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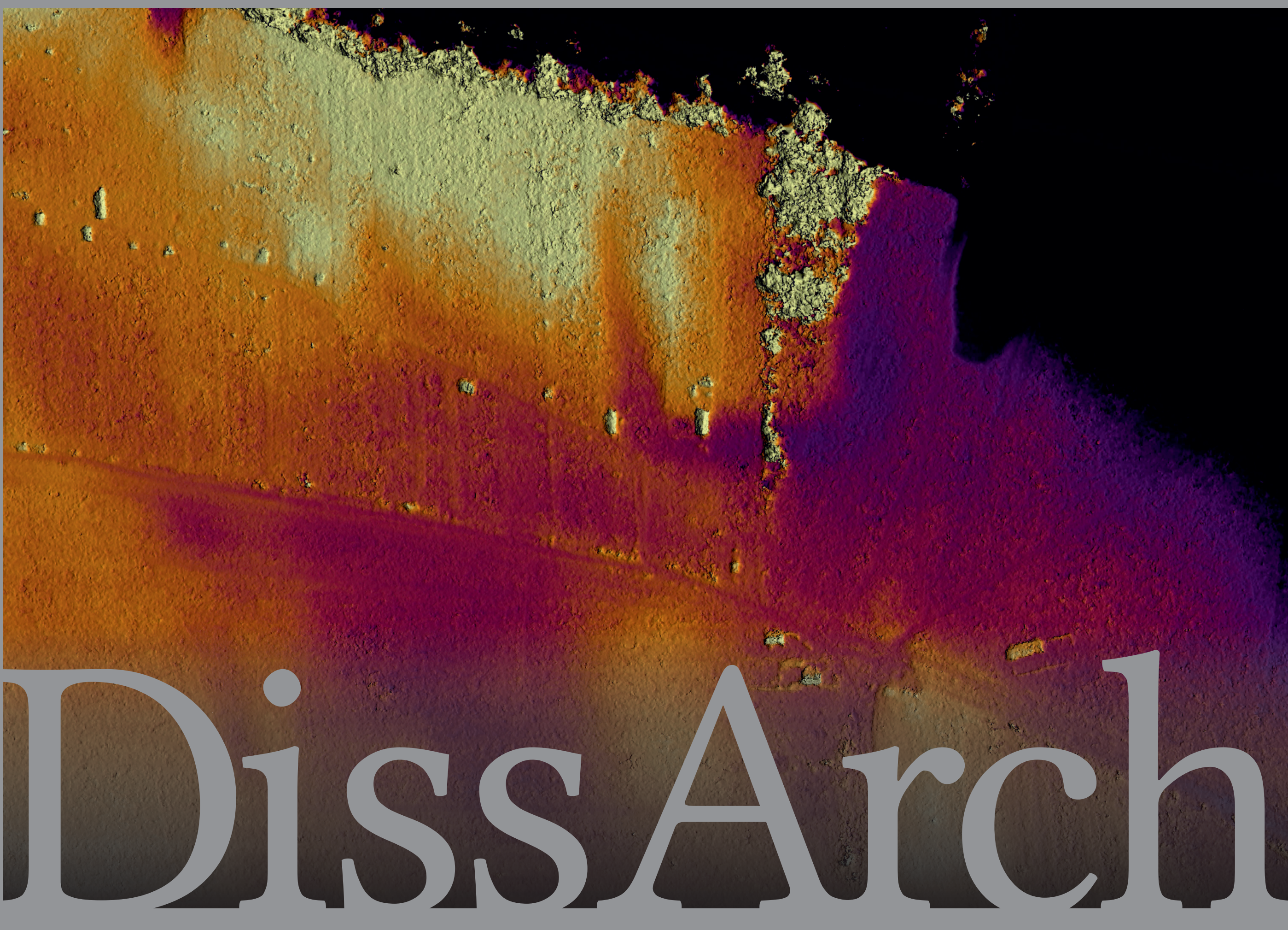


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# New archaeobotanical finds from the Baradla Cave

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**Abstract:** The Baradla Cave is located in the Aggtelek Karst Region in Northern Hungary; it is one of the oldest known prehistoric sites in the country. The first excavations there in 1876–1877 are considered a milestone in Hungarian archaeology, and the research involved the first archaeobotanical analyses in Hungary. Although the cave was used in many periods with varied intensity, the vast majority of the artefacts are dated to the Middle Neolithic, while the Late Bronze Age represents a smaller but still significant portion of the archaeological record. The latest rescue excavation was carried out in 2019 in the *Róka-ág* [Róka branch] of the cave by a team from the Institute of Archaeological Sciences of the Eötvös Loránd University. This paper presents the preliminary results obtained from the archaeobotanical analyses of the macro-remains recovered from the soil samples collected during this excavation. The charred remains were badly preserved, but it was possible to identify, among other seeds, emmer, barley, pea, and lentil. The uncertain dating of the samples further complicated the interpretation of the archaeobotanical finds.

**Keywords:** archaeobotany, Neolithic, Bronze Age, cave

## Introduction

With more than 150 years of research, the Baradla Cave is one of the longest-studied archaeological sites in Hungary. Despite this, the unearthed archaeological features have remained difficult to interpret due to incomplete documentation and unfavourable conditions (e.g., thin and mixed cultural layers, disturbance).

