Animal keeping and hunting in the Slavonic proto-urban centre Spandau. Some remarks on a recent publication

By Wolf-Rüdiger Teegen

Introduction

Spandau, today a district of Berlin, was a Slavonic settlement where in the 10th century a fortress was established. The proto-urban centre consists of a main fortification (ring wall) and bailey *(fig. 1)*, located primarily on two islands in the river Spree. It was an important economic centre and market place of the middle and late Slavonic period (9th to 12th centuries AD), as can be deduced from the findings (e. g. von Müller et al. 1993).

In 2015, the analysis of animal bones retrieved from the Slavonic fortress during recent excavations was published by Peggy Morgenstern[1], based on the author's doctoral thesis, successfully defended in 2013 at the Moritz-Arndt-University Greifswald. Supervisors were Felix Biermann (archaeology) and Norbert Benecke (archaeozoology). The Landesdenkmalamt (State Heritage Office) of Berlin made the bone material accessible and gave permission for study. The German Archaeological Institute in Berlin (DAI) supported the task with a fellowship.

Research and rescue excavations in fortress, bailey and *suburbium*

The excavations (1961–1993) in the Slavonic fortress Berlin-Spandau were directed by Adriaan von Müller and Klara von Müller-Muči. It was one of the major projects in Slavonic archaeology in former West Germany, together with excavations in east Holstein (e. g. Starigard) and in so-called Wendland in Lower Saxony (e. g. Hitzacker). Both von Müllers have published the results of their excavations in several monographs (von Müller / von Müller-Muči 1983; 1987; 1989; 1999; von Müller et al.1993). They also initiated bio-archaeological research in Spandau and its surroundings. It is interesting to note that the Academy Institute (Zentralinstitut für Alte Geschichte und Archäologie) in East Berlin had started bio-archaeological investigations in connection with research into the Slavonic period as early as the 1950s / 1960s (e. g. Müller 1962).

The excavations from 1961 to 1993 focused on the main fortification and the bailey (cf. *fig. 1*). Approximately 200,000 bone fragments (not 700,000 as the author writes on p. 18) were recovered; c. 70,000 of them, as well as bone and antler objects, had previously been studied by Cornelia Becker at the Free University of Berlin (1989; 1993a; 1993b; 2003). A final publication, however, never appeared. Unfortunately, this huge amount of osteological material seems to be lost (p. 19).

An extended, unfortified *suburbium* was discovered during archaeological rescue investigations (2005–2009) by the Landesdenkmalamt of Berlin (Michas 2010; 2011, with references). During this intervention, small trenches were also excavated in the wall of the main fortress and in the area of the bailey *(fig. 1)*. Dendrochronological dating of wood samples from the wall revealed an earliest

[1] Peggy Morgenstern, Tierknochenfunde aus dem slawischen Burgwall von Berlin-Spandau. Archäozoologische Studien zu Umwelt und Wirtschaft. Studien zur Archäologie Europas volume 26. Habelt Verlag, Bonn 2015. € 49.00. ISBN 978-3-7749-3958-5. 200 pages, 58 figures, 112 tables, 14 plates.

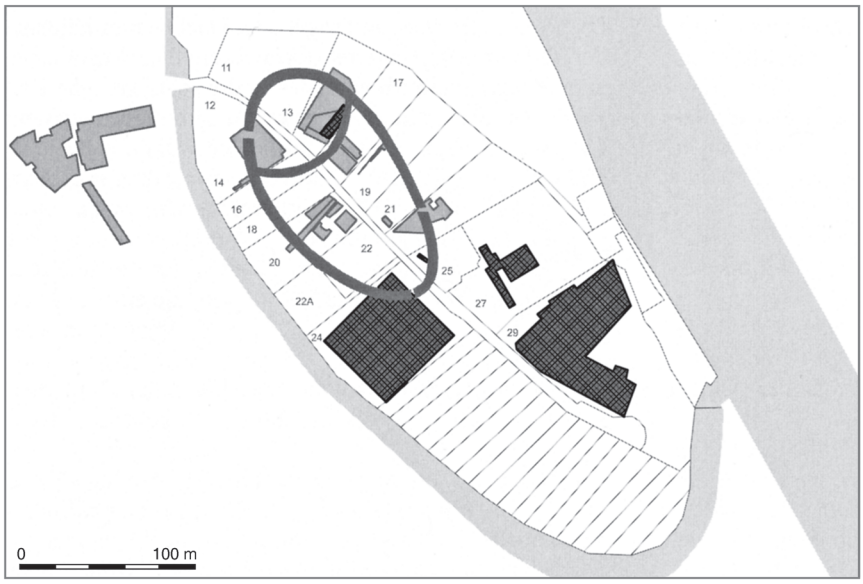

Fig. 1. Spandau, Slavonic settlement agglomeration with the main fortification, bailey and *suburbium.* Light grey: Excavations by Adriaan von Müller and Klara von Müller-Muči. Dark grey: Recent excavations (2005–2009). Further indicated are the current trenches Burgwall 11–29.

date from 876, and others from the first half of the 10th century AD (p. 17). Construction at the Slavonic fortress of Spandau, therefore, only took place in the middle Slavonic period – similar to other fortresses in the Berlin-Brandenburg area. This new chronological framework affords a revision of the previously published dating of the osteological material and the bone and antler objects.

