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Summary

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14. Early Medieval Agglomeration of Libice and its Hinterland.	XXX
14.1. Contents	
14.2. Summary	
14.3. List of illustrations	
14.4. List of tables	
Tables	XXX

14.2. Summary

This book deals with the issue of Early Medieval central place in Libice nad Cidlinou, its settlement structure and hinterland. This site belongs to the group of the most important Bohemian Early Medieval settlement agglomerations. The Early Medieval stronghold in Libice nad Cidlinou is situated on the confluence of the rivers Elbe and Cidlina in the eastern part of Central Bohemia, approx. 60 km east of Prague. The agglomeration of Libice can be defined as the stronghold and its immediate vicinity. This area formed part of the stronghold's daily life. It includes all traces of human activity, especially settlement and burial places, located within a range of 2 km (Fig. 2) outside of the fortified area. Border of the agglomeration can be determined on the basis of high density of archaeological trenches especially in the cadastre of the modern villages of Libice and Kanín, to the south and north of the fortified enclosure.

The Early Medieval agglomerations emerged during the 7th–12th centuries in the wide area of Northern, North-western, Central and Eastern Europe (Clarke – Ambrosiniani 1991; Piekalski 1999). This type of urban settlements represents a new phenomenon beyond the borders of the former Roman Empire (see Hodges 1988). While the North-western early towns like Wolin, Ribe, Birka, Dorestat, Haithabu and Hamwic played mainly their roles as trade centres, the fortified sites in Central and Eastern Europe fulfilled functions of political, military, ideological and also economical centres. The fortified sites (in Slavic languages: hradiště, grad, grodzisko) represent quite a wide group of different types of settlements at the top of their hierarchy were Early Medieval agglomerations. Despite the different natural and geopolitical conditions, the Early Medieval agglomerations and the early towns are comparable in several aspects, above all in their urban character¹. Other similarities are visible in terms of their spatial structure and pop-

¹ The Early Medieval agglomerations correspond well to definition of Early Medieval town defined by M. Biddle (1976, 100). These criteria are: defences, a planned street system, a market(s), a mint, legal autonomy, role of a central place, a relatively large and dense population, diversified economic base, plots and houses of 'urban' type, social differentiation, complex religious organization, judicial centre. Possession of more than one of these characteristic is establish a prior case for urban status (see Scull 1997).

ulation size². The fortified central part covering usually tens of hectares were surrounded by open rural settlements and burial places within distance up to 2 kilometres (Fig. 1).

Historical Background

The earliest recorded date in the history of Libice is 981: the Chronicler Cosmas (d. 1125), wrote that on that date: *Obiit Zlaunic, pater sancti Adalberti ... ducis metropolis fuit Lubic sita loco, ubi amnis Cidlina nomen perdit suum intrans liberioris aque in fluvium Labe* (Kosmas, 49). Libice is assumed to have been a centre of extensive domains of the Slavníks family. Libice had awaked the interest of historians and archaeologists already at the end of the 19th century. The stronghold is considered to be the seat of the Slavníks noble family among whose members belonged also the second Prague bishop Saint Adalbert. The long-time discussions of historians, archaeologists, and numismatists have focused mainly on the nature of interrelations between two noble families ruling in Bohemia – the Slavníks and the Přemyslids (Sláma 1995, Lutovský – Petrář 2004). Importance of the Slavník family position is, among other things, attested by a reference preserved in the legend written by Adalbert's biographer Bruno of Querfurt concerning the kinship of Saint Adalbert's Father Slavník to the German Emperor Henry II.

The Slavníks' exceptional position in Early Medieval Bohemia is documented also by two mints situated in Libice and in Malín (20 km south of Libice) that ran in the 980's and 990's. The rule of the Slavníks family ended on September 28th, 995 when Libice was attacked by troops of the Duke Boleslav II and all present members of the family were killed. During the 11th century Libice became a Přemyslid warden castle, one link in the Přemyslid castle system. In the year 1108 warden Božej of the Vršovci noble family together with his son Bořut fell victims to the wrath of the Prince Svatopluk. The last men-

² Haithabu: 1000 inhabitants (Steuer 1984); Hamwic: 2000–3000 inhabitants (Morton 1992, 55); Birka: 2000 inhabitants (Clarke – Ambrosiniani 1991, 135), Dorestat: 1000–2000 inhabitants (Wickham 2005, 682), Mikulčice: 1000–2000 inhabitants (Poláček 2008), Břeclav – Pohansko: 1000 inhabitants (Dresler – Macháček 2008), Libice: 600–900 inhabitants (Mařík 2008).

tion of a fortified settlement at Libice comes from the year 1130 and in 1228 Libice reappears in written sources only as a village in ownership of the Benedictine nuns of the Convent of St. George at the Prague Castle.

