clear evidence of interactions taking place within the communities inhabiting the area between southern Scandinavia and the Carpathian Basin (Vandkilde 2014).

Acknowledgements

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Appendix 1. Catalogue of Bronze Age amber finds from Hungary and paleontological site with master sample of ajkaite
1 n.d. – no available data; cca.: without AMS radiocarbon data from the site, the estimated absolute dates based on the relative archaeological chronology; 2 D= diameter, L = Length, W = width, We = weight; S = small, less than 10 mm; M = medium, 10 mm to less than 20 mm; L = large, 20 mm or more (according to Sprincz and Beck 1981); 3 If the inventory number is available

No.	Site	Context	Relative chronology	Absolute chronology[1]	Number of amber finds	Type and Size of amber finds (Fig. 6)[2]	Analysis	Place of deposit; Inv. No[3]	References
1	Iharkút	Dinosaur locality	Late Cretaceous	n.d.	1	piece of an amber (ajkait master sample)	Botfalvai *et al.* 2021; this study	n.d.	Botfalvai *et al.* 2021
Early and Middle Bronze Age Finds in Hungary									
2	Baks-Levelény	hoard	MBA 3 Koszider period, Vatya c.	cca. 1600-1500/1450 BC	20	Group III and V D=25 mm, 22 mm	Beck and Sprincz 1981, Table 1 and Fig. 1	Móra Ferenc Musem (Szeged) Inv. No 66.2.19, 19a, 20. 3 beads remained in Museum	Trogmayer 1967, Abb. 3. 1-2, 4; Sprincz and Beck 1981, 206-207; Mozsolics 1988, 51.
3	Battonya-Vörös Október TSZ	Grave No 68; inhumation burial of a maturus woman	MBA 1-2 Maros/Mureş c.	site dated to 2000-1700 BC based on 16 radiocarbon dates after Allentoft *et al.* 2015; O'Shea *et al.* 2019	1	Group IXA D= cca. 20 mm	Beck and Sprincz 1981, 208 (unbpublished)	Munkácsy Mihály Museum (Békéscsaba); Inv. No (see Szabó 1999, 26)	Sprincz and Beck 1981, 208; Szabó 1999, 38-39, Abb. 22. 68/2; O'Shea *et al.* 2019, Table 2, Fig. 4.
4	Bölcske-Vörösgyír	hoard	MBA 3 Koszider phase, Vatya c.	cca. 1600-1500/1450 BC	47	Group IB, III, IV, VIIB D=11-32 mm	-	Hungarian National Museum (Budapest) Inv. No 1883.52.1-9.	Wosinsky 1896, 395-396; Mozsolics 1967, 131, Taf. 34, 7-43; Sprincz and Beck 1981; Kovács 1994; Kiss 2012b, 100, 102
5	Budajenő-Hegyi-szántók	settlement	MBA 2-3 Vatya III-Koszider phase	cca. 1800/1700-1500/1450 BC	1	fragment	-	Ferenczy Museum Centre (Gödöllő)	Repiszky 2004, 184; Gucsi and Szabó 2018