The 2019 rescue excavation carried out in the *Róka-ág* by a team from the Institute of Archaeological Sciences of the Eötvös Loránd University[1] provided an excellent opportunity to clarify some unresolved questions, including the ones regarding agriculture. Unfortunately, the 22 archaeobotanical samples (115 litres of soil samples in total) yielded a low amount of macro-botanical remains, and, in most cases, assigning them to a particular historical period was impossible. Although these two factors made the evaluation of the findings very difficult, the results may still be worth publishing to help future research. This paper presents these results and the attempts to find ways to interpret them.

The Baradla Cave is situated in the territory of the Aggtelek Karst Region in north-eastern Hungary. The cave's entrance is at the foot of a giant cliff near the village of Aggtelek. The cave was visited and used in numerous archaeological periods, the two most important being the Middle

1 Nyírő et al. 2022.

Neolithic and the Late Bronze Age. Most known finds could be dated to the Middle Neolithic. The scatter of the Neolithic finds covers a larger area in the cave than that of Late Bronze Age findings.[2] József Korek excavated[3] a Middle Neolithic settlement and burials outside the cave near the entrance; however, the cave itself and its Neolithic archaeological record should not be interpreted as a regular settlement but as a ritual space. The large amount of pottery does not imply that food was stored inside the cave, as the climate there was unsuitable for storing food for a longer time. The function of the stake holes found in great numbers in the cave should also be considered in a ritual context (e.g., a platform for offerings) as opposed to 'profane' housing. This is also true in the case of the numerous fireplaces that are sometimes closely associated with fine pottery and the bones of younger people. It is clear that the Baradla Cave was a venue for complex rituals in the Middle Neolithic, but the precise nature of these rituals is unknown.[4]

The Late Bronze Age use of the cave differed from the Middle Neolithic in many respects but should still be considered ritual. Compared to the Neolithic record of the cave, the number of Late Bronze Age finds is lower, mainly concentrated closer to the entrance. Two types of phenomena from this period of the cave are worth emphasising: burials and depositions. The burials excavated by Jenő Nyáry in 1876 in the *Pitvar* [Courtyard] and *Temetkezési-folyosó* [Passage of Burials] followed the same rite. They were all inhumation graves in shallow pits, although cremation was way more widespread in this period and region. Pottery, stone tools, bone tools, and charred seeds were placed next to the remains as grave goods or offerings. It is also possible that the graves were occasionally revisited to perform complicated rites. There is no evidence of a connection between the graves and the depot finds. In 1929, Ferenc Tompa found a bronze depot in the *Csontház-terem* [Ossary Room], while later, István Csalog discovered a gold treasure in the same chamber. These depot finds are generally considered to be sacrifices or offerings.[5]

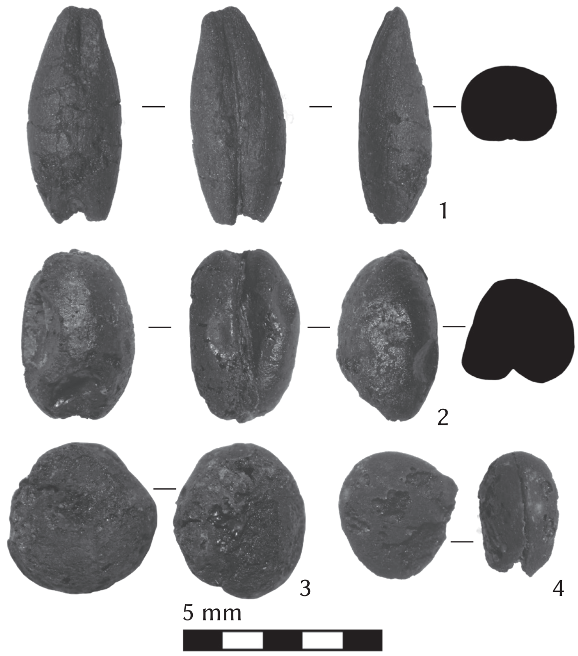


**Fig. 1.** Images of selected seeds from the Baradla Cave. 1 – barley, 2 – free-threshing wheat, 3 – pea, 4 – lentil

## Research history

As the cave is the birthplace of Hungarian archaeobotany, it seems appropriate to start this overview with a paper summarising its archaeobotanical research history. Jenő Nyáry carried out the first three archaeological excavations in Baradla Cave in 1876–1877. The finds were processed by numerous researchers, including Imre Deininger, who performed the first archaeobotanical research in Hungary on some charred seeds found in the cave. Jenő Nyáry presented the results (including

2 Holl 2007, 279–280.

3 Korek 1970.

4 Rezi Kató 2020, 44–49.

5 Rezi Kató 2020, 49–55.

archaeobotanical ones) at the 8th International Congress of Anthropology and Prehistoric Archaeology[6] held in Budapest in 1876 and later published a summary of the multidisciplinary research in an exceptional monograph in 1881.[7] In 1882, Lajos Kossuth wrote a paper about the work of Nyáry, in which he also discussed the plant remains.[8]

