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THE MIDDLE AGES IN POLLEN-ANALYTICAL RESEARCH ON THE TERRITORY OF THE CZECH REPUBLIC

Abstract: An orientation survey of mostly the author's own results of pollen analyses of medieval sediments from archaeological sites in the Czech Republic is presented. The aim of the several-year-long cooperation with archaeologists was to find out whether, and to what extent, the results of pollen analysis are able to specify more exactly the outcomes of archaeological research. Existing pollen-analytical results confirmed their potential to contribute to interdisciplinary archaeological-archaeobotanical research. From a pollen-analytical perspective it was possible to distinguish early medieval material from high medieval material, particularly in the area of larger medieval towns. Selected finds of palynomorphs (pollen grains, spores and Non-Pollen-Palynomorphs) are mentioned in more detail in the chapters "Botany and pharmacy", "Hygiene and social situation", "Problems of the age, function and/or disappearance of some archaeological features and situations" and "Pollen analysis and history".

Key words: Pollen analyses, Middle Ages, Czech Republic.

Introduction

The Czech Republic has a long tradition in pollen-analytical research of the sediments both of peat bog and water biotopes. However, co-operation between palynologists and archaeologists in the study of sediments from archaeological situations is comparatively recent. In contrast, the intensive co-operation of specialists in macroremains-analyses with archaeologists enjoys a longer tradition (Fig. 1). Specialists with a botanical education

who were directly employed at archaeological workplaces were already yielding high-quality and numerous results in the days of the former Czechoslovakia. They were: dr. E. Opravil – the Archaeological Institute of the Academy of Sciences of the Czech Republic, Brno; dr. V. Čulíková – the Archaeological Institute of the Academy of Sciences of the Czech Republic, Prague; ing. E. Hajnalová – Archaeological Institute of the Slovak Academy of Sciences, Nitra and the other).

The research in Most (NW Bohemia) can be considered the beginning of already highly-targeted pollen-analytical research into medieval anthropogenic sediments from archaeological sites. The research was initiated by archaeologist Prof. J. Klápště and the first results were published in 1980 (Jankovská 1983, 1985, 1986). These results were later compared with the pollen-analyses of Komořany Lake (Jankovská 1988) and further extended (Jankovská 1990, 1995c, 2002 and others). The pollen-analytical research of the medieval Most was continued by the pollen-analytical research in Prague (Jankovská 1987, 1991b, 1995a, 1997b, Kozáková et Pokorný 2007, Kozáková et Boháčová 2008, Břízová et Bartošková 1994, Břízová 1998), Prachatice (Jankovská 1996), Nymburk (Jankovská 1998), České Budějovice (Jankovská 2001, Pokorný et al. 2002), Mikulčice (Jankovská et al 2003, Svobodová 1987, 1993), Brno (Čulíková and Jankovská 2004, Zapletalová et al. 2005), Litovel (Kočár et al. 2008), and Čáslav (Jankovská 2010). Most of the pollen-analytical results from Prague, Plzeň, Jihlava, Opava, Brno, Žatec, Šumperk, Kadaň, Soběslav, Chrudim, Cheb and many other sites exist only in the form of non-published research reports (Jankovská unpublished). Besides the areas of larger medieval towns the pollen-analytical research was also performed in various country settlements ((Bystřec – Jankovská 2006, Mstěnice-Nekuda and Jankovská 2005; Hrdlovka – Čulíková et al. 2008; Jindřichův Hradec – Jankovská and Pokorný J. 2002 and at other sites). There are also many published works dealing with pollen analyses from medieval archaeological sites. They summarize and generalize the results obtained (eg. Jankovská and Kratochvílová 1988, Jankovská 1991a, 1994, 1999, 2005, Kozáková et al. 2009 and the other).

The aims of the first pollen analyses (particularly those from Most and Prague) were:

1 – to discover whether there are pollen grains and other palynomorphs at all in the sediments from archaeological sites.

2 – to consider whether the predicative value of the pollen spectrum is sufficient, should their occurrence be confirmed.
3 – to interpret the results according to the needs of archaeology as well as according to the one's own discretion, when a sufficiently rich and intact pollen spectrum was demonstrated.
4 – to find certain patterns in pollen assemblage spectra (particularly in wider sets of results) which would make possible a more exact dating of medieval archaeological material.
5 – to evaluate interesting finds from botanical, zoological and other points of view in order to give biology specialists source materials to more fully inform their perspective on the history of the individual taxa found.

Fig. 1. Location of pollen-analytically studied archaeological sites in the Czech Republic

Results

The results being evaluated of pollen analyses from various archaeological sites of the Middle Ages are mainly the author's (see List of References). From them the results and data were chosen which, according to the author,

present the issue and progress in pollen-analytical research of archaeological sites.

The following was determined:

1 – Pollen and other palynomorphs do occur in the fill of archaeological situations. The sediments of cesspits of various function and sediments in wells are the richest in quantity and quality. Additionally, the sediments of man-made water biotopes—cisterns, water ditches and ponds—are richer in pollen. Soil layers composed of material from biotopes which were anthropically heavily influenced in the past (market places, roads, yards, etc.) were also usually richer in the spectrum of palynomorphs. In contrast, layers of natural soils are very poor in pollen grains, with the exception, for now, of the sites at Kounovské řady – raw (Jankovská 1997a) and Chotěbuz (Jankovská unpublished).

