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New evidence for the Bronze Age fortification at Pilsen-Hradiště, West Bohemia: A multidisciplinary approach

Introduction

This paper presents a recapitulation of interdisciplinary research conducted in 2012 and 2013 on an important archaeological site located in the cadastral area of Pilsen-Hradiště (Hradiště u Plzně) in the central part of West Bohemia.[1] The fortified site was reported for the first time in the second half of 19th century. Our new project, carried out as a summer training school for students of archaeology within a larger project "The Partnership in Research and Presentation of Archaeological Heritage",[2] investigated the site with the aim to re-evaluate the knowledge of the site's history compiled in the past. Furthermore, it aimed to address some newly postulated problems. The character of our research questions required close collaboration with a number of scientific disciplines, which can contribute to archaeological research with their own methodological approaches. We will recapitulate the history of research on the site and the main outcomes of our two research seasons.

The fortified site is situated on the present-day southern margin of Pilsen at the coordinates 49.7136N:13.4007E, but historically this area functioned as a separate village, a part of the town's economic hinterland (**Fig. 1**). The ancient hillfort is located on a terrain spur elevated 20–30 m above the narrow neck of a large meander of river Úhlava. The layout of the fort is kidney-shaped (dimensions ca. 200 × 100 m, 1.65 ha), with a single line of enclosing rampart preserved to a varying height around its perimeter. While the remains of defensive construction are not discernible on the eastern side (where it may have been destroyed by erosion and road construction), on the north – where the access to the site is easiest – we can find a massive rampart. Here its top still rises up to 3 m above the inner area of the hillfort and up to 7 m above the meadow on the outer side. There are known (yet unpublished) traces of prehistoric and early mediaeval settlements on the nearby river terraces and – about 1 km to the north on the hill called Homolka - an early mediaeval burial ground, dated to the 10th–11th century AD.[3]

History of research

The site has been known to archaeology for more than 150 years, and since then a number of small-scale surveys and excavations have been undertaken there. The earliest report comes from the year 1862, when the prehistorian F. Olbricht visited this fortification together with a town counsellor Pecháček.[4] Later it was mentioned among the sites renowned for the so-called "vitrified ramparts", i.e. stones with traces of intensive fire.[5] In the 20th century two important excavations took place. The first of them was carried out by F. B. Horák, who commissioned the first detailed plan of the site to be made specifically for archaeological purposes and dug several trenches into the rampart at various places. This plan and a drawing of one trench section is archived at the Department of Prehistory of the Museum of West Bohemia, Pilsen. The finds discovered by F. B. Horák can be dated to two dominant periods: the Late Bronze Age and late Hallstatt periods.[6] After the First World War sand started to be extracted from the old river terrace on the southeast part of the site, while the rest of its area continued to be used as fields. Rescue excavations undertaken in the sand quarry by V. Čtrnáct in 1947 brought to light important pottery finds, which are variably referred to in literature as representing the end of the Early Bronze Age or the transitional horizon

[1] Similar summaries were already published in Šmejda 2014a; Šmejda *et al.* 2015.

[2] Šmejda 2014b.

[3] Schejbalová 2011.

[4] Sklenář 1992.

[5] Šnajdr 1893.

[6] Chytráček/Metlička 2004, 224–229.

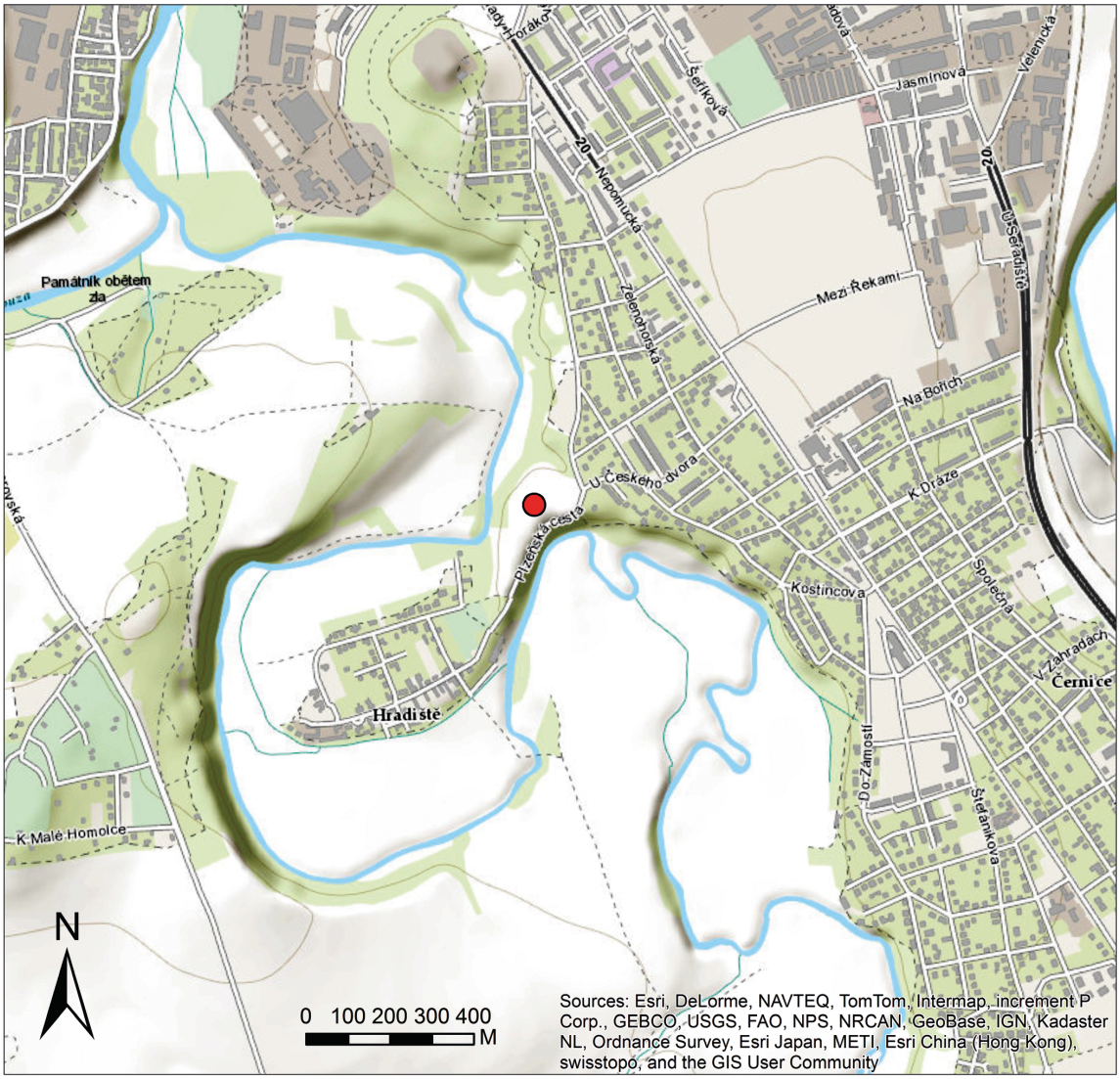

Fig. 1 Localization of the site Pilsen-Hradiště (adapted in ArcGIS by the author)

Fig. 2 Aerial photograph from 1970 shows the hillfort with a nearly finished recultivation of the former sand quarrying (source: Military Geographic and Hydro-Meteorological Office in Dobruška)

Fig. 3. Aerial photograph of the hillfort (looking north). South-oriented slopes of the rampart are clearly defined as snow melted there due to more intensive sun irradiation. Notice a short segment of the eastern rampart in gardens to the right of the road (photo by the author)

between the Early and Middle Bronze Age.[7] The hillfort was added on the national list of important archaeological monuments in 1958, the mineral extraction was halted, and the large sandpit resulting from previous quarrying, which by then had destroyed at least 20 % of the inner area, was gradually recultivated (**Fig. 2**). Finally, a modern contour plan of the site was elaborated in 1975 by the Archaeological Institute of the Czechoslovak Academy of Sciences. Together with limited collections of finds obtained from fieldwalking, this overview of earlier research activities is complete.