During the first excavation by Jenő Nyáry in 1876, piles of carbonised seeds were found next to the thirteen human skeletons unearthed in the *Csontház-terem* and the *Folyosó* [Passage]. The relationship between the seeds and the human remains cannot be determined anymore. A small amount of seeds was sent to Rudolf Virchow[9], who gave them to Paul Ascherson and Ludewig Wittmack for identification. Jenő Nyáry gave the rest of the seeds to Imre Deininger, who managed to identify ten cultivars and fourteen weed species. Most cereal grains were common wheat, followed by millet and naked barley. Legumes were mainly represented by grass peas, but also Celtic beans, lentils, and peas. Some of the seeds were subjected to chemical analysis by Tamás Kosutány. A 'fist-sized' bread fragment was also found alongside the seeds. The surface of the bread was densely covered with camelina seeds. Deininger also identified some millet bread pieces.[10] In 1967, Mebus A. Geyh radiocarbon dated some of these millet seeds to 2560±75 BP.[11]

During the third excavation season in 1876, Jenő Nyáry found carbonised wheat, millet grains, and pea seeds inside four niches in the *Denevér-ág* [Denevér Branch]; the botanical finds of this campaign were not identified by Imre Deininger.[12]

According to P. Hartányi and her colleagues, a collection of botanical finds (emmer and millet grains and pea and vetchling seeds) was presumably recovered during an excavation led by Ottokár Kadić in the 1930s, although the exact archaeological context is unknown.[13]

In 1940, Pál Greguss identified charcoals from the Baradla Cave, providing only an indistinct description of the find context in his paper. The charcoals were presented to him by Hubert Kessler, who found them with Neolithic pottery in the *Paradicsom* (*Oszlopok-csarnoka*) [Paradise, also known as Room of Columns], *Denevér-ág*, and *Nagytemplom* (*Fekete-terem*) [Large Temple or Black Room]. Kessler also sent a smutty pottery sherd to Greguss, which was most likely recovered during the excavation by Mária Mottl[14] in 1940. Greguss could not find any plant remains on the sherd but managed to identify the charcoal as *Quercus petraea*, *Quercus pubescens,* and *Carpinus betulus.*[15]

In 1959, Erzsébet Patek and László Jakucs found pottery sherds, one containing cereals, near a place called *Szultán pamlaga* [Sultan's Divan] in the *Kupola-terem* [Domed Room]. Patek dated the sherds to the Early Iron Age, while the cereal grains were later identified as barley.[16] As this area is situated 2 km (around 1 hour of walking) away from the entrance of the cave, these sherds do not fit into the scatter of other finds because mostly the areas close to the entrance were used in prehistory. Also, nowadays, no finds or other archaeological phenomena can be found in *Szultán*

6 Nyáry 1877.
7 Nyári 1881; Rezi Kató 2014, 328–329.
8 Kossuth 1882, 170–173.
9 Virchow 1877.
10 Nyáry 1881, 53–64.
11 P. Hartyányi et al. 1968, 32.
12 Nyáry 1881, 163; P. Hartyányi et al. 1968, 31–33.
13 P. Hartyányi et al. 1968, 33.
14 Holl 2007, 269.
15 Greguss 1940.
16 P. Hartyányi et al. 1968, 33; Gyulai 2010, Fig. 208.

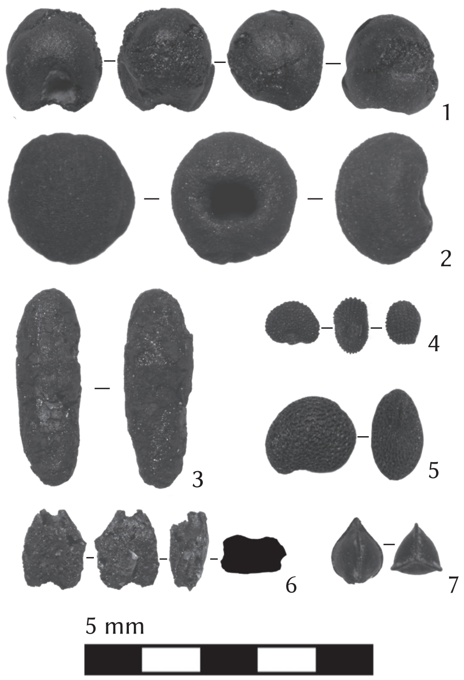


**Fig. 2.** Images of selected seeds from the Baradla Cave. 1 – millet, 2 – blue woodruff, 3 – *Coronilla*, 4 – ragged-robin, 5 – black nightshade, 6 – green/bristly foxtail / cockspur grass, 7 – curly dock / red sorrel

*pamlaga*, leaving the authenticity of the discovery rather questionable.[17]

There are several mentions of the charcoals found in the cave by László Vértes (in 1953[18] and 1959[19]).

In 1976, paleontologist László Kordos conducted excavations in the *Csontház-terem*, the *Denevér-ág*, and the *Róka-ág*. The work focused on stratigraphy, as Kordos planned to use the archaeological material to date the changes in the small vertebrate fauna. He managed to separate two Neolithic and two mixed Neolithic–Bronze Age layers. All the excavated soil (650 kg) has been transported to the surface and washed. The archaeobotanical material was given to István Skoflek for identification, but the results were not published.[20]

## Materials

In 2019, a team from the Institute of Archaeological Sciences of the Eötvös Loránd University carried out a rescue excavation in the Baradla Cave in the path of a planned walkway reconstruction; the work was completed by a metal detector survey in a larger area of the cave.[21] The rescue excavation covered three different areas in the cave. Using a mixture of judgmental and systematic sampling strategies, more than 115 litres of soil were recovered during the excavation (Tab. 1).