The animal bones from these rescue excavations are the basis of the present work by Peggy Morgenstern. Furthermore, the bone finds from a small trench in the bailey, excavated in 1986, were studied. This permits comparisons between the different parts of the agglomeration (main fortification, bailey, *suburbium*): trench Burgwall [BW] 15 is located in the main fortification, trench BW 17 is in the bailey, and trenches BW 24, 27 and 29 are located in the *suburbium*. All data in tables 85–112 (pp. 129–186) are labelled with the adequate trench numbers.

Investigation of the faunal assemblage: an overview

In Peggy Morgenstern's general table 2 and in several other tables, data are listed according to the find areas mentioned above. Total sums are generally missing (they can be found here in *tab. 1*) and percentages are given only occasionally in the tables; sometimes they can be found in the text. The minimal number of individuals (MNI) is never given for the domestic animals in the relevant tables. Sometimes they can be found in the text.

In total, 33,653 bone fragments (KNZ) with a total weight (KNG) of 635.477 kg were studied. The species could be determined in 74.3 % (n=25,039) of the cases, or in 94.3 % (599.7 kg) of the weight, respectively. Eight domestic and 20 species of wild mammals are present. Fowl consists of up to two domestic (?) and 32 wild species. For fish, there are nine, reptiles one, and molluscs three species present *(tab. 1)*.

Species name *(Latin)*	Species	Morgenstern 2015 No. of species	Spandau fortification	Spandau bailey	Spandau *suburbium*	Spandau total	Becker 1993b Spandau	Morgenstern 2015 Spandau citadel
Equus caballus	horse		60	74	471	605	3000	68
Equus asinus	donkey		1	0	2	3		
Bos taurus	cattle		1479	1218	2521	5218	15000	443
Ovis ammon	sheep (included in the ovicaprines)		*68*	*79*	*133*	*280*		*21*
Capra hircus	goat (included in the ovicaprines)		*16*	*13*	*51*	*80*		*4*
Ovis ammon/ *Capra hircus*	ovicaprines		632	616	1164	2412	10000	114
Sus domesticus	pig		1777	2501	4328	8606	20000	492
Canis familiaris	dog		3	3	92	98		13
Felis catus	cat		3	7	18	28		2
	domestic mammals	8	3955	4419	8596	16970		1132
Mammalia	wild mammals	20	1007	1346	4060	6413	21210	448
	domestic and wild mammals		4962	5765	12656	23383		1580
Gallus domesticus	chicken		93	168	208	469		15
Anser domesticus/ *Anser anser*	domestic goose/ wild goose		14	35	39	88		5
	domestic fowl	2	107	203	247	557		20
Aves	wild fowl	32	40	143	151	334		8
Pisces	fish	9	132	311	210	653		7
Reptilia	reptiles	1			1	1		
Mollusca	molluscs	3	5	5	29	39		
	determined		5246	6427	13294	24967		1615
	horse, partial skeleton		3	1	23	27		
	cattle, partial skeleton		5		2	7		
	sheep, partial skeleton			2		2		
	capra, partial skeleton				2	2		
	pig, partial skeleton		2	4	12	18		

Species name *(Latin)*	Species	Morgenstern 2015 No. of species	Spandau fortification	Spandau bailey	Spandau *suburbium*	Spandau total	Becker 1993b Spandau	Morgenstern 2015 Spandau citadel
	dog, partial skeleton			5	4	9		
	dog / wolf, partial skeleton				1	1		
	cat, partial skeleton			3	1	4		
	red deer, partial skeleton			2		2		
	Total of partial skeletons		***10***	***17***	***45***	***72***		
	total determined		5256	6444	13339	25039		
	n. d.		1255	3357	4002	8614		95
	Total		**6511**	**9801**	**17341**	**33653**	**c. 70000**	**1710**

Tab. 1. Spandau, proto-urban complex and citadel. Abbreviated table of bone frequencies (NISP). Data from Morgenstern 2015 and approximate data from Becker 1993b. Species names of domestic mammals according to Gentry et al. 2004.

Seven out of eight domestic mammal species were known earlier (Becker 1993b, 102 tab. 1). New findings are the domestic donkey and the following species of wild mammals: elk, aurochs, wisent, pine marten and polecat. Fallow deer was no longer detected.

The average weight of bone fragments of determined species is 23.8 g, the average for undetermined fragments is 4.2 g (KNZ 8614, KNG 35.777 kg). The material consists only of hand-collected finds. The sediment was neither sieved nor underwent flotation (see below).

In the extended chapter 3 "Results", all species detected are presented. The bulk of the animal bones consists of domestic mammals (KNZ 16,970 = 67.8 %, KNG 352.3 kg = 58.7 %). They were studied by frequency, degree of fragmentation, age and sex distribution, withers height and body shape, as well as pathological alterations. All sub-chapters for each species end with a short summary ("Fazit").

The sub-chapters on wild animals (wild mammals KNZ 6326 = 25.3 %, KNG 173.6 kg = 28.9 %) also summarise the zoogeography and ecology of the single species. The present study confirms Cornelia Becker's observation of a high percentage of wild animals, and therefore a major significance of hunting (ibid.).