2 – As results from the above mention, the predicative value of the pollen spectrum depends directly on its quantitative and qualitative composition. It is very difficult to present any interpretation from a small set of palynomorphs.

3 – Based on a sufficiently rich pollen spectrum and from a sufficient number of samples extracted from one site it was possible to tell the archaeologists the following:

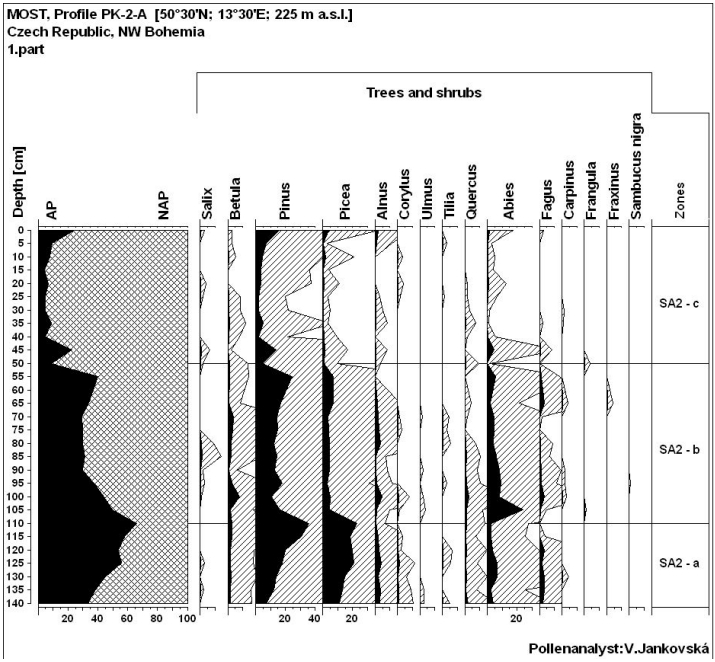
- a – what the environment was like at the site and in its surroundings at the time when the samples were deposited (mainly in terms of the vegetation cover of yards, roads, shambles, back-yards, gardens, pastures, etc.),
- b – what plants were cultivated and consumed by man (mainly from waste pit material),
- c – what the socio-hygienic situation was like. This can be judged from the presence and quantity of tunics of intestinal parasite eggs (*Trichuris*, *Ascaris*, *Enterobius*, *Taenia* and others) mainly in cesspits, and from predominantly nitrophilous vegetation (e.g. Chenopodiaceae, which are an indication of sewer waters, faecal admixtures). Also frequent are finds of intestinal parasites in the sediment of wells.
- d – if a sufficient number of pollen grains of woody plants is available, a palaeoreconstruction of forest covers, even in more remote surroundings, can be performed with a certain degree of caution.

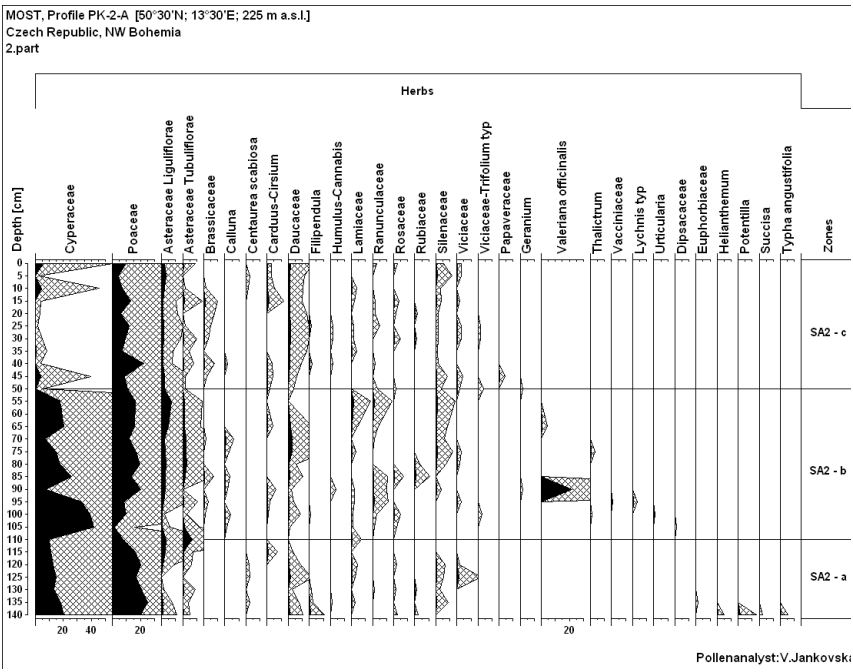
4 – Thanks to the gradually growing number of pollen-analytical results from anthropogenic sediments it was possible to distinguish pollen spectra for the main parts of the Middle Ages.

