RADKA KOZÁKOVÁ · MARTIN TREFNÝ · KATEŘINA POSTRÁNECKÁ

# USING POLLEN ANALYSIS TO DETECT MICROSCOPICAL TRACES OF THE ORIGINAL CONTENTS OF AN ETRUSCAN BEAKED FLAGON FROM OSTROV U STŘÍBRA (OKR. TACHOV / CZ) NEAR PILSEN

During the rescue excavations in January 2013 in Ostrov u Stříbra (okr. Tachov/CZ), just of Pilsen, a cremation grave was uncovered (figs 1-2). It contained an iron sword, two iron knives, an iron spearhead, an iron ring, a ceramic vessel, and a bronze beaked flagon (*Schnabelkanne*). Based on the type of the bronze flagon and other finds, the grave may be dated to the Late Hallstatt, respectively Early La Tène period (approx. 475-400 BC; figs 3-4).

The importance of the grave assemblage consists in the presence of an Etruscan beaked flagon, which represents the third find of an intact vessel of this kind in the Late Hallstatt/Early La Tène period in Bohemia

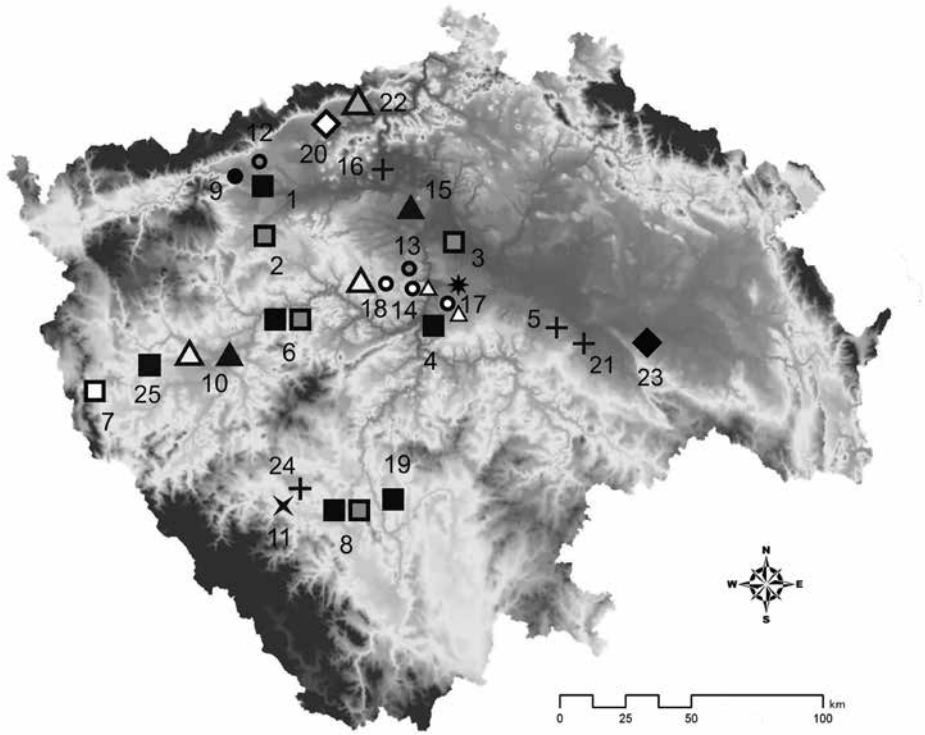



**Fig. 1** Greek and Etruscan imports and their imitations in Bohemia in the 6th-5th centuries BC. – Bronze vessels: ■ beaked flagons (*Schnabelkannen*) or their parts; ▣ bowls; □ stamnos-situla; + bowls with a pearl-band decorated rim; ◇ olpe. – Glass vessels: ✕ aryballos. – Ceramics: ●●● Attic ceramics; ✷ Greek transport amphorae fragments; ▲ local imitations of Greek red-figure cups; △ local imitations of developed ceramic forms of Mediterranean provenance; ◬ painted decoration on local ceramics inspired by southern motives; ◆ clay imitation of the bronze beaked flagon probably of the Celtic origin. – **1** *Činov.* – **2** Hořovičky. – **3** Hořín. – **4** *Praha-Modřany.* – **5** Hradenín. – **6** Chlum. –**7** Mírkovice. – **8** Hradiště u Písku. – **9** Kadaň. – **10** Plzeň-Roudná. – **11** Strakonice. – **12** Droužkovice. – **13** Tuchoměřice. – **14** Praha-Ruzyně-Jiviny. – **15** Chržín. – **16** Slatina. – **17** Praha-Pitkovice. – **18** Dobrovíz. – **19** *Hosty.* – **20** *Lahošť.* – **21** Nebovidy. – **22** Radovesice. – **23** Tuněchody. – **24** Rovná. – **25** Ostrov u Stříbra. The provenance of the finds from the sites typed in *italic* is unclear. – (After Trefný/Polišenský 2014, fig. 3 with additions).