6	Budakalász-Csajerszke	Grave No 1025; urn burial of a 23-30 year-old male	EBA 2 Bell Beaker c.	site dated between 2580-1780 cal BC; based on 10 radiocarbon dates: Czene 2017, Fig. 17; Olalde *et al.* 2018	1	probably Group I D=9 mm	Horváth 2017, Fig. 12.46	Ferenczy Museum Centre (Gödöllő); Inv. No 2005.14.1025.	Horváth 2017; Czene 2017; Olalde *et al*. 2018
7	Budapest-II. Máriaremete (Nagykovácsi)-Remete Cave	hoard	MBA 3 Koszider phase, Vatya c.	cca. 1600-1500/1450 BC	17	Group IB, III, IV, VIIB D=10-20 mm	this study	Budapest Historical Museum Inv. No 73.2.1-17.	Gáboriné Csánk 1984; Mozsolics 1988, 28, Abb. 4
8	Csepreg-Kavicsbánya	Grave No 3 inhumation burial of a genetically identified male child aged 4-5	EBA 2 Somogyvár-Vinkovci or Leitha-prodersdorf c.	2270-2040 cal BC; (Szécsényi-Nagy *et al*. forthcoming)	1	irregular piece of an amber	-	Savaria Museum (Szombathely) Inv. No 69.20.	Károlyi 1975, 173-174; Ilon 1996, 19-20, Fig. 7, Pl. III. 12; Szécsényi-Nagy *et al.* forthcoming
9	Csongrád-Felgyő	settlement pit	MBA 2-3 Vatya III-Koszider c.	cca. 1800/1700-1500/1450 BC	1	Group VIII D=16 mm	-	Katona József Museum (Kecskemét) Inv. No 66.6.45.	Sprincz and Beck 1981, 481, Fig. 4. 16; Fischl and Guba 2010, 47. kép 6.
10	Dunaújváros-Dunadűlő	Grave Nrs 251, 948	MBA 1 Vatya I c.	cca. 2000/1900-1800/1700 BC	47	Group II and III D=10, 12 mm	-	Intercisa Museum (Dunaújváros)	Bóna 1975, 56; Sprincz and Beck 1981, 478, 484, Fig. 2.5, Table 2; Stahl 2006, 108; Vicze 2011, 108, Pl. 37. 9, Pl. 99. 12
11	Dunaújváros-Kosziderpadlás	Hoard No 1	MBA 3 Koszider phase, Vatya c.	cca. 1600-1500/1450 BC	21	Group IB, IIA, III, V, VI, VIIB D=9-33 mm	-	Intercisa Museum (Dunaújváros)	Mozsolics 1967, 134, Taf. 48, 1-20; Sprincz and Beck 1981, 484, Table 2; Stahl 2006, 108
12	Encs-Mérnöki-teleptől délre	Cemetery with 1093 graves	MBA 1-3 Füzesabony c.	cca 2000/1900-1600/1500 BC	2	n.d.	-	Herman Ottó Museum (Miskolc)	Mengyán and Dávid 2018; Mengyán and Dávid 2019

No.	Site	Context	Relative chronology	Absolute chronology[1]	Number of amber finds	Type and Size of amber finds (Fig. 6)[2]	Analysis	Place of deposit; Inv. No[3]	References
13	Füzesabony-Öregdomb	settlement	MBA 2-3 Füzesabony B-C period, Koszider	site dated between 1800-1500 cal BC; based on dates Szathmári *et al.* 2019	1	Group VIIB, D=12 mm	Horváth *et al.* 2017	Hungarian National Museum (Budapest) Inv. No 1948.46.68.	Sprincz and Beck 1981, 476, Fig. 4.2, Table 2; Horváth 2013; 2016; Szathmári *et al.* 2019
14	Győr-Ménfőcsanak-Szeles-dűlő	Grave No 33 cremation burial with 35 ceramic vessels	MBA 2-3 Transdanubian Encrusted Pottery c.	cca. 1800-1500/1450 BC	1	probably Group III	-	Rómer Flóris Art and Historical Museum (Győr)	Figler 1996; Melis 2023, 62. ábra a
15	Hegyeshalom-Újlakótelep	Grave No. 5 inhumation burial of an adult woman	EBA 3-MBA 1-2 Gáta-Wieselburg c.	cca. 2100/2000-1700 BC	1	probably Group VI D=11 mm	this study	Hansági Museum (Mosonmagyaróvár) Inv. No 65. 4.3.1.	Szathmári 1988, Fig. 8.1-15; Nagy and Figler 2009, 257-258, Fig. 1; Melis 2020a, Fig. 2.13
16	Hernádkak-Temető	Grave Nos 16, 67, 74, 81, 94, 95, 96, 103, 105, 110, 123 (Bóna 1975: Grave Nos 67, 74, 81, 110)	MBA 1-2 Füzesabony A-B period, Füzesabony c.	cca. 2000/1900-1700 BC	40	Group IB D= 9 mm	Horváth 2017; and this study	Hungarian National Museum (Budapest) Inv. No 1952.3.32.	Bóna 1975, 148, 159-160, Taf. 164. 5-6, 22, 27; – Sprincz and Beck 1981, 478, 484, Fig. 2. 5, Table 2; Schalk 1992, 139, 183-188, Abb. 54; Stahl 2006, 108-109; Horváth 2017
17	Jászdózsa-Kápolnahalom	Hoard No 1 (from the settlement, 1895)	MBA 1-2 Hatvan c.	cca. 2000/1900-1700 BC	24	Group VIIB	-	Hungarian National Museum (Budapest) Inv. No 125.1895.191.	Hampel 1896; Mozsolics 1967, 142; Sprincz and Beck 1981, Fig. 4. 2, Fig. 7; Stahl 2006, 109; Tárnoki 2015, 17