The closest excavation area to the entrance of the cave was in the *Teknősbéka-terem* [Turtle Room]. Here, a 16 by 1 m trench was opened, which yielded mainly Middle Neolithic and Late Bronze Age potsherds and animal bones. A few cm-thick cultural layer was found in the lower areas of the trench, from which two samples were collected.

From the *Teknősbéka-terem*, the excavation continued in the *Folyosó* to the *Róka-ág*. A 30 by 1.2 m trench was opened after the concrete walkway had been removed from the top of the cultural layer. The cultural layer was thicker in the passage (2–15 cm), but it was impossible to distinguish between the Neolithic and Bronze Age layers there. The find material comprised pottery sherds, animal bones, as well as polished stone and socketed bronze axes. The density of the finds gradually decreased inwards the passage. A fireplace and 200 stake holes were also discovered in the passage. Six soil samples were taken from this area.

The largest excavation area was in the *Biológiai labor* [Biological Laboratory], where the cave floor had been levelled during the construction of the walkway and the archaeological cultural layers

17 Holl 2007, 269, 277.

18 Hungarian National Museum, Archaeological Documentation Collection: 52.A.I

19 Hungarian National Museum, Archaeological Documentation Collection: 863-05-5-1959.R

20 Hungarian National Museum, Archaeological Documentation Collection: III.15/1977; Ha 97.VII.73; XIV.153/1976

21 Nyírő et al. 2022; The Neolithic artefacts of the excavation were discussed by Gizella Kovács in the next issue.

**Tab. 1.** List of archaeobotanical samples from the Baradla Cave

| Sample Number | Location | Notes | Sample Volume (l) |
|---|---|---|---|
| 1 | *Teknősbéka-terem* | 0–1 m | 1 |
| 2 | *Teknősbéka-terem* | 8–9 m | 6 |
| 3 | *Folyosó* | 26–27 m | 3.5 |
| 4 | *Folyosó* | 26–27 m; from underneath a jar | 3 |
| 5 | *Folyosó* | 27–28 m | 6 |
| 6 | *Folyosó* | 29–30 m | 7 |
| 7 | *Folyosó* | 29–30 m | 6 |
| 8 | *Folyosó* | – | 2.5 |
| 9 | *Biológiai labor* | 3–4 m, eastern part | 20 |
| 10 | *Biológiai labor* | 6–7 m | 4 |
| 11 | *Biológiai labor* | 6–7 m | 5.2 |
| 12 | *Biológiai labor* | 6–7 m, eastern part | 4 |
| 13 | *Biológiai labor* | 8–9 m | 6 |
| 14 | *Biológiai labor* | 8–9 m | 4.5 |
| 15 | *Biológiai labor* | 8–9 m | 7 |
| 16 | *Biológiai labor* | 11.5–13 m | 7 |
| 17 | *Biológiai labor* | From under the travertine | 3 |
| 18 | *Biológiai labor* | From under the travertine | 4 |
| 19 | *Biológiai labor* | From under the travertine | 3 |
| 20 | *Denevér-ág, Bejárati terem* | – | 5.5 |
| 21 | *Denevér-ág, Bejárati terem* | – | 6.5 |
| 22 | *Csontház-terem* | From above the depot find | 0.5 |

were shovelled into the bed of the cave's stream. This fill was removed during the excavation, and the original travertine surface of the stream bed was cleaned, revealing a preserved Neolithic layer under a travertine layer. It contained only Middle Neolithic finds, as the travertine 'shell' prevented it from becoming mixed with the relics of other periods, thus making it the only layer that could be accurately dated. It contained a large quantity of pottery sherds, two stone axes, and a flint blade.

A Neolithic layer was observed in the eastern and southern parts of the *Biológiai labor*, yielding large amounts of Middle Neolithic pottery and some obsidian blades and splinters in patches. The layer also remained intact under the former brick building of the dark room. More than 400 stake holes were found in the *Biológiai labor*. Some of them could definitively be dated to the Middle Neolithic, together with the overwhelming majority of the finds recovered from there. On the other hand, only a few Bronze Age finds provided evidence of the later use of this room. Eleven samples were taken from the *Biológiai labor*, including three from under the travertine layer.

The metal detector survey discovered a Middle Bronze Age depot in the *Csontház-terem*. It comprised 59 bronze items (pendants, discs, and ingots). The pendants and discs were most likely sewn on a fabric that had been folded before deposition. The objects were put into a pit and covered by stone slabs. One archaeobotanical sample was taken from above the depot find.

In the *Bejárati terem* [Entrance Room] of the *Denevér-ág*, the rocks accumulated in a slope by erosion were removed in an area of over 1 $m^2$. Two more samples were collected from the thick soil layer under the rock rubble.

## Methods

The volume of the soil samples was measured first, and then, machine-assisted flotation was used to extract the botanical finds. The released and overflowing flot fraction was caught by a 400 μm-mesh sieve. A 2 mm-mesh net was used to withhold the heavy residue. The conditions and observations made during flotation were also recorded.

The heavy fraction was sorted using a magnifying glass; charcoal pieces, charred seeds and other archaeological finds were picked out. The volume and the proportion of the flot fraction were measured. Then the flot fraction was sorted under a binocular stereomicroscope. Bone fragments, modern seeds, and small inorganic finds were separated. Charcoals larger than 2 mm were picked, counted, and measured for volume and weight separately.

The criteria system developed by Stefanie Jacomet[22] was used to identify cereal grains and chaff types. Other seeds and fruits were classified using various seed atlases and handbooks.[23] The results were also cross-checked with a recent seed and fruit collection.