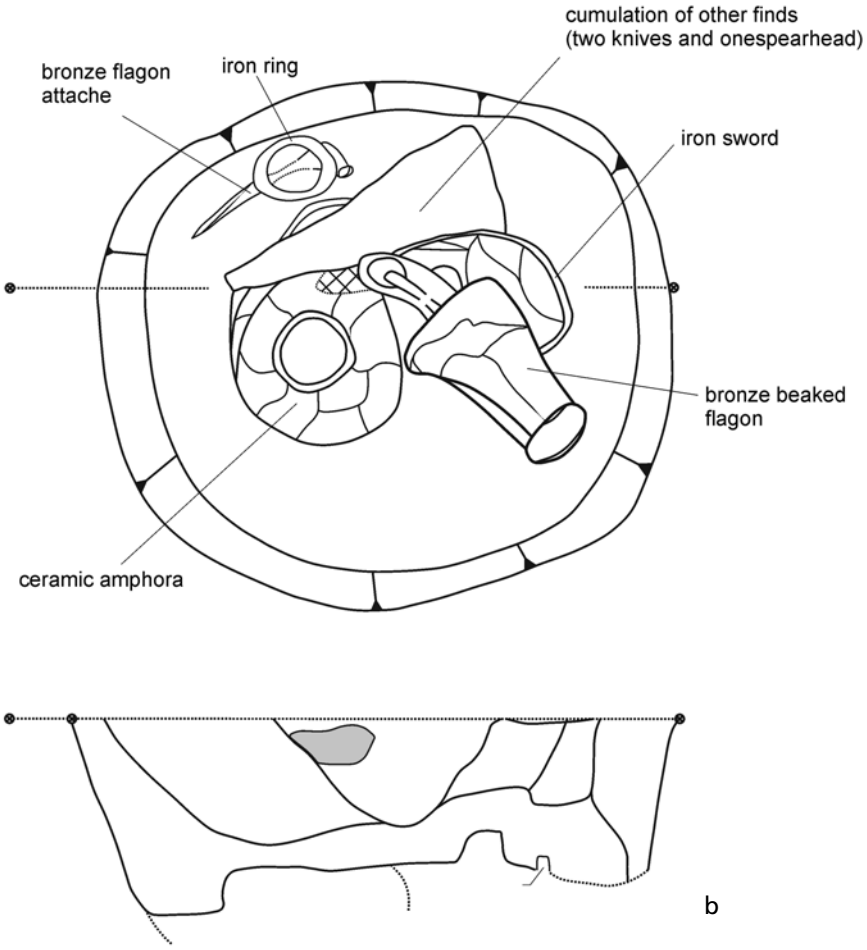

**Fig. 2** Ostrov u Stříbra (okr. Tachov/CZ). The overall plan of the excavated area. Position of the grave with the beaked flagon marked with an arrow. – (Illustration K. Postránecká).

(Trefný 2012, 22-26). The Etruscan imports of bronze beaked flagons in the Bohemian territory are furthermore represented by some finds of isolated handles. However, the provenance of some of them is unclear and in doubt (Kysela/Hlava 2014).

The previous finds of two intact beaked flagons come from Chlum (okr. Rokycany/CZ) and Hradiště (okr. Písek/CZ; **fig. 1**). Both were discovered in the 19th century without the attention of a professional archaeologist. The new flagon, unearthed during regular archaeological excavations, represents the first case of a completely documented find within the archaeological context.

This paper focuses on palynological research connected with the beaked flagon and the aim to detect traces of its previous contents. Many examples from Europe illustrate that exclusive graves dated mostly to the period between 1700 and 400 BC were often equipped with some kind of vessel containing a beverage (Koch 2003). Pollen analysis is a crucial method for indication of the character of the original beverage because the most important ingredients, such as honey, grape wine or beer, can be determined by pollen


a




b

**Fig. 3** Ostrov u Stříbra (okr. Tachov/CZ): **a** photo of the grave with the beaked flagon after uncovering. – **b** drawing of the grave with indication of individual finds. – (Photo and drawings K. Postránecká ).


**Fig. 4** Ostrov u Stříbra (okr. Tachov/CZ): **1** the beaked flagon after restoration. – **2** handle. – **3** detail of the ornamentation. – (Photos R. Pelíšková).

grains. Only recently chemical methods, mostly spectrometrical techniques, were combined with pollen analysis. Further details about the varieties of alcoholic drinks were thus revealed and specified. Mixed drinks often contained a number of ingredients – local fruit or grape wine, honey or mead, fermented cereals, bittering agents from *Myrica gale* or *Achillea*, and *Juniperus* flavour or pine resin as a conservant (McGovern/Hall/Mirzoian 2013).

A bronze beaked flagon with remnants of pure mead was, for instance, found in an Early La Tène grave in Glauberg (Wetteraukreis/D; Rösch 1999). Residues of beverages were nevertheless detected in many other types of vessels such as large bronze cauldrons, clay pots (Dickson 1978; Pokorný/Mařík 2006; Kvavadze et al. 2007; McGovern/Hall/Mirzoian 2013), some parts of wine sets (Rösch 2005; McGovern/Hall/Mirzoian 2013), or even a birch-bark bucket (Koch 2003).