Animal economy in different parts of Spandau

Most data are listed according to the structure of the site – main fortress, bailey and *suburbium* – in tables and figures. This is useful and important: It is at once perceptible that there are no or only slight differences between the major find spots. Peggy Morgenstern interprets them – as Cornelia

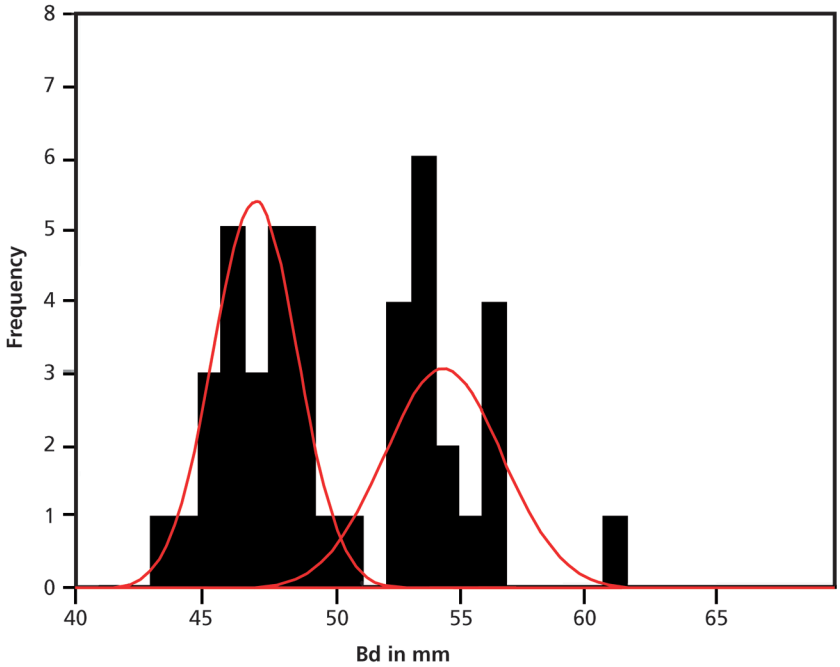

Fig 2. Spandau, cattle metacarpals. Mixture analysis of the distal breadth (Bd) in mm (n=43). On the left are the females (n=23; mean 47.1 ± 1.7 mm), on the right the males (n=18; mean 54.4 ± 2.3 mm). Two metacarpals could not be sexed. The outlier with Bd = 61.5 mm is probably an ox. Data from Morgenstern 2015.

Becker did before – as an indication for only slight social differences in diet (partially based on wild animals) and the possibility of participation in hunting for the inhabitants of the different parts of the fortress (p. 113). It has to be stated, however, that we do not really know about the social or economic status of the inhabitants of single houses. Distinguishing the houses of the social elite, of merchants and of the "normal" people and the lower classes in particular, is generally problematic in prehistoric and historic archaeology. To have at least a closer look into different eating habits, house-based mapping of animal bones could be useful (cf. Becker 1995).

The main fortress was not only home to the elite, but also to servants / slaves and other people. Due to standardised houses, it is a difficult task to attribute them to different social settings. This fact has also to be considered for the bailey and *suburbium*. The differentiation between main fortress, bailey and *suburbium* gives, therefore, only an insufficient view on the complex social reality in Slavonic times. In this case, a more context-based approach would be appropriate, as could be shown for Starigard regarding the birds of prey (Teegen in press).

Altogether, 9.8 % of the animal bones bear traces of cutting, chopping or carving. These traces are particularly evident in the vertebral bodies (p. 26). However, no further information is given, which is quite unfortunate, since an analysis of butchering marks could give insights into slaughtering techniques, as several researchers have shown (see the classic study by Boessneck / von den Driesch 1975; Schulz / Gust 1983). Moreover, a consideration of the monograph by Monika Doll (2003, with further references), also dealing with the reconstruction of meat cuts, would have been helpful. Likewise, the concept of meat classes (A to C) introduced by Hans-Peter Uerpmann (1973) was ignored by Morgenstern. For butchering and cooking debris like those from Spandau, this topic should have been studied in much more detail.

	Spandau fortification	Spandau bailey	Spandau *suburbium*	Spandau total	Branden-burg	Luckau	Lübben-Steinkirchen	Mittenwalde
Juvenile	10.2	18.0	6.0	11.4	18.0	40.0	32.0	30.0
Subadult	29.4	34.0	27.0	30.1	41.0	12.0	36.0	10.0
Adult	60.4	48.0	67.0	58.5	41.0	48.0	32.0	60.0
M	6.9	16.7	13.2	12.2	27.8	16.7	14.3	19.4
F	93.1	83.3	86.8	87.8	72.2	83.3	85.7	80.6

Tab. 2. Cattle. Frequencies of age and sex composition of the animal bones from Spandau and surrounding Slavonic sites (data from Morgenstern 2015; Teichert 1988).

As Hans Reichstein has shown for the early medieval site Elisenhof (Reichstein 1994), it is useful to compare the average weights of excavated skeletal elements with those of a complete reference animal. Such diagrams reveal the over- or under-representation of skeletal elements in the specific archaeological record (cf. pig: fig. 9; cattle: fig. 16; small ruminants: fig. 26; horse: fig. 34). For Spandau generally, most species from the main fortress, bailey and *suburbium* show very similar frequencies. Vertebrae are under-represented in all domestic species and in all areas from Spandau, which may be the result of different causes: low numbers of vertebrae determined by species or vertebrae taphonomy (e. g. eaten by canids). Furthermore, one could think of their uses as construction and substruction material for streets and paths, as has been shown by Hans Reichstein and Maike Tiessen for Viking age Haithabu (Reichstein / Tiessen 1974, 13; 15 fig. 4).

According to the number of bones (KNZ), domestic pigs are most numerous at Spandau, according to the bone weight (KNG), domestic cattle take first place. They were probably the most common source for meat. The ovicaprines follow in third place. Layers of dung are indicators for animal keeping in stables in the bailey and *suburbium* (p. 106 with note 331). Autumn was probably the main season for slaughtering – the differences between the seasons were, however, small (p. 106).