17	Jászdózsa-Kápolnahalom	Hoard No. 2 (from the settlement, 1966, Level 11, upmost Hatvan layer)	MBA 1-2 Hatvan c.	site dated between 2450 and 1750 cal BC (based on 8 dates for early and late Hatvan period, excluding Koszider phase)	168	probably Group II, III, VI D= 4-16 mm	this study	Damjanich János Museum (Szolnok) Inv. No 76.1.40.	Stanczik and Tárnoki 1992, 124-125, Abb. 368. 2-10; Csányi *et al.* 2000, 154, Abb. 4-6, Abb. 5. 2; Stahl 2006, 109 erroneously mentions 10 amber beads; Tárnoki 2015
18	Kakucs-Turján	settlement from 8, and 9-11 phases	MBA 2-3 Vatya III-Koszider, Vatya c.	site dated between 1800-1650 cal BC	5	Group IB or II D=7 mm	Jaeger 2016; Jaeger *et al.* 2018; Jaeger *et al.* 2020	Ferenczy Museum Centre (Gödöllő)	Jaeger 2016; Jaeger *et al.* 2018
19	Kópháza-Szélesföldek	Grave No S-1625 inhumation burial	EBA 3-MBA 1-2 Gáta-Wieselburg c.	cca. 2100/2000-1700 BC	3	different types, but not identifiable based on the excavation report	-	Rómer Flóris Art and Historical Museum (Győr)	Ujvári 2019, 20-21. 7-9
20	Kölesd-Nagyhangos	hoard	MBA 3 Koszider phase, Transdanubian Encrusted Pottery c.	cca. 1600-1500/1450 BC	4	probably Group VIIB, IXC, X	-	Hungarian National Museum (Budapest) Inv. No 1903.11, 1903.13.	Hampel 1903, Abb. 427, 430. 3-6; Mozsolics 1967, 151-152; Stahl 2006, 227.
21	Kötegyán-Sarkadi út (Gyepespart)	hoard	MBA 2-3 Gyulavarsánd c.	cca. 1800-1500/1450 BC	11	Group IB, II, III, IV, VIIC	Horváth *et al.* 2017	Hungarian National Museum (Budapest) Inv. No 1965.32.11.	Kovács 1968, 210, Abb. 2.9; Mozsolics 1967:145-146; Sprincz and Beck 1981, 480, 483, Table 2; Stahl 2006, 109; Horváth 2017, Fig. 13, A.
22	Megyaszó	Grave Nos 95 and 121	MBA 2-3 Füzesabony B-C, Füzesabony c.	cca. 1800-1500/1450 BC	7	Group IB, VIIB	Horváth 2017, and this study	Hungarian National Museum (Budapest) Inv. No 1952.1.152, 188.	Bóna 1975, 148, 160, Taf. 189.9; Schalk 1992, 139, note 322; Schalk 1994; Horváth 2017, Fig. 13, E