Pollen is preserved in the contact layer of bronze surfaces due to the toxic effect of copper on microorganisms that normally decompose organic matter. This can be a great advantage in cases where the organic matter is mostly decomposed, as was the case of the grave from Ostrov u Stříbra. No macroscopical residues of any type were visible on the inner surface of the flagon which sets our example apart from the studies

mentioned above. We made pollen analyses of 14 samples taken from the layer closest to the bronze surface in order to detect microscopical traces of the original contents. Our two assumptions were: 1. pollen detected from the outer surfaces of the flagon come from the secondary soil filling the grave; and 2. pollen detected from the inner surfaces come from the secondary soil filling the flagon plus residue potentially from the previous contents. We expected that pollen spectra from the inner surfaces may contain some significantly different pollen components that might indicate honey, wine, or beer ingredients.

## METHODS

The flagon was taken out of the grave for detailed excavation in the laboratory. The reason for this was limited time for the rescue's archaeological research and the poor state of the flagon, thus the effort to separate the flagon from the sediment very carefully. During the laboratory excavation both the inner and outer surfaces of the flagon were sampled for pollen analysis by simple scraping of an approx. 1 mm thin layer of sediment that was in closest contact with the bronze (**fig. 3b**).
Samples for pollen analysis were first treated in 10 % KOH then potential carbonates were removed by 10 % HCl, silicates were diluted in concentrated HF, and most of the organic material was removed during acetolysis (using acetic acid anhydride and sulphuric acid in a 9:1 ratio). Samples were finally mounted in glycerine (Faegri/Iversen 1989). Because the number of pollen grains present in the samples was very low in most cases, the minimum counted sum was 150 grains. In natural sediments like peat, where pollen is numerous and well preserved, the sum of counted pollen is usually more than 500. Pollen types were defined according to M. Reille (1992) and H. J. Beug (2004).
14 samples were analysed, nine from the inner and five from the outer surfaces (**fig. 3b**). The results are presented in bar charts made in Excel 2010.

## RESULTS

### Archaeological context of the grave and previous finds of the beaked flagons in Bohemia

The cremation burial was located in a pit with a diameter of c. 1.2 m and a depth of c. 1 m. The grave inventory included the flagon, an iron sword which was bent, two iron knives of a type called *Hiebmesser*, an iron spearhead, an iron ring and a ceramic amphora. Approximately two thirds of the grave area were in a level of individual finds covered by black plastic soil, which most likely represented the remnants of the funeral pyre (**fig. 3a**). The bronze flagon was discovered c. 0.5 m beneath the surface layer in which the grave was first visually registered. The handle was found separately, c. 80 cm from the flagon. The body of the proper flagon was dented. It cannot be excluded that this deformation was caused by the movement of heavy construction machinery on the surface before the excavations (**fig. 4**). The body of the flagon was filled with the soil filling of the grave.
From the point of view of typology, the overall form of the body of the flagon mediates between the basic forms A and A1, after D. Vorlauf (1997, fig. 3; cf. **fig. 4**). D. Vorlauf furthermore divides a type 2a (Vorlauf 1997, fig. 23), spread in Etruria, Picenum, northern Italy, Switzerland, eastern France and the Middle Rhine area in Germany, which corresponds to non-decorated flagons of form A with a ringfoot or offset in the transitional zone of the body and bottom. The Ostrov flagon corresponds in many features with this type. The

ornamentation of our piece with a palmette, volutes, and a human head or mask may be compared with the finds from Urmitz (Lkr. Mayen-Koblenz/D) or Siesbach (Lkr. Birkenfeld/D) in Rhineland-Palatinate, which correspond to the motif 3b, defined by D. Vorlauf (1997, pl. 31). The Urmitz ornamentation is a part of the flagon of the A type, well comparable with our piece (Jacobsthal/Langsdorf 1929, pl. 16, 32; Polenz 1971, 26; Schaaff 1971, pl. 11, 2; Mutz 1972, fig. 18; Vorlauf 1997, 29 pl. 5, 30-30b). However, the decoration is slightly different in the number of the palmette leaves, which are nine, compared to our example with only eight leaves. The same may be said in the case of the ornamentation from Siesbach, being a flagon of the A type (Jacobsthal/Langsdorf 1929, pl. 3, 31; Haffner 1976, pl. 8, 9a-d; Vorlauf 1997, 27 pls 4, 27; 31, 27). It may also be emphasised that all three flagons are approximately of a similar size: Ostrov u Stříbra – preserved height c. 25 cm, Urmitz – preserved height c. 26 cm, Siesbach – preserved height 28.4 cm.

Considering the chronology of the above comparisons and also the evolution of the influx of other sorts of southern importations in the Bohemian area, such as other types of Etruscan bronze vessels (Chytráček 1983) or Attic pottery (Trefný 2011), it is possible to propose a date for the Ostrov flagon between the end of the second quarter and the end of the 5$^{th}$ century BC.

The cremation grave in Ostrov u Stříbra was a part of a larger polycultural site. However, it seems that it represents individual activity from the Late Hallstatt/Early La Tène period because the absolute majority of the finds in the surrounding area belongs to the Final Bronze Age Nynice culture. In this respect, one noteworthy part of this site is represented by a rectangular ditch with an interruption located at a distance of approx. 450 m to the southwest of the actual grave (**fig. 2**). Such structures in the Hallstatt and Early La Tène period are connected with the local elite and are interpreted as so-called princely courts. In this phase of the evaluation of this excavation it is still impossible to date this structure, but the eventual connection with the described grave cannot be excluded. However, the final classification of the overall situation is a matter of future debate.