The past research revealed that it was a multiperiod site protected by a massive fortification, which was destroyed at least once by a high-temperature fire. Many questions however were left unanswered, e.g. how many times was the fortification re-built? Can each prehistoric period recognized in the excavated material (i.e. Early/Middle Bronze Age, Late Bronze Age, and late Hallstatt period) be regarded as a settlement protected by some type of physical barrier? What type of construction was used and could it have served effectively for military protection? How did the site function in its environmental setting? These questions could not be answered without obtaining new data in the field, and they were addressed by the project.

When starting our field project in 2012, we aimed to shed more light on these research questions, taking the site as a specimen of a larger group of prehistoric central places. We decided to study this site in both its local and wider geographical context and to establish it as a focal place in the dialog between a range social and natural sciences. Besides the academic interests, we used this opportunity to train students of archaeology in field methods and to raise the local public awareness about the important part of cultural heritage in their neighbourhood.

[7] Jílková 1957, 41; Jiráň 2013, 84.

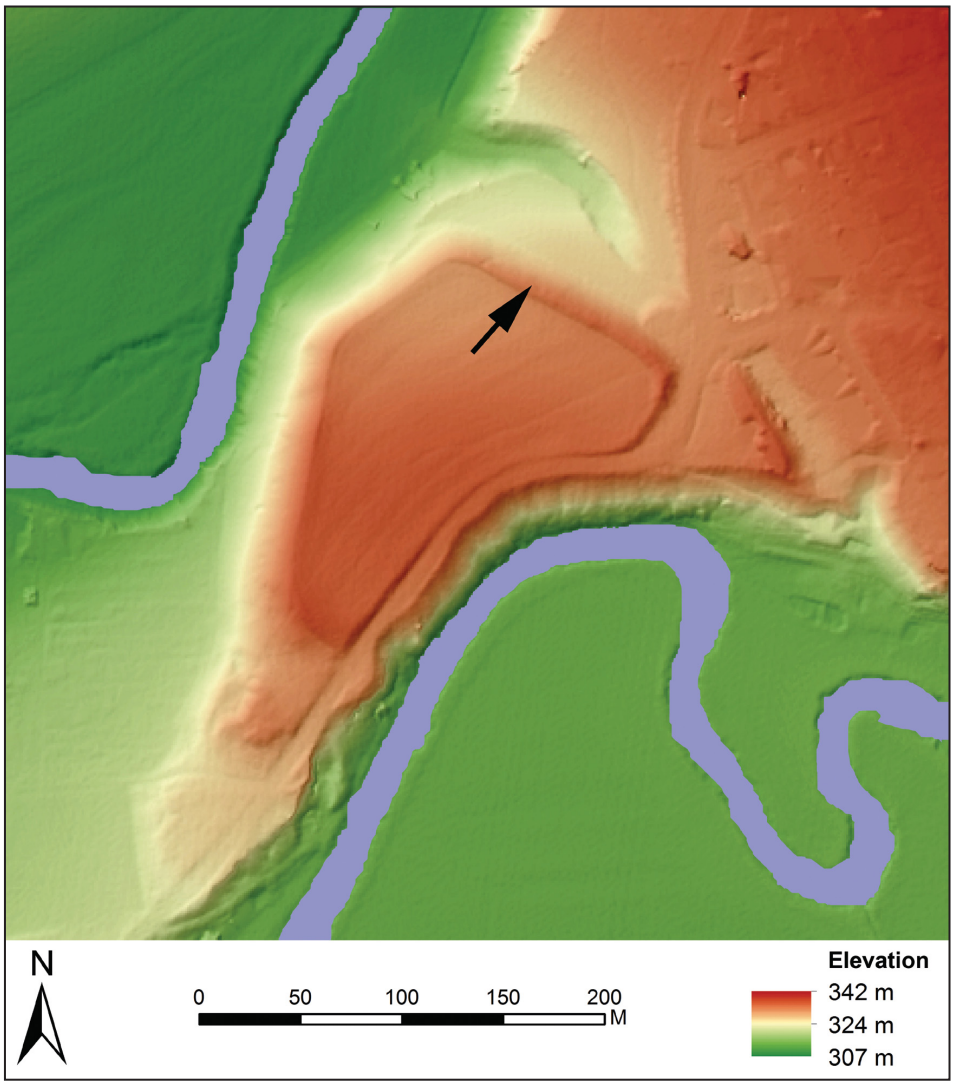

Fig. 4 Digital terrain model of the site, based on LIDAR data from the State Administration of Land Surveying and Cadastre of the Czech Republic. The eastern rampart segment detached from the main part of the site is clearly visible. The arrow marks the position of the main trench excavated in 2012–2013 (graphics by the author)

Archaeological prospection

The first group of methods that were applied in advance at the excavations, but continued to be consulted repeatedly in various stages of our project include aerial reconnaissance and geophysical prospection. We investigated changes in land-use and vegetation cover in the target area by means of historic aerial photographs taken in various decades of the 20th century. This archival imagery was complemented by our own aerial prospection conducted well before the official start of our project (**Fig. 3**). Very useful data were acquired by airborne laser scanning (LiDAR), allowing visualization of a detailed terrain model in geographical information system (GIS). This elevation model provides an excellent overview of the topographic setting of the site and the well preserved features of its anthropogenic relief (**Fig. 4**). A combination of various techniques of aerial survey offered a good description of the rampart and its state of preservation in various parts of the site, as well as the general geomorphology, development of vegetation cover and progressive urbanization of the surrounding area over the last century.