No.	Site	Context	Relative chronology	Absolute chronology[1]	Number of amber finds	Type and Size of amber finds (Fig. 6)[2]	Analysis	Place of deposit; Inv. No[3]	References
23	Mende-Leányvár	settlement	MBA 3 Koszider phase, Vatya c.	cca. 1600-1500/1450 BC	1	Group VIII	-	Hungarian National Museum (Budapest)	Kovács 1975; Sprincz and Beck 1981, 481, Fig. 4.17, Fig. 7, Tab. 2; Horváth 1999, Table 1; Stahl 2006, 227.
24	Nagycenk-Lapos-rét	Grave No. 61 inhumation burial of a male, aged 48-54	MBA 1-2, Gáta-Wieselburg c.	1894-1697 cal BC		probably Group VI D=18 mm	this study	Museum of Sopron Inv. No 2006.1.61.3	Gömöri *et al.* 2018, 24, Fig. 14.61/3
25	Ópályi-Tangazdaság	Grave inhumation burial of a male with vessels, necklace (bronze spirals and amber beads), axe and dagger	MBA 3, Koszider phase, Füzesabony c.	cca. 1600-1500/1450 BC	n.d.	n.d.	-	Jósa András Museum (Nyíregyháza)	Németh 1966, 85-88, Abb. 1.1, 2. 5a-b; Mozsolics 1973, 165; Sprincz and Beck 1981, Fig. 8; Horváth 1999
26	Polgár-Kenderföld-Majoroshalom	Grave No. 301 inhumation burial of a senilis woman	MBA 3, Koszider phase, Füzesabony c.	cca. 1600-1500/1450 BC	3	Group II-VII?	-	Déri Museum (Debrecen)	Dani *et al.* 2004, 95, Abb. 14. 1.
27	Sóskút-Baratház (26/4)	settlement from mixed mass finds	MBA 1-3, Vatya I-III, Koszider phase, Vatya c.	site dated between 1900-1600 cal BC	1	fragment	-	Ferenczy Museum Centre (Gödöllő)	Earle *et al.* 2012; Kulcsár *et al.* 2022

28	Szakony-Kavicsbánya	Grave Nos 2 and 6 inhumation burial No. 2 belongs to a 22-25 year-old female; burial No. 6 and 7 was a consecutive burial of a female (Individual I) aged 45-60 and an unidentified Individual II aged 8-30, with only a couple of bone fragments and an amber bead	MBA 1-2 Gáta-Wieselburg c.	1924-1743 cal BC (one radicarbon date from Grave No. 1)	2	Grave No. 2: probably Group VI, D=10 mm Grave No. 6: probably Group I or VII, D=10 mm	-	Museum of Sopron Inv. No 60.66.2, 60.70.1.	Ilon 1996, 25, Fig. 5, Table 4, Table 5; Melis 2019, Fig. 5, Fig. 9, 3.
29	Százhalom-batta-Földvár	settlement several layers	EBA 3-MBA 1-2 Nagyrév and Vatya c.	cca. 2100/2000-1700 BC	3	n.d.	Horváth 1999	Matrica Museum (Százhalombatta)	Horváth 1999; Vicze 2002, 137
30	Sziget-szentmiklós-Felső Ürgehegyi-dűlő	Grave Nos 84, 162, 176, 532, 539, 609	EBA 2 Bell Beaker c.	Grave 539: 2560-2470 cal BC, Grave 176: 2340-2210 BC	9	Group I, IB, and discoid beads without perforation, and unique lozenge-shaped beads	this study	Ferenczy Museum Centre (Gödöllő) Inv. No. 2009.11.84.4. 2009.11.162.23. 2009.11.176.2-3. 2009.11.532.1-3. 2009.11.539.9. 2009.11.609.4.	Patay 2013