The archaeological context of two other bronze beaked flagons, found in the past in Bohemia, was considerably different from the situation in Ostrov u Stříbra near Pilsen. Both sites, Chlum near Rokycany and Hradiště near Písek, were tumuli with a rich grave inventory that clearly indicates its affiliation with the contemporary princely elite. This is attested not only by the presence of Etruscan beaked flagons, but also by many other finds, some of them made of gold (Píč 1900, pl. 31; 1905, pl. 29; Drda/Rybová 1998, 46; Sankot 2003, fig. 29 pls 2-6). Similar situations may be registered in many sites in the area north or northwest from the Alps. Conversely, the inventory of the cremation grave from Ostrov u Stříbra is, with the exception of the flagon, represented only by the sword, two knives, a spearhead, an iron ring and a clay vessel (**fig. 3a**). Based on this assemblage, the mentioned grave can hardly be ascribed to the local elite, but rather to a warrior or a person of similar status. In any case, this archaeological context could indicate an accessibility of goods such as Etruscan imported beaked flagons also to members of other (higher?) social levels, not only to the princely elite of the contemporary society. The discovery of the bronze beaked flagon also shows that in Early Iron Age Bohemia the higher social classes were appreciative recipients of luxurious goods, as indicated by the finds of imported Attic pottery (Trefný 2011) or a recently identified Greek north Aegean transport amphora (Trefný/Polišenský 2014), indicating the local consumption of Greek wine.

### Results of pollen analysis

The flagon was in contact with secondary soil of uncertain origin and age from both inside and outside. It is therefore clear that a considerable amount of pollen comes from this secondary soil and logically is also of uncertain origin and age. This uncertain part of pollen spectra can be referred to as background pollen com-

ponent and includes a group of pollen taxa present in all samples. During the analysis the aim was to find samples with pollen spectra significantly different from this background pollen component.

Three groups of samples can be recognised from the results: 1. samples with no or an extremely low number of pollen (nos 4-5, 9, 17, 20, 22 and 27); 2. samples with a background pollen component (nos 6, 8, 26 and 29); and 3. samples with a background pollen component but also a significant occurrence and counts of insect-pollinated taxa (nos 3 and 10-11; **fig. 5**).

Samples with or without an extremely low number of pollen were taken from the unimpaired inner surface of the flagon (nos 4, 17, 22 and 27) or from the inner surface close to the mouth of the flagon (nos 9 and 20). Sample no. 5 was taken from the black charcoal layer and, apart from minor pollen components, contained a dense matrix of microscopic charcoal particles (**fig. 5**).

Pollen spectra from the outer surface (samples nos 8 and 26) contained background pollen, which was composed mainly of cereals and weeds such as Chenopodiaceae, *Polygonum aviculare*, Asteraceae Cichorioidae, *Matricaria* type, *Plantago lanceolata*, *Artemisia* or *Urtica*. The background pollen compo-

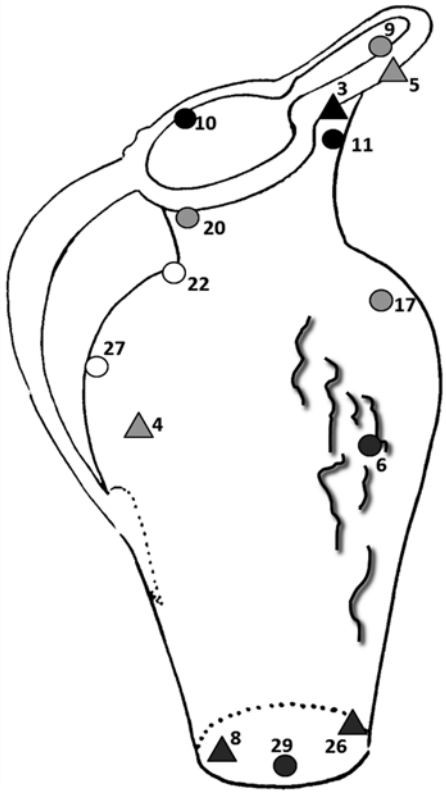



**Fig. 5** Ostrov u Stříbra (okr. Tachov/CZ). The beaked flagon with positions of samples taken for pollen analysis. – Circle: samples from inner surface; triangle: samples from outer surface; white: samples with no pollen; light grey: samples with extremely low amount of pollen; dark grey: samples with contaminations of modern pollen; black: samples with indices of honey. – (Illustration R. Kozáková).