The Minimum Number of Individuals (MNI) was calculated from the number of identified fragments for further statistical analyses. The identification of the individual botanical finds was also documented in photos.

## Results

It was possible to identify 2,210 seed or fruit remains in total, most of which were cereals (Tab. 2). In comparison, legumes, weeds, and wild plants appeared only in small numbers. It should be noted that the overall archaeobotanical results of the Baradla Cave were mainly influenced by a single sample rich in grains taken from above the hoard, which may distort the proportions and cause the overrepresentation of certain species. The numbers of the sample taken from above the depot find (No. 22) extracted leaves only 287 fruit and seed remains in the remaining 21 samples, which is considered a low quantity. In this case, too, most archaeobotanical finds were cereals (163 pieces).

However, most cereal remains were unsuitable for more precise identification and classified as wheat or barley (*Triticum/Hordeum spec.*). Among the cereal grains that could be better defined, millet (*Panicum miliaceum L.*) was the most prevalent. Of course, the predominance of millet would be much more striking with the 1,950 millet grains from the sample above the depot find included in the count. Millet has been cultivated in Hungary since the 15th century BC, and it became the most important cereal in the Late Bronze Age.[24] Its popularity was largely due to its short vegetation period, which enabled more complex and diverse farming systems to emerge.[25] After millet, barley

22 Jacomet 2006.

23 Brecher 1960; Schermann 1967; Bojnanský – Fargašová 2007; Beijerinck 1947; Berggren 1981; Anderberg 1994; Nesbitt 2008; Barkley – Martin 1961; Cappers et al. 2012.

24 Filatova 2022, 39–40.

25 Kneisel et al. 2015, 275–277.

(*Hordeum vulgare L.*) was the second most common identified cereal (25 pieces). Most barley grains could be classified as hulled barley, and only one seed bore the characteristics of naked barley. In the case of four grains, it was impossible to tell whether they belonged to hulled or naked barley. Barley was one of the founder crops, the group of cereals and pulses first domesticated in the Fertile Crescent. It was cultivated in Europe since the Early Neolithic, but unlike einkorn and emmer, it remained prominent even during the Bronze Age.[26]

Different wheat species were also found in small quantities. Of these, free-threshing wheat was the most abundant (*Triticum aestivum L. subsp vulgare (Vill.) Mackey/T. turgidum cv. durum (Desf.) Mackey*) (7 pieces). Free-threshing wheat species were cultivated in both the Neolithic and the Bronze Age but only became prominent in later periods. It was impossible to tell whether these grains were durum or common wheat. Three grains could only be identified as wheat (*Triticum spec.*). Grains of einkorn (*cf. Triticum monococcum L.*), emmer (*cf. Triticum turgidum L.subsp. dicoccum (Scrank) Thell.*), and spelt wheat (*Triticum aestivum L. subsp. spelta (L.) Thell.*) were only identified (one grain of each) with some uncertainty. All three are hulled wheats. Einkorn and emmer are also founder crops. Both were among the most important cereals in the Pannonian Basin between the Early Neolithic and the Bronze Age, when other cereals replaced them. Spelt was only developed later in Transcaucasia and first appeared in Europe during the 5th millennium BC. The cultivation of spelt became significant during the Late Bronze Age.[27]

Fewer pulses were identified than cereals (44 pieces). Over half could be classified as lentil (*Lens culinaris Medic.*) (26 pieces). Pea (*Pisum sativum L.*) was represented by eight seeds. Both pulses are founder crops cultivated in the Pannonian Basin since the Early Neolithic.[28]

The only evidence of gathering plants was the presence of a single unidentified stone seed.

As for weeds, white goosefoot (*Chenopodium album agg.*) was the most numerous. It is a typical weed of arable fields rich in nutrients, but its seeds were also gathered as a cereal substitute in certain periods.[29] The second most common weed was black nightshade (*Solanum nigrum L.*). Several species of the *Poaceae* family, typical weeds of arable land, were also present.

## Discussion

The major obstacle in interpreting the archaeobotanical results is that most samples could not be linked with a particular historical period because they have been taken from homogeneous cultural layers where Middle Neolithic and Late Bronze Age finds were mixed. It can, therefore, be assumed that the samples are also of mixed composition, i.e., they evolved in multiple periods influenced by many unrelated factors. These samples are generally unsuitable for examining the agricultural pattern of a particular archaeological period as they reflect all factors that played a part in their formation.

The question is whether it is possible to separate these factors. In most cases, this would be complicated by the low representativity of the samples, but some logical conclusions can still be drawn. For example, millet was certainly deposited after the Neolithic; therefore, the presence of millet might indicate the level of post-Neolithic impacts. Of course, this approach also has its obvious limitations.

26 Zohary – Hopf 2000, 59–69.

27 Gyulai 2010, 67–127; Zohary – Hopf 2000, 33–58.

28 Zohary – Hopf 2000, 94–108.

29 Csapody et al. 1993, 172–174; Gyulai 2010, 104–105.

Another possible way of interpretation is to observe how the cumulative effects of all factors vary spatially and how they correlate with other archaeological finds. The different excavation areas were selected as units for such an analysis because they also corresponded to the natural topography of the cave. Samples from each area were combined to increase the representativity and, thus, relevance of the results.