5 – Finds of some pollen and spores of interesting plants and Non-Pollen-Palynomorphs were mentioned.

The basic features of pollen spectra from the material of medieval anthropogenic sediments are that:

a) there is a prevalence of herb pollens over the pollen of wooden plants,
b) among the herbs, the synanthropic taxa predominate,
c) there are cultivated plants that always constitute a significant proportion of the taxa of synanthropic vegetation,
d) pollen grains of cereals are always predominant among the cultivated plants,
e) plants of weedy communities of field cultures, ruderals, rubbish heaps, permanently trodden surfaces, pastures, meadows and secondary-steppe biotopes have an important share in the synanthropic pollen spectrum,
f) depending on the function of the archaeological sites from which the material was analysed, there are usually specific microscopic finds (e.g. mainly fungi and some undetermined NPP). They are mostly missing in the sediments from natural biotopes (i.e. peat bogs, lakes, etc.),
g) in the material of waste pits, and in cesspits especially, there are tunics of intestinal parasitic worm eggs. Their number rises steeply in the High Middle Ages,
h) since the High Middle Ages pollen grains of some "exotic" plants can be found in the material of cesspits, wells and some other situations,
i) the difference between the pollen spectra of the Early and the High Middle Ages was defined based on the composition of the pollen spectrum,


MOST, Profile PK-2-A [50°30'N; 13°30'E; 225 m a.s.l.]
Czech Republic, NW Bohemia
1.part
Trees and shrubs
Depth [cm]
AP
NAP
Salix
Betula
Pinus
Picea
Alnus
Corylus
Ulmus
Tilia
Quercus
Abies
Fagus
Carpinus
Frangula
Fraxinus
Sambucus nigra
Zones
SA2 - c
SA2 - b
SA2 - a
Pollenanalyst:V.Jankovská


MOST, Profile PK-2-A [50°30'N; 13°30'E; 225 m a.s.l.]
Czech Republic, NW Bohemia
2.part
Herbs
Depth [cm]
Cyperaceae
Poaceae
Asteraceae Liguliflorae
Asteraceae Tubuliflorae
Brassicaceae
Calluna
Centaurea scabiosa
Carduus-Cirsium
Daucaceae
Filipendula
Humulus-Cannabis
Lamiaceae
Ranunculaceae
Rosaceae
Rubiaceae
Silenaceae
Viciaceae
Viciaceae-Trifolium typ
Papaveraceae
Geranium
Valeriana officinalis
Thalictrum
Vaccinlaceae
Lychnis typ
Urticularia
Dipsacaceae
Euphorbiaceae
Helianthemum
Potentilla
Succisa
Typha angustifolia
Zones
SA2 - c
SA2 - b
SA2 - a
Pollenanalyst:V.Jankovski

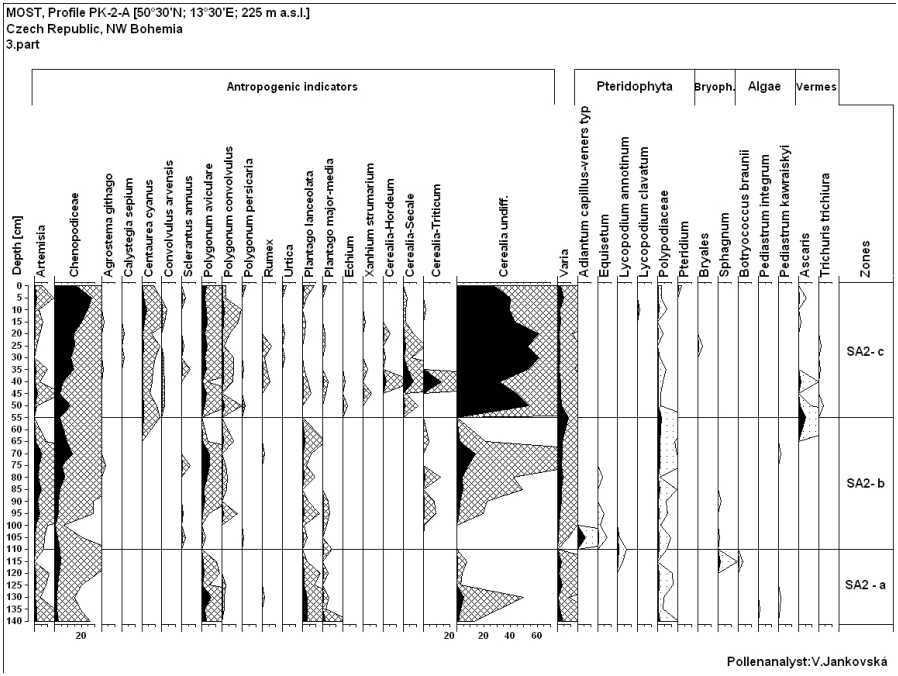


Fig. 2. Pollen diagrams from the town Most (modified after Jankovská 1995c).