Domestic cattle (KNZ 5218, KNG 167.7 kg) of both sexes were probably not only a meat source but also used as working animals. This is not only indicated by their advanced age, but also by impressions on the horn cores (fig. 24) caused by yoking them. This interpretation is supported by pathological alterations of the phalanges (p. 42), which however are not described in detail. Calves are under-represented.

The distal breadth of the metacarpals is often used for sexing. On p. 40, Peggy Morgenstern refuses to employ this method for Spandau due to the possible work load of the cows. If we undertake a mixture analysis *(fig. 2)*[2] (for details see Hammer 2017, 150–151) of distal metacarpal breadth (n=43), we get a typical sex dependent distribution. There are 23 females and 18 males (56 % to 44 %); only two metacarpals could not be sexed. Other bones indicate that cows out-numbered males 4 : 1 (p. 42).

[2] All statistical investigations and plots were calculated using the PAST package Vers. 3.16 (Hammer 2017; Hammer et al. 2001).

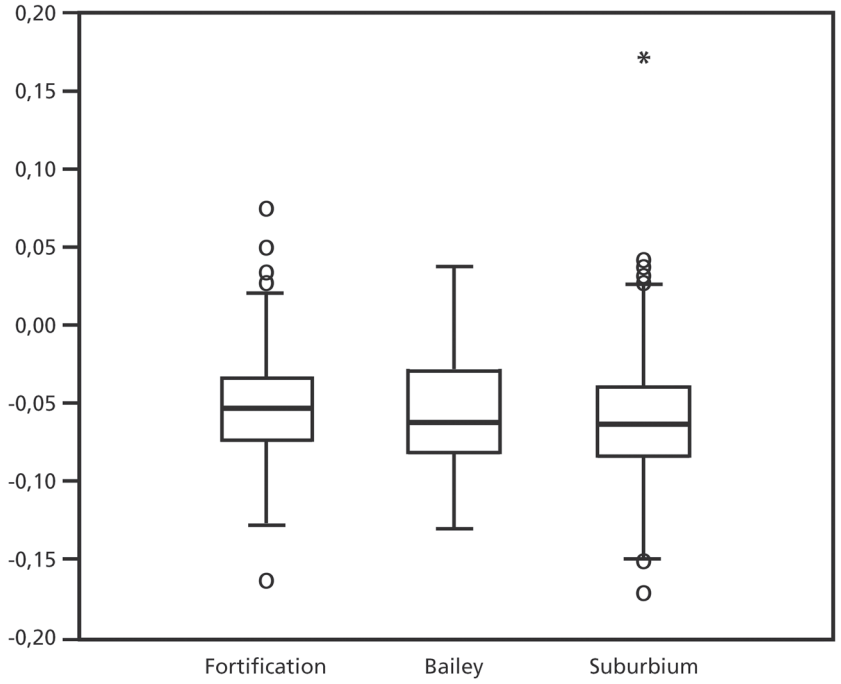

Fig. 3. Spandau, cattle. Box plots of the Logarithmic Size Index (LSI) of different breadth of humeri, radii, metacarpi, femora, tibiae, metatarsi and tali for fortification (n=152), bailey (n=133) and *suburbium* (n=362). The horizontal line in the box marks the median, their ends the 25th and 75th quartile, respectively. The whiskers show the standard deviation. Data from Morgenstern 2015.

Calculating the Logarithmic Size Index (LSI)[3] on the basis of published breadths of cattle humeri, radii, metacarpi, femora, tibiae, metatarsi and tali (pp. 135–141 tab. 86), there is a slight decrease in the LSI between fortification (n=152), bailey (n=133) and *suburbium* (n=357) *(fig. 2)*. While this is a trend, it is, however, not significant when using the Wilcoxon test. The LSI expresses the animals' bone breadth and depth and, therefore, the attachment of muscles. This "reflects the economically important body mass" (Pöllath / Peters 2005, 226). With caution, it can be deducted that cattle with a higher body mass were used in the main fortification.

The results of the LSI correspond well with the withers height: its maximum of 104.4 cm can be observed in the fortification (n=12), the low of 100.2 cm in the bailey (n=14) and 101.6 cm in the *suburbium* (n=58). The sample size is, however, small.

In all three areas of Slavonic Spandau, complete, mostly elderly cattle were slaughtered *(tab. 2)*.

N. Benecke (1994, 208–286 and passim) has analysed the sex and age composition of several Slavonic animal bone remains by cluster analysis according to Ward. For the different domestic species, he found characteristic compositions. The same features (cf. *tab. 2*) were here used for a

[3] LSI = log X – log Standard (X = measurement, Standard = corresponding measurement of the standard individual). For details see Meadow 1999. As standard individual, the cow skeleton no. 25 from the "Staatssammlung für Anthropologie und Paläoanatomie München" (SAPM) was used (see Manhart 1998, tab. 103).