Three groups could be distinguished based on the samples with a higher proportion of charcoal (Fig. 3). The samples from the *Biológiai labor* and the *Folyosó* contained the least charcoal (less than 0.4 g/l). The samples from the *Denevér-ág* and the *Teknősbéka-terem* had medium amounts of charcoal (0.8–1.2 g/l). The sample richest in charcoal was the one taken from above the depot find. The ratio of number to volume of charcoal fragments was used to describe the fragmentation of charcoal. The samples from the *Folyosó*, the *Denevér-ág*, the *Teknősbéka-terem* and the depot find were equally fragmented. Most samples from the *Biológai labor* were generally highly fragmented, but the samples taken from under the travertine layer (dated to the Neolithic) were almost twice as fragmented as the rest.

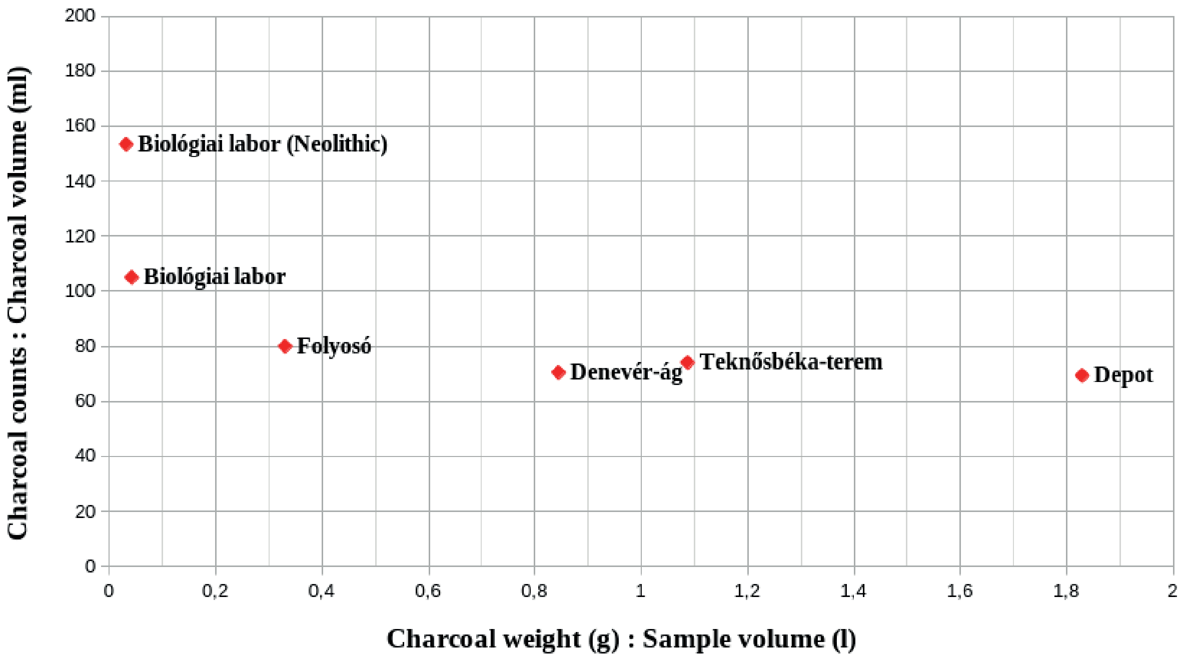


**Fig. 3.** Composition of samples by charcoal weight (g): sample volume (l) and charcoal counts: charcoal volume (ml) ratios

The two samples combined from *Teknősbéka-terem* were generally rich in plant remains compared to most samples from Baradla Cave. Most seeds found there were millet and wheat or barley. The high proportion of pulses (both lentils and peas), approximating the quantity of cereals, makes this location outstanding in the cave. On the other hand, the percentage of weeds is low.

Compared to the *Teknősbéka-terem*, the *Folyosó* had a lower seed density. This is not the only difference between the two places. The proportion of pulses is lower in the *Folyosó*, while that of weeds is higher. The cereal spectrum is also different. Millet is still present, but it seems to be less prominent. Instead, barley and wheat (particularly hulled barley and free-threshing wheat, among others) are more prevalent.

The lowest seed density was observed in the *Biológiai labor*. It was only possible here in the cave to collect samples (sample Nos 17–19) under the travertine layer that could certainly be dated to the Middle Neolithic. Therefore, these samples will be discussed separately from the rest taken in the *Biológiai labor*. As for the samples with uncertain dating, their composition differed significantly from those from the *Teknősbéka-terem* and the *Folyosó*. Weed seeds dominated the samples from the *Biológiai labor*, their number exceeding that of the cultivated plants. The cereal spectrum of these samples was comparable to the one from the *Folyosó*. Millet was negligible, as the sample only contained one possible millet seed. In contrast, most identified cereals were wheat or barley, mainly hulled barley. The proportion of pulses was also low.

Middle Neolithic samples contained a lower proportion of weed seeds than the other samples from the *Biológiai labor*, while their cereal spectrum was similar to them and those taken from the *Folyosó*. They were dominated by wheat and barley (mainly hulled barley and free-threshing wheat), while millet was completely absent. Pulses were present in a small proportion.

The two samples from the *Bejárati terem* at the *Denevér-ág* had a higher seed density than those from the *Teknősbéka-terem*. Although these samples contained fewer pulses (mainly lentils) than the ones from the *Teknősbéka-terem*, they had similarly low weed seed density and cereal spectrum. The most common cereal in the *Denevér-ág* samples was millet, followed by wheat or barley.