Dating of Early Medieval Libice

Dating of archaeological finds from Libice is based mainly on pottery finds (Princová – Mařík 2006) and on individual items from grave inventories. Three major development stages have been distinguished at the site: Phase I: the Middle ‘Hillfort’ period, Phase II: the Late ‘Hillfort’ period, and Phase III: the Terminal ‘Hillfort’ period. Beginnings of the Early Medieval centre at Libice agglomeration can be traced as far as on the turn of the 10th century. This dating is based mainly on graves richly equipped with jewellery influenced by the late Great Moravian production (Tables 11: 2; 42: 16, 21; 47: 2–3; 49: 1–2). Typical pottery of this period is decorated by diagonal combed stitches and combed wavy lines (Fig: 8: 1–3). Traces of settlement have been documented on the right bank of Cidlina, and on the inner and outer bailey. However, existence of fortifications remains somehow unclear (Mařík 2006). Even though layers dated to the Phase I have been attested in most of the trenches on southern edge of the outer bailey it was possible to identify them as remains of fortification only in the Trench 2 (Princová – Mařík 2006).

Occurrence of so-called pottery of the Slavníks phase (Princová 1994) is significant for the Phase II (the Late ‘Hillfort’ period). Typical decoration of this pottery consists either of horizontal lines on pots’ upper two thirds and a simple or combed wavy line or of one row of diagonal lines of combed stitches under the rim (Fig: 8: 4–8). It is made of very sandy material with a high admixture of mica; and its typical colour varies from dark red to red-brown. In terms of dating, this pottery is not absolutely restricted to the period of Slavníks’ domination over the stronghold. Appearance of the so-called pottery of the Slavníks phase can be synchronized with pottery with chalice-shaped rims from the Central Bohemia, dated *post quem* from the first third to the half of the 10th century, and it prevails in the material until turn of the 11th century. A conspicuous change was recorded on the inner bailey, where a burial place from previous period had been covered by a levelling layer into which a church, a ducal palace and several other buildings were embedded. Fortification of the baileys shows two phases of destruction dated to the Phase II (Mařík 2006). Military assault that ended, according to the historical tradition, the rule of the Slavníks family in the year 995 has not been attested in ar-

chaeological evidence; and, thus, transition from the Phase II to III remains quite indistinct.

Identification of the Phase III (the Late – Terminal ‘Hillfort’ periods) is based more on grave inventories than on settlement finds. Burial grounds outside the fortified area ceased their existence and a new one appeared within the enclosure. This change may be identified with fundamental transition that occurred in burial rites. On the other hand, absolute dating of settlement finds remains more complicated. During the 11th century, the so-called pottery of the Slavníks phase was replaced by pottery with an upwards pulled rim that is characteristic for the Terminal ‘Hillfort’ period. The earliest collection of finds from the Phase III is dated by a denar of the Duke Bořivoj II in the first half of the 12th century (Fig. 10).

Libice Agglomeration and Natural Environment

Fortified area of the enclosure of Libice is situated on two remnants of sand and gravel terraces above the rivers of Cidlina and Elbe. The stronghold’s smaller part, the inner bailey, is completely surrounded by river floodplain, while the larger, outer bailey, and is protected by river floodplain only on its southern side. Modern level of the floodplain lies approx. 4–6 m lower than ground level of the inner and outer bailey. Detailed geological survey has shown that since the Early Medieval Age approx. 2 m of sediments have accumulated on the alluvial plain (Havrdá 2006).

Altogether, three archaeobotanical analyses aimed at reconstructing the natural environment in vicinity of the stronghold have been conducted. Description of the Early Medieval natural conditions on outer bailey is based mainly on analysis of filling of the Feature 126 excavated on the outer bailey (Čulíková 1999). Several samples were obtained from sediments extracted from outer fortification moat (Čulíková 2006, Kozáková – Kaplan 2006). Our understanding the natural conditions within the river floodplain has been significantly enlarged by pollen analysis of organic content of a ceramic vessel discovered on the burial site of Kanín (Pokorný – Mařík 2006). Also results of paleoecological analyses have contributed to reconstruction of the nature of landscape around Libice, especially the river floodplain. The vegetation was dominated by dry to mesic meadows and pastures. In the surroundings of the stronghold the forest was mainly cleared but not completely. Willows (*Salix*) and poplars (*Populus*) were growing on the banks of rivers and oxbows, i.e. near water and on frequently flooded places. Forest on higher and dryer levels consisted mainly of oak (*Quercus robur*) and elm (*Ulmus*), with an admixture of hornbeam (*Carpini-*

nus betulus), common maple (*Acer campestre*) and linden (*Tilia cordata* and *T. platyphyllos*). The above-mentioned pollen analysis shows that the AP/NAP³ ratio was balanced. Pastures and meadows were situated very close to the castle and were continuously changing into forest. The floodplain area to the south of stronghold was probably used for either grazing or hay-making while, according to the pollen analysis, arable land seems to have been situated elsewhere.