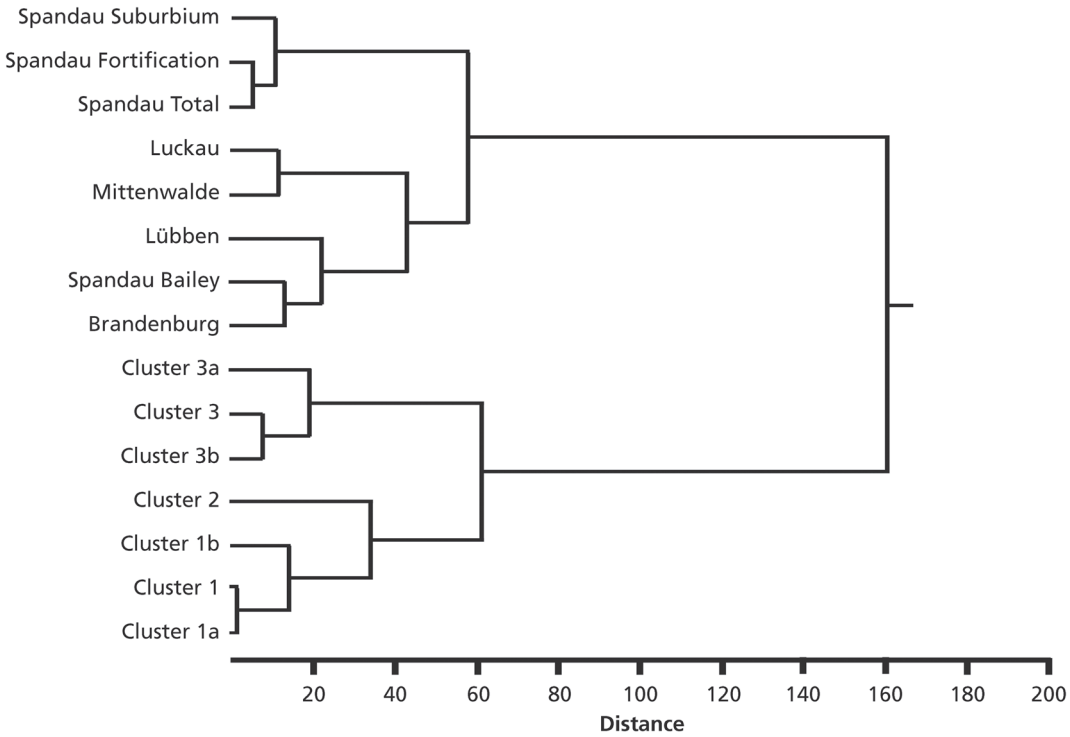

Fig. 4. Cattle from Spandau and other Slavonic sites in the Berlin-Brandenburg area. Cluster analysis according to Ward, using Euclidian distance. Data from Morgenstern 2015, 38–39 figs 18–19; 41 fig. 22 and tab. 13; Teichert 1988.

cluster analysis, together with some other Slavonic fortifications from the Berlin-Brandenburg area. The data from Morgenstern's table 3 is clustered in three separate clusters (here *fig. 4*): Cluster 1 (Spandau fortification, *suburbium* and Spandau total) is quite different from the remaining two clusters; Cluster 2 contains Luckau and Mittenwalde, while Cluster 3 consists of Lübben, Brandenburg and Spandau bailey. This means that there were different regimes in animal keeping and / or slaughtering: Cluster 1 shows a low frequency of juveniles (< 14 months), several subadults (15–35 months) and a high frequency of adult animals (> 36 months). Cluster 2 shows a high frequency of juvenile (< 14 months) and older animals (> 36 months). In Cluster 3 Lübben is isolated due to its equal age distribution (cf. *tab. 2*). Spandau bailey and Brandenburg are located here due to the somewhat elevated number of juveniles there and the reduced frequency of adult animals; furthermore, both sites have a higher number of male individuals *(tab. 2)*.

If we compare the data from Morgenstern's table 3 with the averages of the three main clusters of Norbert Benecke's (1994, 209) cluster analysis, there is a complete divergence between the data from Spandau-Brandenburg and Benecke's data (here *fig. 4*). This could mean that the composition of the cattle herds in the Berlin-Brandenburg area was quite different from the overall composition of late early medieval cattle in central Europe in general. This topic needs, however, more detailed analysis.

Domestic pigs (KNZ 8600, KNG 89.8 kg) had an average withers height of 73.3 (64.6–83.7) cm. They had quite good feed in the forests along the river Spree. Mainly juvenile to early adult animals were slaughtered. The distribution of the skeletal elements shows the cutting up of

complete carcasses in the bailey and *suburbium*. Skull fragments are under-represented in the main fortress. This could be a sign for the presence of portioned meat in the main fortress (probably brought from the bailey or *suburbium*?). Sex and age distribution is indicative of local pig keeping.

Among the 2412 bones (= 26.1 kg) of small ruminants, there are 280 that enable species determination. The sheep-goat ratio is 4 : 1 (p. 44; tab. 18). The withers height could be determined only for sheep (average 64 cm, range 54.7–69 cm). Complete carcasses of ovicaprines were cut up on all the main sites at Spandau. The presence of a high number of shin bones in the main fortress cannot be explained. Tibiae are not heavily muscled and are indicative of meat class B according to Uerpmann (1973). Mainly juvenile to early adult small ruminants were slaughtered. According to the pelvic fragments, there are more mother sheep; according to the horn core, however, the sex ratio is equal. The small number of very young or very old animals (> 4 years) negates secondary products production (like wool and milk production). The keeping of ovicaprines was thus focused on meat production.

Of particular osteological interest is a sheep skull with four horns (fig. 31). A comparable find is known from the contemporary Slavonic fortification of "Mecklenburg" (Müller 1981, figs 1–3). We may suspect that such a remarkable animal was kept in the main fortification.

In total, 605 horse bones with a weight of 66.9 kg could be identified. Their average withers height is 136 (range 114–153) cm, which can be classified as middle according to Vitt (1952). This is similar to horses from other sites in the Berlin-Brandenburg area. Most bones show no traces of cutting; this is an indication that hippophagy was not practiced. Furthermore, several (partial) skeletons were found. Horses were used for riding and for work, as is shown by their advanced age: 16 mandibles could be aged, six are of an age range of 12–13 and four of 17–25 years. The sex ratio is equal.