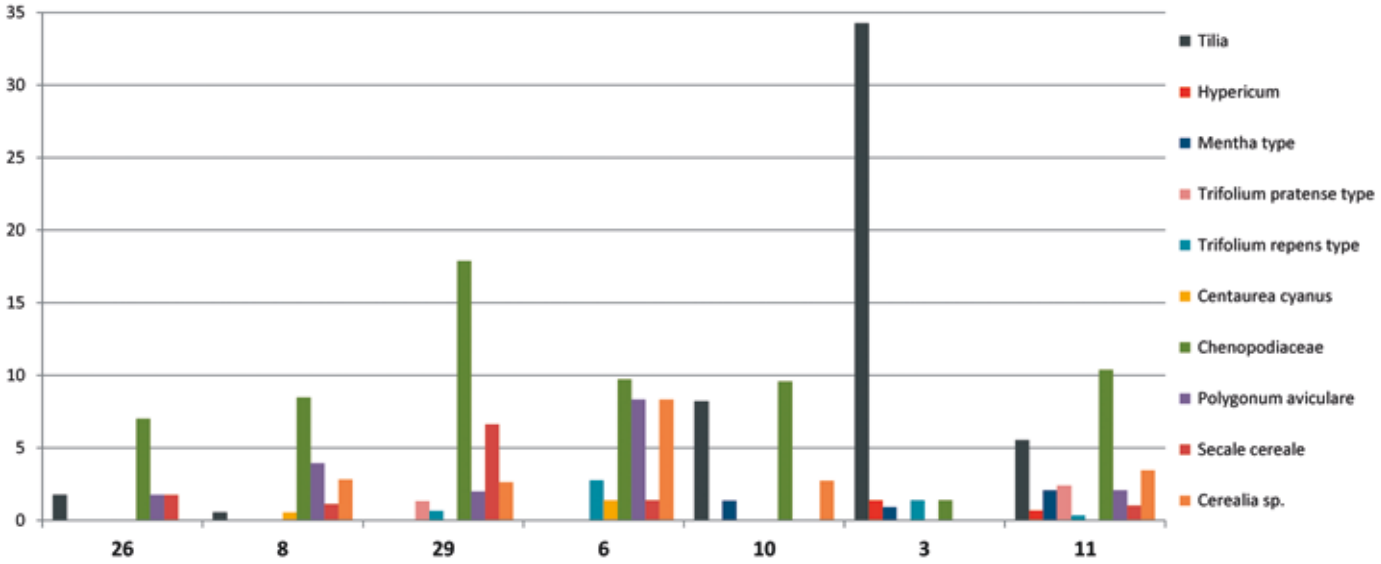



**Fig. 6** Ostrov u Stříbra (okr. Tachov/CZ). Proportions of selected pollen types in particular samples. Honey was indicated in samples nos 3 and 10-11. – (Illustration R. Kozáková).

| pollen sample no. | 26 | 8 | 29 | 6 | 10 | 3 | 11 |
|---|---|---|---|---|---|---|---|
| trees | | | | | | | |
| *Abies* | | 1 | 1 | 2 | 3 | 3 | 5 |
| *Acer* | | 2 | | | | | |
| *Alnus* | 1 | 2 | 1 | | 4 | 3 | |
| *Betula* | 11 | 25 | 5 | 6 | 17 | 18 | 18 |
| *Carpinus* | 1 | 1 | | | | | |
| *Corylus* | | 1 | | | | 1 | 3 |
| *Fagus* | 3 | 8 | | | 3 | 15 | 3 |
| *Juniperus* | | | | | | | 1 |
| *Picea* | 2 | 2 | 3 | | 1 | 2 | 2 |
| *Pinus* | 36 | 20 | 18 | 22 | 24 | 11 | 24 |
| *Prunus* type | | | | | 1 | 1 | 1 |
| *Quercus* | 20 | 10 | 4 | 2 | 9 | 19 | 2 |
| *Salix* | 2 | | | | | 2 | |
| *Sambucus nigra* type | | 1 | | | | | |
| *Sorbus* type | | | | | | 1 | |
| *Rosa* type | | | | 1 | | | |
| *Tilia* | 3 | 1 | | | 10 | 74 | 16 |
| herbs | | | | | | | |
| *Agrostemma githago* | | | | | | | 1 |
| *Alchemilla* | | 1 | | | 1 | | 1 |
| *Anthriscus* type | | | | | 1 | | |
| Apiaceae | 3 | | | | 3 | | |
| *Artemisia* | 2 | 1 | 1 | 4 | 6 | | |
| *Aster* type | 1 | 2 | 2 | 5 | 3 | 2 | 6 |
| Asteraceae - Cichorioidae | 8 | 7 | 8 | 12 | 7 | 2 | 21 |
| *Astragalus* type | | | | 1 | | | |
| *Ballota* type | 1 | | | | 1 | | 1 |
| *Bidens* type | | | | | | | 1 |
| Brassicaceae | | 1 | 3 | 1 | | 3 | 4 |
| *Centaurea cyanus* | | 1 | | 3 | | | |
| *Centaurea jacea* type | | | | 2 | | | 5 |
| *Cerastium* type | | | 1 | 1 | 4 | | |
| Cerealia sp. | 1 | 5 | 4 | 11 | 5 | | 10 |
| *Cirsium* type | 1 | 1 | | | | | |
| *Convolvulus* | | | | | | | 1 |
| Cyperaceae | 2 | 6 | | 1 | | | 2 |
| *Daucus* type | | 1 | | | | | |
| *Filipendula* | | | | | 2 | 1 | 1 |
| *Fumaria* | | | 1 | | | | |
| *Galeopsis* type | 4 | | | | | | 1 |
| *Gnaphalium* type | | | | 1 | | | |
| Gramineae | 28 | 32 | 42 | 41 | 30 | 11 | 61 |
| *Hedera helix* | | | | | 1 | | |

**Tab. 1** Ostrov u Stříbra (okr. Tachov/CZ). Absolute numbers of pollen types and non pollen objects in particular samples. Samples nos 4-5, 9, 17, 20, 22 and 27 contained no or extremely low number of pollen.