No.	Site	Context	Relative chronology	Absolute chronology[1]	Number of amber finds	Type and Size of amber finds (Fig. 6)[2]	Analysis	Place of deposit; Inv. No[3]	References
31	Szőreg-C	Grave Nos 2 and 114 , 181, 211 inhumation burial Nos 2 and 114 are adultus woman	EBA 3-MBA 1-2 Maros/Mureş c., Szőreg phase 2-3	early phase dated between 2100-1800 cal BC the whole site dated between 2100-1700 cal BC based on 16 dates in Allentoft *et al.* 2015; O'Shea *et al.* 2019	10	Group IB, III, IV, VIIB D=15, 13.8, 11 mm	Beck and Sprincz 1981, 207, Table 1	Móra Ferenc Museum (Szeged) Inv. No 53.115.599 (1), 599(2), 581, 625.	Bóna 1975, Taf. 94-127, Taf. 128. 5-10, Taf. 129. 1-3, 5-7, Taf. 130. 1, 3, 5; Sprincz and Beck 1981, 476, Fig. 2. 8; Fig. 3. 9, 13; Fig. 4. 1, 5, 7; Fischl 2000, 80; Allentoft *et al.* 2015; O'Shea *et al.* 2019, Fig. 2.
32	Takácsi-Református-erdő-dűlő	hoard	MBA 1-2, Transdanubian Encrusted Pottery c.	cca. 2000/1900-1700 BC	17	n.d.	-	Esterházy Károly Museum (Pápa)	https://papa-ma.papaesvideke.hu
33	Tatabánya-Bánhida (Dinnyeföldek)	Grave No. 18	MBA 1-2 Transdanubian Encrusted Pottery c.	cca. 2000/1900-1700 BC	2	n.d.	-	Kuny Domokos Museum (Tatabánya)	Cseh 1996, 28; Cseh 1999, 32, Pl. 1. 1, Pl. 2. 1, Pl. 5. 5; Kiss 2012b, 183, 260
34	Tiszapalkonya-Erőmű	Grave No. 7 or 8	MBA 3, Koszider phase, Füzesabony c.	cca. 1600-1500/1450 BC	2	Group IX or X?	-	Herman Ottó Museum (Miskolc) Inv. No. 60.4.1-41.	Kovács 1979, 60-62, Abb. 4. 5; Horváth 1999
35	Tiszakeszi-Szódadomb	hoard	MBA 3, Koszider phase, Füzesabony c	cca. 1600-1500/1450 BC	3	Group IB, II, III D=15-20 mm	this study	Herman Ottó Museum (Miskolc) Inv. No 53.432.2-4.	Bóna 1957, 214, 216, 233, Taf. 4; Mozsolics 1967, 87, 170; Sprincz and Beck 1981; Fischl 2014

36	Újhartyán-Vatya	cemetery (no grave number known)	MBA 2-3, Vatya II-III.,Vatya c.	cca. 1800/1700-1500/1450 BC	6	n.d.	-	Katona József Museum (Kecskemét)	Bóna 1975 Taf. 33, 12-13; Sprincz and Beck 1981, 476, Fig. 7-8; Horváth 1999, Table 1
37	Veszprém-Rákóczi tér	Grave Nos II and XII (creamation burials)	MBA 2-3, Transdanubian Encrusted Pottery c.	cca. 1800-1500/1450 BC	2	Group II or III?	-	Laczkó Dezső Museum (Veszprém) Inv. No 53.5.111.	Éri *et al.* 1969, 243, Site 51/40; Kiss 2012b , 183, Pl. 50.9.
EBA-MBA					**486 pieces**				
Late Bronze Age finds in Hungary									
38	Battonya-Vadaszán tanya	Grave No 1 (inhumation burial)	LBA 1, Tumulus c.	cca. 1500-1400/1300 BC	1	Group IXA D= 20 mm	-	Munkácsy Mihály Museum (Békéscsaba)	Sprincz and Beck 1981, 476, Fig. 5.48; Kállay 1983, 45-47, Fig. 5. 12; Horváth 1999, Table 1; Stahl 2006, 108
39	Budapest-Békásmegyer	Grave No 51 (cremation burial)	LBA Urnfield c.	cca. 1200-1000 BC	1	a large amber disc, Group 1B? D=cca. 20 mm	-	Budapest Historical Museum Inv. No 64.46.192.	Kalicz-Schreiber *et al*. 2010, Abb. 84, Taf. 28. 4
40	Detek	Grave No 6 (cremation)	LBA 1 Piliny c.	cca. 1500-1400/1300 BC	3	Group I A, D=7 mm Group X, D=7 mm and 9 mm	this study	Herman Ottó Museum (Miskolc) Inv. No 63.12. 1-3.	Kemenczei 1968, 170, 174, Fig. 6. 25, Fig. 9-11; Sprincz and Beck 1981, 477-478, Fig. 8, Table 2; Horváth 1999; Stahl 2006, 108
41	Fertőszent-miklós-Ikvapart	Grave No. S340 (inhumation burial)	LBA 1 Tumulus c.	cca. 1500-1400/1300 BC	5	more types, before restoration Group VI, V, III?	-	Rómer Flóris Art and Historical Museum (Győr)	Savanyú 2020; B. Savanyú pers. comm.