A number of geophysical methods were used in experiments in order to contrast their outcomes and usefulness in the specific conditions of the site. We tested the following techniques: electromagnetic induction, magnetometry, georadar, electrical resistivity, and seismic refraction. Most of them were used only in a spatially limited sample, with the exception of the caesium magnetometer, which we succeeded in applying on the entire extent of the enclosed settlement (having first removed most of the shrubs growing on the

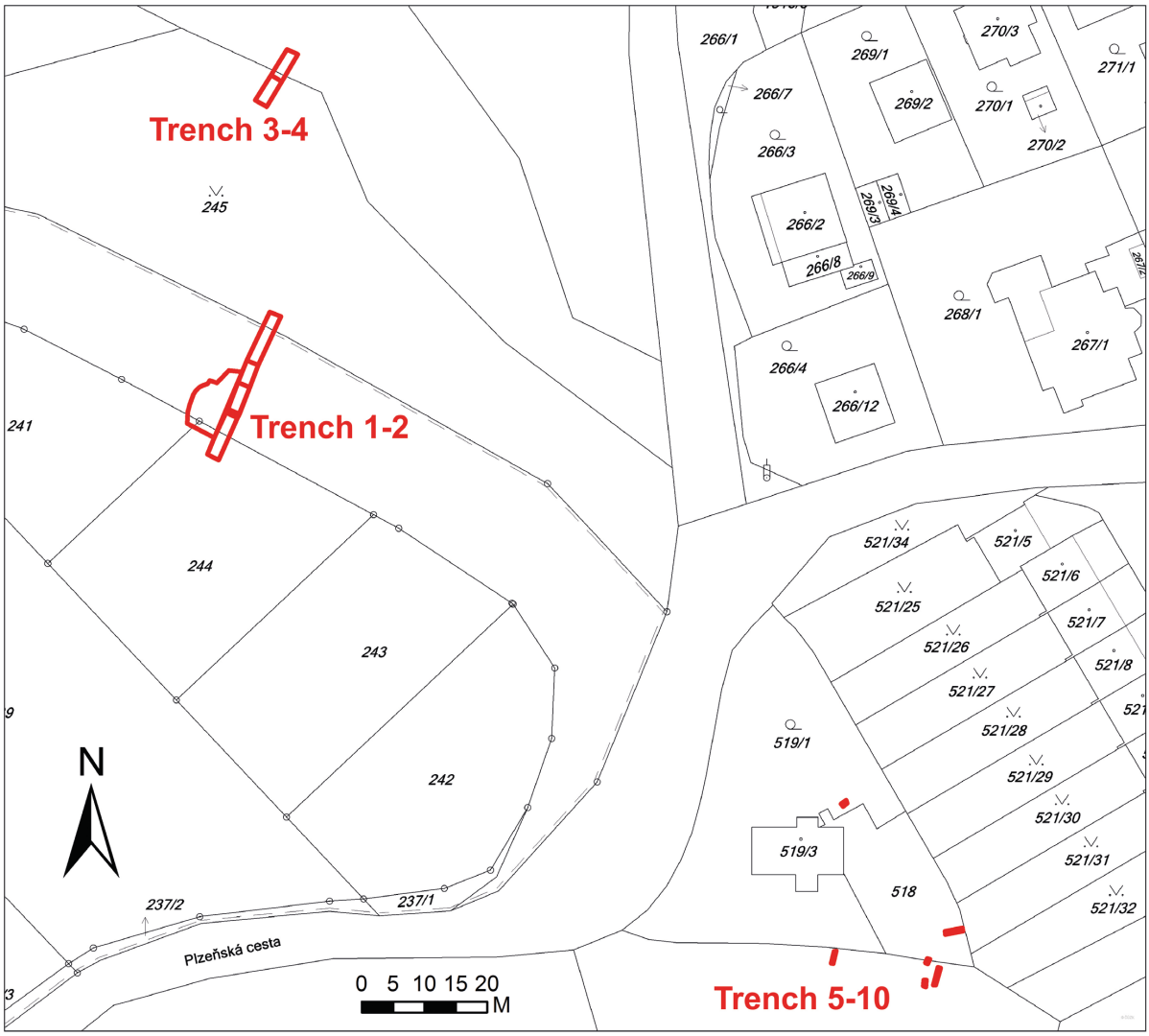

Fig. 5 Trenches excavated in 2012 and 2013. The excavation through the northern rampart is marked as Trench 1-2 (the cadastral map adapted by the author)

abandoned fields) and of the meadow adjacent to the site at its northern part.

The results of geophysical survey show clearly the extent of the former sand pit that destroyed a large part of the site's interior in the middle of the 20th century (geophysics reveal that the maximal extent of mineral extraction was probably even larger than what was known from historic aerial photographs). Another important information is that the line of fortification consists of highly magnetic material, and such physical properties indicate that at least its uppermost layers had been affected by a strong fire along the whole of its surviving length. There are also signals of potential ancient settlement pits and lines dividing the inner area into parts, which can be of relatively recent origin (pre-modern field division). This interpretation of observed geophysical anomalies still has to be tested by further work.

Excavation

As the survey methods alone cannot resolve important questions of chronology and socio-economic aspects of ancient settlements, it was necessary to select a suitable place for an investigation by excavation. Consequently, the main effort was devoted to the elaboration of a section through the rampart on the northern side of the enclosed area, where this feature seemed to be best preserved and potentially most informative. It is well known that such man-made barriers are often able to retain and preserve significant accumulations of sediments at their upslope side, which would normally get destroyed by erosion. A space free of tree cover was chosen for a main excavation trench (trench 1), originally 2 m wide and 14 m long (**Fig. 5**); there the cultural stratigraphy of this site started to be examined in the summer and fall of 2012.

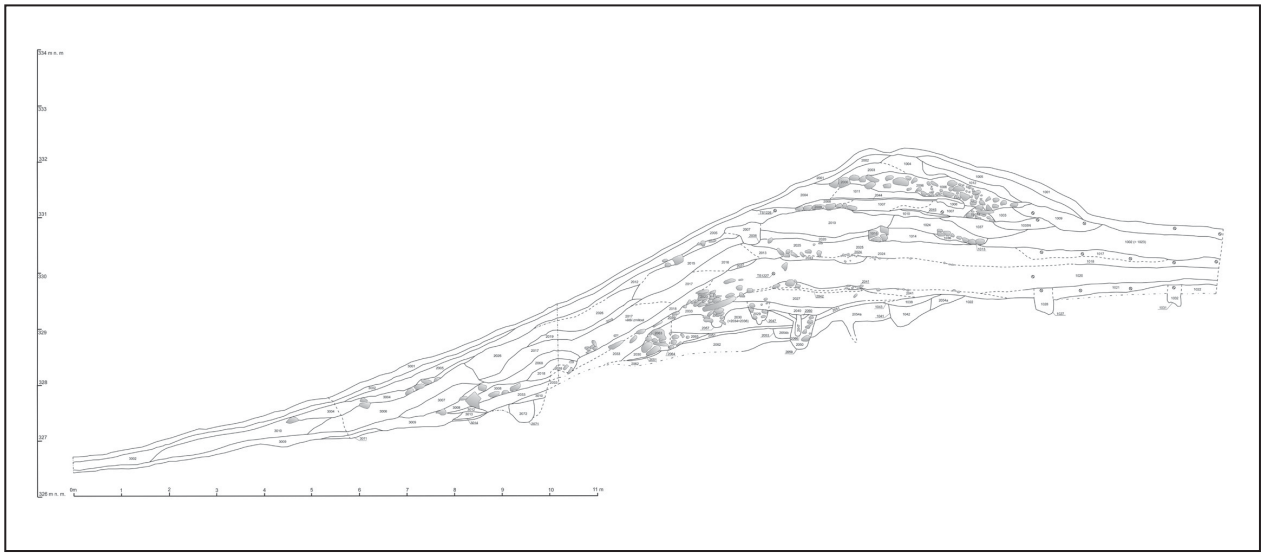

Fig. 6 Main cross-section of the northern rampart, facing east, seasons 2012–2013
(drawing by D. Vokounová Franzeová after the original field documentation)

While the major part of work was accomplished in the first season (2012), the section was prolonged outwards in the following summer 2013 to obtain as complete a picture as possible of the stratigraphy of inclined destruction layers forming the outer foot of the massive rampart. With this extension, the joint section of trenches 1 and 2 reached the cumulative length of nearly 26 m. In the central (highest) part the layers had accumulated to a massive 4 m thick sequence, sloping down toward both ends. The slope gradient was steeper and more prominent to the north, following the natural inclination of the bedrock, formed by the old surface of river terrace (**Fig. 6**).