Early Middle Ages

The set of results of the pollen analyses from the Early Middle Ages is not extensive compared with the results from the High Middle Ages. The richest set of analysed samples comes from the locality Prague 1, Malá Strana, Tržiště 259/III. (archaeological research of Dr. J. Čiháková, Jankovská 1997b). It's true that the pollen spectrum of woody plants (AP) is relatively rich from the qualitative point of view but there is overall very little pollen of woody plants. Evidently this is due to the greater distance of the site under research from the natural forest biotopes. The site and its surroundings are situated in the vicinity of Prague.

Castle and was already considerably anthropically influenced in the Early Middle Ages (see also Kozáková et Boháčová 2008). This is confirmed by qualitatively and quantitatively rich herb pollen spectrum (NAP). Cereal pollen – *Cerealia* type and *Triticum* type – is wholly dominant. Only a small quantity of pollen of *Secale cereale* was found,

and quite sporadically that of field weed *Centaurea cyanus*. In contrast, there was found an almost regular and higher occurrence of pollen of *Agrostemma githago*, *Convolvulus arvensis*, *Polygonum aviculare*, *P. convolvulus*, *Rumex acetosella*, of various taxa of the family Silenaceae, Viciaceae, Brassicaceae, etc.. Markedly high pollen values were found in *Artemisia*, Chenopodiaceae, Asteraceae, Daucaceae, and Poaceae. This unambiguously confirms a considerable ruderalization of the site and its vicinity. Synanthropization is also indicated by the taxa of permanently trodden biotopes, e.g. *Plantago lanceolata*, *P. media,* and *P. major*. A very similar pollen-analytical situation was also found in the Prague 1 site, Malá Strana, Mostecká cesta (research of Dr. J. Čiháková, Jankovská unpubl.). There is also a rich set of various taxa of herbs here whose expansion was enabled by human activities (see also Břízová 1998). This occurred due to secondarily steppe like and eutrophized biotopes. Deforestation of the formerly forest country permitted the expansion of shrubs – *Rosa*, *Prunus*, *Sambucus*, *Cornus*, *Hedera,* etc.

The Most site in NW Bohemia (see Fig. 2 and – Jankovská 1995c) can be given as an example of the Early Middle Ages deposited in a continuous pollen-analytical processed profiles. This period is already characterised by a disturbed species composition of forest and the retreat of the original forest biotopes. Human activities manifested themselves here by expanding synanthropic vegetation on permanently trodden surfaces (*Polygonum aviculare*, *Plantago lanceolata*, *P. major*, *P. media*), rubbish heaps and other secondarily eutrophized biotopes (Chenopodiaceae, *Artemisia* as well as some remains of intestinal parasites – *Ascaris*).

However, then relatively wide cultivation of cereals (*Cerealia – Triticum* type, *Cerealia* sp. div. – evidently mainly *Panicum*) was also confirmed. The absence or very low presence of *Centaurea cyanus* and *Secale* pollen confirms that the period is older than the High Middle Ages. Pollen of field weeds *Agrostemma githago* and *Scleranthus annuus* was found. Also the samples preliminarily dated back to the Early Middle Ages from the area of the fortified settlement Chotěbuz – Podobora (archaeological research of Dr. P. Kouřil, Jankovská unpubl.) contain a very similar pollen spectrum. Unlike the samples from the High Middle Ages from the same site, pollen of *Fagopyrum*, *Centaurea cyanus* and even the spores of *Anthoceros*, which occur here in unusual quantities in the High Middle Ages, are missing here.

Unlike the sediment of the High Middle Ages, the sediment from the Early Middle Ages lacks the pollen grains of "exotic" plants (*Myrtus*, *Borago,* and *Fagopyrum*). *Centaurea cyanus* pollen, as well as *Trichuris* and *Ascaris* egg envelopes*,* occur in this period only sporadically.

Pollen analysis was performed on a larger set of samples from various mineral layers (Jankovská et al. 2003) dated to the period of fortified settlements at the Milkulčice site—the era of the Great Moravian Empire. The pollen spectrum was quantitatively and qualitatively poor and, above all, had very little informative value. The pollen spectrum from several different archaeological situations (e.g. a well) at Mikulčice (Svobodová 1987, 1990, 1993) was substantially richer; of course its age may be questionable. The presence of a relatively higher number of pollen grains of *Fagopyrum* and *Centaurea cyanus* could indicate that the analyzed sediment is younger. The same applies to the site Pohansko (Svobodová 1990). Pollen of the discussed plants has not been found yet in the sediment from the Great Moravian Empire at the Pohansko site (Doláková et al. 2010). It is necessary to keep the problem open till further and, above all, more numerous analyses are performed.

High Middle Ages

The results of pollen analyses from the sediments from archaeological sites of the High Middle Ages in the Czech Republic are already sufficiently numerous. The data, obtained above all from material from cesspits of various function, the sediments of wells, dumping grounds of medieval rubbish, soil layers and many others deposits have allowed us to gain information about the environment and life of medieval people. Most of the data was furnished by pollen analyses of urban areas of larger medieval towns (e.g. Prague, Most, Plzeň, Chrudim, Nymburk, Opava, Brno, České Budějovice, Prachatice, and other). However, the sets of results from these towns are also suitably complemented with pollen analysis data from many smaller medieval communities where less numerous samples were processed.