No.	Site	Context	Relative chronology	Absolute chronology[1]	Number of amber finds	Type and Size of amber finds (Fig. 6)[2]	Analysis	Place of deposit; Inv. No[3]	References
42	Jánoshida-Berek	Graves Nos 113, 134, 140, 273	LBA 1 Tumulus c.	Grave No. 113: 1500-1406cal BC, Grave No. 140: 1499-1326 cal BC	74	probably Group IA, D=5-8 mm; Group IB, V, VI, D=13-22 mm; a big semi-spherical disc: new type: Group XII, D=54 mm; a triangular, new type: Group XI, L=28 mm, W=21 mm	this study	Damjanich János Museum (Szolnok) Grave No. 113: Inv. No 80.2.48-51, Grave No. 140: Inv. No 81.2.76.	Csányi 1980; Sprincz and Beck 1981, Fig. 8; Horváth 1999, Table 1 (mentions 71 beads); Csányi 2013; 2017, Fig. 5, Fig. 10; Csányi 2019, 50-51.
43	Jobbágyi-Hosszú-dűlő 3. Tenk	Grave No. 158 (Str. No 187) (cremation burial)	LBA 1 Tumulus c.	cca. 1500-1400/1300 BC	1	Group IB D=18.6 mm	-	Dornyay Béla Museum (Salgótarján)	Fülöp and Váczi 2014; Fülöp and Váczi 2016
44	Kurd	hoard	LBA Urnfield c.	cca. 1200-1000 BC	131	Group IA (9 pieces), IB (1),VIIA (4), IXA (S: 7), IXB (76), IXC (27), IXD (4), IXE 2), X (1)	-	Wosinsky Mór County Museum (Szekszárd) Hungarian National Museum Inv. No B25.1933.1-65, 22.18951-278.	Müller 1972 mentions 226 amber beads; Mozsolics 1985, Taf. 26. 3-4; Sprincz and Beck 1981, Fig. 5, Fig, 8, Table 2.
45	Nyírkarász-Gyulaháza	burial mound, excavated in 1901	LBA Felsőszőcs/Suciu de Sus c.	cca. 1500-1400/1300 BC	n.d.	n.d.	-	Jósa András Museum (Nyíregyháza)	Mozsolics 1973, Taf. 67.
46	Regöly-Kesziállás	hoard with bronze, gold and amber finds	LBA Urnfield c. (Ha A1)	cca. 1200-1000 BC	172	Group IA (4 pieces), VIIA (1),VIIB (1), VIIC (3), VIII (1), IXA (S: 7, L: 1), IXB (S: 73, M: 12, L: 1), IXC (S: 38, M: 6), IXD (S: 1, M: 1), IXE (9), (1)	-	Wosinsky Mór County Museum (Szekszárd)	Mészáros 1977, 71, VII. t.; Sprincz and Beck 1981, Fig. 5, Fig, 8, Table 2; Stahl 2006, 110.