Archaeological Excavations at the Libice Agglomeration

As was already stated above, the fortified area of the stronghold of Libice is situated on two remnants of sand and gravel terraces of the Cidlina and Elbe Rivers. Smaller part of the stronghold, designated as the inner enclosure also called 'the acropolis' (Fig 2: A), covered approx. 10 ha, and was completely surrounded by river floodplain. Larger part, the outer enclosure (Fig. 2: B), occupied 14 ha, and was protected by the river floodplain only on the south. Western and northern sides were divided by former oxbows of the Cidlina River. Modern level of the floodplain lies approx. 4–6 m lower than surface of the Early Medieval inner and outer baileys. Detailed geological survey proved that since the Early Medieval Ages approx. 2 m of sediments have covered the river floodplain (Havrda 2006).

Inner Bailey

In the years 1948–1953 and 1967–1973, systematic excavations were conducted on inner bailey under the leadership of R. Turek. Research focused mainly on eastern part of the inner bailey, where masonry foundations of Early Medieval buildings were expected to be found. This expectation was completely fulfilled by unearthing of a church, a 'princely palace' and a burial place (Turek 1981; Princová 2001). Unfortunately, archaeological trenches covering 4.5 % of the inner bailey's area that concentrated in the eastern part provided only minimum information about the settlement nature of the whole area. R. Turek assumed that due to construction of the church and the 'princely palace' in the mid-10th century the inner bailey had been depopulated (Turek 1966–1968, 94; Turek – Hásková – Justová 1981, 35–37). In his opinion, the entire inner bailey would be assigned exclusively for the princely family and members of the higher social echelons. Nevertheless, this assumption has never been proved right and results of archaeological excavations in the

narrow trenches oriented north–south (Fig. 5) have never been published.

Non-destructive archaeological research conducted since the year 2000 has clearly shown that the organization of space was probably more complicated. Aerial photographs taken in the years 2000 and 2007 showed quite a number of crop-marks indicating very high settlement density (Fig 3). Although dating of the crop-marks is doubtful, pottery shreds datable to Phases I and II were found on entire area of the inner bailey during surface collection. If the crop-marks indicate remains of the Early Medieval settlement, it is possible to estimate that during the Phases I and II the inner bailey was settled quite intensively. Rectangular grid of crop-marks occupying southern part of the bailey has been revealed by spatial analyses. This area was also separated from the rest of the bailey by some kind of fencing (Fig 4).

Outer Bailey

Archaeological excavations in the area of outer bailey have been conducted since the year 1974. Most of them were rescue excavations preceding construction of new buildings (Justová 1980; 1985; 1990). Outer bailey is covered by a relatively even network of 94 trenches that show very high density of the Early Medieval settlement activities. Sunken features of oval or irregular shape represent the prevailing group of archaeological evidence. However, functions of these features remain in most cases obscure. Dwelling features have been identified only in several cases. At present, the current state of evaluation of these excavations forbids any reconstructions of spatial organization and development of this area. Excavation of the Trench 14 provided some evidence regarding density of the settlement activities. In this trench covering 6000 m², nearly 700 sunken features dating to the Phases I and II were unearthed. In Trench 2 located in the south-eastern part of the outer bailey, archaeological excavations revealed remains of a huge building on stone foundations (the so-called 'priestly house', Fig. 5). On the basis of finds of a ceramic zoomorphous vessel (the so-called *aquamanile*) and writing tools (*stilo*), this dwelling was attributed to ecclesiastical environment (Justová 1980, 248–251; Princová 1994, 194; Princová 1995, 257–258). Other interpretations of this structure focused mainly on finds discovered there. J. Sláma (1995, 194) pointed out that those writing tools could also be used by merchants. Likewise, the *aquamanile* might not have been intended only for ceremonial washing of hands of a priest but more probably it was used for washing the fingers of table companions during their meals (Klápště 2007). For the Early Medieval Age, existence of a church on

3 AP – arboreal plants; NAP – non-arboreal plants.

the outer bailey is documented only indirectly. The earliest written evidence on the Church of Our Lady that was built in the centre of outer bailey is dated to the 14th century. However, development of cemetery that encloses it goes back to as early as Phases II or III (Mařík 2005). Furthermore, burial place located within a settled area that would lack any sacral structure seems to be quite unusual. Second indication represents dedication of the altar to Our Lady that is mentioned in legends of St. Adalbert, which played an important role in the young saint's healing activities (Princová 1994, 194). On the other hand, it is not certain that St. Adalbert was born at Libice at all and the altar could have been placed in some private chapel (Sláma 1997, 18).

Right Bank of the Cidlina River

Archaeological research conducted on right bank of the Cidlina River has been connected predominantly with industrial constructions since the end of the 19th century. In the year 1896, an Early Medieval settlement place and a cemetery were discovered during renovations of railway station ('*U nádraží*' site) (Hellich 1897, Mařík 2003). Two other cemeteries were excavated in 1891–92 ('*U cukrovaru*' site) and 1913 ('*Na růžku*' site). Since the year 1979, the area on right bank of the Cidlina River within the cadastre of modern village of Libice has been systematically observed. Altogether, 152 trenches covering c. 10 000 m² have been excavated there.