The marked prevalence of herb pollens (NAP) over the pollen of woody plants (AP) is characteristic for the pollen spectrum of the High Middle Ages from urban areas of the aforementioned medieval towns. From herbs it is pollen of cereals, field weeds, vegetation of rubbish heaps, permanently trodden areas of yards, roads, trenches and similar man-created biotopes that

prevails. Pollen of cereals, field weeds and meadow vegetation evidently penetrated into urban areas with straw, grain, chaff, hay, litter and other plants material used in the farm and household. The regular occurrence of the pollen of *Secale* is particularly characteristic of all Czech medieval towns for the High Middle Ages even though *Triticum* pollen type (*Triticum*, *Hordeum*, *Avena*) predominates. Within *Cerealia* sp.div, it is *Panicum* that evidently has considerable share. *Fagopyrum* and *Pisum*/*Vicia* were typical crop-plants of the High Middle Ages. *Centaurea cyanus* is a significant indicator of High Middle Ages. Its pollen forms an unbroken curve in the profiles of pollen diagrams, as does *Secale*. *Agrostemma githago* occurs sporadically, but is, however, an important anthropogenic indicator, as with the significant majority of the found taxa: for example *Alchemilla*, *Arctium*, *Artemisia*, *Consolida*/*Nigella*, *Convolvulus*, *Echium*, *Rhinanthus*/*Euphrasia* type, *Humulus*/*Cannabis*, *Lotus* type, *Mercurialis annua*, *Plantago lanceolata*, *P. media*, *P. major*, *Polygonum aviculare*, *P. convolvulus*, *P. persicaria* type, *Scleranthus annuus*, *S. perennis*, Brassicaceae, Chenopodiaceae, *Viciaceae* and many other taxa. The occurrence of spores of *Anthoceros punctatus* and *A. laevis* (Bryophyta) is also typical for this period.

Pollen of *Myrtus* type, very often of *Sambucus nigra* and sporadically of *Juglans*, *Vitis* and *Aesculus,* was regularly found in the pollen spectrum of woody plants.

A difference in the vegetation composition of pollen spectra from large medieval towns and country settlements was also found by pollen-analytical research. Pollen spectra from villages was closer to the natural vegetation cover and the "exotic" taxa were completely missing in most cases.

In the area of the extinct medieval village Bystřec (Jankovská 2006) it was possible to reconstruct the situation at the time it was active and the cause of the extinction of the village from the pollen spectra of the separate layers.

Pollen-analytical research within the area of so-called Kounovské řady raw (Jankovská 1997a) confirmed that they are the result of the Late Medieval up to the Modern Period. Thus, speculations of an almost mysterious nature to their origin and function were laid to rest. According to the pollen analyses, these stone rows served as borders between separate fields.

Pollen analysis of dust and rubbish from old medieval books (Jankovská 1995b) yielded source material which contributed towards a reconstruction of their place of original storage and employment.

Very valuable results from the country settlements we found through pollen-analytical research during investigation of the Chotěbuz site (Czech Silesia) – Jankovská unpubl.

Comments on some finds

Botany and pharmacy

Borago officinalis – This species, whose nearest natural occurrence is in southern Europe, was evidently not only employed in Bohemia and Moravia in the Middle Ages, but was also cultivated. Mathioli (1596) describes its employment in an infusion "for strengthening the heart and brain, to purify the blood, in the case of unconsciousness and to encourage sad and melancholic persons". The infusions for external use are suitable for those who "are stung by a snake or other unclean poisonous earthworm". Pollen of *Borago* was found in the cesspits from the High Middle Age in Prague on Václavské náměstí – Square (archaeological research of dr. V. Huml), in Náměstí Republiky – Square (dr. P. Juřina) and in Opava on Drůbeží trh – Market (dr. M.Zezula) – all pollen-analyses: Jankovská unpublished. Presently *Borago* is seldom cultivated for its leaves, which are used for salad.

Calluna vulgaris **–** Pollen of *Calluna vulgaris* is a regular component of pollen spectra from the high medieval material of nearly all Czech medieval towns. The frequency of *Calluna vulgaris* pollen is even higher in the material from most high medieval archaeological sites than from the pollen spectra of peat-bog sediments. This phenomenon can be explained in several ways. *Calluna vulgaris* could possibly have been used in medieval cuisine (tea? – still practised in Russian Karelia 'til today, for example), in medicine (infusions), in households and farmsteads (brooms? bedding?). Additionally, *Calluna vulgaris* probably grew more frequently in the High Middle Ages than today, particularly in degraded biotopes and those considerably influenced by man, as well as within the area of large cities and their vicinity.

Mathioli (1596) mentions the use of *Calluna vulgaris* in medieval folk medicine. For example the juice from leaves and flowers was used in the form of drops and compresses to heal eye diseases. Infusions were used against swellings and joint pain in steam baths. The oil from its flowers was supposed to heal skin diseases, especially those on the face. The treatment

is also mentioned in the case of snakebites, when crushed flowers and young twigs were used as compresses.