The excavation followed the stratigraphic units, which were recorded by textual description (in a structured way), drawings and photographs. Interesting details and larger situations were also documented by photogrammetry, the control points being measured by a geodetic total station to record all the field data into Czech national geodetic grid S-JTSK. The section provided abundant artefacts, charcoal for radiocarbon dating and other ecofacts for natural scientific analyses (animal bones, botanical macrofossils, and soil samples). The final stage of 2012 excavation was recorded by terrestrial laser-scanning.

The previously unexpected depth of a very heterogeneous stratigraphy presented serious problems with the stability of the trench walls and safety of workers throughout the excavation. Although we used wooden props and a steel grid to support the walls, in the later stage of the 2012 season we had to widen the upper part of trench on the west side, which was less stable and prone to collapsing. This provided us with the opportunity to collect more sediment samples and to finish the documentation of the lower parts of the stratigraphy.

In addition to the main trench, several other small test pits were opened in the northern part of the site. These were investigated to answer specific questions regarding the relationship of the settlement to the erosion gully in the north vicinity of the main fortification line, the site's dating, and the purpose of the rampart segment located in present-day private gardens in the easternmost part of the enclosed area (**Fig. 5**).

It seems that this rampart has a very different character when compared to the main fortification line. Though we could work only on the surface and shallow subsurface level on this eastern rampart, we recognized only a monotonous mass of light brown sediment forming this feature, with no construction details, and no traces of fire, charcoal, animal bones or pottery. This is strikingly dissimilar to the situation observed on the main rampart line (in the North and West), where the observed richness of finds and layers was remarkable. Therefore, we may hypothesize that the eastern rampart has a "life history" different from that of the main rampart, but as yet its dating and development remains largely unknown due to lack of finds.

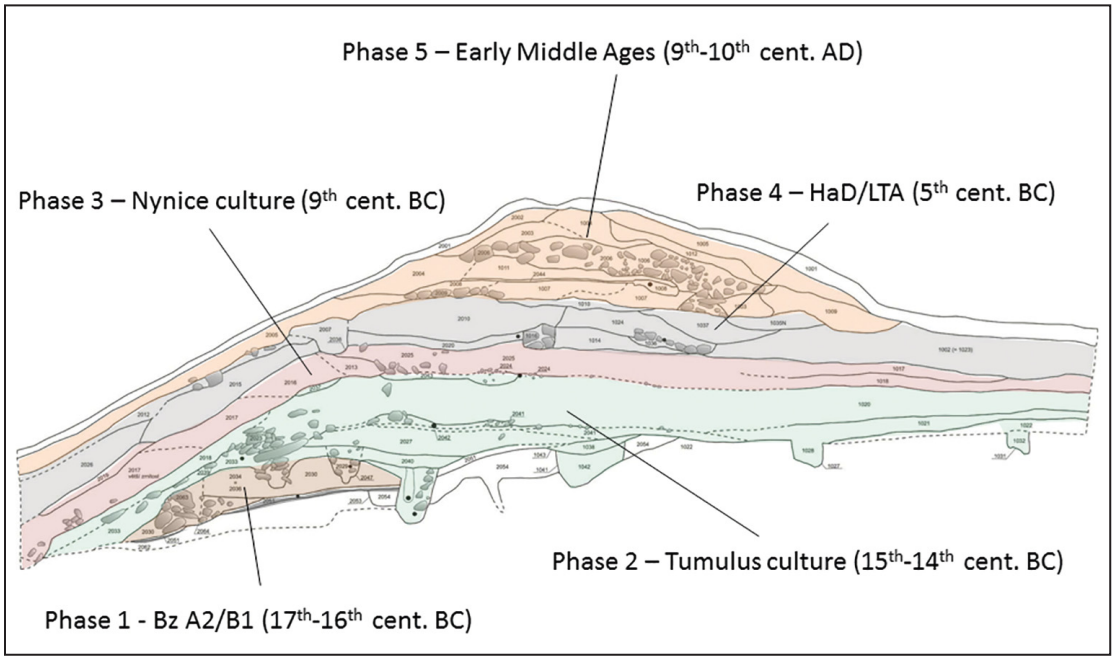

Fig. 7 Overview of the main chronological phases in the central part of the northern fortification line (graphics by the author)

Northern rampart

The main trench cutting the northern rampart revealed a very complex stratigraphy, which answered most questions that we had asked at the beginning of our project. It also helped to understand better the original plan and drawing commissioned by F. B. Horák in 1911. It turned out that there are at least five clearly distinguishable chronological phases hidden in the sequence of the layers inside the rampart (**Fig. 7**), of which two were totally unknown before our excavation started. Our new chronological model is based on the dating of pottery finds associated with individual stratigraphic units and on radiometric dates. The samples for radiocarbon analysis were selected with the aim to date primarily the remains of construction wood contextually linked to the built structures, such as stone walls and palisades. These charcoal samples were dated in the Beta Analytic lab,[8] and the whole series of 17 submitted samples was successfully measured.

The following overview of known construction phases lists archaeological periods as they were recognised from the associated finds (with the exception of the phase no. 5, where there were no relevant finds of ceramics), and from the calibrated radiocarbon dates. We cannot exclude that

Fig. 8 A posthole with stone packing, probably a part of the Middle Bronze Age fortification system (photo by the author)

these dates may be affected by the "old wood" effect, which means that the dates correspond to the time of wood growth and not exactly to the time of the use of wood for construction purposes in the studied context. It means that whilst the wooden

[8] http://www.radiocarbon.com.