The Early Medieval settlement evidence on right bank of the Cidlina River is distinctly weaker than in the enclosure. Settlement remains (round 40 Early Medieval sunken features) concentrates along the fluvial terrace edges. Three to four concentrations that can be interpreted as settlements of smaller scale or homesteads have been identified there (Fig. 15). People who inhabited this area probably buried their dead on smaller burial places in the neighbourhood (Fig. 5; sites: H 2, H 3, H 4, H 12). In comparison with the extensive burial places at Kanín and on the inner bailey, grave inventories on the right bank are rural in their character. This corresponds well with estimations of population that used these burial places (see chapter 10.1.2.). In the Phase I the three to four homesteads mentioned above could have been inhabited by 17–33 people, and by 30–55 in the Phase II (Fig. 15).

Left Bank of the Cidlina River

Archaeological excavations on left bank of the Cidlina River have focused mainly on extensively agriculturally used fields in cadastres of modern villages of Libice and Kanín. The largest burial area (c. 8.5 ha)

of the Libice agglomeration has been unearthed there. First Early Medieval graves were discovered there already in the mid- 19th century. It was the amateur archaeologist Jan Hellich who undertook two minor excavations campaigns there in 1903 and 1911 (Fig. 18). In course of rescue excavations conducted in the years 1962, 1966–1969, 1971, the burial area of Kanín was divided into three sites designated *Kanín I–III*.

Settlement in the Floodplain

The Early Medieval settlements within floodplain appear on sand dunes and remains of alluvial terraces. In the second half of the 19th century, several solitary finds from settlements situated in floodplain were obtained from former brickworks between the Libice stronghold and modern town of Poděbrady. The only one modern excavation was conducted in the site of '*U Radiostanice*' (Fig. 23). However, results of this research have not been completely published yet.

The so-far recorded mediocre cultural layers and relatively small number of sunken features suggest a short-time usage of these sites inhabited by population engaged in fishing, stock-raising, and finally forest and raw materials exploitation. Cultivation appears to have been quite inappropriate in these sites since river floodplain areas lacked sufficiently developed soils and were regularly threatened by floods. Information regarding possible nature of human settlement and activities conducted on these sites can be retrieved from Paleobotanical investigation and analyses (Čulíková 2006; Kozáková – Kaplan 2006).

This type of sites seems to concentrate mainly in vicinity (up to 3 km) of central (or significant) places. The examples from Moravia (Fig. 22) indicate that the floodplain settlements could be an integral part of centres like Mikulčice or Břeclav – Pohansko.

Archaeological Map of the Libice Agglomeration

Archaeological Map of Libice represents a Geographical Information System used as a basis for processing the long-term archaeological excavations in the Libice agglomeration. The map is based on vector plans drawn in the GeoMedia 6.0 Professional software environment that enables easy linking to databases created in the MS Access program and problem-free import and export of data from other commonly used GIS environments. The Archaeological map of Libice contains two main types of data: graphic data obtained from vectorized field documentation and connected descriptive databases containing their non-graphical attributes. The map development process was divided into three phases. The first step represented basic site map in which archaeologically investigated areas we-

re marked. In the second preparatory phase all available drawn field documentation was converted into a digital vector format that enables easy identification of immovable archaeological finds and, in the third phase, their linking to non-graphic databases. The analysis of archaeological data uses partial databases built to solve clearly defined questions as creating a single central regional database seems to be counter-productive at the current state of processing. The amassed data are archived in multiple data formats (txt, shp, dgn) in order to ensure compatibility with other GIS systems.

Burial Places

Since the end of the 19th century, altogether ten locations with the Early Medieval burial evidence have been found in the Early Medieval fortified enclosure at Libice nad Cidlinou and in its immediate vicinity. A relatively dense network of rescue excavations both within the enclosure and in its agglomeration has enabled not only estimation of the plausible size of these cemeteries but also assumption that their total number will not probably change. Beginnings of the Early Medieval burials at the Libice agglomeration can be traced back to as early as turn of the 10th century. The first conspicuous change was recorded in the cemetery on the inner bailey in the first third to half of the 10th century. Graves dated to the Middle 'Hillfort' were covered by a levelling layer into which a church and several other buildings were embedded. Outside the fortified area of the enclosure continuous development has been recorded up to the beginning of the 11th century when cemeteries (*Kanín*, *U cukrovaru* and *U nádraží*) ceased its existence and a new one appeared on the bailey (*Katolická fara* – Fig. 30, *Ke hradišti* – Fig. 33, *U evangelické fary* – Fig. 34). Shifting of burials to immediate vicinity of the Libice seat is also indicated by a fundamental change in the burial rite. This phenomenon can be caused by lesser demands placed upon the bailey whose important gradually declined; although significant role was also played by gradually spreading Christianity. From the point of chronology, it has been established that in the ceramic material, which is used most commonly for dating purposes, it is possible to securely distinguish the Middle 'Hillfort' period horizon, while the differences between the Late and Terminal 'Hillfort' period material are minimal. Identified structure of cemeteries within the Libice agglomeration is comparable to that at other Early Medieval centres such as Prague Castle, Budeč and Levý Hradec.