| pollen sample no. | 26 | 8 | 29 | 6 | 10 | 3 | 11 |
|---|---|---|---|---|---|---|---|
| *Helianthemum* | | | | | | 2 | |
| *Heracleum* | 2 | | | | | | |
| *Hordeum* type | | 1 | | | | | 1 |
| *Humulus* | | | | | | | 1 |
| *Hypericum* | | | | | | 3 | 2 |
| *Chaerophyllum* type | | | 1 | | | | |
| Chenopodiaceae | 15 | 15 | 27 | 17 | 14 | 3 | 30 |
| *Lamium album* type | | 1 | | | | | |
| *Matricaria* type | 10 | 1 | 5 | 6 | 3 | 3 | 14 |
| *Melampyrum* | | | | 1 | | 2 | 2 |
| *Mentha* type | | | | | 2 | 2 | 6 |
| *Mercurialis* | | | | | 1 | | |
| *Papaver rhoeas* type | | | | | | 2 | |
| *Peucedanum* type | 1 | 3 | | | | 2 | 2 |
| *Phyteuma* type | | | | | | 3 | |
| *Plantago lanceolata* | 2 | 9 | 5 | 7 | 8 | 14 | 7 |
| *Plantago major* | | | | | | 1 | 1 |
| *Plantago media* | | | | | 1 | 1 | |
| *Polygonum aviculare* | 1 | 7 | 3 | 14 | | | 6 |
| *Potentilla* type | 2 | | | | 3 | | |
| *Ranunculus acris* type | 1 | | | | 2 | 1 | |
| *Ranunculus sceleratus* type | | | | | | 1 | |
| *Rhinanthus* type | | | | | 1 | | |
| Rubiaceae | | 1 | | | 1 | 1 | 1 |
| *Rumex acetosa* type | | | | 1 | 1 | | |
| *Scabiosa* | | 1 | | | | | |
| *Scleranthus annuus* | | | | 1 | | | |
| Scrophulariaceae | 1 | | | | | | |
| *Secale cereale* | 2 | 2 | 10 | 4 | 1 | | 3 |
| *Silene* type | | | | 1 | | | |
| *Solanum nigrum* | | | 1 | | | | |
| *Stellaria holostea* | | 1 | | | | | 3 |
| *Thalictrum* | | | | 1 | | | |
| *Trifolium pratense* type | | | 2 | | 1 | | 7 |
| *Trifolium repens* type | | | 1 | 4 | | 3 | 1 |
| *Triticum* type | | | 2 | | | | 6 |
| *Urtica* | 1 | 2 | | 6 | 2 | | 5 |
| *Veronica* type | | 1 | | | 1 | 1 | |
| Viciaceae | | | | | 2 | 2 | |
| **non pollen objects** | | | | | | | |
| monolete spore | 2 | 1 | | 3 | 1 | 2 | 5 |
| trilete spore | 1 | | 1 | | | | |
| *Anthoceros punctatus* | | | 1 | 2 | 2 | | 1 |
| *Sporomiella* | 4 | 4 | 8 | 24 | 12 | | 8 |
| *Podospora* | 1 | | | | 2 | | 1 |
| *Thecaphora* | | 2 | 3 | 6 | 2 | | 3 |
| sum | 168 | 177 | 151 | 179 | 180 | 216 | 289 |

nents are further formed by grasses (Poaceae) and trees, mostly *Betula* and *Pinus* (fig. 6; tab. 1). The same characteristics had pollen spectra from inner but damaged surfaces where secondary soil could easily get inside the flagon (samples nos 6 and 29; fig. 5). Background pollen components evidently contain modern pollen. This is directly indicated by pollen of taxa that are extremely unlikely to be found in the Hallstatt period in the territory of the Czech Republic such as *Centaurea cyanus* and *Secale cereale* (Dreslerová/Kočár 2013). Furthermore, most of the pollen grains in these samples were very well preserved (especially in the case of samples nos 26 and 29) and the whole pollen assemblage seems to reflect recent conditions, featuring field crops, weeds, and forest with a dominance of pine. Since the flagon was found at a depth of only 50 cm, it could easily have come in contact with recent soil during ploughing.

Specific pollen spectra were detected in three samples from near the beak – samples nos 3 and 10-11 (fig. 5). Significantly high numbers had pollen of *Tilia*, especially in sample no. 3 (fig. 6). *Tilia* is an insect-pollinated tree and under normal conditions for pollen transport, its pollen never reaches such extreme ratios in comparison with anemophilous tree taxa (cf. pollen counts of *Tilia* with *Pinus* and *Betula* in tab. 1). In addition, several insect-pollinated herbs occurred in these samples, though not in such high pollen counts – *Mentha* type, *Hypericum*, *Trifolium repens* type, and *Trifolium pratense* type. The rest of the pollen spectra must be considered as background component because they do not differ from the characteristics mentioned above. For samples nos 3 and 10-11 it is again clear that some pollen grains are modern contaminations, most probably *Pinus* (at least some part of *Pinus* pollen counts), Chenopodiaceae, cereals, or *Polygonum aviculare*. Samples nos 10 and 11 were taken from the inner surface in the uppermost part of the flagon (fig. 5).