Fagopyrum* cf. *esculentum – Pollen grains of *Fagopyrum* can be found in the high medieval pollen spectra regularly even though mostly only sporadically. This applies to the finds from the cesspits, wells and find layers from most medieval towns (Prague, Most, Plzeň, Chrudim, etc.). The largest quantity of *Fagopyrum* pollen grains from the environment of a medieval town was found in Opava, at the Drůbeží trh site (Poultry Market). They came mostly from the fills of cesspits dated to the 15th century. The set of 30 pollen grains from Opava – Horní náměstí (Upper Square) sites were roughly of the same age (archaeological research Dr. M. Zezula). A large quantity of *Fagopyrum* pollen was found in the Chotěbuz site – Podobora at Český Těšín (Czech Silesia – research Dr. P. Kouřil, pollen analyses – Jankovská). It can be supposed that *Fagopyrum* might have been cultivated exclusively at this site. Furthermore, the high number of cereal pollen grains (*Cerealia*) bears witness to the existence of fields right where the samples were taken. Though these high medieval samples were originally supposed by archaeologists to come from the Early Middle Ages it was just the high occurrence of *Fagopyrum* that proved their high medieval origin. The history of *Fagopyrum* within the territory of the former Czechoslovakia in the larger context of central and eastern Europe was studied by Opravil (1974). This author supposed that *Fagopyrum* was getting into Czech Republic from the south via the Danube and also outside the Carpathian Arch via Poland. Only our numerous finds of the *Fagopyrum* pollen grains from the area of the Czech part of Silesia (Opava, Chotěbuz) have been able to confirm this "northern path" of *Fagopyrum* propagation.

The clear majority of finds of *Fagopyrum* comes from the High and Late Middle Ages and from the Modern Age. The finds from the Early Middle Ages are quite sporadic and, what is worse, not always trustworthy.

***Myrtus* type** – This minute pollen belongs most probably to the kitchen spices *Eugenia caryophyllata* Thumb., i.e. "cloves", indigenous to the archipelago of Moluccas. According to the information of the medieval book – Mathioli (1596) – it was used in medieval medicine as well as in the household. A special power was accredited to it. This power consisted in energizing the heart, liver, stomach and head, but beyond that, cloves were also used as a remedy for "plague air", for improving beer, etc. Even though cloves was a very valuable article, its pollen grains are found regularly in the

cesspits and wells from the High Middle Ages in most of the Czech medieval towns. They were found for example in: Prague: U radnice 5 (archaeologist research Dr. Zv. Dragoun), Ungelt (Dr. J. Richterová), Karlovo náměstí (Dr. V. Kašpar); Václavské náměstí (Dr. V. Huml, Dr. P. Starec), Náměstí Republiky (Dr. P. Juřina) – all wells, Alšovo nábřeží (Dr. P. Starec) dumping ground; Opava: Drůbeží trh (cesspit) – Dr. M. Zezula; Nymburk: Náměstí Přemyslovců (wells) – Dr. K. Motyková; Plzeň: Náměstí republiky 8, No. 96 (well) – Dr. R. Široký, Dr. K. Nováček; Prachatice (water piping) – Dr. J. Beneš; Chrudim: Filištínská ulice (cesspit) – Dr. J. Frolík (all pollen analytical research V. Jankovská).

There can be two explanations for the occurrence of *Myrtus*-type pollen (in the case of "cloves") in the sediments of wells. Cloves could be put into the wells for example as a means of disinfecting "bad water". However, wells could also be used secondarily as cesspits where cloves could end up either through alimentary tract (faecal cesspits) or from the remains of infusions (waste pits).

Of course, pollen grains of *Myrtus* type could theoretically also belong to *Myrtus communis*. Mathioli (1596) describes wide employment of myrtle in medieval medicine as well as in cosmetics, both externally and internally. Myrtle fruits were, for example, used before drinking spirit in order to avoid intoxication. Crushed fruits and leaves were supposed to help those who "poisonous and dead-causing mushrooms ate". Men used to dye their hair black with an infusion of myrtle, and the juice from its fruit allegedly acted as a remedy against the poison of "spiders and scorpions" (Jankovská 1987, 1995a). The nearest place where common myrtle grows wildly is southern Europe, in the Mediterranean area.

Xanthium strumarium – The pollen of this plant is easily determinable. It was found in large quantities in the site Hrdlovka (archaeological research of Dr. P. Meduna-Jankovská 1995c, Čulíková et al. 2008). However, it occurred regularly in smaller quantities in several archaeological sites in Prague, Most, Chrudim, Litovel and sporadically in other sites. Mostly this was case of deposits from the High Middle Ages. Opravil (1963, 1983) evaluates this taxon as archaeophyt. Mathioli (1596) writes that *Xanthium* "grows in old yards, behind fences, especially in leys which are usually fertilized by grazing cattle dung". This plant evidently already occurred frequently in the days of Mathioli. Hence it does not seem probable that is was introduced to our country after the discovery of America, as still

mentioned in botanical literature. Our pollen finds of *Xanthium* support the evaluation of the taxon as an archaeophyt, i.e. a plant already introduced to our country by pre-Columbian times. It is commonly held that the extract from the root was employed for dyeing textiles yellow in the past. However, Mathioli (1596) does not mention the use of the plant for dyeing, but he does mention that "hair can be smeared with an infusion in lukewarm water and it will be nicely yellow" and "the root crushed up to dust and drunk with wine takes away all kinds of unhealthy things from the body from which leprosy could arise in the body". Today the four species of the genus *Xanthium* growing in the Czech Republic are mostly mentioned as the species introduced from North and/or South America. All of them grow in synanthropic biotopes.