Burial places are supposed to be one of the most important sources for exploration of social ranking of the former societies. Items regarded as indicators

of higher social status (jewellery, weapons) were discovered at two sites, at Kanín and at the inner bailey. The comparison of numbers of finds showed that two cemeteries are similar (Mařík 2005). The remaining burial places outside the fortifications were more rural in character. The cemeteries at Kanín and at the inner bailey differ markedly, however, in terms of the occurrence of vessels among the grave goods, these not appearing at all either on the acropolis, or in those graves into which the deceased was deposited in an unusual manner (on the stomach, side etc.; Fig. 39). Only one such grave was found at the inner bailey while 23 cases have been attested at Kanín. The undignified position of the body and minimum of grave-goods implies that the buried people lived on the periphery of the society. The second viewpoint in social evaluation of a Burial places represents is the location of the cemetery. Among the burial places within the agglomeration it was the site at the inner bailey in the immediate vicinity of the settlement that had the higher-ranking position. This burial place was restricted for a quite limited group of people probably on the top of the social ladder. Population estimates also showed that the cemetery at the inner bailey was used by quite a small group of people as compared to the Kanín site (Fig. 49). While some general image of the structure of the society could be drawn on the basis of burial places in the Libice agglomeration; reconstruction of the settlement pattern is a more complicated question. We can assume without any serious doubt that the burial places on the right bank of Cidlina belonged to the settlements in the neighbourhood. The origin of people buried at Kanín and in the inner bailey seems to be more uncertain. The size of both burial places implies that they were used by people from the very intensively inhabited area of the fortified enclosure. Starting from the top, the cemetery located nearby the church and palace was used by people who belonged to the ruling echelon of society. Kanín was probably used as a central burial place for the rest of inhabitants of the fortified enclosure. Those buried included undoubtedly important persons equipped with swords, spurs, jewellery, etc., people who did not undergo standard burial ritual and were more or less thrown into the grave.

Hinterland of the Libice Agglomeration

The economical hinterland of Early Medieval Libice agglomeration is defined as an area that served or could served for subsistence of the centre. The research was focused on food production and the raw materials used in constructions. Special attention was paid to structure of forest and its exploitation. Reconstruction of hinterland was divided in two parts. The

first step was an estimation of the requirements of the agglomeration and potential of surrounding landscape to satisfy them. The second part deals the issue of the Early Medieval settlement structure within the potential hinterland.

Population Size of the Libice Agglomeration

The estimation of population size was based on the results of excavations of Early Medieval cemeteries.

They offer quite a complete picture in terms of their size thanks to the very high density of the archaeological trenches. The population size was calculated using formula introduced by Acsadi – Nemeskery (1970):

Population size = (Life expectancy at birth x number of buried individuals) / time

The number of individuals buried was calculated from the hypothetical original size of the burial places and the density of graves per m². There is the only one completely excavated cemetery inside the agglomeration of Libice, the site 'U cukrovaru' (Fig. 5, 16). In the case of partly excavated burial places, their original size has been reconstructed on the basis of nearby trenches with negative evidence. Non-destructive methods were also used, such as geophysical survey and aerial photographs of the Kanín burial ground (Fig. 18, 27). It is assumed that the spatial organization of a burial ground is regular throughout the whole area. This assumption was tested on all excavated burial grounds in the agglomeration. A distinct difference emerged between the burial grounds inside the enclosure and in the rest of the agglomeration (Fig. 50). The median of the density of all excavated parts in the vicinity of the enclosure is 0.035 individuals per m², while the average density of buried individuals is nearly ten times higher in the cemetery in inner bailey (0.35 individuals per m²).

The population life expectancy at birth could be ascertained by anthropological analysis of skeletons from modern excavations. Two analyses have been carried out in Kanín (27 years) (Blajerová 1985) and at the inner bailey (21 years) (Hanáková 1969). The two figures do not differ strikingly from the average for prehistoric and early medieval communities (Neustupný 1983). Although the burial places are very convenient for the Libices chronology, their absolute dating is still problematic. For each phase an earlier and later limit was established; nearly every burial place was also used for more than one phase and there were many graves without any dating material on the burial places. The population of those burial places had to be calculated as average for both phases

without any chance of detecting the dynamics of their development.

The method used to estimate the population gives only approximate values, because chronology is not precise and the latest burial grounds in particular (the third phase are in a poor state of preservation as well as hard to map in terms of boundaries. We therefore did not attempt a detailed calculation of 'missing' children (Neustupný 1983) or precise estimates of adults and juveniles in the community. The estimated extent of the unexcavated or destroyed parts of burial places is based on assumption of regular spatial organization of graves within the whole area. It sets a maximum of buried individuals and upper limit of calculated population size must be regarded as an absolute maximum too. In my own view the lower limits of the calculations are closer to reality. The number of inhabitants of the whole agglomeration (Fig. 49) during the first and the second phase was 600–950, while the population in the third phase rapidly decreased (300–370 of inhabitants).