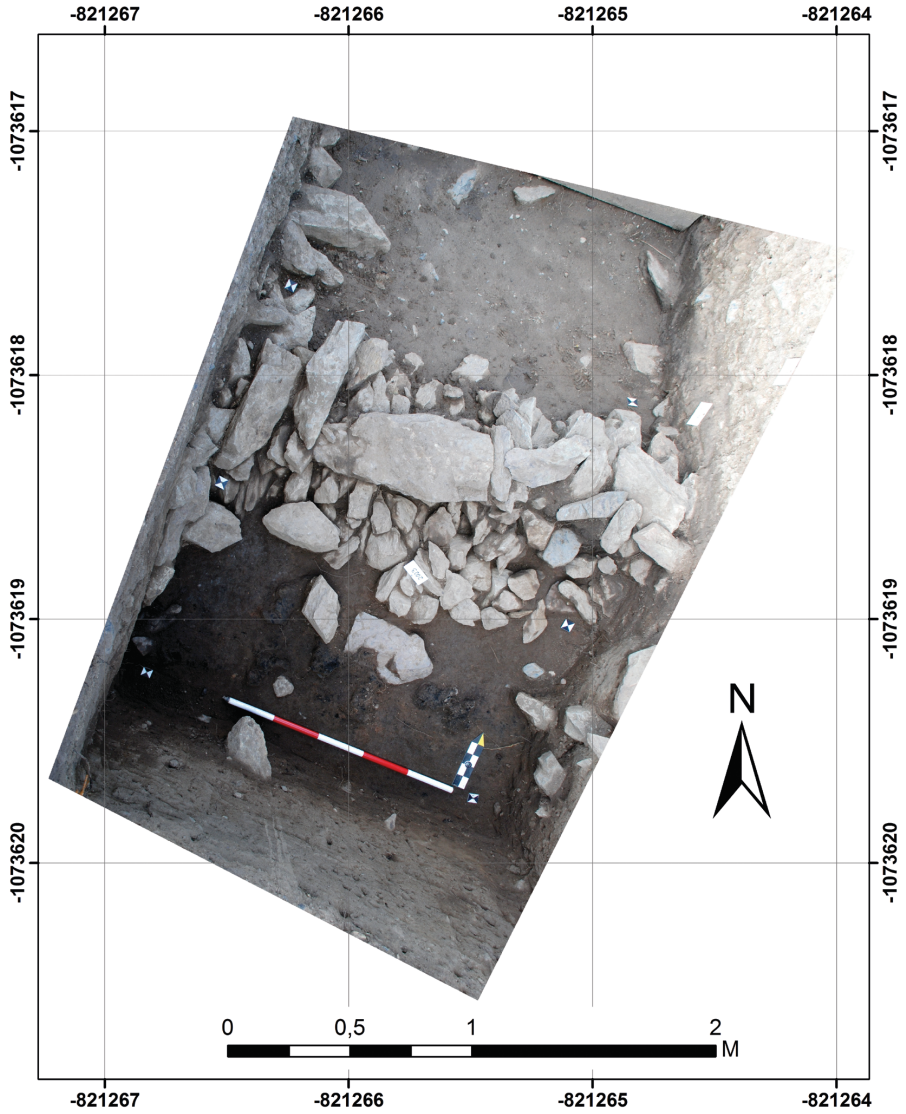

Fig. 9 A relict of the Middle Bronze Age stone wall, representing the front component of the fortification. Large fragments of carbonized wood were found on the inner (southern) side of the wall (photogrammetry by J. Plzák)

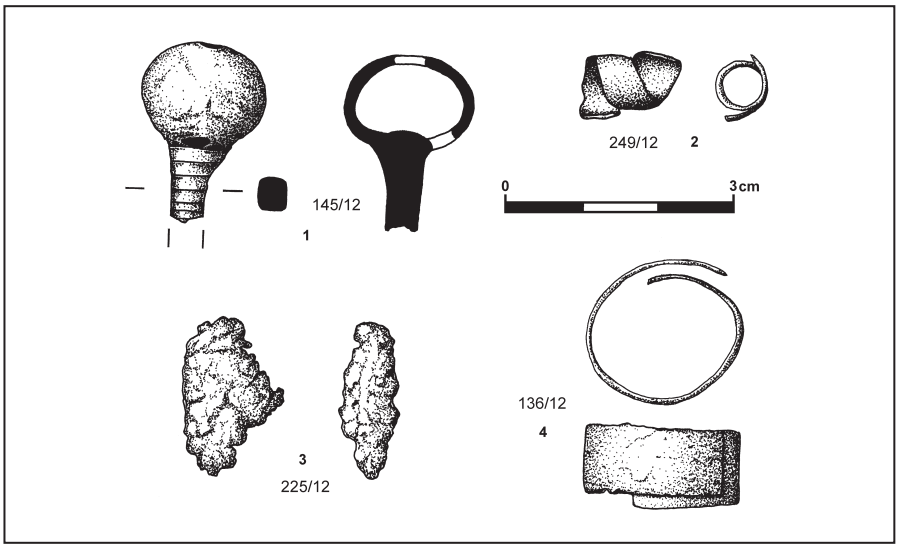

Fig. 10 Small bronze artefacts found in the Middle Bronze Age layers (drawing: Museum of West Bohemia in Pilsen)

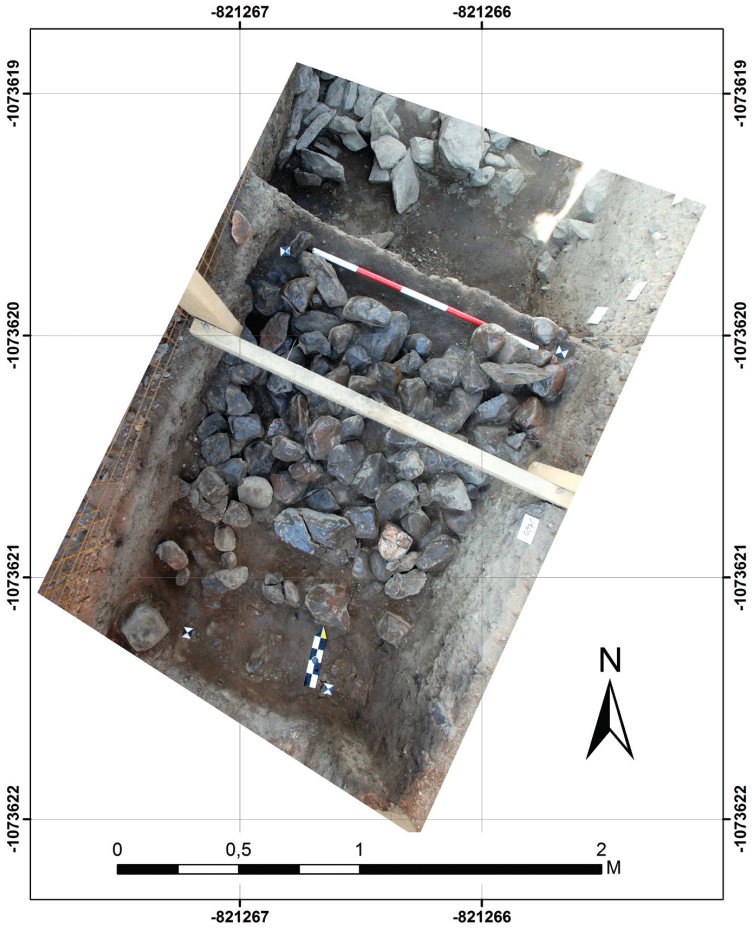

Fig. 11 A platform constructed using river cobbles, probably a part of the Late Bronze Age fortification. Traces of the earlier, Middle Bronze Age wall built completely from quarried stone can be seen in the lower elevation on the top of the photo (photogrammetry by J. Plzák)

constructions may have been actually slightly younger than their respective ^{14}C dates, with our relatively broad calibration intervals (2 sigma) the risk of a significant error is relatively small. The main recognized phases are:

1. The transitional period between the Early and Middle Bronze Age (17th–16th century BC);
2. Middle Bronze Age Tumulus culture (15th–14th century BC);
3. Final Bronze Age Nynice culture (9th century BC);
4. Late Hallstatt /early La Tène period (5th century BC);
5. The early mediaeval phase (9–10th century AD).

The first phase corresponds well with the finds from older rescue excavations carried out in the former sandpit, and we can claim now for the first time that already in this phase (Bronze Age A2/B1) the settlement had some form of enclosure.