Adianthum capillus-veneris – In the profile, formed by the mixture of anthropogenic and natural sediments in the alluvium of the Bilina river in Most, 48 spores of this fern were found in one layer. The find, though surprising, was only mentioned in the publication (Jankovská 1995c) since it could not be explained. At the beginning of the year 2004 Prof. E. Kvavadze from Georgia became interested in the find. The reason was that the spores *Adianthum* were regularly found in archaeological finding layers from several sites in Georgia that were studied by this specialist in pollen analyses. Often the *Adianthum* spores occurred here along with the finds of tunics of parasitic worm eggs. Prof. E. Kvavadze's question as to whether this fern could be employed in popular medicine as an antihelminticum, i.e. a remedy against parasitic worms, cannot yet be answered. Mathioli (1596) mentions various internal and external uses of this plant, but does not mention its use as an antihelminticum. But he writes that "woman hair" (i.e. *Adianthum*) soaked in an infusion helps against "a heavy breath, wheeziness and against jaundice and bad spleen. It drives out urine from the body, crumbles stone and helps against belly bloating. Externally applied infusion from *Adianthum* should be used as a remedy against baldness."

Today *Adianthum* is used in the Czech Republic only as a decorative indoor plant. Nevertheless, an infusion from another fern, i.e. *Dryopteris filix-mas,* is still used today in veterinary medicine as an antihelminticum.

Anthoceros – The spores of *Anthoceros punctatus* and *A. laevis* (Bryophyta) are also an important anthropogenic indicator of the Middle Ages in particular. They are quite regularly found in the pollen spectra from

this period. They are a good indicator of medieval fields which were lying fallow for a certain time.

The greatest quantity of spores of *Anthoceros* was found in the pollen spectra in high medieval material in the site Chotěbuz (pollen analyses: Jankovská unpubl.) in the Czech Silesia, north to Český Těšín. This site is known above all as an important fortified settlement (Early Middle Ages) – Kouřil (1994). The fact that the spores of *Anthoceros* occur here only in material which was dated by local pollen analyses to the High Middle Ages, as hitherto determined and not to early medieval time as archaeologists previously supposed is interesting. The spores were not found here in samples dating from the Hallstatt and Early Middle Ages periods. The cause of such a high occurrence of both *Anthoceros* species (*A. laevis* predominated) was evidently the fact that the samples most probably came directly from the material of the original medieval fields. At present the territory under research is wooded, and traces of fields are not noticeable. Regularly, but sporadically, the spores of both the species of the genus *Anthoceros* were found in the pollen spectra from most of the medieval material. They got into the archaeological sites with plant material brought in from fields, meadows, and pastures. Neither the occurrence of these mosses directly in the urban area of the settlements in the edaphically suitable biotopes can be excluded.

Hygiene and social situation

The finds of tunics of intestinal parasite eggs in anthropogenic sediments helped again to widen our ideas of life in past human communities. The presence of these microscopic objects not only in the contents of cesspits but also in the refuse from households, in the sediments of wells, in soil profiles and in various deposits mostly from the medieval age, tell of a gloomy hygienic situation in those times. Above all the egg tunics of small tapeworm *Trichuris* cf. *trichiura* and roundworm *Ascaris* cf. *lumbricoides* were found. Even though it is mostly impossible to safely differentiate the human species of these intestinal parasitic worms from animal ones within the pollen-analysed material, it can be expected that the parasites in our sediments are mostly of human type. Within the medieval sediments these finds are recorded at many sites of medieval towns – Most, Prague, Nymburk, Plzeň, Chrudim, Brno, Opava, České Budějovice and other sites. The oldest find of *Trichuris* sp. comes from the Palaeolithic Hôrka-Bolek site in Slovakia

(Jankovská unpubl.) – research of Dr. L. Kaminska. From the La Téne period it is the find of *Trichuris* from Liptovská Mara – Slovakia, (Jankovská unpubl.) – research of Dr. K. Pieta.

The remains of other parasitic intestinal worms are found only sporadically, evidently due to a worse resistance of their egg tunics (e.g. pinworm – *Enterobius* and various species of tapeworms – *Taenia*, etc.). Thanks to the finds of parasitic worms it has been confirmed that many wells very often served secondarily as cesspits, and even latrines. Even the wells from the 13th and 14th centuries from Prague – Castle, Jiřské náměstí (George's square) contained an unusually high number of *Trichuris* and *Ascaris* (Jankovská unpubl. – research of Dr. J. Frolík).