The most surprising result was obtained from the sample taken from above the hoard. The density of archaeobotanical finds in this sample was extraordinarily high: the collected soil sample was only 0.5 litre but contained 1,921 seeds. The composition of the sample is even more interesting as it contained almost exclusively millet. Samples that contain finely cleaned millet in such quantities are generally considered stocks. What makes the interpretation of the sample uncertain is its unclear relationship to the depot find. The archaeologists noted that the soil above the depot was rather mixed and, therefore, considered impossible to date precisely. While it is possible that the composition of the sample and the hoard were not the result of the same series of events and, therefore, the two phenomena are unrelated, one could easily argue that it is unlikely that these two peculiar and physically connected phenomena (a rich archaeobotanical sample and a bronze depot, both of which are rare in the Baradla Cave) were unrelated.

Based on the charcoal and seed proportions of the samples, they can be classified into three groups. The first group consists of the samples from the *Teknősbéka-terem* and the *Denevér-ág*. They have a medium proportion of moderately fragmented charcoal, while the proportion of seeds is generally above average. Most seeds are cereal grains (mainly millet, followed by wheat or barley). In both cases, the proportion of weeds is low. Although there are more pulses than the average in the *Denevér-ág*, even more were found in the *Teknősbéka-terem*. The second group consists of the samples from the *Biológiai labor* and the *Folyosó*. They are poorer in charcoal and seeds. The charcoals from the *Folyosó* are moderately, while the ones from the *Biológiai labor* are slightly more fragmented. The most fragmented charcoal came from under the travertine shell in the *Biológiai labor*. The cereals in these samples are mainly wheat or barley grains, millet being present only in small quantities. While the number of pulses is below average, the proportion of weeds is above average. As for weeds, the samples from above the travertine shell in the *Biológiai labor* stand out, with weeds making up almost half of all seeds. The third group consists of a single sample from above the depot with an average amount of moderately fragmented charcoal and a remarkable number of millet grains.

It is impossible to say exactly what caused the differences between the groups. Most differences can possibly be traced back to the dissimilarities in utilising cave space within a single period. It is also possible that the cumulative influences in different periods contributed to the sample formation to varying degrees from area to area. These two effects most likely worked together.

However, it is worth considering the samples from the second group (*Folyosó* and *Biológiai labor*). These samples are similar in many ways, including the low number of millets, which were not cultivated in the Neolithic. Based on their stratigraphical position, some of these samples could be dated to the Middle Neolithic, and some even come from an area dominated by Middle Neolithic finds (*Biológiai labor*). It is possible, but not yet proven, that the formation of these samples was influenced mainly by Middle Neolithic processes.

## Summary

Of the 22 samples, only the one taken from above the Bronze Age depot yielded larger amounts of archaeobotanical finds. It contained mainly millet, which became a flagship wheat during the Bronze Age. What was remarkable about the sample was seed density, which was unusually high compared to the other samples. This sample was only 0.5 litre but yielded 1,902 grains, while the other samples (115 litres in total) contained less than 300 seeds altogether. As the sample was taken from a mixed layer, it cannot be dated with certainty to the Bronze Age, and there is no evidence that the deposition of the hoard and the large amount of charred seeds were connected. On the other hand, the density of the sample raises questions about coincidence; these might be answered by future research.

The only samples that could be dated with certainty are those taken from under the travertine shell in the *Biológiai labor*, from a layer that formed during the Middle Neolithic. These samples were rather poor in archaeobotanical remains and provided little evidence of the Middle Neolithic plant use in the Baradla Cave.

The other samples were taken from mixed layers unsuitable for dating. The archaeobotanical record of the cave bears no sign of being the result of ritual activity. It was possible to detect some differences between the excavation areas based on the archaeobotanical properties of the samples; however, the origin of these differences is unknown, as the samples might have been formed either in a single archaeological period or during multiple ones. All that can be said is that the samples from the *Biológiai labor* and the *Folyosó* are similar, while the ones from the *Denevér-ág* and the *Teknősbéka-terem* form another group. The samples from the first group contained fewer millet grains, which may also indicate that they were less exposed to Bronze Age influences; that, however, cannot be proven.

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**Tab. 2.** Archaeobotanical identification of plant remains in the samples from the Baradla Cave

| Taxa/Sample No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cerealia* | | | | 1 | | | | | | | | | | | | | | | | | | 15 |
| *Triticum/ Hordeum spec.* | 1 | 8 | 3 | 3 | 2 | 8 | 2 | 2 | 15 | | 1 | 1 | 2 | 4 | | 2 | 1 | 3 | 3 | 9 | 7 | |
| *Triticum spec.* | | | | | | 1 | | | 2 | | | | | | | | | | | | | |
| *cf. Triticum monococcum L.* | | | | | | | | | 1 | | | | | | | | | | | | | |
| *cf. Triticum turgidum L.subsp. dicoccum(Scrank) Thell.* | | | | | | | | | | | | | | | | | | | | | | 1 |
| *Triticum aestivum L. subsp. spelta (L.) Thell.* | | | | | | 1 | | | | | | | | | | | | | | | | |
| *Triticum aestivum L. subsp vulgare (Vill.) Mackey/T. turgidum cv. durum (Desf.) Mackey* | | | 1 | 1 | | 1 | | | | | | | | | | | | | | | | |
| *cf. Triticum aes-tivum L. subsp vulgare (Vill.) Mackey/T. turgi-dum cv. durum (Desf.) Mackey* | | | | 1 | | | | | | | | | | 1 | | | | | 2 | | | |
| *Hordeum vulgare L.* | | 3 | | | 2 | 6 | 3 | | 1 | | | | 1 | 4 | | 1 | | | 1 | 1 | | |
| *cf. Hordeum vul-gare L.* | | | | | | | | | 1 | | 1 | | | | | | | | | | | |