Of particular interest is the presence of the domestic donkey in Spandau, with three bone fragments found in the main fortress and the *suburbium* (pp. 54–55). Donkey bones in the western Slavonic area were discovered for the first time in Berlin-Köpenick (Müller 1962, 83); for the rest of the area only a find from Hitzacker is known (id. 1998). Due to the findings both of horse and donkey bones, the breeding of mules seems possible.

It is interesting to note that 92 out of 98 dog bones were discovered in the *suburbium*; furthermore, five partial skeletons were found in the bailey, four in the *suburbium* (tab. 24). The average withers height of the dogs is 57 (range 35–67) cm, arguing for the use of the dogs as hunting and watchdogs. Small dogs, which often are connected with higher social classes, are missing.

Most of the cat bones (18 out of 28) were also discovered in the *suburbium*. There are three partial skeletons from the bailey and one from the *suburbium* (tab. 25). Twelve out of 19 bones for which the age was determined belong to juvenile cats (below 8.5 months of age); the others were older than 10–12 months of age. There is at least one neonate cat. The mortality of cats between birth and weaning period is generally very high (up to 30 %; cf. Root et al. 1995). The (neonate) kittens are, therefore, underrepresented at Spandau.

Morphological analyses of height and shape of the (domestic) mammals are restricted on a comparison of withers heights. Tables 65–84 (pp. 127–128) show the withers heights and the skeletal elements which were used for their calculation, according to the different species and the three sites.

The major part of the domestic fowl bones (469 out of 557) belongs to the domestic chicken. The sex ratio (M / F) is 43 / 68 according to the tarsometatarsus. The average of juvenile chicken is 24 % for all three areas (p. 82). It was not possible for the 88 goose bones to distinguish between

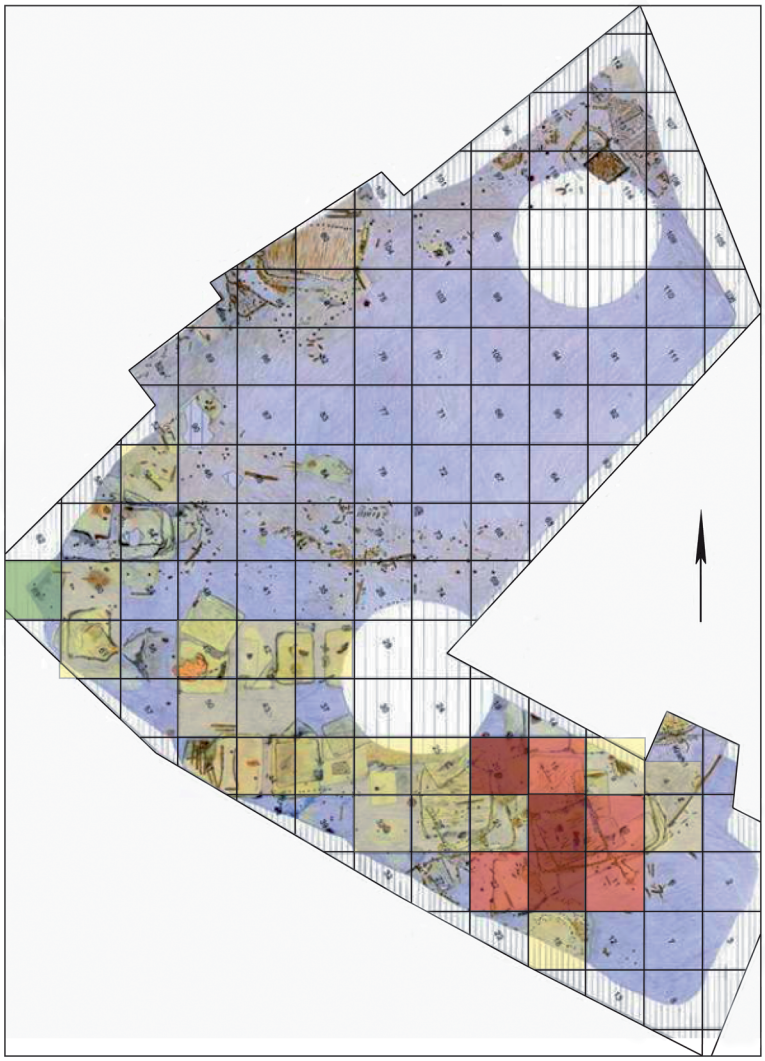

Fig 5. Spandau, trench Burgwall 29. Distribution map of bone weights per quadrant projected on the excavation plan. Scaling: 1–50 g (blue), 50–100 g (green), 100–300 g (yellow), 300–600 g (red), 600–850 g (dark red) (from Morgenstern 2011, fig. 2, combined with data from Morgenstern 2015, plate 11) (compilation by W.-R. Teegen).

the domestic and the wild form. The author takes the low number of juveniles (4.9 %) as an indicator for wild geese and hunting (p. 82).

Some traces of pathological alterations are mentioned, but the relevant references are not given. Stress markers like linear enamel hypoplasia can often be observed on pig teeth – also from Slavonic contexts. They reveal insights into behaviour and pig keeping such as could be shown for Starigard and other Slavonic places (cf. Teegen 2005; Teegen / Kyselý 2014).