The next phase connected to the Tumulus culture (Bronze Age B2/C1) includes at least two rebuilding stages and indicates a relatively complicated system of palisades (**Fig. 8**) and a stone wall (**Fig. 9**) that later collapsed and created a distinctive layer of basalt blocks spread down the slope (stratigraphic unit 2039). The existence of this Middle Bronze Age fortification is a completely new finding, with no preliminary indications in the data from past research. Together with the previous phase, it could have remained unnoticed by previous research, because they were buried relatively deep beneath the present surface and reaching them is technically quite complicated. In the layers deposited on the inner side of this Middle Bronze Age defensive structure during and after its period of function, several small bronze objects were found, including a globular perforated head of a pin (**Fig. 10**).

The final Bronze Age horizon of layers accumulated on top of the above-mentioned relics provided only minor traces of stone construction, this time made exclusively of river cobbles (**Fig. 11**),

resembling a pavement (unit 2024) that could have served as a foundation platform for some structure built of perishable material (wattle construction filled with earth?). The hypothesis that some kind of rampart existed in this period is supported by a large amount of loose material, which fell downslope from this level and could be clearly traced on the section (units 2013, 2016 and 2017).

Above the final Bronze Age layers, a quite impressive debris of Ha D fortification was preserved, which clearly disintegrated during a high-temperature fire. Frequent finds of partially melted and "vitrified" basalt rocks are associated with this particular horizon (namely units 2007 and 2010), and it is almost certain that also the older reports referring to this type of material on the site are related to this Early Iron Age phase. It is highly probable that F. B. Horák did not manage to get much deeper during his excavations than to this level, because all major layers from this horizon upwards seem to be clearly recognizable on his drawing.

It is interesting to note that distinctive late La Tène pottery fragments, which could be re-fitted, were scattered on top of the Ha D wall ruins. This, together with other pottery finds of the same date from the hillfort interior, testifies that there was a human presence on the site in the Late Iron Age. No traces of fortification belonging to this period have been revealed though.

The uppermost part of the rampart was unexpectedly dated to the early Middle Ages. Two radiocarbon dates from oak timbers (unit 1008) oriented perpendicularly to the fortification line (**Fig. 12**) point most probably to the 9th/10th century AD, although the calibration interval is wider in both ends. This was a surprising discovery, because no early mediaeval artefacts have ever been found on the site, not even during our excavation. But we have already mentioned that roughly contemporaneous early mediaeval sites including a burial ground are known from the close vicinity of this hillfort, so the reutilization of an earlier prehistoric fort in early Middle Ages should not come as a big surprise. However, this situation is interesting from a methodological point of view. On how many other sites does the lack of datable finds obscure identification of some rebuilding phases? The use of natural scientific dating methods certainly has a critical importance in addressing this question in future research.

From the evidence collected at Pilsen-Hradiště it is clear that the complete sequence of late prehistoric and early historical periods, which were particularly active in building fortified settlements in West Bohemia,[9] is represented on the site. Each new wall was rebuilt directly upon the debris of the previous phase. In this way, the anthropogenic terrain gradually increased over centuries' time, resulting in an elevated edge crowned by the rampart of the latest, early mediaeval phase. Another new discovery is that the abrupt difference in height between the outside and the inside, as it is observed today, was mostly created by past human activities, not by the natural topography. It is obvious now that the site of Pilsen-Hradiště preserves an enormous soil archive of archaeological and environmental records, spanning almost three millennia of local settlement history.

Vitrified fortification

Many ancient and historic defensive works are known for the presence of what is sometimes called "vitrified" fortifications, chronologically falling predominantly into the Iron Age. Although this phenomenon can in some regions take an extreme form, where large portions of ramparts seem to have been transformed by heat into an amorphous glassy appearance, in the case of Pilsen-Hradiště (Hradiště u Plzně) and in most other Central European cases we can speak about only partially melted and vitrified individual rocks and about their clusters within the fortification debris. This phenomenon had become the subject of archaeological interest very early on, particularly in Central European[10] and Scottish[11] archaeology, but it has been studied also in France, Iberian Peninsula and Scandinavia.[12] A variety of interpretations have been proposed in the past, summarized recently by Wadsworth *et al.*[13] in four major categories: strengthening of stone construction (engineering technique), hostile destruction by attackers, destruction by inhabitants during purposeful site abandonment, and burning walls as part of ritual practices.

[9] Maličký 1950; Šaldová 1981; Svobodová 1992; Chytráček/Metlička 2004; Chytráček/Šmejda 2005.
[10] Šnajdr 1893.
[11] Childe/Thorneycroft 1937.
[12] Kresten/Ambrosiani 1992; Catanzariti *et al.* 2008.
[13] Wadsworth *et al.* 2016.

Fig. 12 Construction detail of the latest, early mediaeval fortification. Charred wooden timbers were radiocarbon-dated to the 9th–10th century AD (photo by P. Menšík)

While the first option, intentional vitrification of stone walls as part of their constructional reinforcement, may seem at first sight rather as fantasy, recent research nevertheless concluded that it can be a tenable option in regions with specific geological conditions (types of rock used in fortifications). In many cases, however, similar finds can be explained more parsimoniously as a result of processes that accompany intense destructive fires. Wood (and especially hard wood such as oak) was used in abundance in such constructions, which dried out perfectly over time. In any case, a number of conditions still must have coincided (chemistry of materials included in a construction, temperature, air flow etc.) to produce the melting of rock on a larger scale.[14] Modern experimental work could so far replicate the destructive effects known from best archaeological examples only marginally and perhaps also somewhat accidentally.[15]

From our excavations we collected several boxes of heavily burnt and partially vitrified basalt blocks of variable sizes (**Fig. 13**). These were contextually bound to the destruction of the late Hallstatt (Ha D) defensive wall (unit 2010). It is obvious that a whole spectrum of changes caused by destructive fire can be studied on this material, from changes of natural colour and cracking of the rock surface, to the formation of porous texture, melting and, in the most extreme cases, vitrification of the original material. Almost identical material was recently published from the contemporary 5th century BC context on Glauberg in Hessen.[16] On many recovered samples from Pilsen-Hradiště it is possible to observe heterogeneous admixtures melted together and sometimes even imprints of wood texture. Similar casts were obtained by experimental burning of a rampart replica conducted in the United Kingdom in the 1930s.[17]

Our own experiments were only laboratory-based, and we found that the local metabasalt needs to reach the temperature of 900°C to change colour and crack, but still retain the original structure. Most pieces of rock from the Hallstatt phase in our trench were affected this way. Only the temperature reaching 1166° C forced the rock

[14] Friend *et al.* 2008; Baitinger/Kresten 2012; Wadsworth *et al.* 2017.

[15] Ralston 1986.

[16] Baitinger/Kresten 2012.

[17] Childe/Thorneycroft 1937.