The population size was calculated for each burial ground separately, to give a view on the communities that used the burial ground. The largest were the burial grounds near Kanín (454–730 inhabitants in phases I and II), for a settlement that could have been situated only within the fortified area. The cemetery at the inner bailey was probably destined for a particular group in this society, since status is indicated not only by the rich equipment of the graves, but also by the position of the cemetery itself. As regards the rest of the society living in the agglomeration, the people who used to bury their relatives in the immediate vicinity of their dwellings had completely different perception of the world of the dead. Smaller burial places on the right bank of Cidlina were used by communities they did not exceed a population of 30 inhabitants. Only site H 12 (Fig. 5) may have been larger, but the quality of archaeological sources is very low in this case and most of the burials were found in the 19th century. This means that the estimated size of the burial ground is only an upper limit and the real number of graves probably lower.

Landscape and its Economic Potential

The reconstruction of agrarian landscape is based on paleobotanical and geological studies (see chapter 3). The natural environment of the agglomeration was divided in three parts: 1. within the enclosure with its intensive traces of settlement we can assume the strong impact of human activity; this can be regarded as a place of consumption. The paleobotanical analyses from the outer bailey (Čulíková 1999) suggest the existence of gardens, where some vegetable and

fruit may have been grown. 2. Pollen analyses show that the river floodplain was covered by dry to mesic meadows and pastures. The forest was not completely chopped down and the pasture took place on meadows as well as in the forest. Unfortunately our knowledge on livestock breeding is not sufficient to allow us to estimate the proportion of food production that it represented. 3. The dryer and higher situated places on the river terraces north of the agglomeration and southeast on the left bank of Cidlina in the neighbourhood of burial places of Kanín. This area covered by sandy light brown soil and black soil was probably arable land.

Arable Land and Production

The capacity of fields to satisfy the need for cereals is influenced by several factors: seed return, yield per hectare, average consumption per head. These three factors are used as a basis for the calculation of the amount of permanently arable land necessary for subsistence of the community. The estimate of the amount needed to support one person range between 0.2–3 ha (Fig. 52). The divergence is caused by each author taking different views of the factors mentioned above. The lower estimates reflect an optimistic figure on seed return 4–8 (Gunilla – Olsson 1991), while usual assumption is that only 3 corns returned from one (Goetz 2005, 230–231; Kudrnáč 1962, 1958). The upper limit 3 ha proposed by B. Dzieduszycka (1985) estimates 2 ha for cereals production and 1 ha for legume. She also assumes very high annual requirements for cereals (278.9 kg) per person. While for example E. Neustupný and Z. Dvořák (1983) specified the maximum consumption of 240 kg only where cereals were the sole source of food. The lowest estimate of consumption per head after E. Gunilla and A. Olsson (1991) is only 65.4 kg.

Wood and Forest

Wood played a very important role in the early medieval economy as an essential raw material. The range of applications of timber was very wide: as building material for fortifications and houses, fuel in households, pottery firing and metallurgy. Our estimates are focused on the construction of houses and fortification and on the firewood in households. Although archaeological research has shown that there was iron–smelting and refining of silver and gold within the agglomeration and probably the firing of pottery as well, it is impossible to determinate the volume of these activities. Reconstruction of Early Medieval forest in the Libice vicinity on the basis of the paleobotanical analyses mentioned above, offers only a quite

general characterization of hornbeam–oak wood on dryer places and marsh alder carr in the inundated areas. The mosaic of meadows and pastures merged in the immediate vicinity of the enclosure into pasture forest and natural forest.

Fortification and Wood Consumption

The fortification of the enclosure has been the subject of archaeological research on several occasions, but precise reconstruction is still impossible, because of insufficient publication as well as the poor state of preservation (Mařík 2006). The rampart was built of loam with wooden reinforcement, the front and probably also the inner side were covered by stone packing. The rampart was approximately 10 m wide (Turek 1966–68) and 2 846 m long. The height of this type of construction was according to structural calculations around 4–5 m (Procházka 1986; Pavlis 1978) and the total volume 93 918 m³. The proportion of wood used in this type of fortification did not exceed 7 % of the total volume 6 574 m³ (Procházka 1986), which required 9–15 hectares of forest that had to be cut down in a very short time (Fig. 55). There have been recorded maximally two phases of fortification in Libice enclosure that could not be dated earlier than in the phase I or II and that is why the calculation of requirement on construction wood are made only for those two periods.