If we look at the find context, Morgenstern mentions that the animal bones were found in settlement pits, houses and cultural layers (p. 20), but a context-oriented study is unfortunately missing, although the book cover with a map of building structures demonstrates that sufficient

archaeological data is present and a "household"-based context-analysis would have been possible (see below). There are, however, distribution maps using 5 x 5 m quadrants (plates 1–14) of several figures such as bone weight (KNG), ratio of domestic / wild animals, ratio of cattle / pigs / ovicaprines and worked bone / antler. Several concentrations are visible. Also, possible workshops for bone / antler working can be hypothesised (see below). But without more detailed information on archaeological contexts, these distribution maps can only be partially interpreted. One has to go back to her preliminary report, where she published a plan from the 2005 excavation trench in the *suburbium* (Morgenstern 2011, 72 fig. 2) where several houses are present. On such a plan, it is easily possible to plot the distribution of the bone finds, as shown in *figure 5*.

As mentioned above, several partial skeletons of horses, cattle, ovicaprines, pigs, dogs and cats were found; there is also a red deer present (p. 27 tab. 2). Unfortunately, there are differences in the number of skeletons between the general table 2, the species specific tables 4 (pigs), 10 (cattle), 15 (ovicaprines), 22 (horses), 24 (dogs), 25 (cats) and the text. While the age distributions are mentioned in the text, the skeletal composition of these partial skeletons is nowhere explained, although the skeletal elements preserved could yield important information on their cultural significance. It is possible that some of the partial skeletons result from religious offerings, as could be shown for Starigard. The horse cadavers were deposited mainly in the ditches and in the former shore areas (p. 51). This observation is also of archaeological interest, as these areas were probably still visible as depressions at the time of deposition.

Wild animals and birds

Of particular interest is the high number of wild animals; both the number of fragments (KNZ) and the bone weight (KNG) range between 25 % and 30 %. The percentages from the proto-urban complex at Spandau and the citadel of Spandau are very similar (cf. tabs 2 and 3). Generally, the percentage of wild animals in prehistoric and historic (also Slavonic) animal bone assemblages is below 10 %, often even under 5 %. In contrast, the ratio for Slavonic fortresses in the Spree-Havel-area and near the Oder River can be as high as 60 % (fig. 39). The percentages of wild animals in the fortifications from Spandau (proto-urban complex and citadel) are a good fit.

Wild mammals are represented by red deer, roe deer, wild boar, elk, wisent, aurochs, wolf, brown bear, lynx, beaver, otter, badger, forest polecat, marten / pine marten, squirrel, wild cat, red fox, hare and hamster. The latter could also be a recent disturbance. The lack of small mammals like mice and rats may be due to the excavation techniques (cf. Schmölcke / Heinrich 2006): as was mentioned above, the sediment from the pits and layers was neither sieved nor underwent flotation. In contrast, the flotation finds from Starigard show large numbers of different species of small mammals, birds and fishes (Prummel 1993, tab. 7).

The different species of wild mammals are indicators for different kinds of hunting: there is hunting for meat (red deer, roe deer, wild boar, aurochs, wisent), so-called "Schutzjagd" – hunting to protect herds (brown bear, wolf, red fox, wild cat?) – and hunting for fur (brown bear, lynx, wild cat, red fox, beaver, otter, badger, [forest] polecat, marten / pine marten, squirrel). Regarding hunting at Spandau during the Middle Ages, Cornelia Becker has published an extended paper (Becker 1993b). The largest number of different wild species is known from the *suburbium*. This fact probably results from the large trenches in this area (cf. *fig. 1*). In contrast, the trenches in the main fortress and the bailey studied by the author are quite small, which may explain why the findings from the *suburbium* outnumber those from the main fortress and the bailey (cf. *tab. 2*).

		Becker 2003		Morgenstern 2015	
Formenrepertoire	*Types*	*Bone*	*Antler*	*Bone*	*Antler*
Dreilagenkamm	three layered comb	3	48	1	? 2
Kammfutteral	comb sheath / case		10		
Einlagenkamm	one layered comb	3	1		
Zinkenplättchen	prong plate	7	9		1
Zinken	prong		1		
Endplättchen	end plate		1		
Kammbügel	comb yoke		3		
Steilkamm	comb with long prongs	3		1	
"Kammfragment"	"comb fragment"				1
Hacke	hoe		9		1
Beschlag	fitting	3	3		
Griff	handle	2	8		4
Messergriff	knife handle				1
Rippenmesser	rib knife	1			
Schlittknochen	skate bone	11		20	
Knochenkufe	bone skid	1			
großer Glätter	large smoother	10			
kleiner Glätter	small smoother	6			
großer Behälter	large container		5		4
Nadelbüchse	needle case	11			
grobe Nadel	coarse needle	69		8	
Geweihspitze	antler point		61		4
Pfriem	awl	191	3	? 6	
Riemenhalter	strap holder	5	7		
Amulett	amulet	1	1		
Spielstein	(game) token	1	1		
Schnurrer	buzzer / whirligig	11		? 6	
Falzbein	bone folder	1	1		
Stempel	punch	10	3		
Knebelangel	toggle rod	1	2		
durchlochter Astragalus	perforated talus	2			
Zahnanhänger	tooth pendant	1			
Hammer	hammer	1			
Beilchen	small axe	1			
Würfel	die	1			
*Schneideunterlage	*cutting pad	2			
*grober Griff	*coarse handle	6			
*unregelmäßig gelochte Phalanx	*irregularly perforated phalanx	17			
Arbeitsabfall	working waste			19	15
Total		**382**	**177**	**55**	**33**

Tab. 3. Spandau, late Slavonic site. Worked bone or antler objects and debris (? = questionable, * = uncertain). Most of the material published by Becker (2003) was found in the bailey, while most of the findings published by Morgenstern (2015) were discovered in the *suburbium*.