Fig. 13. Selection of rocks from the debris of the Early Iron Age (Ha D) fortification with traces of intensive burning (photo by the author)

to melt and reach the liquid state in our laboratory conditions. However, the temperature necessary for melting the rock may have been lower in real conditions, depending on a possible presence of materials serving as a flux in the construction of the wall. During the cooling stage, new minerals – including magnetite – appear in the heavily transformed structure of the rock, increasing its magnetic susceptibility.[18] Only a minority of stones show that they locally reached the liquid state, but their number and spatial distribution along the fortification line still indicate that the energy unleashed during the catastrophic destruction of the Hallstatt D/ La Tène A rampart was enormous. Such fires must have offered quite an impressive spectacle that lasted for days and nights.[19]

Our observations from Pilsen-Hradiště fully support the hypothesis that the defensive system of the Early Iron Age was obliterated during a cataclysmic fire. Whether or not this event was caused by an attacking enemy or by inhabitants of the enclosed settlement (either accidentally or on some purpose) cannot be resolved on the basis of available data. Interestingly, the last (early mediaeval) phase of the fortification also bears traces of intensive burning (**Fig. 12**). The evidence shows timbers either charred or turned completely into light grey ash, and a significant amount of sandy sediment showing a spectrum of distinctive red tones. As this construction was different, in terms of both material and structure, from the previous Iron Age wall, traces of melting and vitrification are missing here, despite the rather similar way of their devastation.

Geochemistry

One of the progressive methods currently used to characterize archaeological layers on investigated sites is multi-element chemical analysis.[20] The X-ray fluorescence (XRF) spectrometer that we used for this analysis measures the weight ratios of detectable chemical elements in fine fractions of sediments (particles < 2 mm). We were able to find the presence of 31 chemical elements in 70 samples. The aim was to obtain the chemical composition of most layers across the whole stratigraphy of the rampart section. This method revealed several meaningful patterns. For example, the stratigraphic units which supposedly had

[18] RNDr. J. Zavřel, unpublished report.

[19] Ralston 2006, 162–163.

[20] Wilson *et al.* 2008; Wilson *et al.* 2009; Hejcman *et al.* 2013.

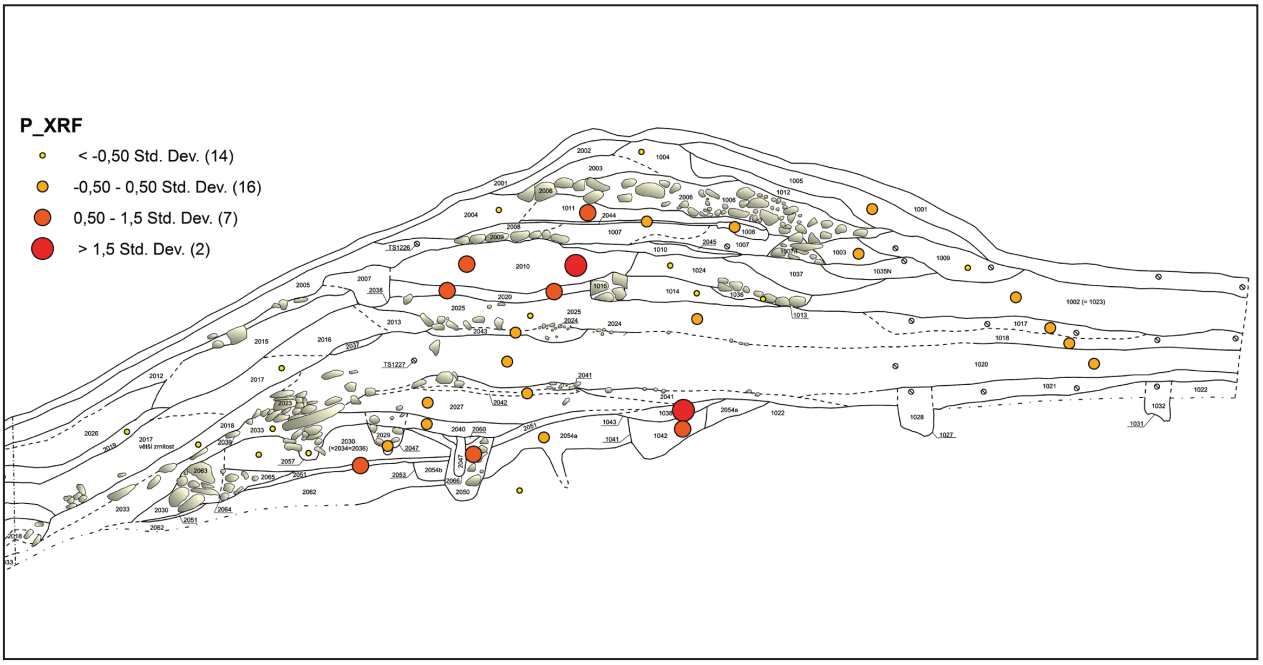

Fig. 14 Relative distribution of phosphorus in the cross-section of the northern rampart. Higher concentrations of P indicate decomposed organic content (wood, biomass ash etc.) (XRF measurements by M. Čekalová, graphics by the author)

high organic content, such as remains of wooden constructions or dark layers with concentrations of charcoal, showed an enrichment in C, Ca, P, Sr, and Zn. On the other hand, samples of the bedrock sand unaffected by human activities are lacking significant levels of these elements, and instead they are mostly composed of K, Na, Ni, and Si. Of course, the chemistry of soils and sediments is a complex matter, but the archaeological layers can be classified in a relatively straightforward manner into certain groups with similar chemical characteristics. Measured chemical composition can be studied by statistical tools or plotted over the section drawing to explore visually the spatial distribution of elemental concentrations across the entire archaeological stratigraphy (**Fig. 14**). These properties, if studied carefully and with necessary caution, do reflect the formation processes of sediments, showing the extent of human influence and subsequent taphonomic processes. Therefore, this approach can supplement other types of archaeological description and provide useful information about the sedimentary record we study.

Petrography

Interesting insights were brought into our discussion from the petrographic analysis of the exposed rampart section. Each chronological phase seems to be characterized by a specific selection of rocks that were used for construction purposes.[21] Building stone was not selected haphazardly across the site lifetime. All construction materials were locally available: metabasalts, river cobbles and other types of silicates were the most favoured, while schist was used only exceptionally. Individual construction phases had their own preferred materials: basalts prevailed in the Middle Bronze Age, river cobbles in the final Bronze Age, a combination of various rocks in the Early Iron Age, and similarly so in the early mediaeval period, with the addition of schist slabs, which fixed the inner ends of partially preserved oak timbers in the final phase. Although all these building materials could be obtained close to the site, enormous amounts that had to be retrieved, transported and used in construction works of this scale presented a massive task in terms of organization and management.

Subsistence and the environment

One of the key components of our project is a reconstruction of the vegetation in the catchment area of the site and identification of plants and animals exploited as the subsistence basis for the res-

[21] RN Dr. Jan Zavřel, unpublished report.

ident population. Even though we cannot expect very detailed information on these topics to be retrieved from excavation focused primarily on the fortification system, our sampling for ecofacts was relatively successful and presents a valuable contribution towards better understanding of lifeways and ecosystems in the Pilsen basin throughout prehistory. A selection of main trends observed in the data will be described in this section.