The most specific results come from sample no. 3. It was taken from the black charcoal layer underneath the rim of the beak (fig. 5). It differs from the other samples not only due to extremely high pollen counts of *Tilia*, but also due to the absence of weeds and crops that can be considered as modern contamination and that forms an important part of the background pollen component. Chenopodiaceae, which are commonly found in other samples, have a very low pollen ratio in sample no. 3 (fig. 6; tab. 1). This may suggest that the charcoal layer provided some kind of barrier that prevented contact between modern and old pollen.

## DISCUSSION

### Indices of honey

It may be assumed that the results of the pollen analysis from samples nos 3 and 10-11 showed clear evidence of the presence of honey in the flagon. Significantly high counts of *Tilia* pollen exclusively in these three samples are combined with an absence or minor presence of *Tilia* pollen in the rest of the samples. It is therefore clear that the pollen of *Tilia* does not belong to the background pollen component, unlike the other tree taxa common in all the samples, especially *Pinus* and *Betula*. Such numerous counts of *Tilia* pollen definitely reflect some anthropogenic and intentional reason for deposition. A variant that a bunch of flowers had been put in the grave and left the pollen grains on the upper part of the flagon seems too unlikely because it is hard to imagine a bunch of flowers made of lime branchlets. In addition, the presence of the flagon itself, together with many analogies of the remnants of a beverage detected in a vessel from a grave, cause us to explain our results as a trace of honey. Numerous studies show that specifically *Tilia* together with *Filipendula* are two pollen types that predominate in almost all cases of honey residues (Dickson 1978; Rösch 1999; 2005; Koch 2003; Pokorný/Mařík 2006; Kvavadze et al. 2007; McGovern/Hall/Mirzoian 2013). In few cases the dominant or co-dominant pollen in the honey pollen assemblage are *Calluna* or *Salix*

(McGovern/Hall/Mirzoian 2013; Pokorný/Mařík 2006). Other pollen types that are often connected with honey, though rarely form the dominant part of the pollen assemblage, are *Acer*, *Trifolium*, *Mentha* type, *Hypericum*, *Centaurea jacea* type, *Centaurea nigra* type, *Helianthemum*, various Asteraceae, and other zoogamous plant taxa (Rösch 1999; Pokorný/Mařík 2006). In our samples from Ostrov u Stříbra such attendant pollen types are mainly *Mentha* type and *Hypericum*, which occurred only in the samples with significantly higher counts of *Tilia* (nos 3 and 10-11). With some uncertainty, *Trifolium repens* type and *Trifolium pratense* type can also indicate honey in samples nos 3 and 11, but their pollen was also indicated in samples nos 6 and 29, where honey is not assumed to have been the reason (**fig. 6**).

We did not find any other case where pollen analysis was applied to an empty vessel. All the studies about fossil beverages containing honey were made on macroscopical residues observed in various bronze or clay vessels. In such studies the fossilised contents of the vessel were analysed directly and thus any contaminations played a minimal role. From the pollen concentration in the residue of the beverage the amount of honey can be estimated, leading to conclusions whether the original fluid was pure mead or whether honey or mead was only one of the ingredients of a mixed beverage (Rösch 1999; Koch 2003). Pure mead seems to have been donated just in special cases, as in the extraordinarily rich Late Hallstatt grave in Eberdingen-Hochdorf (Lkr. Ludwigsburg/D), where the amount of mead in a bronze cauldron was estimated to have been 350l (Koch 2003). Another example of pure mead being the most probable interpretation of pollen results is the known Early La Tène grave from Glauberg. In this case, fossilised mead was found in a local bronze beaked flagon (Rösch 1999).

In the bronze beaked flagon from Ostrov u Stříbra the character of the beverage can hardly be specified because we did not work with any macroscopical residue to be able to measure the proportion of honey in the original contents of the flagon. Neither can we precisely distinguish between pollen originating in secondary soil and pollen originating in honey. We can only say that pollen of *Vitis* was not detected in our samples and thus a wine component was not proven. Furthermore, it seems evident that the pollen of cereals is not connected with the beverage because they are absent in sample no. 3, which obviously contained minute contaminations, but frequent in other samples where contaminations are clear. No traces of honey were detected inside the flagon. All three samples indicating honey are concentrated on its upper part. The most specific sample (no. 3) was taken from the outer rim of the flagon. Such a distribution of the honey-indicating samples can correspond to the fact that the flagon fell down in the grave and its contents poured out. The remnants of the original contents could have clung to the surface of the upper part of the flagon. Another possibility is that the flagon was put in the grave empty and the traces of honey indicate a beverage that was frequently served in it and that it was not properly washed out.