Houses and Firewood

Despite very intense archaeological research, we know very little about the appearance of the early medieval houses in Libice. Only 8–10 sunken dwellings have been recorded (Princová – Mařík 2006). The absence of more evidence suggests that houses were timbered and built on the surface, thus leaving no traces. For timbered houses in Gross Raden S. Labes und U. Sommer (1996) estimate that construction 9 m³. W. Dzieduszycki (1977) estimates 8 m³ for houses in Kruzswica. Taking into consideration the fact that the wood was used not only for the house but also for outbuildings, we accept the higher level of the further calculations the 15 m³ calculated by D. Dreslerová (1996), which also includes construction of fences and other farm buildings. If we suppose that there was one family (4–6 members) in one homestead, it is possible to reach an estimate of 66–158 homesteads in the agglomeration during the first and the second phase and 50–92 in the third phase (Fig. 55). In addition to timber for building, every household needed a large amount of firewood. Some experiments have shown that 6–10 m³ (Labes – Sommer 1996) up to 20 m³ (Pleinerová 1986) of wood were burnt in a single household yearly.

Timber Resources and Forest Management

Wood requirement can be divided into two groups. Major constructions like fortification or the building of several houses in the same time had more impact on the forest and could be close to clear cutting. However archaeological excavations have shown that timber harvesting was selective, orientated to tree trunks with a diameter of 17–28 cm (Procházka 1986), and in the specific case of Libice it was about 17 cm (Turek 1966–68). The most convenient and the most frequently employed building material was oak (Procházka 1986, see Behre 1983). The timber reserve of an oak forest is conditioned by the age of the forest, height of the trees and crop density. Modern data shows that it can be harvested up to 700 m³ per ha (Schwappach 1943). S. Labes und U. Sommer (1996) estimate the timber production at 187 m³ per hectare and W. Dzieduszicki (1977) at 300 m³ per ha. Although the sources for the two estimates are not explained in detail, considering the modern data and selective timber harvesting they can be accepted as realistic. The forest and its timber resources were probably intact in the time of foundation of the stronghold. A distinct growth of the settlement in the agglomeration is associated with the beginnings of the castle in the middle ‘Hillfort’ period and traces of the previous settlement were sporadic in the Early ‘Hillfort’ Period (mid– 7th to 8th centuries). The second category of necessary timber for the agglomeration is firewood and probably construction wood for repairs. These demands did not require extensive timber harvesting. Forest management based on coppicing and pollarding has been documented since the Neolithic period (Rosch 1990; see Dreslerová – Sádlo 2000) and there is no reason to believe it was not practised in the early medieval agglomeration of Libice. The annual yield of coppiced wood is higher than the high forest (Míchal – Petříček 1999). Depending in an interval of clearance this kind of woodland management is able to produce different types of timber, 5–6 year–wood for firewood, 20 year–wood for charcoal and straight trunks for building work (Labes – Sommer 1996). The annual yield from the recent coppiced oak forest is 5 m³ per ha (Vyskot 1958, 200). If we assume that this woodland management covered demands for firewood and part of the construction wood necessary for renovations (every 20 years), the coppiced forest had to cover 84–656 ha in the Phases I, II and 64–278 ha in the Phase III (Fig. 54, 55).

Three Models

The data estimated and calculated for the Libice agglomeration specify the hypothetical demands of the

population and the capacity of the natural resources to satisfy them. The required areas were measured within the buffer zones created around the fortified area on the digital map of the Libice agglomeration with help of GIS software Geomedia Professional 6.0. Three buffers were made for each model. Arable land was measured on brown sandy soils and black soils (gley soils, podzolic soils and floodplain deposits were excluded), clear-cut forest within the whole buffer and renewable coppiced forest on the river floodplain. The buffer zone is an artificial geometric figure bounding an area in a given distance around the fortification of the enclosure, which makes it easy to measure irregular areas. The differences between the upper limits of the estimates (in some cases as much as ten times) have led us to construct three spatial models. The maximalist model shows the highest possible requirements of maximum population (950 persons I–II phase, Fig. 56: A; 370 persons III phase, Fig. 56: D) with the worst variant of agricultural production and timber resources. On the other hand, the minimalist model assumes the best harvest for the lowest limit of population (600 persons I–II phase, Fig. 56: C; 300 persons III phase, Fig. 56: F). The two models represent the boundaries of possible speculations about size of economic hinterland, but they are not close to reality. For this reason a third ‘middle model’ was created. The middle variable value for estimate of arable land has been used the J. Kudrnáč (1962), the calculation and the average population size for each phase (Fig. 52). The medium extent of the coppiced forest has been calculated using the arithmetic mean between maximum and minimum households within the agglomeration. Two sets of each model were created. The first set is applicable for the first and second phase together, because the population size in the two periods differed only minimally (Fig. 56: A–C). The second set is valid for the third phase (Fig. 56: D–F). There are also some settlements in the vicinity of the enclosure with arable land inside the created buffers. This area has to be excluded from the calculations and measurements. The detailed research on micro-regions of early medieval sites has proved that the arable land was situated up to 300–500 m from the sites (Gunilla – Olsson 1991) and the complete site catchment does not exceed 2000 m (Gunilla – Olsson 1991; Dulinicz 1991; Behre – Kučan 1994). The estimate of timber resources shows in each model that the requirements of the agglomeration could be satisfied in its vicinity and transport of timber from further distances was not necessary. This finding seems also to be in line with the results of paleobotanical analysis. The fact that the most distant fields are situated 4.2 km suggests that the most cereal production could take place in the vicinity of the agglomeration and some

smaller part was dependent on settlements forming the economical hinterland of the agglomeration. **Not a single one of these three models is a reconstruction of the past reality**, because many factors that could influence the results have not been taken into consideration. Higher-ranking members of society as well as some groups of specialised craftsmen did not take the same part on agricultural production as the rest of the community. Furthermore trade, which indubitably strongly influenced the life of Libice, is not part of the calculations. All the three models simply try to define the boundaries of further thinking about the economy of centres like Libice.