The results of anthracological analysis confirm that practically in all periods oak was selected as the construction wood. Small charcoals, dispersed in excavated layers and most probably representing fuel wood, have a more varied taxonomic composition. If we take this as a proxy for environmental reconstruction, it would offer a plausible picture of landscape development. In the Middle Bronze Age, a relative balance among spruce, beech, oak, pine, and taxa of open landscape can be discerned, but the trend towards the late Hallstatt period suggests continuing deforestation and prevalence of pine and acidophilic oak forests among the resources available to local population.[22]

In agricultural production, barley and wheat prevailed in the Middle Bronze Age, being increasingly complemented by millet and pulses towards the end of the Early Iron Age. This observation is in accordance with the general Central European trend.[23] The archaeobotanical evidence includes also seeds of common weed plants accompanying the aforementioned crops. The final Bronze Age horizon yielded the most abundant set of plant remains, while the other periods are rather underrepresented, which must be taken into account in their interpretation.[24]

Animal bones were a relatively scarce category of finds. The only period that allows some quantification is the Middle Bronze Age horizon. Out of 118 analysed bones, the slight majority is cattle (43 %), followed closely by sheep/goat (40 %), pig (13 %) and rarely represented taxa – horse, deer and hare.[25]

It must be stressed that environmental and subsistence data are only preliminary and of limited informative value, given the contexts sampled. We could not study settlement features related to residential activities. Our samples come entirely from fortification debris and cultural layers adjacent to the fortification from the inner side that were most probably sedimented here as a result of erosion from the inner area of the settlement. Future research aimed specifically at these questions should target more relevant, household contexts in the site interior, if such can be found. The combined information from different parts of the site and contemporary soil archives in the surrounding region would provide a much more accurate picture.

Conclusions and future prospects

The site of Pilsen-Hradiště (Plzeň-Hradiště) provides important information on several prehistoric and early historical periods. It seems to be a particularly valuable source for enhancing our knowledge of the transitional period between the Early and Middle Bronze Age periods, when Bronze Age societies in Central Europe reached the stage of full development, testified by the emergence of new traits in metallurgy, warfare, trade, social display and other areas of life.[26] This period is still not well understood in Bohemia, and especially for a better understanding of the situation in the Pilsen basin the reported site is of special importance.[27] Certainly, there will be more discoveries in the future of enclosed settlements belonging to the Middle Bronze Age Tumulus culture buried under remains of later fortifications. A similar case has been recently reported from another West Bohemian hillfort of Vladař.[28]

It is well known that there are periods of building and abstaining from building of fortifications during the prehistory in the study region. It is another feature of great interest that on the site it was possible to demonstrate that every major period of fortifying strategic locations is represented here, since the end of Early Bronze Age to the early mediaeval period. Even the late La Tène pottery finds were discovered, indicating some activity in this phase, although no traces of related fortification could be identified.

Fortifications certainly had multiple social and economic functions, and they also represented the most sophisticated, monumental architecture

[22] Determination by Mgr. P. Kočár and Mgr. R. Kočárová.
[23] Kočár/Dreslerová 2010.
[24] Determination by Mgr. P. Kočár.
[25] Determination by Mgr. Z. Sůvová.
[26] Jockenhövel 1990.
[27] Jiráň 2013.
[28] Chytráček/Šmejda 2005.

of the prehistoric times in Central Europe.[29] Settlements encircled by defensive walls displayed and advertised the capabilities of the complex societies which built them. It is therefore important to continue the comparative research of prehistoric enclosures and defensive works to understand their life histories, intentions for their construction and a whole variety of possible uses. This complex phenomenon cannot be explained as an isolated problem, because it was closely intertwined with other aspects, profane and sacral, of prehistoric life, and in many ways it structured inter and intra group social interactions, creating a sense of common identity.[30]

It was possible within the limits of this chapter only to scratch the surface of several intriguing problems connected to investigation of the rampart at the fort of Pilsen-Hradiště. We can highlight some of them in this summary: repetitive episodes of defensive constructions keep the very same outline of enclosure, but using different raw materials and construction techniques; a strikingly different character of the eastern rampart segment; geochemical classification of archaeological layers; and the long-term dynamics of interactions between the settlement and its environment. We need to continue with the study of individual site components, such as the Late Iron Age phase of fortification that was destroyed in such a ferocious fire that the solid metabasalt rocks in the wall cracked and crumbled to grit and sometimes even melted and vitrified. Also this event must be seen as part of wider social and political changes and not be studied as an isolated and local problem.

Another question that must be repeatedly addressed in the near future is the position and role of hillforts and other central sites in the surrounding settlement structures. In the case of Pilsen-Hradiště, a situation for such studies is fortunate, as it is located in a climatically favourable and fertile microregion that was densely settled throughout prehistory and that has been surveyed and studied from the archaeological perspective for decades.

Lastly, fortified settlements cannot be effectively studied without a multi-scalar approach and larger comparative framework, which integrates not only archaeological theory and empirical data, but also intensive cooperation and dialogue between social and natural sciences. Only this broad discussion can bring a better understanding of the ways in which the communities involved mobilized necessary resources, applied functioning logistics, and harmonized all tasks including feeding the labour force and specialized craftsmen to finish the truly monumental architecture of their respective periods. Those tasks were truly demanding a concentrated effort and their successful accomplishment reveals the high level of organization of the societies in later prehistory and demonstrates the skills of their political and ritual leaders, craft specialists, warriors, commoners, and probably unfree labour force, all of whom had to participate in building and maintaining such impressive centres of the ancient social landscape.

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Ladislav Šmejda, New evidence for the Bronze Age fortification at Pilsen-Hradiště, West Bohemia: A multidisciplinary approach

The article presents an interdisciplinary project that is focussed on an important cultural monument, namely a fortified hilltop settlement in the cadastre of Hradiště near Pilsen. This fortification is attested by five phases, which correspond to the main epochs of the erection of west Bohemian ramparts during the time span from the turn of the early to the Middle Bronze Age until the early medieval period. Geophysical prospection and trial excavations conducted there in 2012 and 2013 revealed important and new information on the stratigraphy and natural environment of the site. The project is particularly directed towards collaboration between archaeology and scientific studies. Geophysical and geochemical aspects of archaeological contexts, archaeobotanical and archaeozoological finds as well as geological composition of the materials from the fortification were analysed. Special attention was given to the problematic of the so-called vitrified walls *(Schlackenwälle)* associated with this site.

Ladislav Šmejda, Neue Befunde zur bronzezeitlichen Befestigung in Pilsen-Hradiště, Westböhmen: ein multidisziplinärer Ansatz

Der vorliegende Artikel stellt ein interdisziplinäres Projekt zur Erforschung eines bedeutenden Kulturdenkmals, nämlich einer befestigten Höhensiedlung im Kataster von Hradiště bei Pilsen, vor. Es handelt sich um eine Befestigung mit fünf belegten Phasen, die den Hauptepochen der Errichtung der westböhmischen Burgwälle entsprechen und einen Zeitraum von der Wende von der frühen zur mittleren Bronzezeit bis zum Frühmittelalter umfassen. In den Jahren 2012 und 2013 wurden hier eine geophysikalische Prospektion und Sondierungsgrabungen durchgeführt, die viele wichtige und neue Informationen zur Stratigraphie und natürlichen Umgebung der Fundstelle erbracht haben. Das Projekt ist besonders an der Zusammenarbeit zwischen der Archäologie und den Naturwissenschaften ausgerichtet. Geophysikalische und geochemische Eigenschaften der archäologischen Befunde, archäobotanische und archäozoologische Funde sowie die geologische Zusammensetzung des Materials von der Befestigung wurden analysiert. Spezielle Aufmerksamkeit ist der Problematik der sog. Schlackenwälle gewidmet, mit der diese Fundstelle traditionell verbunden wird.