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*Zusammenfassung / Summary / Résumé*

**Die Verwendung von Pollenanalytik zum Aufdecken von Mikrospuren des originalen Inhalts einer etruskischen Schnabelkanne aus Ostrov u Stříbra (okr. Tachov/CZ) bei Pilsen**

2013 wurde bei Rettungsgrabungen in Ostrov u Stříbra ein Brandgrab mit einer etruskischen Schnabelkanne aus der Späthallstatt-/Frühlatènezeit entdeckt. Abgesehen von der kostbaren Kanne war das Grabinventar im Vergleich zu den außergewöhnlichen reichen archäologischen Fundkontexten sowohl aus der Tschechischen Republik als auch dem sonstigen nordalpinen Europa eher ärmlich ausgestattet. Die Kanne von Ostrov u Stříbra war umgefallen, zerbrochen und mit Sediment verfüllt aufgefunden worden. Im Inneren wurden keine makroskopisch bestimmbaren Reste des Inhalts entdeckt, jedoch verwendeten wir Pollenanalysen, um mikroskopische Spuren des ehemaligen Inhalts zu bestimmen. Mehrere Sedimentproben im engsten Kontakt mit der bronzenen Oberfläche wurden genommen, weil dort Pollenkörner durch die toxischen Kupferoxide erhalten sein können. Dabei wurden 14 Proben von der äußeren und inneren Oberfläche der Kanne analysiert. Drei Proben vom oberen Teil der Kanne besaßen ein auffallend anderes Pollenspektrum mit einem extrem hohen Anteil an *Tilia*-Pollen. Andere Pollentypen, die ausschließlich in diesen Proben vorhanden waren, stammen von *Hypericum* und *Mentha*. Alle erwähnten Arten werden durch Insekten verbreitet und mit Honig in Verbindung gebracht. *Tilia*-Pollen stammen sehr häufig aus den noch erhaltenen Überresten von Getränken aus

verschiedenen Gefäßen in anderen Gräbern. Diese Analogien zusammen mit dem Fehlen einer alternativen Interpretation führen zu dem Schluss, dass die Kanne aus dem Grab von Ostrov bei Pilsen mit einem honighaltigen Getränk gefüllt war.


Using Pollen Analysis to Detect Microscopical Traces of the Original Contents of an Etruscan Beaked Flagon from Ostrov u Stříbra (okr. Tachov/CZ) near Pilsen

In 2013 rescue excavations in Ostrov u Stříbra uncovered a cremation grave with an Etruscan bronze beaked flagon dated to the Late Hallstatt/Early La Tène period. Apart from the precious flagon finds, the inventory of the grave was poor in comparison with the extraordinarily rich archaeological context from which similar flagons are known in the Czech Republic as well as from within Europe north of the Alps. The flagon from Ostrov u Stříbra was found fallen, broken and filled with secondary soil. No macroscopical residues of any content were discovered inside, but we applied pollen analysis to detect microscopical traces of the original contents. We took samples of the sediment in closest contact with the bronze surface where pollen grains are preserved due to the toxic effect of copper. 14 samples from outer and inner surfaces of the flagon were analysed. Three samples from the upper part of the flagon had significantly different pollen spectra with extremely high counts of *Tilia* pollen. Other pollen types present exclusively in these samples were *Hypericum* and *Mentha* type. All the mentioned taxa are insect-pollinated and can be associated with honey. The pollen of *Tilia* is especially dominant in the fossilised residues of beverages found in various vessels come to light in graves. Such analogies, together with a lack of other probable interpretations of our data, lead us to the conclusion that the flagon from Ostrov near Pilsen was filled with a beverage containing honey.

L'utilisation d'analyses polliniques pour détecter des traces microscopiques du contenu original d'une œnochoé étrusque de Ostrov u Stříbra (okr. Tachov/CZ) près de Pilsen

Des fouilles de sauvetage à Ostrov u Stříbra en 2013 ont permis la mise au jour d'une tombe à crémation avec une œnochoé de bronze étrusque datée de la fin du Hallstatt/début de La Tène. A l'exception de la découverte de la précieuse cruche, l'inventaire mobilier de la tombe est pauvre en comparaison avec les contextes extraordinairement riches desquels ces mobiliers proviennent d'habitude, en République tchèque comme au Nord des Alpes. La cruche de Ostrov u Stříbra a été découverte renversée, cassée et remplie de sédiments en contexte secondaires. Aucun résidu macroscopique d'aucun genre n'a été découvert à l'intérieur, nous avons appliqué l'analyse pollinique afin de détecter des traces du contenu original. Nous avons prélevé des échantillons de sédiments au contact de la surface de bronze, zone sur laquelle des grains de pollen sont conservés à cause de l'effet toxique du cuivre. 14 échantillons, en provenance des surfaces intérieures et extérieures de la cruche ont été analysés. Trois échantillons en provenance de la partie supérieure de la cruche avaient un spectre pollinique qui montrait une différence significative d'avec le reste, avec des décomptes extrêmement élevés de pollen de *Tilia*. D'autres types de pollens étaient présents dans les mêmes échantillons, il s'agit de *Hypericum* et de *Mentha*. Tous les pollens mentionnés sont diffusés par le biais des insectes et peuvent être associés à du miel. Le pollen de *Tillia* est spécifiquement dominant dans les résidus de boissons analysés dans d'autres récipients en provenance d'autres tombes. De telles analogies comme l'absence d'autres interprétations probables de nos données nous amène à la conclusion que la cruche d'Ostrov près de Pilsen était remplie d'un breuvage contenant du miel.

Traduction: L. Bernard



*Schlüsselwörter / Keywords / Résumé*

Tschechische Republik / Böhmen / späte Hallstattzeit / frühe Latènezeit / Schnabelkanne / Pollenanalyse / Met
Czech Republik / Bohemia / Late Hallstatt / Early La Tène / beaked flagon / pollen analysis / mead
République tchèque / Bohème / Hallstatt final / La Tène ancienne / œnochoé / analyse pollinique / hydromel



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