Potential Economical Hinterland of Early Medieval Libice

The space of potential economic hinterland of the Early Medieval Libice was defined and explored under several conditions:

A – Diversity of natural environment: The space has to cover more geological units as well as more than one type of natural environment (see Fig. 57, 58).

C – Distance between the Libice agglomeration and borders of the investigated area has to be more than half the distance between Libice and other centres of comparable importance in the same period. Two sites fulfill this condition: the Early Medieval Hillfort of Kouřim and the agglomeration at Kolín (see Fig. 62–65).

B – Density of archaeological activities has to be evenly distributed within borders of investigated area (see Fig. 60).

The potential economical hinterland of Libice was analysed on area covering 500 square kilometres. The main source of archaeological data represented Archaeological Database of Bohemia⁴ (Fig. 61–64). In the middle ‘Hillfort’ period (the first phase of Libice) were founded settlement agglomerations in Libice and Kolín. The agricultural settlements were situated on the edges of river terraces on light sandy brown soils. The density of agricultural settlement increased during the following the Late ‘Hillfort’ period (the second phase of Libice). This chronological phase is also connected with a new feature in the settlement network. There were founded 3 new fortified settlements between Libice and Kolín on the right bank of Elbe (Fig. 64). These fortified locations are very comparable in terms of: 1. location – They were founded on remnants of river terraces surrounded by floodplain, 2. extent – It was ranging between 2.7 ha – 5 ha, 3. dating – They were indwelled in the Late ‘Hillfort’

period (the second phase of Libice) to the Terminal ‘Hillfort’ (the third phase of Libice). For these reasons they are assumed as part of larger settlement system connected with the centres in Libice and Kolín.

The most of open settlements within the analysed area were concentrated along the Cidlina (east of Libice) and the Elbe rivers (south of Libice). The concentration of settlements along the river of Cidlina is assumed to be more convenient for of the economical hinterland of the Libice agglomeration especially in the Late ‘Hillfort’ and the Terminal ‘Hillfort’ when the new strongholds were built along the Elbe river. This hypothesis can confirm also the donation deed to the Saint George monastery at the Prague Castle from 1227. This document mentioned a group of six villages around former stronghold of Libice (Fig. 69). Similar settlement structures based on written sources have been identified in case of other Přemyslid centres. The princely donations (villages, services, taxes, products of specialised craftsmen) to ecclesiastic institutions dated to the 10th – 11th century were concentrated within the distance of 8 kilometres (Fig. 70, 71) and spatial analyses of these donations implies that they mirror part of the economical hinterland of the former centres.

It is obvious that the radius of 6 or 8 km did not cover all the needs of a central place (like some mineral raw materials, specialized professions, etc.). However, it seems rather evident that the impact on natural environment as well as the need of human labour did not exceed the latter mentioned distance of several kilometres.

14.3. List of Illustrations:

Fig. 1 Early Medieval agglomerations. **Litoměřice:** 1 – burial places, 2 – Middle and the Late ‘Hillfort’ period settlement, 3 – the Late ‘Hillfort’ period settlement, 4 – fortification (after *Zápotocký 1965*, Fig. 27); **Kaupang:** Viking period (after *Clarke – Ambrosiani 1991*, Fig. 4.16); **Žatec:** Early Medieval agglomeration, A – castle, B – fortified outer bailey, C – southern unfortified bailey, D – suburbium, 1 – non-church burial places, 2 – settlement (modified after: *Čech 2008*, Fig. 1); **Haithabu:** Viking period, (after *Clarke – Ambrosiani 1991*, Fig. 4.12); **Gniezno:** 10th–11th century, A – castle, B – cathedral, C – church, D – settlement at the Lech Hill, E – stronghold, F – burial place, G – settlement, H – dam, I – bridge (after *Janiak – Stryżewski 2001*, Ryc. 2); **Dorestad:** Early Medieval Age (after *Verwers 1988*, Fig. 16); **Staré Město:** Great Moravian settlement agglomeration, A – Na Valách church, B – Na Špitálkách, C – St. Michael church and Na Dědině palace, D – church Rybárny, E – chapel at the island of St. George (after *Galuška 2008*); **Nitra:** Great Mo-

4 The database is central evidence of archaeological excavations in Bohemia and it is maintained by the Institute of Archaeology of the Czech Academy of Sciences in Prague.