According to hygienists from the Czech Republic the occurrence of *Trichuris trichiura* today is quite exceptional and is found almost exclusively in immigrants from SE Asia.

Problems of the age, function and/or disappearance of some archaeological features and situations

The so-called Kounovské stone rows can serve as an example. This is a forest site in western Bohemia (Jankovská 1997a). The age and function of these formations has been the subject of many levels of discussion which have often bordered on the "Däniken"-esque. The results of pollen analyses, which were presently again completed with new facts (Jankovská unpubl.), unambiguously tend towards the prosaic. The finds of large quantities of cereal pollen bear witness to the existence of fields in exactly the location of the mentioned "Kounovské stone rows". Field weeds – pollen of *Centaurea cyanus* and *Mercurialis annua* as well as the pollen of *Secale* confirm that the age of these fields does not go beyond the High Middle Ages. The same was confirmed by the pollen grains of *Fagopyrum* found. Some pollen finds are even from the Modern Period, as the pollen of *Larix* would imply. The results of pollen analyses from the area of the "Kounovské stone rows" do not, in any case deny the existence of a former Celtic settlement in the vicinity, as was finally unambiguously proven by archaeologists. The outcomes of pollen-analytical research concern only the function of the stone rows themselves.

In general, pollen analysis can determine the moment when, and manner in which, as a result of the creation of settlements and farming features

(fields, meadows, pastures, etc.), man began to change originally natural biotopes (mostly forest ones) into synanthropic biotopes. In the same way the manner of farming as well as disappearance of settlements, villages, etc. can also be documented through pollen-analyses. Secondary vegetation succession, by which the antropogenetically formed biotope returns to climax state (wars, natural disasters), can be reconstructed. This was quite well documented by e.g. pollen analyses near the extinct, medieval village Pfaffenschlag (Rybníčková et Rybníček 1975). The disappearance of farmhouses in a medieval village due to a natural catastrophe—in this case a landslide and its subsoil slide due only to human activity—was suggested by the results of pollen analysis in the case of a large archaeological research project of Dr. L. Belcredi in the area of the extinct village Bystřec (Jankovská 2006).

Also, the existence of fields at the location of a present larger forest complex in the Chotěbuz site – Podobora (research of Dr. P. Kouřil) was documented by pollen analytical research. The composition of pollen spectra proved that these fields existed here in the High Middle Ages and not in the Early Middle Ages as originally supposed (Jankovská unpubl.).

Pollen analysis and history

Pollen analysis of the dust gathered during the restoration of old books also offered interesting results. Four books, printed between 1500 and 1530 were kept in the Franciscan monastery in Kadaň (NW Bohemia) till the 1960s. After that they were transferred to Strahov Monastery in Prague. The dust, taken from behind the pages of the books contained a relatively rich pollen spectrum. The composition of its trees was in surprising compliance with the original composition of the forest vegetation of the Krušné hory Mts. This is evidence that the books were used in the monastery in Kadaň, the town at the foot of these mountains. The composition of the herbs in the pollen spectrum was already markedly synanthropic at that time. Cereal pollen grains including *Secale* were found. Field weeds *Centaurea cyanus*, *Scleranthus perennis*, *Polygonum aviculare*, *P. convolvulus* were determined. Pollen grains were also regularly found of plants whose occurence centres mostly around rubbish heaps, ruderals (*Artemisia*, Asteraceae, *Campanula rapunculoides*, *Urtica*), yards, roads and other permanently trodden surfaces (*Plantago lanceolata*, *P.major-media*). These finds mean that the dust that

settled between the sheets of books at the time bears in itself interesting pieces of information about the environment of a certain period over a certain time. Restorer Mr. J. Vnouček even expressed his opinion that pollen analysis could show the original place where books from the property of the Rosenbergs were kept when they were taken away to Sweden in 1648 at the end of the thirty-year war. This could be successful if a sufficiently rich pollen spectrum could be found in the dust of the books and in other impurities.

Summary

The pollen analyses of the material from various archaeological situations of the medieval age from the Czech Republic has produced many valuable results. The first pollen analyses for the needs of archaeological research were originally meant to find out whether their results can be used for making the archaeological interpretations more exact. When it was found out that a part of the sediments from archaeological sites contains pollen grains, more detailed pollen analytical research was started. The results of pollen analyses made it possible to reconstruct the state of the environment in settlements and their surroundings, mostly with regard to vegetation cover. Nevertheless, the research of cesspits, wells and deposits of various functions has also brought evidence pertaining to cultivated, consumed and technical plants. The determination of non-pollen objects (so called Non-Pollen-Palynomorphs) increased the interpretation possibilities of the original pollen analysis. The information about socio-hygiene in the period under study was interesting for archaeologists. To botanists the results obtained by pollen-analyses brought to light new details concerning the history of individual plants. A similar situation was also true in other branches of biology. The results of pollen analyses suitably complement the results of macroremains analyses. These form the basis of archaeobotanical research since they can determine the finds of macroremains in more detail than the pollen analysis. By means of pollen analysis it was possible to distinguish the early medieval samples from the high medieval ones.

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