Some wild species live in quite characteristic habitats. Their presence at Spandau thus also suggests the existence of different environments in the surroundings of Spandau (forest, open forest, forest rim, open land like fields and green land, etc.). Morgenstern explains this in the final chapter and correlates her findings with the archaeobotanical evidence. With this interdisciplinary approach, she can draw a lively picture of the landscape around the site.

The birds also contribute to this image. The 278 wild bird bones belong to 32 different species (tab. 49). Ducks are the most common (182 bones, six species); 129 of the bones were determined as mallard (tab. 50).

It is remarkable that there is only one bone of a sparrow hawk (tab. 52) in Spandau. Falcons and goshawks are missing completely. In contrast, there are five bones of white-tailed eagle (tab. 52). The common interpretations for this are the "Schutzjagd" mentioned above and the use of feathers for arrow production. Morgenstern also discusses the use of the sea eagle for hunting purposes (p. 90). This seems not very likely, however, due to character and behaviour of the white-tailed eagle. Hunting with the golden eagle is, however, possible and confirmed for central Asia since prehistoric times (cf. Soma 2015). *Corvidae* (cf. tab. 52) could also have been used as bait (so-called "Vorlasswild") to train falcons and goshawks (cf. Schuster 2002). It has to be considered that ravens as the largest songbirds in Europe, and as particularly intelligent animals, could also have been kept in captivity.

Totally, 654 fish fragments are present, representing nine different species (ide, common bream, eel, river perch, pike, asp, common roach, tench and catfish). The catfish shows the highest number of fragments in the sample; nearly 40 % of the catfish had a length of more than 150 cm (fig. 57).

The reptiles are represented by a plastron fragment of a swamp turtle (p. 100).

Remarkable is the presence of an oyster shell (pp. 100–101, fig. 58) from the *suburbium*. As Morgenstern rightly points out, it seems not very likely that oysters were eaten. It is probable that the shell was used as a souvenir or for magical purposes. Medieval inland finds of oysters are documented only for Sulzbach castle (Pasda 2004, 111–112). Other mollusc species present are the large freshwater mussel with ten shells and the painter's mussel with 28 shells (pp. 100–101).

Conclusions

It should be emphasised that the bone material from Spandau is very well documented metrically (pp. 129–186, tabs 85–112). This allows the calculation of the Logarithmic Size Index (LSI) *a posteriori* (see above with *fig. 2*). In contrast to several older publications, the find spots and the inventory numbers are also given. In future, this should allow a correlation between metrical data and the archaeological features.

For a household-archaeological approach (cf. Becker 1995), the publication of the feature-based bone lists are missing. Such data could be made available easily via the internet. This is also the topic of the IANUS project, organised by the DAI (http://www.ianus-fdz.de/, last access 12 February 2018). A model for the exchange of archaeozoological data in central Europe is the Ossobook initiative from Munich and Basel (Kaltenthaler et al. 2016). Nevertheless, in the digital age I also regard the publication of metrical data and other primary data in paper form still appropriate. The maintainability of printed materials is still unbeatable.

Antlers from red deer, roe deer and elk were collected in the surroundings of Spandau and were the basis for extended antler working (for previous work see Becker 1993b; 2003, tab. 3). The relatively low number of worked bones and antlers found during extended excavations in the *sub-*

urbium is striking. There are also much fewer artefact classes present in the *suburbium* than in the bailey (Becker 2003, tab. 3).

Only one previously unknown type was recorded – a knife handle (pp. 104–105). Unfortunately, neither drawings nor photographs of the bone and antler artefacts were published, nor a correlation with Cornelia Becker's findings; this correlation is provided here in *table 3*. The distributions maps (plates 9 and 14) indicate several small accumulations of worked bone and antler in the *suburbium* in the trenches Burgwall 27 and 29. During analysis of the old finds from the bailey, shops for bone and antler working could be localised (Becker 1989, figs 30–31; 2003, fig. 9).

In the final chapter 7, Morgenstern discusses the diet of the people from Spandau, considering both archaeozoological and archaeobotanical data. She also mentions some studies on stable isotopes for dietary reconstruction from northern and central Germany, as well as from Poland. In this discussion of western Slavonic dietary habits the reviewer misses the recent studies from Bohemia and Moravia (e. g. Smrčka et al. 2008; Kaupová et al. 2014; other papers were only recently published, e. g. Halffman / Velemínský 2015; Frolík / Kaupová 2016). In future, it would be interesting to compare the archaeozoological and archaeobotanical record mentioned above with the results of stable isotope analyses from the skeletons from Spandau (not yet analysed; an anthropological catalogue was published by Bernd Herrmann 1989).

Peggy Morgenstern has published an important middle to late Slavonic animal bone assemblage only some years after their excavation – and prior to the archaeological data. We should be grateful to her and the DAI for this laborious task. The publication expands significantly our knowledge on Slavonic animal keeping, hunting and the environment in the Berlin-Brandenburg area. It is the largest osteological material for this zone published so far and in depth. The mass of metric data is particularly welcome. This is a treasure and offers the basis for further studies (cf. *figs 2–4*). The monograph is, therefore, an important contribution to the archaeozoology of Slavonic sites. Furthermore, it is an extended supplement to previous publications from the Berlin-Brandenburg area[4].

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[4] Hopefully, also the archaeological record with the buildings in particular, but also ceramics and small finds will be studied and published in the (near?) future. Only then the osteological findings can be really considered in an archaeological framework.

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