| **Taxa/Sample No.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Panicum miliaceum L.* | | 15 | | | 2 | 2 | 1 | | | | | | | | | | | | | 10 | 8 | 1813 |
| *cf. Panicum miliaceum L.* | | | | | | 1 | 1 | | 1 | | | | | | | | | | | 6 | 1 | 89 |
| *Indet. Fabaceae (cultivated)* | | 1 | 1 | 1 | | 1 | | | 1 | 1 | | 1 | | | | | 1 | | 1 | 1 | | 1 |
| *Pisum sativum L.* | | 2 | | | | | | | | | | | | | | | | | | | | |
| *cf. Pisum sativum L.* | | 3 | | | 1 | | | | | | | | | | | | | | | 2 | | 1 |
| *Lens culinaris Medic.* | 1 | 13 | | | 1 | 1 | | | 2 | | | | | | | | | | | 8 | | |
| *Vicia spec.* | | 1 | | | | | | | | | | | | | | | | | | | | |
| *Medicago spec.* | | 1 | | | | | | | 3 | | | | | | | | | | | 1 | | |
| *Medicago spec./ Trifolium spec.* | | | 2 | | | | | | | | | | | | | | | | | | | |
| *Trifolium spec.* | | 1 | | | | | | | 2 | | | | | 1 | | | | | | | | |
| *Coronilla spec.* | | | | | | | | | 2 | | | | | | | | | | | | | |
| *Asperula arvensis L.* | | | | | | | | | 1 | | | | | | | | | | | | | |
| *Galium spec.* | | 1 | | | | | | | | | | | | | | | | | | | | |
| *Chenopodium album agg.* | | 1 | 1 | | 1 | 1 | 1 | | 4 | | 2 | | | 5 | | | | 1 | | 1 | | 1 |
| *Chenopodium hybridum L.* | | | | | | | | | | | | | | | | | | | | 1 | | |
| *Rumex crispus L./ acetosellaL.* | | 1 | | | | | | | 1 | | | | | | | | | | | | | |
| *Lychnis flos-cuculi L.* | | | | | | | | | 1 | | | | | | | 2 | | | | | | |

| Taxa/Sample No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Solanum nigrum L.* | | | 1 | | | | 1 | 1 | 8 | | | | 1 | | | | | | | | | |
| *Poacae* | | | | | | | | | 4 | | | | | 4 | | | | | | | | |
| *Poa trivialis L.-type* | | | | | | | | | 1 | | | | | | | | | 1 | | | | |
| *Poa annua L.* | | | | | 1 | | 1 | | | | | | | | | | | | | | | |
| *Bromus arvensis L.-type* | | | | | 1 | | | | | | | | | | | | | | | | | |
| *Setaria viridis (L.) PB./ verticillata (L.) R. et Sch./ Echinochloa crus-galli (L.) P. B.* | | | | | | | | | | | | | | | | | | 1 | | | | |
| *Stipa spec.* | | | | | | | | | 1 | | | | | | | | | | | | | |
| *Apiaceae* | | | | | | | | | 1 | | | | | | | | | | | | | |
| *Oenanthe spec.* | | | | | | | | | | | | | | | | | | | 1 | | | |
| *Camelina spec.* | | | | | | 1 | | | | | | | | | | | | | | | | |
| *Lamiaceae* | | | | 1 | | | | | | | | | | | | | | | | | | |
| *Malva spec.* | | | | | | | | | | | | | | | | | | | | 1 | | |
| *Cornus sanguinea L.* | | | | | | | | | 1 | | | | | | | | | | | | | |
| *Indet. Seed* | | | | | 1 | 1 | | | 3 | | | | | 2 | | | | | 1 | | | |
| *Indet. Stone fruit* | | | | | 1 | | | | | | | | | | | | | | | | | |
| *Charcoal >2 mm (count)* | 377 | 1459 | 195 | 591 | 786 | 1076 | 156 | 18 | 101 | 50 | 225 | 259 | 177 | 162 | 35 | 67 | 9 | 68 | 153 | 1642 | 894 | 260 |
| *Charcoal >2 mm (g)* | 0.4515 | 7.159 | 0.4812 | 1.1804 | 1.4623 | 5.7187 | 0.2613 | 0.1481 | 0.1485 | 0.0754 | 0.3778 | 0.7263 | 0.5955 | 0.3258 | 0.0503 | 0.1307 | 0.0077 | 0.1148 | 0.1945 | 7.8097 | 2.3233 | 0.9145 |
| *Charcoal >2 mm (ml)* | 1.8 | 23 | 1.75 | 4 | 5.8 | 22 | 1.25 | 0.5 | 0.6 | 0.4 | 1.5 | 3.35 | 2.1 | 1.5 | 0.3 | 0.5 | <0.1 | 0.5 | 0.9 | 25 | 11 | 3.75 |