47	Sükösd-Árpás-dűlő V.	Grave No.1, inhumation burial of a female aged 20-25;	LBA 1 Tumulus c.	1540-1430 cal BC (95.4%) (Pásztor *et al.* 2022)	6	Group IB, V, D=12 mm new type: Group XI, L=28 mm new type: Group XII, D=35-37 mm	this study	Türr István Museum (Baja) Inv. No 2021.1.42, 45, 97, 150.	Pásztor *et al*. 2022.
48	Szécsény-Benczúrfalva-Majorhegy	Hoard no. 2	LBA Late Piliny-early Kyjatice c. (RBD-Ha A1)	*cca.* 1350-1100 BC	770	Group IA, IB, II, III, IV, V, VI, VIIA, VIIB, VIIC, IXA, IXB, IXC, IXD, IXE D=3 mm-31 mm	-	Hungarian National Museum Forgách-Lipthay Castle Museum (Szécsény) uninv.	Guba and Tankó 2023
49	Szilvásvárad-Kelemen-széke	hoard with bronze ornaments, 2 big amber beads	LBA Kyjatice c.	cca. 1200-1000 BCE	2	Group IXE new type: Group XII; D=?	-	Dobó István Castle Museum (Eger)	V. Szabó 2019, Fig. 168.
50	Szurdokpüspöki-Hosszú-dűlő	Grave No 1 Inf. II child inhumation burial	LBA 1 Tumulus c.	1600-1420 cal BC	6	Group IA, IB, D= 6-8 mm; Group variant of X?, D=24 mm	this study	Hungarian National Museum Forgách-Lipthay Castle Museum (Szécsény) Inv. No 2008.4.3.15, 16.	Guba and Bácsmegi 2009, Taf. 2. 4-5.
51	Tápé-Széntéglaégető C	Grave Nos 184, 215, 412, 666	LBA Tumulus c.	cca. 1500-1200 BC	6	W=17 mm, amber cube, Size: 16×15×15 mm, We=0.8 g (Group V, and one unique cubic ornament	Beck and Sprincz 1981	Móra Ferenc Musem (Szeged) Inv. No 65.1.209, 249	Trogmayer 1975, 46, 52-53, 92, 141, Taf. 16. 2, Taf. 19.7; Taf. 217,7; Sprincz and Beck 1981, Table 2: 184. 2; Csányi 2017, 210; O'Shea *et al.* 2019.

No.	Site	Context	Relative chronology	Absolute chronology[1]	Number of amber finds	Type and Size of amber finds (Fig. 6)[2]	Analysis	Place of deposit; Inv. No[3]	References
52	Tiszafüred-Majoros-halom	Grave No. 342 D 342 inhumation burial belongs to a 22-25 year-old female	LBA 1 Tumulus c.	site dated between 1530-1270 cal BC (Dani *et al.* forthcoming)	1	amber nugget L= 35 mm	-	Hungarian National Museum (Budapest)	Kovács 1975a, 35-36, 55, Fig. 25a-b, Pl. 31.17; Sprincz and Beck 1981, Fig. 5.45, Table 2; Hajdu 2012, 2. táblázat; Csányi 2017, 210; Dani *et al.* forthcoming
53	Zalaszent-mihály-Pötréte	hoard hoard found in 1967 during peat-bog mining: 250 amber beads and 247 bronze artifacts, textile remains: ceremonial dress (pontificals)	LBA Urnfield c. (Reinecke BD-Ha A1)	cca. 1200-1000 BC	250	Group IA (67 pieces), IB (1),VIIA (10), VIIC (4), IXA (S: 10, M: 6, L: 1), IXB (S=81, M= 42, L=2), IXC (S=13, M= 6), IXD (1), IXE (2), X (1); largest: 43×37×19 mm, W=3 mm, D=4 mm	-	Göcseji Museum (Zalaegerszeg) Inv. No 69.11.1.	Müller 1972, Fig. 5; Sprincz and Beck 1981, Fig. 5, Fig. 8, Table 2; V. Szabó 2019, 32, Fig. 18.
LBA					**1429 pieces**				

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